atibt
FOR THE SUSTAINABLE MANAGEMENT OF TROPICAL FORESTS

FAIR & PRECIOUS BY atibt ÉDITIONS

9

A FEW CLARIFICATIONS ARE IN ORDER!

DRYING

A standing tree can contain a very large amount of water necessary for its life and its development. In most cases, and in order for the timber to be used, most of this water must be removed to prevent excessive deformations and shrinkage, to reduce the risk of degradation by biological agents, to improve physical and mechanical properties, and to facilitate machining or gluing, as well as the application of finishes.
The timber's humidity content tends to naturally balance out in the environment in which it is found. The drying speed depends mainly on the timber's initial humidity content, the final equilibrium humidity content, the cross-section of the timber to be dried, the timber's variety, the exposure to weather, the renewal of air, etc.
Drying the timber to a humidity as close as possible to the equilibrium humidity that it will reach in the final structure is one of the basic rules that should be kept in mind to avoid a large number of incidents.

NATURAL DRYING

Air circulation generated by wind and local convection, as well as heat from solar energy, favour the evaporation of humidity contained in timber. In order to facilitate air circulation between planks, they should be spaced apart by means of spacer strips referred to as wooden spacers. In practice, the boards are stacked in several rows (or beds) and spaced apart by the height of the wooden spacers placed perpendicular to the length of the boards. This arrangement is also the most common way of packing packages (or stacks), taking into consideration both ease of handling and transport in addition to ventilation.
The size of the stacks must remain below 1.8 metres, otherwise the air circulation speed is insufficient. The height of the stacks is only limited by their stability. If the boards to be stacked are of different lengths, the longest ones should be placed in the first row and in descending order. Also, where lengths permit, it is possible to arrange several planks in one length by adding short wooden spacers to support the ends of the planks.

The most appropriate thickness of the wooden spacers for hardwoods is 19 mm and 27 mm for softwoods. In order to limit the risk of board deformation during the drying process, a maximum spacing of the wooden spacers between each row is defined according to the thickness of the boards and the timber's density or stiffness. For a stack to receive a new row of boards, the wooden spacers must be placed exactly on top of those supporting the previous row. The ends of the boards must be supported without overhang to avoid bending deformations during drying and to limit the speed of drying of these parts, which can lead to the appearance of cracks.

To further reduce splitting in timber ends, an anti-splitting paint can be applied to the ends of the boards (which may contain an emulsion wax). Or, brackets can be nailed into the ends of the boards, or metal strips, or S-shaped pieces of metal or plastic.

The boards should be arranged in each row with a gap between the edges of at least 1 cm.

Maximum spacing of wooden spacers:

Thickness of the boards	Greater than 50 mm	50 mm to 25 mm	Less than 25 mm
Soft timber	1 000 mm	600 mm	300 mm
Hard timber or with a tendency to deform	600 mm	400 mm	300 mm

The wooden spacers must be dried and possibly treated if they are not naturally durable.

One of the most important drying parameters to manage is the exposure of the stacks to bad weather. Frequent exposure to rain will not allow the timber to dry and may even favour the development of fungi. On the other hand, exposure of the timber to intense sun heat can cause deformations or cracks. Shelter under an open shed or with basic corrugated iron sheeting on the outside is therefore recommended to help the timber dry.

Piles of timber should be built on a stable and possibly drained foundation. The lower rows of the stack should be set well apart from the ground, as air circulation is greatly reduced at ground level and humidity is higher there. This distance should be at least 400 mm with a system that allows air to pass through. The pile can be supported by a structure consisting of lumber planks and/or joists. Regular inspections should be conducted to prevent vegetation from invading the piles, blocking air circulation and allowing insects (especially termites).

