

A FEW CLARIFICATIONS ARE IN ORDER!

TIMBER HUMIDITY

HUMIDITY CONTENT OF TIMBER

The humidity of timber is defined by the EN 13183 standard as the ratio of the mass of water contained in the timber to the mass of dry timber:

$$H \% = \text{Mass of water} / \text{Mass of dry timber}$$

Note: The humidity content of timber in standing trees varies between 60% and 200% depending on the species. There are two types of water present in timber: free water and bound water.

Free water is contained in the cells (the cell is similar to a tube, its interior space is called the cell void). It is easy to extract from the timber; in this case we speak of draining and drying.

Bound water is inside the cell walls and can only be extracted in the form of steam; this is referred to as drying.

Let's compare the behaviour of timber to that of a sponge. When the latter has just been immersed in water, it is soaked and swells, and a simple squeeze is enough to extract the «free» water from it. This operation does not make the sponge «dry», though, as it must be exposed to as dry an environment as possible in order to evacuate the «bound» water, and the sponge will often firm up while deforming itself. However, no matter the environment, a balance is reached between the water in the atmosphere and the water contained in the material (see the hygroscopic equilibrium nomogram).

Using the above humidity definition, we refer to the fibre saturation point as FSP, the timber humidity level at which the amount of bound water in the timber is at maximum without the presence of free water. This

value is particularly important for shrinkage calculations, as below this value, humidity variations are accompanied by size variations. This phenomenon is also similar to the behaviour of a sponge. FSP = Saturated bound water mass / Mass of dry timber.

For temperate timbers (softwoods, oaks, sweet chestnut trees, ...), the FSP reaches a 30% humidity level and is considered to be equal to this value in most documents. In contrast, the FSP of tropical timber varies between 15% and 45% depending on the species.

The technical data sheets of each species provide information on the timber's FSP. The data are averages and it is therefore possible to find variations (+ or -) in terms of the average value that is given.

METHOD OF DETERMINING THE HUMIDITY LEVEL

The most reliable way to determine the humidity level in timber is by measuring differences in mass. A sample of timber of any shape (rather small in size, particularly in the longitudinal direction of the fibres, so as to reduce the drying time) is weighed and its wet mass is noted as M_h . This sample is then dried completely in a ventilated oven at 103°C ($\pm 2^{\circ}\text{C}$ to be above the boiling temperature of water but without degrading the timber). The sample is weighed regularly until it stabilises at its anhydrous weight; its anhydrous mass is noted as M_0 . The mass of water is deduced as the difference between the mass of the humid timber and that of the dry timber. Thus, the humidity content level is determined by:

$$H\% = (M_h - M_0) / M_0$$

Some devices allow you to measure the humidity content of timber without destruction, provided that they are correctly calibrated for the type of timber being examined.

There are two types of instruments, some of which some operate by measuring the resistivity and others by measuring the capacitive effect.

As timber is an insulating material par excellence (thermal, acoustic, electrical, etc.), water is quantified in proportion in the timber according to the behaviour of an electromagnetic field.

HYGROSCOPIC EQUILIBRIUM

Depending on the environment in which the timber is, its stabilising humidity content is defined by the air's temperature and relative humidity (the amount of water vapour in the air). This timber humidity is said to be in hygroscopic balance with its surroundings. These equilibrium humidity values are listed in a hygroscopic equilibrium nomogram. They have been calibrated for temperate timber whose fibre saturation point is 30% (equilibrium at 0°C and 100% air humidity).

For tropical timber, where the FSP is much more variable, the equilibrium humidity level isn't always exactly as shown on the nomogram.

For example, for timber with an FSP of 30% in an environment with a 20°C temperature and a relative air humidity level of 65%, its hygroscopic equilibrium humidity level is close to 12%.

The time required for the timber to reach the equilibrium humidity level varies according to the type of timber, its cross-section, and the humidity variations it is subjected to. It can be accelerated at higher temperatures (the artificial drying principle). In reality, an equilibrium humidity level is never reached, as humidity stabilises at about 1% above the equilibrium humidity level during drying and about 1% below the equilibrium humidity level during humidification.

TRADE NAMES

Humidity rate H	Denomination of timber at rate H	Form of water in the timber
> PSF	Green or fresh timber	Free water, impregnation water, combined water
PSF	Saturated timber	Saturation point: (without free water) impregnation water is at its maximum, combined water
22 à PSF %	Dried or semi-dry timber	Impregnation water and combined water
17 à 22 %	Commercially dry timber	
13 à 17 %	Air-dried timber	
< 13 %	Dried out timber	
0 %	Anhydrous timber	Combined water

The trade names AD (Air Dried), KD (Kiln Dried) and «shipping dry» are frequently misused.

