

# TECHNICAL NOTE NUMBER 189

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## DIFFERENCES BETWEEN HEARTWOOD AND SAPWOOD

Sapwood is the outer light-colored portion of a tree trunk through which the water passes from the roots to the leaves, and in which excess food is often stored. Heartwood is the central core of the trunk. In most woods the heartwood can be distinguished from the sapwood by its darker color. But in hemlock, aspen, cottonwood, beech with white heartwood, all spruces except Sitka spruce, basswood, holly, hackberry, tupelo gum, and the true firs (not Douglas fir), there is very little difference in the color of the heartwood and the sapwood.

As new sapwood is formed under the bark, the inner sapwood changes to heartwood. In the wood undergoing this change the living cells die; the pores in some woods become plugged with frothlike growths, known as "tyloses;" and the cell walls, and in some species the cell cavities, become infiltrated with various substances, some of which darken the wood. In certain species these infiltrations are known to add appreciably to the weight of the wood, for example, in ebony and rosewood, in which the pores become filled with more or less soluble deposits; and in redwood and black locust, in which the water soluble infiltrations may add 5 to 15 percent to the dry weight.

In over 500,000 tests, which have been made by the Forest Products Laboratory, Madison, Wisconsin, on the various species of wood grown in the United States, no effect upon the mechanical properties of the wood due to its change from sapwood into heartwood has been found in most species. The heartwood of oak, pine, and Douglas fir, for example, is not intrinsically stronger than the sapwood, as has often been supposed to be the case; nor

is the sapwood of hickory and ash intrinsically stronger than the heartwood, as is sometimes claimed in connection with handle stock. However, in some species, in which the heartwood is high in infiltrations or "extractives," such as redwood, western red cedar, and black locust, the heartwood has been found to be considerably stronger in certain strength properties than the sapwood. In these species, however, the amount of sapwood in virgin-growth timber is relatively small.

Heartwood as a rule, is more durable than sapwood in damp locations and less subject to attack by certain insects and by stain- and mold-producing fungi. It usually is colored and therefore considered more ornamental than the white sapwood, except in a few cases; in yellow pine interior finish and maple flooring, for example, the white sapwood is preferred. Heartwood is less permeable to liquid and therefore more suitable for tight cooperage, tanks, and conduits. The heartwood of some species contains more valuable extractable materials, such as tannin and dyes, than does the sapwood.

Sapwood, as a rule, takes preservative treatment better than heartwood. In general, sapwood when green contains considerably more moisture than does heartwood, the difference being more pronounced in the softwoods. With few exceptions sapwood seasons faster per unit of time than does heartwood, but because of its higher percentage of moisture when green it dries in about the same time. The difference in density between heartwood and sapwood of American woods is usually not great but since sapwood contains on an average more moisture than does the heartwood it follows that when green the weight per cubic foot of the sapwood averages higher than that of the heartwood. Because sapwood is the outer portion of the tree it contains in large trees fewer common defects, such as knots, shakes, and pitch streaks. In resinous species the sapwood usually contains less resin than the heartwood. Sapwood is more free from odor and taste.