PCWI
PRECISION INSTRUMENTATION

MOISTURE PROBLEMS IN WOOD

A moisture meter can beat the oven

It is well known that during the kiln drying process, a moisture differential develops in wood, leaving the surface drier than the core. The 'moisture gradient' as it is called, is required to provide the driving force which causes the water to move through the wood. During the unassisted drying out process, the moisture gradient is much less, due to the amount of time it takes to thoroughly dry out.

Oven drying

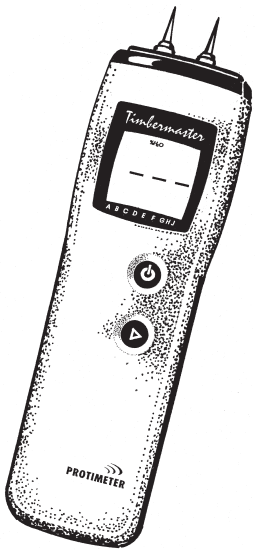
The combination of high temperature and relatively high humidity causes wood to dry rapidly without degrade. "Drying schedules" are detailed recipes for carrying out the process as quickly as possible without damage, having regard to the species of wood and its dimensions. Nevertheless, when sufficient moisture has been removed from the wood the moisture gradient remains. With good kilning, using a mild schedule, this gradient should be quite small and can be almost completely eliminated by "conditioning" the wood at the end of the schedule. Conditioning involves deliberately raising the humidity of the kiln atmosphere to reverse the drying process for a short time. It is an expensive process, though, both in time and fuel and is not always carried out effectively.

Traditional moisture determination in wood that has been kilned on too severe a schedule, and not conditioned or allowed time to achieve equilibrium, is a problem. The kiln operator normally determines the amount of water lost by weighing trial pieces and by oven determinations on sections cut from boards chosen at random. This gives the average moisture content of the piece tested, but reveals nothing about the distribution of the moisture. If there is a severe moisture differential, an oven determination can be misleading.

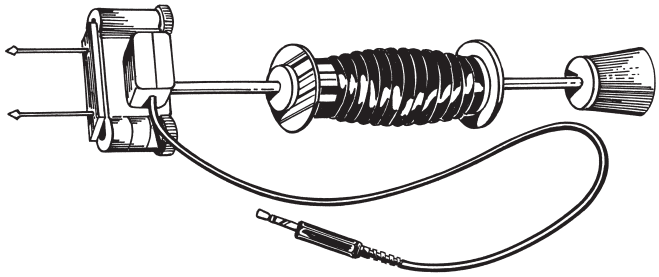
Finished wood that retains a really severe moisture gradient will distort badly if it is sawn but should retain its shape as long as it remains in its original dimensions. During the few weeks after kilning, excess moisture will slowly diffuse into the outer layers and ultimately the moisture content will be even all through. It may then safely be deep sawn. However, some types of wood are notoriously slow to even out or reach equilibrium. Oak and sweet chestnut are two well-known examples that may take months to become reasonably even.

Verifying with a Moisture Meter

A case was reported in which Japanese oak supplied against a specification (requiring a maximum moisture content of 15%) was shown by the supplier's oven test to be within the limit. The purchaser, however, using a **Timbermaster** with a **Hammer Electrode** obtained readings of 20% to 23% at the centre of the 38mm material while surface readings varied down to 12%. Had this material been deep sawn for furniture as the purchaser had intended, severe warping and checking of the damp surface would have occurred.



The moral to be drawn is that an oven moisture test is not the whole story. The wood must be tested at various depths to ensure that moisture is reasonably evenly distributed. This is only possible with a moisture meter such as the **Timbermaster** or **Mini** and with a **Hammer Electrode** with insulated pins that can be driven to a sufficient depth.



This is not an argument against kiln drying. It has long been established that, properly carried out, kiln drying can produce results as good as those of natural seasoning in spite of the much greater speed. The need for verification of moisture content at the centre of wood necessitates some form of electronic measurement.

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TRADA (the Timber Research and Development Association, an independent research organisation) says in its report of 15 July 1980: “in practical terms good **moisture meters** are **better** than oven dry methods. This is because the error in a moisture content average is made up of two parts, namely the error of each reading and the number of tests. With an acceptable moisture-meter-error, the number of tests economically possible with a meter soon cancels out the apparent greater accuracy of oven dry methods.”