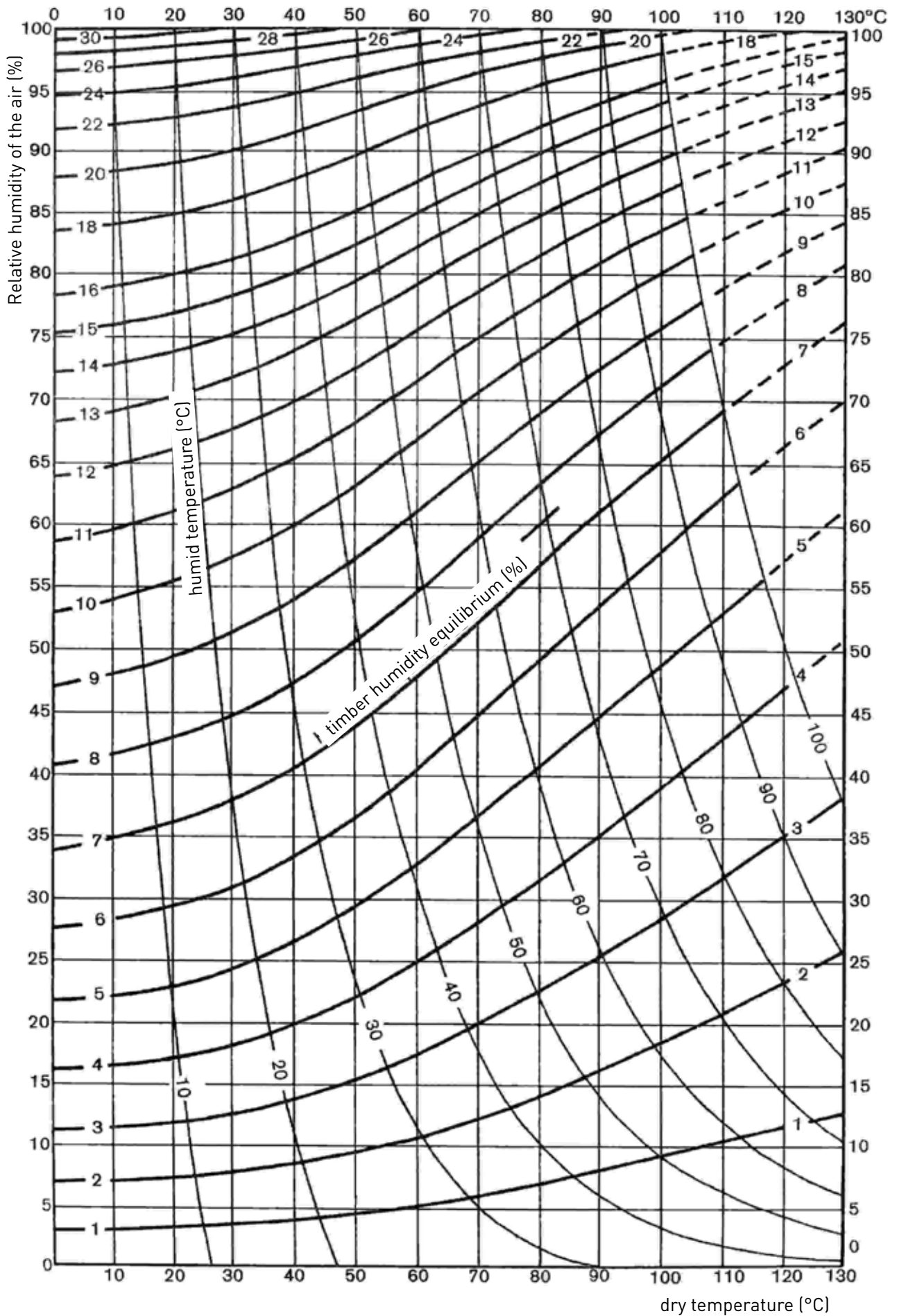
KD means «kiln dried». The humidity rate that is achieved must always be specified. It is usually set between 9% and 22%.

