



# Controlling Moisture Content in Stored Lumber

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## Introduction

For most regions of North America, hardwood lumber destined for manufacture into products such as furniture, cabinets, millwork, and others is carefully kiln dried to 6-8 percent moisture content. Once the lumber is kiln dried, it needs to be stored in the appropriate environment of temperature and relative humidity or it will simply regain moisture. If the lumber is then manufactured into a product used in a typical residence or office, it will again lose moisture, shrink and possibly warp, resulting in an unacceptable appearance.

Most commercial lumber producers and users understand this principle of moisture regain in kiln dried lumber. Where lumber is stored for extended periods, the temperature inside the storage area is elevated above the outside temperature, thereby lowering the relative humidity in the storage area. This is standard industry practice. Many smaller woodworkers do not understand moisture regain and, as a result, may improperly store well-dried lumber.

## Wood Releases and Gains Moisture

Table 1 presents the equilibrium moisture content (EMC) for temperate wood species for any given temperature and relative humidity. EMC is a technical term. With changing temperature and relative humidity, wood is constantly releasing or gaining moisture. This change occurs slowly. At a set temperature and relative humidity, wood will eventually equilibrate to a certain moisture content

or EMC and stay there until environmental conditions change. For example, at 70° F and 35 percent relative humidity, the EMC for wood is 6.9 percent. These are also the conditions that are very comfortable to human beings and typical of conditions in homes and offices.

When summer conditions of 80° F and 80 percent relative humidity develop, the wood EMC increases to 15.7 percent. This does not mean that the lumber will suddenly change to this high moisture content, although with time, it will. Length of time is hard to estimate, but with a few weeks to a month or more, a significant change in moisture content can occur. Another example is a heated house during winter time. Assuming no substantial humidification is occurring, the relative humidity can drop to 20 percent or less and at 70° F, the EMC is 4.5 percent. Again, the change takes time and after a winter of heating, cracks can develop in wood floors, and furniture joints can open.

One board, fully exposed will change moisture content relatively quickly as compared to an entire stack of lumber. Thinner lumber or veneer, reacts faster than thicker stock. Tightly stacked lumber changes moisture content on its periphery first, with the center slower to respond.

Lumber destined for interior application is dried to 6-8 percent moisture content because this moisture content is midway between normal extremes of EMC, and a certain amount of movement one way or the other is acceptable.

## Stored Lumber

Properly kiln dried lumber stored inside of a residence where temperature is controlled, will not significantly gain or loose moisture, thus there is little shrinking or swelling. However, if the lumber is stored in a damp basement, unheated garage or other storage area, it will regain moisture. Fortunately, relatively inexpensive instruments (Figure 1) that measure the temperature and relative humidity are available at building supply stores. These instruments can be used to determine if lumber is being stored under the correct environmental conditions. Be sure to keep a fresh battery as a partially depleted battery can give erroneous readings.

## Equipment for Monitoring Humidity and Temperature

Relative humidity is somewhat difficult to measure. If possible, any new instrument should be checked against a known standard. The author has compared readings from several inexpensive instruments with

laboratory quality equipment. Although readings of relative humidity are not always identical, they are reasonably close.

If the relative humidity is too high in a small lumber storage area, household dehumidification units can be used to lower it. To control costs, it is helpful to store the lumber in an enclosed space so large open areas are not being conditioned. Tightly wrapping veneer and lumber in plastic will also help to maintain the proper moisture content, but even with this method, kiln dried wood will eventually regain moisture.

The moisture content of the lumber at the time of use should also be determined. Many wood workers and even commercial companies try to process lumber as quickly as possible to avoid regain. Unfortunately, this method can be risky and problems such as warping and open joints can develop. Therefore, adequate equipment to monitor temperature and relative humidity should be purchased to determine if the desired conditions are being maintained. If not, corrective action is necessary.



Figure 1. Hand-held temperature and humidity monitoring equipment

**Table 1. Equilibrium wood moisture content (EMC) for a given relative humidity and temperature**

	Relative Humidity															
	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95
°F	-----Wood Moisture Content (percent)-----															
<b>30</b>	4.6	5.5	6.3	7.1	7.9	8.7	9.5	10.4	11.3	12.4	13.5	14.9	16.5	18.5	21.0	24.3
<b>40</b>	4.6	5.5	6.3	7.1	7.9	8.7	9.5	10.4	11.3	12.3	13.5	14.9	16.5	18.5	21.0	24.3
<b>50</b>	4.6	5.5	6.3	7.1	7.9	8.7	9.5	10.3	11.2	12.3	13.4	14.8	16.4	18.4	20.9	24.3
<b>60</b>	4.6	5.4	6.2	7.0	7.8	8.6	9.4	10.2	11.1	12.1	13.3	14.6	16.2	18.2	20.7	24.1
<b>70</b>	4.5	5.4	6.2	6.9	7.7	8.5	9.2	10.1	11.0	12.0	13.1	14.4	16.0	17.9	20.5	23.9
<b>80</b>	4.4	5.3	6.1	6.8	7.6	8.3	9.1	9.9	10.8	11.7	12.9	14.2	15.7	17.7	20.2	23.6
<b>90</b>	4.3	5.1	5.9	6.7	7.4	8.1	8.9	9.7	10.5	11.5	12.6	13.9	15.4	17.3	19.8	23.3
<b>100</b>	4.2	5.0	5.8	6.5	7.2	7.9	8.7	9.5	10.3	11.2	12.3	13.6	15.1	17.0	19.5	22.9
<b>110</b>	4.0	4.9	5.6	6.3	7.0	7.7	8.4	9.2	10.0	11.0	12.0	13.2	14.7	16.6	19.1	22.4
<b>120</b>	3.9	4.7	5.4	6.1	6.8	7.5	8.2	8.9	9.7	10.6	11.7	12.9	14.4	16.2	18.6	22.0
<b>130</b>	3.7	4.5	5.2	5.9	6.6	7.2	7.9	8.7	9.4	10.3	11.3	12.5	14.0	15.8	18.2	21.5
<b>140</b>	3.6	4.3	5.0	5.7	6.3	7.0	7.7	8.4	9.1	10.0	11.0	12.1	13.6	15.3	17.7	21.0
<b>150</b>	3.4	4.1	4.8	5.5	6.1	6.7	7.4	8.1	8.8	9.7	10.6	11.8	13.1	14.9	17.2	20.4
<b>160</b>	3.2	3.9	4.6	5.2	5.8	6.4	7.1	7.8	8.5	9.3	10.3	11.4	12.7	14.4	16.7	19.9

The equilibrium moisture content (EMC) of wood is that moisture content which wood will eventually equalize to given a fixed temperature and relative humidity. If the temperature and relative humidity change the moisture content of the wood will change.

Source: Wood Handbook [www.fpl.fs.fed.us](http://www.fpl.fs.fed.us)

