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LONGITUDINAL SHRINKAGE OF WOOD

The lengthwise shrinkage of wood in drying from the green to the oven-dry condition is normally somewhere between 1/10 and 2/10 of 1 percent. In drying to an average air-dry condition of about 12 percent moisture content, the normal shrinkage is only about half as much, the amount varying from 1/20 inch to 1/10 inch in a board 8 feet long.

As a rule, therefore, the user does not need to make any particular allowance for the longitudinal (lengthwise) shrinkage of wood, certainly no such allowance as he must make for transverse shrinkage. Nevertheless, trouble may easily arise if the longitudinal shrinkage becomes abnormally large, as sometimes happens. To prevent such trouble the following information on the main causes of excessive lengthwise shrinkage, their identification, and means of avoiding or controlling them will be found useful:

1. Compression wood is a hard, heavy, brittle type of wood generally formed on the lower side of branches and leaning trunks of coniferous (softwood) trees. No fixed longitudinal shrinkage value can be assigned to it, but its shrinkage is in general excessive, in extreme cases running as high 5 to nearly 6 percent (green to oven-dry), which would mean a shortening of 10 or 11 inches in a 16-foot length; this is more than the average transverse shrinkage for many species. More often its longitudinal shrinkage is less than 1 percent, but well in excess of ordinary working tolerances.

The principal effect of compression wood, however, is not direct end shrinkage so much as crooking or bowing of lumber or dimension in drying, owing to its uneven distribution in the piece. Likewise an occasional streak of compression wood that adjoins normal wood will pull itself apart in drying, so as to form cracks across the grain. Defects of this kind are as a rule well taken care of in grading the material. Sometimes, however, the direct shortening causes trouble, as in the opening up of butt joints in

house siding. The prevention of this trouble lies in seeing that the material is thoroughly dry and fully shrunk before it goes into construction.

Compression wood can usually be detected by the greater thickness of the annual growth layers or rings in which it occurs, the summerwood layer being especially thickened. Sometimes the compression wood layers are grouped in close succession, in other cases the thickening occurs sporadically. Compression wood seldom or never occupies the complete circuit of a growth ring within the tree; in cross section it is usually found as a scallop or half-moon pattern. Compression summerwood tends to be somewhat paler in color than normal summerwood, but owing to its greater thickness the area occupied appears darker on the whole than normal wood.

Cross section of log containing compression wood.

Cross sections of wood measuring about 3/16 inch along the grain when held toward a strong light are translucent except in areas containing compression wood, which are practically opaque.

2. Abnormally light-weight wood. Wood below the average weight shrinks lengthwise more than normally dense wood of a given species; this is exactly the reverse of the rule for transverse shrinkage. In lightweight wood the shrinkage along the grain may in exceptional cases be as high as 1.5 percent. In lumber that is graded for density the lightweight material is eliminated from the better grades.

3. Springwood, the lighter-weight, lighter-colored part of the annual growth layer, invariably shrinks more along the grain in drying than the summerwood. Hence, any piece of wood that has a large proportion of springwood will be likely to show excessive end shrinkage.

The difference in lengthwise shrinkage tendency as between springwood and summerwood undoubtedly sets up shearing stresses along the grain, which probably contribute to ease of splitting or slivering. In flat-grain flooring the slivering nuisance can be largely avoided by dressing the stock so that the "bark" side forms the face or wearing surface. In that case the summerwood of each annual layer is uppermost, and the tendency of emerging layers is to curve down at the surface instead of up. Rotary-cut veneer, wherever it happens to include a single annual growth ring, will be especially subject to bowing in that area.

4. Wood taken from near the pith of the tree in some of the softwoods shrinks lengthwise in drying more than the surrounding wood. For this reason short cross breaks are often seen in boards or timbers sawed lengthwise through the pith. For the same reason a narrow piece so cut that the pith runs along an edge will crook as it dries. On the other hand, it has been reported that wood on the bark side of some hardwoods shrinks more than the wood farther in, thereby causing crook or bowing in the reverse direction to the above. This is probably an effect of density decreasing toward the outside of the tree, as frequently happens.

5. Very fast growing softwoods with wide annual growth rings containing relatively soft and light-colored summer-

wood bands have been found to yield wood of high longitudinal shrinkage characteristic. Material showing the most pronounced cases of this type has been found in the butt portion of the trunk.

6. Cross-grained wood. Wood with spiral, diagonal interlocked, wavy, or curly grain may show excessive apparent longitudinal shrinkage on account of having a transverse shrinkage component effective along the length of the piece. Thus, if all the fibers ran through a board at an angle of 45°, it would shrink in the same proportion endwise as edgewise. Even a small knot at the edge of a narrow strip will cause bowing of the strip on account of the cross grain introduced by fibers running around the knot.

7. Wood in long pieces concentrates all its lengthwise shrinkage effect into large gaps at the ends; the longer the piece the wider the gap. The present tendency toward the use of short lengths will help to break up the longitudinal shrinkage into smaller and less conspicuous units, thereby improving the appearance and service of floors and siding.