PAMPHLET 04

WOOD MOISTURE CONTENT AND DRYING LEVELS

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1. DEFINITION OF WOOD MOISTURE CONTENT

The moisture content[1] (MC%) of a piece of wood is the ratio between the mass of water it contains and its oven-dry mass, multiplied by 100 to obtain a percentage[2]:

$$MC\% = \frac{\text{mass of water}}{\text{oven-dry mass}} \times 100$$

The oven-dry mass is obtained by drying the piece of wood at 103 ± 2°C until *the difference in mass between two successive weighings separated by an interval of 2 hours is less than 0.1%* (specified in standard EN 13183-1).
The mass of water contained in a piece of wood is the difference between its wet mass (with the moisture content MC%) and its oven-dry mass:

$$MC\% = \frac{\text{wet mass} - \text{oven-dry mass}}{\text{oven-dry mass}} \times 100$$

* Given this formulation, MC% may exceed 100% for certain light woods such as Ayous, Framiré, Fromager, Limba, Okoumé, etc.
* The sapwood generally has a higher moisture content than the heartwood.
* When the wood is green, the moisture content of light species is usually higher than that of heavy species.

2. METHODS OF DETERMINING MOISTURE CONTENT

To determine the moisture content of a piece of wood, the most reliable method, and the only one recognised in the event of a dispute, is the method defined in standard EN 13183-1, known as the double weighing method:

a. Weigh the initial wet wood sample whose moisture content is to be determined.
b. Dry the sample in a drying oven (at 103 ± 2°C).
c. Weigh the oven-dry sample.
d. Determine the moisture content MC% using the above formula.

Two types of equipment can be used to measure the moisture content of wood, after calibration according to the variety of wood:

- pin-type moisture meters, which measure the resistivity of the wood, which in turn depends on its moisture content; this method is described as slightly destructive because it requires two pins to be inserted into the wood during measurement. This type of device is the most frequently used.
- pinless (or contact) moisture meters, which measure the capacitive effect of the wood, which also depends on the moisture content; this non-destructive method is reserved for very thin pieces of wood (veneers).

These two types of equipment are only reliable where the moisture content is between 8% and 25%.

1. The terms moisture, ***moisture level, dryness*** and ***dryness level*** are sometimes used to refer to this value, but the conventional term ***moisture content*** is preferred.
2. Standard EN 13183-1 *Moisture content of a piece of sawn timber - Part 1: Determination by oven dry method* (June 2002)

3. EQUILIBRIUM MOISTURE CONTENT OF WOOD

Wood is a hygroscopic material: it constantly loses or absorbs water (in vapour form).
The equilibrium moisture content of wood (EMC) is the moisture content towards which wood tends under given climatic conditions that do not vary.

EMC is a function of two characteristics of the air: temperature (T °C) and relative humidity (Rh %).
The EMC curves or Keylwerth diagram[3] (at the end of this document) can be used to determine the equilibrium moisture content of wood.

4. DRYING LEVEL DESIGNATIONS

Preamble: the fibre saturation point (FSP%) is the "threshold" moisture content below which variations in wood moisture content are accompanied by variations in dimensions, and therefore risks of splitting and deformation.[4]

Green wood or freshly felled or sawn timber	MC% > FSP%
Fibre saturation point (FSP%)	Usually varies between 20% and 40% depending on the species, with an average of around 30%
Semi-seasoned timber	22% < MC% < PSF%
Commercially dry timber	17% < MC% < 22%
Air-dried timber	13% < MC% < 17%
Well-seasoned timber	9% < MC% < 13%
Dried-out timber	4% < MC% < 9%
Oven-dried timber	MC% ≈ 0 %

The acronyms AD (for *Air-Dried*), KD (for *Kiln-Dried*) and "shipping dry"" are frequently used in the international tropical timber trade, but can lead to confusion.
The acronym KD stands for "kiln-dried" and must be accompanied by the moisture content of the corresponding wood, considered to be between 9% and 20%.
No moisture content is indicated for *Non-Kiln-Dried* (NKD) wood.