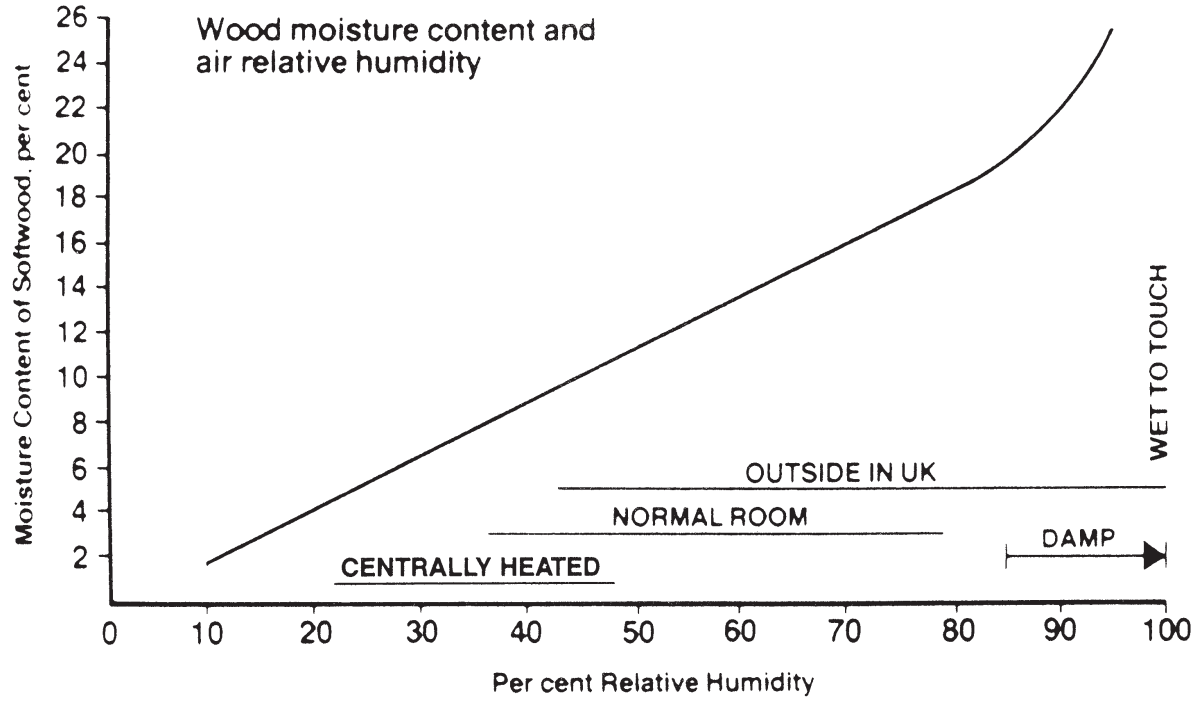
Another extract reads: “...its simplicity and portable nature make the Protimeter Mini an excellent meter for rapid checking of moisture content.. Its accuracy in the range 8% to 18% is usually well within ±2% moisture content laid down in British Standard Specification 1186 Part 1, 1971, for building and joinery timbers; it is normally better than ±1 %...”

Moisture Content of Wood in Use

“To remain stable in use, wood should be dried to within 1 % or 2% of the moisture content it is expected to achieve in service. Problems of shrinkage or distortion are occurring because wood users are still not always aware of the importance of moisture content and do not always ensure that the wood is correctly dried to the required moisture content” (source: BRE News of Timber Research, November 1986)

What is the ‘required moisture content’?

Wood will come to moisture equilibrium with the relative humidity of the atmosphere in which it is being kept. The graph shows the approximate relationship between the relative humidity of air and the moisture content of wood. This applies to typical softwoods used in buildings; the curve for some of the heavier hardwoods would be different. The horizontal lines show the typical range of humidities met in various circumstances. Wood kept in these environments will gradually come into equilibrium at the moisture content levels indicated on the vertical scale. This shows that in ‘normal’ rooms in which the relative humidity is in the ‘comfort zone’ of between 40% and 70% RH, the moisture content of the wood should be between 8% and 16% The consequences of drying wood to below 40% equilibrium relative humidity (erh) are shrinkage, distortion and splitting; above 70%erh, the wood expands and disheartening problems with glues and finishes are encountered; and eventually decay will result.



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