

Significance of wood seasoning

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The process of inducing evaporation of the moisture contained in wood; a type of hydrothermal treatment of wood is known as wood seasoning.

The purpose of seasoning is to reduce the moisture content in the wood to a level appropriate to the use of the articles made from the wood. This prevents changes in the dimensions and shape of the articles, eliminates wood rot, increases the strength of the wood, reduces the weight of the articles, strengthens glued joints, and improves the quality of finishing. Wood is seasoned in various forms: lumber, peeled or planed veneers, crushed wood particles, and semi-finished articles.

The simplest method of seasoning lumber is open-air seasoning, in which the lumber is stacked in the open air or under canopies for a period of two or three weeks to several months. The principal industrial method, kiln drying, uses kilns fed with hot air, a mixture of air and fuel gases, or superheated steam. Kilns with steam are the most commonly used type. Continuously operating kilns are used primarily for large-scale seasoning of

lumber prior to shipping; moisture content is reduced to 18–22 percent. Batch kilns are used to season wood to a moisture content of 7–10 percent.

The reduction of moisture content causes irregular drying of the wood, and internal stresses arise that may cause cracks to form. In order to prevent this, the relative humidity of the drying agent is lowered and the temperature is raised in the course of the seasoning process. Conditions for kiln drying lumber are standardized in the USSR. Depending on the desired intensity of the process and the later use of the wood, the following regimes are used: mild (temperature at the start of seasoning is 40°–50°C), normal (60°–80°C), accelerated (80°–100°C), and high-temperature (over 100°C). The length of the process varies from 15–25 days (mild regimes for hard woods) to 20–30 hr (high-temperature regimes for soft woods). If the wood is to be precision machined, it is steam-treated after seasoning to remove internal stresses. Seasoning in a high-frequency electric field is also used.

Continuously operating roller driers are ordinarily used for peeled and planed veneer. The sheets of veneer are surrounded by hot air (110°–130°C) or fuel gas (150°–250°C) and are moved through the drier on roller conveyors. The process lasts two to 12 minutes. Presses in which the plates are periodically opened and closed may also be used to season veneer. The temperature of the plates is 130°–170°C, and the process lasts up to

two minutes. A promising method for the future is the processing of peeled veneer in a continuous ribbon, rather than in sheets, in driers with forced ventilation through nozzles and metal belt or roller-chain conveyors.



Crushed wood particles for chipboard are seasoned primarily in gas drum driers at temperatures up to 500°C. Pneumatic units in which the particles are seasoned while suspended in a gas stream are also used. For packing chips and small semi finished articles, such as matchsticks, belt driers are used in which heated air is circulated around a layer of material on a mesh belt. Wood in all living trees contains water. The amount of water thus contained varies with the kind of wood, the conditions under which it grew, and the season. It frequently happens that in the sapwood, and sometimes in the heartwood, the weight of the water is more than the weight of the wood substance itself. Thus, the gums when dried may weigh less than half their weight at the time of cutting. In general, as soon as timber is cut it begins

to lose the water it contains. This loss of water is called "seasoning." In addition to the loss of water, other changes occur, such as a fixation or transformation of organic and inorganic materials stored in the wood, and an apparent "oxidation" of the wood substance.

The purposes of seasoning are:

- To prevent injury by insects and decay before the timber is placed in service.
- To increase the durability of timber in service.
- To prevent shrinking and checking of the wood in service.
- To increase the strength of the wood.
- To decrease the weight of the wood and hence reduce shipping charges.
- To prepare the wood for its injection with preservatives and for other industrial uses.

It is well known that if wood can be kept dry it will not decay. House furniture, for example, under ordinary conditions of use will, as far as decay is concerned, last indefinitely. It is solely because of their protection from moisture that the wooden coffins used by the Egyptians have been preserved to us. Water in wood is an absolute requirement for decay. Wood, which can be kept dry, will never decay. Just how much water in wood is necessary in order to meet the requirements of wood-destroying fungi is not known, but from a few tests, which the author has made it, appears that it is in general more than 20 percent.

It has almost unanimously been held that seasoned wood placed in conditions of service where it is subject to decay will last longer than unseasoned wood. While this is sometimes true, nevertheless the importance, which has been attached to air

seasoning as a means in it of prolonging the life of wood, has probably been exaggerated. Authentic records on posts, poles, ties, and mine timbers kept by the Forest Service indicate that there is little or no difference in their durability whether they were placed green or air seasoned.

If green timber is used for construction purposes, it will almost invariably lose water and hence check, shrink, and warp more or less severely. In order to avoid such defects, it is policy to use seasoned wood in place of green in all classes of construction where they prove objectionable. Furthermore, wood, which has been seasoned prior to injection with preservative, is far less liable to check on the surface and thus expose the untreated wood.

The decrease in weight due to seasoning is so large as to warrant holding the timber until seasoned before shipment is made. This fact is now so well recognized that it has become common practice, but because of unfavorable conditions surrounding the seasoning of wood at the place where it is cut, the shipment of green material is sometimes imperative. A single carload of 30-foot chestnut poles if shipped seasoned rather than green would save at least 150 pounds of freight per pole, or, counting 50 poles per car, a total of 7500 pounds. What is true for poles is true even to a greater extent for smaller products because they season more thoroughly.