KILN DRYING

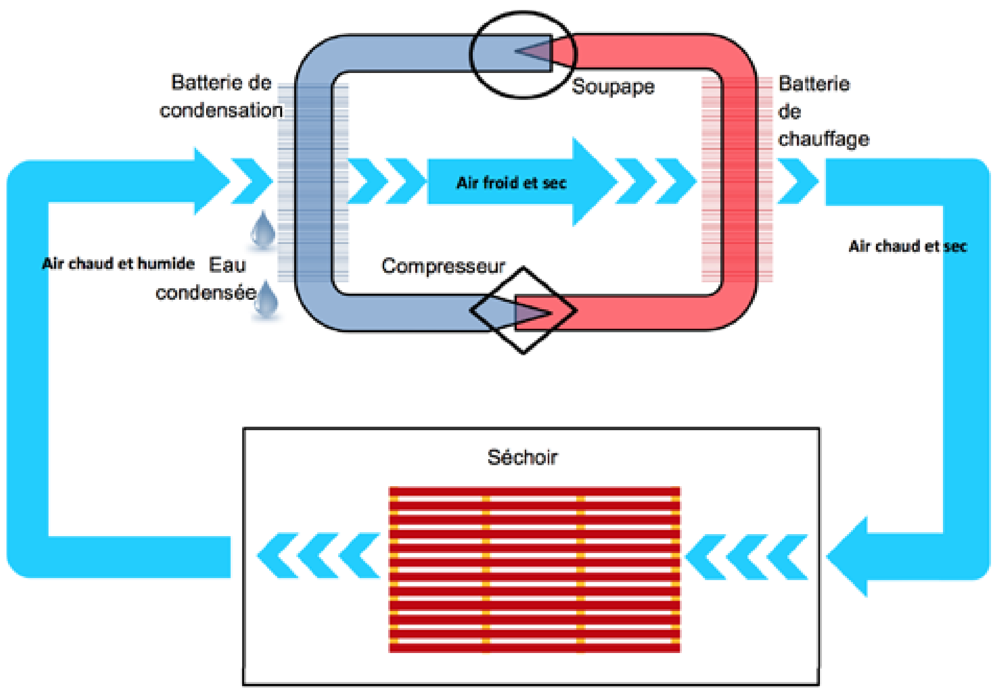
The most frequently encountered artificial drying method is placing piles of timber in an enclosure, called an kiln, where humidity, ventilation and heating are controlled in order to optimise the drying speed. The kilns are differentiated by the type of forced ventilation: longitudinal, top or lateral; and by the heating: steam, hot water, hot oil, hot air or electricity.

The pile is built up using 22 mm thick wooden spacers.

Maximum spacing of wooden spacers:

Thickness of the boards	Greater than 50 mm	50 mm to 25 mm	Less than 25 mm
Hard and soft timber	600 mm	300 mm	200 mm
Timber with a tendency to deform	300 mm	200 mm	200 mm

The optimal air speed for drying most varieties of timber is 3 metres per second. Steering the dryer requires the installation of probes on some of the boards in the stacks to measure the timber's humidity and temperature. Depending on the measurements, the humidity and air temperature are modified in order to keep extracting water from the timber. The humidity gradient, the difference between the timber's humidity and the humidity it should reach in the environment, is defined in a drying chart that is specific for each variety and thickness of timber to be dried.
The water extracted from the timber is found in the ventilation air and must then be extracted from the air. In order to limit the loss of energy in this stage, dehumidification of the air is carried out by condensation in a closed circuit and then by heating.



VACUUM DRYING

As the pressure decreases, the water evaporation temperature also decreases. This principle is used in vacuum dryers by means of a steel container similar to an impregnation tank to generate sub-atmospheric pressure[1]. As for the heat, it isn't introduced into the air, but is usually generated via hollow aluminium plates through which hot water flows. These plates replace the wooden spacers in the stacks. The water contained in the timber evaporates and when the produced water vapour steam comes into contact with the cold wall of the tank, it condenses before being extracted from the tank in a liquid state.

The benefit of this type of dryer compared to a traditional dryer is that it enables small quantities of timber to be dried very quickly. However, there are a few drawbacks: it requires more handling, it consumes more energy and the drying is more heterogeneous.

DRYING ANOMALIES

In addition to deformations of sections (bending, rhombus, etc.) and the deformations along the length of the boards (curvatures, warping, etc.) that occur during drying, the timber may release some of the internal stresses that the tree has accumulated during its growth in order to maintain its balance. This phenomenon is usually accompanied by a loss of material that cannot be predicted prior to the drying process.

End splitting occurs quite easily if the ends of the timber dry too quickly due to a large reduction in cross-section in this area. Timber boards enclosing the core are bound to split due to differences in radial and tangential shrinkage.

Although these imperfections are unavoidable even during careful drying, the following flaws are the result of over-drying:

Surface cracks are caused by a very dry surface (a shrunken layer of wood) of the timber), while the centre of the piece remains humid (and swollen).
Cementation remains the most severe drying flaw because it is imperceptible in appearance. On the surface of timber pieces, the timber becomes impermeable, blocking further drying. This phenomenon is irreversible and causes highly significant deformations during the processing of timber.

Collapses literally mean just that. During the drying process, as free water leaves the timber, surface tension forces are exerted on the cell walls, tending to crush them. When a vapour pocket is formed inside the timber, it exerts sufficient pressure to crush the neighbouring cells and release the vapour they contain, causing a chain reaction. As the timber cools, the vapour turns to water and creates depressions that are large enough to cause the timber to curl up, deforming it and leaving apparent pockets.

Lastly, darker chemical stains may appear during the drying process. The chemical reaction is a form of oxidation. During natural drying, this colouration is superficial, but during forced drying the change in colour can affect the timber in depth. This phenomenon occurs all the more easily on green timbers. To limit the occurrence of this flaw, partial air-drying to the point of fibre saturation is recommended to prevent staining of the timber.

1. Below atmospheric pressure