FNR-133

forestry & natural PURCHASING resources

Quality Control in Lumber Purchasing: Surface, End, and Internal Checking (Honeycomb)

by
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Surface or season checking, end checking, and internal checking or honeycomb, are sometimes costly and troublesome defects when hardwood lumber is processed into furniture, cabinets, millwork, and other products where surface appearance and finish are critical.

Surface and end checks often extend deeper than casual observation on the rough lumber would indicate. Furthermore, many surface checks in hardwoods close in the later stages of drying and may not be particularly evident. However, the lumber is still damaged, and the checks are likely to open as the moisture content of the wood changes at some time in the future. Sometimes the final product is returned from the field. Or excess rejecting of parts may occur during the manufacturing. Honeycomb may not be detected until the lumber is cut up. For these reasons, the lumber should be carefully examined at the time of receipt and care exercised before it is processed into a product.

This publication first discusses the defects of surface and end checking, including methods to eliminate or control the defects, tests to determine their presence, and the appropriate NHLA guidelines. It then discusses internal checks or honeycomb.

Surface and End Checking

Surface Checks

Surface checks are actual failures in the wood that generally occur in the wood rays or at the junction of the wood ray and other adjacent wood tissue on the surface of flat-sawn boards (Figure 1). They occur because the drying stresses exceed the tensile strength of the wood perpendicular to the grain. The surface of the material is drying much faster than the interior. As a result, the surface is trying to shrink. In so doing it is forced into tension, and the wood literally tears itself apart. As the wood dries, the interior will start to shrink, and sometimes the surface checks can become invisible to causal observation (Figure 2).

Surface checks rarely appear on the edges of flat-sawn boards less than 1-1/2 inches in thickness but can occur on the edges of thicker flat- or quarter-sawn stock. Surface checks are also likely to develop in mineral streaks and resin ducts.

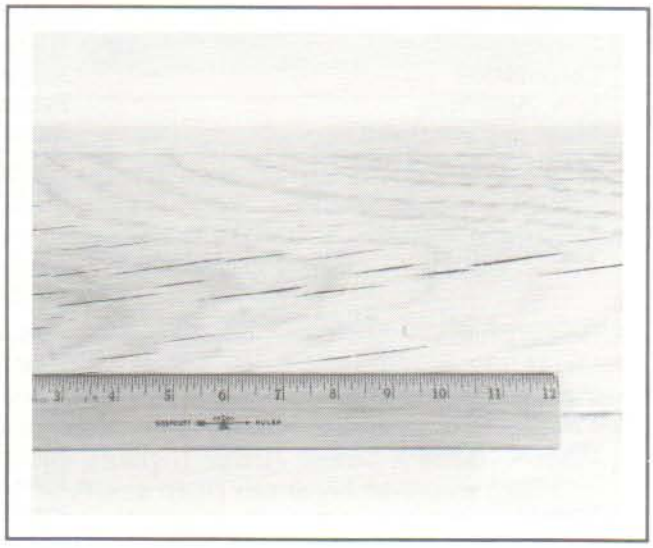

Figure 1. Undesirable deep surface checks in white oak during the early stages of drying.

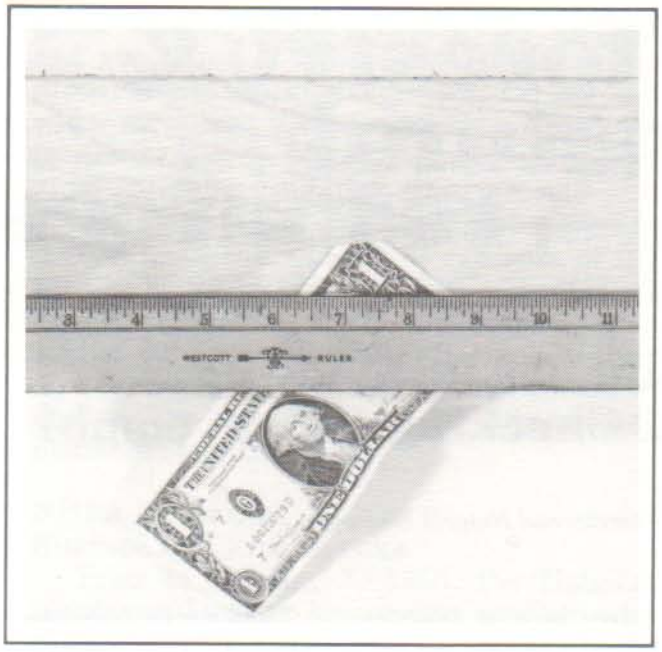

Figure 2. Surface checks shown in Figure 1 are now closed. The moisture content of the board is about six percent. The dollar bill demonstrates the depth of the checks before they closed.