AD means «air-dried». According to the previous definitions, the humidity rate is between 13% and 17% here. The various European standards set the threshold at 20%. Please note: some producers and suppliers understand this term to mean «air-drying

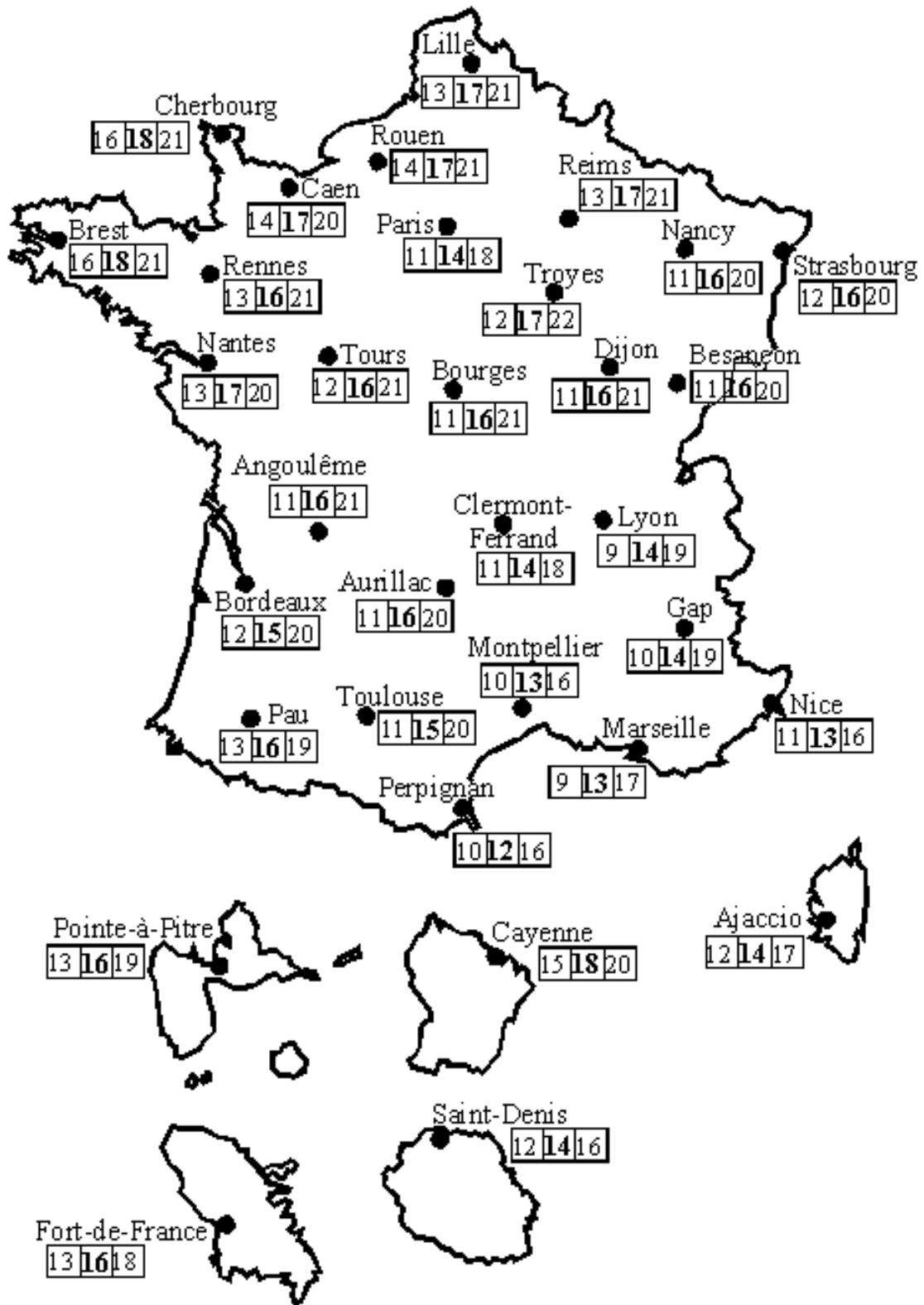
in progress», i.e. not necessarily dried. This misnomer can have serious repercussions; it is therefore necessary to be vigilant regarding the use of the term AD.

Shipping dry means «dry on board ». According to INCOTERMS, sawn timber must be dry enough to withstand transport without damage. It is scientifically recognised that the timber humidity rate above which fungi can degrade the timber is 22%. Shipping dry indicates a timber humidity rate that is below 22%.

HYGROSCOPIC EQUILIBRIUM NOMOGRAM FOR TIMBER (30% FSP)



HYGROSCOPIC EQUILIBRIUM NOMOGRAM FOR TIMBER (30% FSP)



Key: equilibrium humidity in timber in %

A	B	C
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- A : minimum (average over 3 consecutive months)
- B : average (annual average)
- C : maximum (average over 3 consecutive months)



Fair&Precious recommends the purchase of FSC® and PEFC-PAFC certified tropical timber.