Drying Time

STABILITY IS THE AIM OF DIFFERENT METHODS

Theodora Tilton

A previous column discussed the topic of water in wood and highlighted the relationship between moisture content and wood's physical and mechanical properties. I described how free-flowing water is found in the hollow internal spaces of the tube-like wood cells and is constantly flowing upward during the growing season, meeting the needs of the leaves and other living parts of the tree. The bound water, found within the walls of the wood cells, is tightly held, making the wood heavy, flexible and relatively weak.

We learned that once the free water in the central cavities of the cells has left the wood, the bound water within the walls of the wood cells begins its migration to the surface and the surrounding air. As it leaves, the cell walls shrink and become stronger and stiffer. The point where a cell wall's bound water begins its migration out of the log is known as the Fiber Saturation Point (FSP).

We ended with the definition of wood's moisture content as a ratio of the weight of the water in a log to the oven-dry weight of the log. For example, a section of log weighing 10 pounds at the time of cutting and 6 pounds after drying in an oven would have had 4 pounds of water at the time of cutting. The ratio of water (4 pounds) to dry wood (6 pounds) would be 4/6 or 66 percent.

It seems like an unusual way to measure the moisture content, but wood scientists use this "oven-dry" method because of the ease of manipulating weights and moisture contents mathematically for predicting many of wood's properties. What is important to remember is that using this method allows for the moisture content of wood to be above 100 percent. While that seems a little odd or just plain wrong, remember that we are comparing the weight of the water in the log with the weight of only the dry wood of that log.

Now, using all of this information, let's move on to where the moisture is located in a log and the methods of removing it.

In order to understand the types log-drying methods used by the log-home industry, we need to start by stating that many species of trees normally have wood moisture contents in the outer zone of the trunk known as the sapwood that is commonly higher than 100 percent. Some species, such as pine and spruce, can exceed 200 percent moisture content. Other species normally have lower moisture contents, both in the living sapwood that is actively conducting the water for the tree and in the completely dead heartwood that serves as a purely structural component.

Another important bit of information, as you learn about the drying methods and then read about them in advertisements and sales literature, is how the company making a claim about its logs' moisture content determines the advertised moisture content of a log. Large timbers and logs do not have uniform moisture contents throughout their cross section, since the surface of the log dries and regains moisture at a much faster rate than its center. A "dry" log may feel dry on the outside, and an impressive, but misleading, test might show the outer surface to be 12 percent moisture content, but the center can still have all of the moisture that was present at the time of harvest.

For this reason, standards have been established for determining the average moisture content of large timbers and round logs. The standard method is to extract a core sample or place the probe of an electronic moisture meter at a depth equal to 1/6 to 1/7 the diameter of a round log or 1/4 to 1/5 the smallest dimension of a rectangular or profiled sawn timber. That means for a 10-inch diameter round log, the mill will likely use a moisture meter with a probe that reaches approximately 1-3/4 inches into the lateral face of the log. It is customary to check several logs in this manner, and this direct method works with either air-dried or kiln-dried logs.

Let's now focus on how wood in general, and logs in particular, are dried from this saturated state to the level seen in the logs delivered for a home. As soon as a tree is cut down, it begins the drying process. Like flowers cut in a summer garden, a tree cut during the growing season does not die until the sapwood water supplying the leaves is used up or becomes too difficult to transport. This continued use of the stem water after harvest is sometimes used when trees are cut for industrial or home fuel. The trees are cut, and the branches and leaves are left attached, speeding the drying of the stems and enhancing the fuel value of the cordwood or chips.

Most of the time, however, trees are harvested, de-limbed and delivered to a sawmill or log-home company for processing within days. While the raw logs may lose some of their moisture from the cut ends and branch stumps, the bark remains a very effective barrier to moisture loss. Most of the time, sawmills wish to keep the bark on the log in order to prevent the premature drying and cracking with the grain, known as checking, prior to sawing and milling into a profiled log or lumber. Handcrafters that work with green logs will also keep the bark on their logs until the time of scribing and notching and fitting in the wall.

As you know or will learn, some log homes are built using undried logs, while many others use logs that have undergone some period of intentional drying. Handcrafters and profiled log builders both use green, air-drying and kiln-drying methods in preparing their logs for construction.

It is important to understand that the terms "air dried" and "kiln dried" refer to a general method of drying logs prior to use in a log structure. They do not indicate a specific level of dryness. It is not possible to know the average moisture content of a log, however it is dried, without measurement using the standardized techniques discussed later.

Companies producing profiled logs generally cut their raw forest logs into timbers, called cants, prior to further processing. Many log-home companies make no claim regarding the moisture content of their logs and design their systems to handle any settling that occurs during and after construction. So long as the construction system is designed for settling, and the effects of drying from relatively high moisture content are known and accounted for during and following construction, the use of undried or relatively wet logs is absolutely satisfactory. Thousands of beautiful log homes have been built from green logs, and many companies have devoted years to perfecting the science and art of their use.

Another segment of the handcrafted and profiled log-home industry utilizes air-drying in the preparation of their logs. Air-drying of logs and timbers is either a byproduct of storage prior to processing or it is systematically used as a means of lowering their moisture content. Many companies will debark logs from the forest or sawn timbers from the sawmill, stack them in a configuration that allows free air flow over their surface, then wait up to two years before using them. As the logs and cants dry, checks normally form along the length of the logs after the outer region of the log dries below the fiber saturation point.

In recent years, some log-home companies, handcrafters as well as profilers, have added extended air-drying and kiln-drying as a step in the log-preparation process. Like the companies that air-dry their logs for a period of time,

the companies that utilize dry kilns to remove water from the wood are attempting to reduce the weight of the logs and limit the amount of settling that will occur following construction.

I reiterate that in building systems designed to utilize dried logs, the method of drying does not guarantee any particular final moisture content. Logs can be stacked and stored during a wet season and see little drying, or logs and cants can be placed in a kiln for what seems to a layman to be an adequate period of time, then be removed and machined at a moisture content above the fiber saturation point. Remember, just because you are told the logs are air-dried or kiln-dried, they may still have a lot of water remaining.

From this discussion I would like you to take away the following information:

• Large logs and timbers take many months or even years to air-dry.

• "Air dried" and "kiln dried" are not terms that specify a particular moisture content but only describe how a portion of the moisture has been removed from the log.

• Settlement of log walls is primarily a product of log shrinkage.

• The amount of shrinkage occurring in a log after placement in the wall is dependent on its species and moisture content at the time of construction.

• The average moisture content of a round log is determined at a depth of 1/6 to 1/7 of the diameter.

• The average moisture content of a rectangular timber or profiled log is determined at a depth of 1/4 the length of its smaller side.

• Green, air-dried and kiln-dried logs can all be successfully used to build a solid, tight log home.

• If the system is designed for green logs, then they work just fine. They are heavy and cost more to ship, but they can be brought into the yard and processed in a shorter, thus cheaper, period of time.

Moisture content of logs need not be a mysterious and contentious issue when deciding on a company and system for your home. Use this information to get answers to questions you have about what type of log is best for your home. **LHI**

Edwin J. Burke, Ph.D., is professor of wood science in the College of Forestry and Conservation at the University of Montana in Missoula.