Surface checks develop because the wood is drying too rapidly. Rapid drying occurs during hot, dry weather and is further aggravated by strong winds. Checking of green lumber can also be aggravated during transport if the lumber is left uncovered and exposed to the hot sun and wind. Difficult-to-dry species such as oak can check in as little as an hour when exposed to the hot sun. Two-inch-thick heartwood of any species can check. Table 1 shows the tendency of different hardwoods and selected softwoods to surface check.

End Checks

End checks are likewise a serious problem. In thick stock, end checks that are not even hairline cracks on air dried material can extend a foot or more from the end of the piece. It is easy to overlook the significance of end checks, but the effect on yield can be significant. For example, losing three inches of trim from each end of an eight foot long board represents over six percent yield loss.

Table 1. Tendency of different woods to check[1]

Low	Intermediate	High
	Hardwoods	
Alder	Ash	Beech
Aspen	Birch, yellow	Oaks
Basswood	Butternut	Sycamore
Birch, paper, and sweet	Elm, rock	Tanoak
Cherry	Hackberry	
Cottonwood	Hickory	
Elm, American	Maple, sugar	
Magnolia, southern	Pecan	
Maple, red, and silver	Sweetgum	
Tupelo	Walnut	
Yellow-poplar	Willow	
	Softwoods	
Baldcypress	Firs, true	Douglas-fir
Cedar	Hemlocks	Larch, western
Pine, sugar	Pine, longleaf	
Pine, loblolly	Pine ponderosa	
Pine, shortleaf	Pine, red	
Redwood	Pine, slash	
Spruce	Pine, white	

[1]Air Drying of Lumber. 1971. U.S.D.A. Forest Service, Agr. Hbk. No. 402. 110 pp.

End checks are similar to surface checks in that they occur in or along a wood ray but on the ends of boards. End checks associated with wood rays appear as lines on the radius between the pith or center of the tree and the bark. End checks occur because wood dries much faster from the ends of the boards than from the surface. This results in shrinkage and stress at the end of the boards, and the checks develop. Depending on the severity, checks develop into splits to relieve the stress.

Controlling Surface and End Checks

With proper precautions, surface checks or end splits can be eliminated or at least controlled to acceptable limits. Surface checks can be prevented or reduced by protecting freshly sawn lumber from the sun and wind during accumulation at the green chain and during transport. The use of pile covers in the air drying yard will protect the top courses from weathering and checking. As the surface of lumber, particularly oak, is wetted from the weather and then redries, surface checks are driven deeper into the wood. Therefore, lumber should not be left on the air drying yard any longer than necessary. Air drying sheds or covered air dry yards are becoming somewhat more common. Predriers, if properly run, will also help reduce checking and keep the lumber bright. Species prone to checking, such as oak, are sometimes wrapped in burlap to reduce air movement over the surface. Placing the stickered lumber packs in a protected place on the air drying yard may be of minimal help. Lumber cut during the winter months is also less likely to be exposed to severe drying conditions and, thus, less likely to check.

End coating or water spraying of logs will reduce or eliminate end checking during storage. Checks which begin at this time continue to develop once the log is processed into lumber and dried. End coatings applied to lumber within a few hours of sawing have been shown to reduce end checking significantly.

Splits

All trees develop a certain amount of stress as they grow. Usually the outside portion of a log is in tension, and the core is in compression. Thus, as a flat-grain board is sawed from the face of a log it tends to curve away from the headsaw. No particular problems develop.

Sometimes, however, if the log is sawed deep or if a more or less full width board is cut from around the heart area, it will develop deep splits in the ends. These splits are from growth stresses. They occur on a sporadic basis, and are not the result of mishandling the lumber during drying. Splits can also develop from tension wood. Tension wood forms in the upper side of leaning hardwood trees.

Tests for Surface and End Checks

The presence of both surface and end checks is relatively easy to determine. For surface checking, cut one-inch strips across the width of the board and away from the ends and other obvious defects or grain distortions. Now, turn the strip down and band saw 1/8-inch-thick pieces from each face. If these pieces separate when sawed loose or when lightly flexed, surface checking is present (Figure 3). If they do not, the section is free of checks. Successive cuts will help determine how deep the checks penetrate the piece.

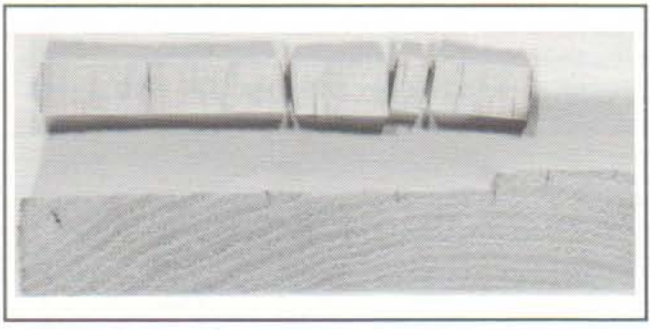

Figure 3. The presence of surface checks can be determined by cutting parallel to the face of a board with a bandsaw. These checks are particularly visible due to the accumulation of dirt. Some checks are not readily visible.

