The Problem: How can a kiln operator know when it is safe to raise kiln temperatures to speed up his drying schedule?

The Answer:

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Drying conditions should be changed in accordance with the moisture content of the lumber being dried. There is only one practical way to determine when these changes should be made and that is by following the moisture loss of the lumber through the use of kiln samples that represent the type of material in the entire charge being dried. The selection of boards from which kiln samples are to be cut, therefore, becomes one of the very important tasks of the kiln operator.

Factors That Affect Selection of Kiln Samples

Species—Species is naturally one of the more important characteristics of wood that influence kiln-sample selection and should be considered when it is necessary to kiln-dry mixed charges of hardwoods. Assuming that the pieces in the mixed charge are all of the same thickness, most of the kiln samples should be selected from the slowest-drying species. Some samples, of course, must be taken from the faster-drying species, but at least for the major part of the drying operation the slowest-drying species will determine the kiln conditions to be used. If, for example, oak and gum are kiln-dried together, the oak, as the slower-drying species, should be represented by a greater number of kiln samples. The quantity of oak in the kiln charge, as compared to the footage of gum, is not important if the ultimate use requirements for both are the same. The difference in drying characteristics between the two species is the thing that counts.

Thickness—The thicker items usually govern operating conditions, and their moisture content should determine the temperature and relative humidity that can be safely used.

Kiln samples, therefore, should be cut from the thicker pieces of a given nominal thickness in the charge. Mis-cut lumber that varies as to thickness between boards and along the length of the same boards requires that the samples be taken from the thicker portions. Since drying time is a function of thickness, a kiln charge is operated on the basis of the performance of the thicker stock rather than of the thinner. To be absurd, but to illustrate the point, 1-in. lumber ordinarily would not be subjected to kiln conditions that can be safely used for veneer.

Moisture Content—The moisture content of the slower-drying species and the thicker items in the kiln charge has a great deal to do with the initial drying conditions to be established. This is particularly true for green and partially air-dried stock. Consequently, kiln-sample selection should be made with some sort of moisture content appraisal. Electric moisture meters that read above the fiber saturation point are helpful. Cutting boards and observing them for wet cores, hefting boards, a knowledge of time on stacks, smelling freshly cut ends or surfaces, ease of sawing and inspection of sawdust, and sound when tapped are among the ways of segregating wetter pieces for kiln samples.

The sapwood of most species has a higher moisture content than the heartwood when the tree is cut. Since heartwood dries more slowly than sapwood, however, high-moisture-content pieces are most likely to be found in the heartwood boards of air-dried stock rather than in the sapwood boards. This suggests that heartwood should be selected in preference to sapwood for kiln samples. Some samples should be chosen to represent the sapwood, but they would be in the minority.

Weight and Grain Direction—With the slower-drying species represented by kiln samples taken from the thicker-than-normal heartwood boards of higher moisture content, final selection should be made on the basis of weight and grain direction. Boards of higher-than-normal specific gravity should be given preference. They have more wood substance per unit volume and are likely to dry more slowly because the diffusion of moisture through this kind of wood is slower. Grain direction influences the drying rate, for flat-sawn boards usually dry faster than quarter-sawn boards.

When to Raise the Kiln Temperatures

When kiln samples are selected in accordance with these suggestions, the operator can manipulate the drying schedule so as to accelerate the drying of the wettest, thickest, and slowest-drying material knowing that the bulk of the kiln charge will come along without damage. For example, when the slow-drying heartwood boards initially having the higher moisture content are down to an average moisture content, which indicates that all the free water has been evaporated, relatively high kiln temperatures can be used with safety. Most commercial hardwoods can be subjected to final drying temperatures of 180° F. or higher when all or a very high percentage of the boards in the kiln charge no longer contain free water. A kiln temperature as high as 180° F. is one of the important accelerators, and if the kiln samples are carefully selected so as to indicate when a temperature this high can be used with safety, rapid kiln-drying without increased seasoning degrade can be accomplished. In general, the kicking point is at an average moisture content of 20 percent of the 4/4 stock and 15 percent for thicker stock. When the safety factor is placed in the careful selection of kiln samples, kiln temperatures can be raised at those points with assurance that honeycombing will not develop.