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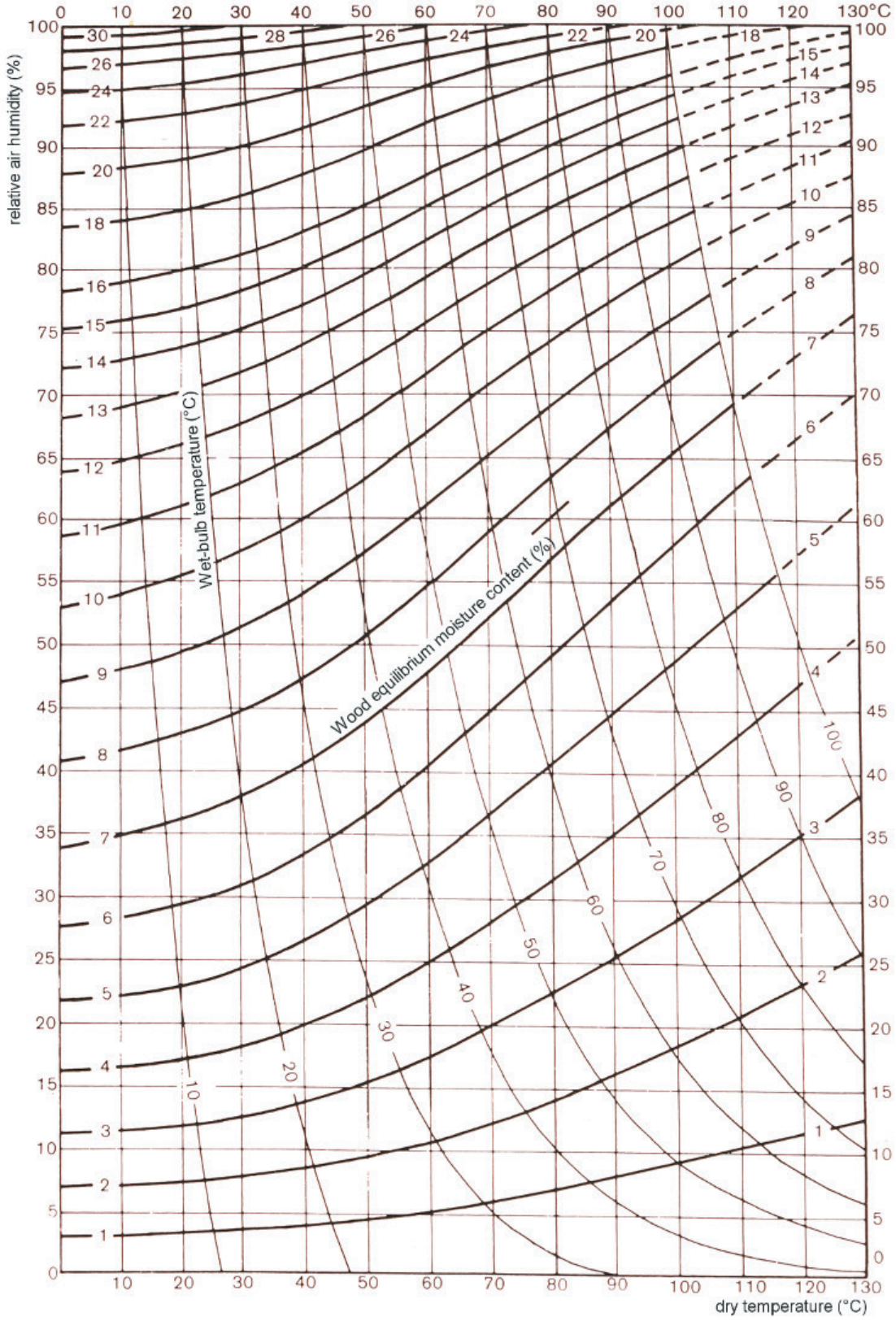
3. These curves were established for temperate softwoods. For tropical woods, the equilibrium moisture content differs slightly from these curves.
4. Wood contains two types of water: free water and bound water. Free water is contained in the cellular and intercellular spaces and is evacuated without the wood shrinking. When the free water has completely disappeared, the wood contains only water chemically bound to the cell walls. The fibre saturation point corresponds to the moisture content of wood saturated with bound water. Below this point, the wood begins to contract as it dries. Elimination of this bound water during drying leads to shrinkage, which causes the wood to split and deform. The PSF usually varies between 20% and 40% depending on the species, but is generally around 30%.

Equilibrium moisture content curves for wood or Keylwerth diagram



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