For end checking, simply begin by cutting the ends of the piece back about one inch or less at a time. If checks are present, the cut-off piece will either fall apart by itself or break easily if lightly flexed. Continue cutting off sections until the wood becomes usable.

It is difficult to estimate the number of samples which should be examined. Refractory species such as oak and beech tend to check more than other species. Also, if the

green wood is exposed to hot, dry weather and sun when it is first manufactured, the probability of checking increases. Thicker and wider stock also checks more than thin stock or narrow boards. Mixed loads should also be more carefully examined since air and kiln drying times and conditions were probably different. As the amount of exposure of the lumber at the air drying yard increases, so does the probability of checking, especially on species such as white oak. Alternate wetting and drying of the wood drives the checks in deeper. The wood will also be more gray or discolored and not bright.

NHLA Rules on Surface and End Checks

Prior to January 1, 1990, the National Hardwood Lumber Association grading rules permitted ordinary surface or season checks in clear-face cuttings.[1] Season checks which did not impair the strength were admitted in sound cuttings and construction grades. Unfortunately, it was not always clear between buyer and seller as to what constituted "ordinary season checks."

The rule has now been changed to read "Ordinary season checks are admitted in clear-face cuttings if they will dress out at standard surface thickness." Thus, for example, season checks should not appear in the required clear face cuttings for the given grade when one inch rough lumber is surfaced to 13/16 inches. The standard surfaced thickness for 5/4 lumber is 1-1/16 inches, for 6/4 it is 1- 5/16 inches, and for 8/4 it is 1- 3/4 inches.

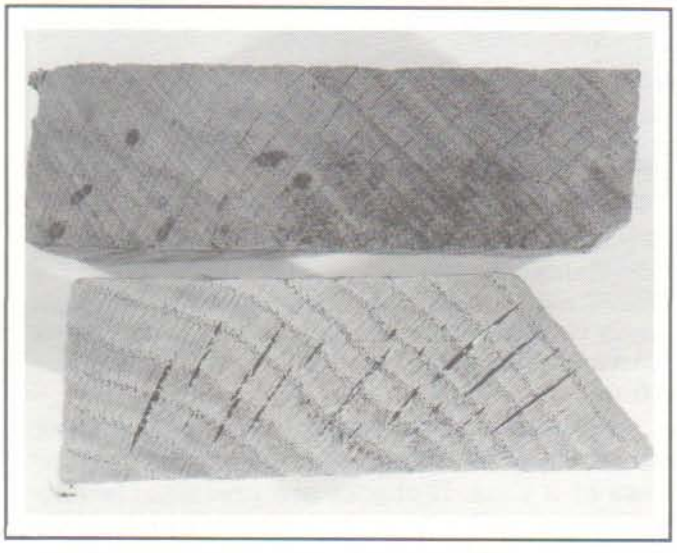

Figure 4. Severe honeycomb in red oak (bottom). Note that the defect was not evident on the ends or surface of the piece (top).

Internal Checks or Honeycomb

Internal checking or honeycomb (Figure 4) is probably one of the most troublesome defects to lumber suppliers and users. "Bottleneck checks" is a term which is sometimes applied when deep surface and end checks have closed tightly on the surface of lumber but remain open below the surface.

Honeycomb is an internal type defect, and it often goes undetected until the lumber is machined. Severely honeycombed lumber frequently has a corrugated appearance on the surface.

Honeycomb, like surface or end checks, is caused by a tension failure across the grain of the wood, and it usually occurs in the wood rays. It is often an extension of a surface check. The wood is literally tearing itself apart. It occurs when the core is still at a relatively high moisture content and drying temperatures are too high.

Thus, to control internal checks during the drying process, the moisture content of the core must be below the fiber saturation point or about 30 percent, before kiln temperatures are raised. It is the responsibility of the dry kiln operator to determine when the core is dry enough so the temperature can be safely raised. He should also check the lumber prior to kiln drying to determine if surface checking or honeycomb occurred during the air drying process. Surface checks which occurred during air drying will usually have small specs of dirt in them, especially those checks located on the upper side of the boards.

The presence of honeycomb is determined by cross cutting several boards. Mixed loads which appear variable in regards to surface discoloration and thickness should be closely scrutinized.

[1]National Hardwood Lumber Association. 1990. Rules for the Measurement and Inspection of Hardwood and Cypress, Box 34518, Memphis, TN 38184-0518. 108 pp.

NEW 2/92 (1.5M)

Cooperative Extension work in Agriculture and Home Economics, state of Indiana, Purdue University, and U.S. Department of Agriculture cooperating; H.A. Wadsworth, Director, West Lafayette, IN. Issued in furtherance of the acts of May 8 and June 30, 1914. The Cooperative Extension Service of Purdue University is an affirmative action/equal opportunity institution.