It is in the preparation of wood for injection with preservatives that seasoning plays a very important part, as it is quite essential to remove some or most of the water from the wood before the preservative can be injected.

Water may be considered as existing in wood in two forms: (1) as "free water" in the cell cavities and (2) as "confined

water" in the cell walls. When wood begins to season, it is the free water, which is first, lost. Wood can lose all of this free water without its strength being affected. Just as soon, however, as water starts to leave the cell walls the strength of wood begins to increase very rapidly, and checking, warping, and splitting are liable to occur. Tiemann the "fiber-saturation point" has called the point where this occurs. It varies in the different species but in general ranges from 25 to 30 per cent moisture. When the free water has left the wood, the wood of course contains a larger air space or volume, which can later be occupied by a preservative like creosote. This may be illustrated as follows: Assume the oven-dry weight of shortleaf pine is 32 pounds per cubic foot, that solid wood substance weighs 97 pounds per cubic foot, that green shortleaf pine contains 21 pounds of water per cubic foot; then about two-thirds of a cubic foot of green pine would be wood substance and water, leaving about one third of the volume air space. If, now, all the free water were removed, almost two-thirds of the cubic foot of wood would be air space capable of occupancy by the preservative.



Aside from the loss of water, which takes place in seasoning, other changes occur. The bordered pits become more or less ruptured, or changed in position, so that passage of liquids through them is facilitated or retarded. Furthermore, the wood cells frequently check as well as the

surface of the wood. Because of these changes, which occur in seasoning wood, practically all processes now call for some kind of a seasoning treatment before the preservative is injected. The chief exception occurs in the Boucherizing process, which is at present of no commercial importance in the United States. Five methods of seasoning wood are now practiced: Open-air seasoning, seasoning in hot air, seasoning in saturated and superheated steam, and seasoning in oil.

Open-air seasoning, as the term implies, consists simply in piling the timber out of doors where it is exposed to the atmosphere. When its moisture content reaches equilibrium with the atmospheric moisture, the wood is said to be "air seasoned." It can thus be seen that the amount of water in air-seasoned wood varies considerably. Thin pieces of wood 2 inches or less in thickness in our northern climates, when air seasoned, contain about 10 to 15 percent of water. Thicker pieces like poles, ties, etc., are, under the same conditions, "air seasoned" when they contain 25 to 35 percent of water. Some Douglas fir bridge stringers 8 inches X 16 inches in cross section contained over 25 percent of moisture after being exposed to the atmosphere for 2 years.

The open-air seasoning of wood is the method most commonly practiced in the United States to prepare it for injection with preservatives. It is cheap, safe to operate, and very efficient. The chief objections to it are the long length of time the wood must be held before it seasons, thus tying up capital in wood and yardage, and dangers from fire, insects, and decay while stored during the seasoning period. In some parts of our country where the climate is warm and damp it is impossible

to air-season certain woods without having them attacked by incipient decay. Other objections to air seasoning are an inability to fill "rush orders" and injury from checking, although this latter objection can be largely overcome by proper methods of piling.

Most efficiently season wood in the open air, it is necessary to subject it to a free circulation of air. Stagnant air is very prone to foster decay. The seasoning yards should, therefore, be in situations exposed to the sun and wind. All of the timber should be raised off the ground and should be piled as openly as possible without producing too rapid drying, which might result in serious checking or splitting. Another precaution is to keep the yard free from water, vegetation, and decaying wood.

The rate at which wood seasons depends upon many factors, chief of which is the time of the year. Spring and summer are in general the two periods when most rapid seasoning occurs. When wood has once air seasoned, any water, which it might absorb from rains, for example, is quickly lost. Air-seasoned poles tested by the author absorbed 15 pounds of water during a thunderstorm but lost all of it within 24 hours after the rain stopped. It is by no means necessary to season wood until it has lost all its free water before it is in satisfactory condition for treatment. Large products such as ties and poles may have, when "air-seasoned," an average of 30 percent of water, but the distribution of this water may vary from 5 to 10 percent in the outer layers of wood as a minimum to 40 or 50 percent in the inner layers as a maximum. If a tie or pole is of such a nature (as is customary) that interior cannot be treated even if it is dry, little or no advantage is gained in attempting to

hold it until this condition of uniform dryness is reached. The object, therefore, in open-air seasoning should be to cut the period of drying as short as possible without decreasing the penetration of the preservative. No fixed time can be given for this, as it depends on too many variables, which must be worked out for the conditions at each plant.

Hot-air Seasoning By "hot-air seasoning" is meant kiln drying the wood. This method is now only practiced in the United States on certain kinds of lumber and small manufactured products. It is rarely if ever used for large products such as piles, poles, and ties. In Europe, however, the method is sometimes employed, especially as a final drying for timber already partly seasoned in the open air. It is felt that the method will not become common practice in our country because equally as good if not better results can be secured in shorter time and at less expense by other means. The method employed in hot air or kiln drying consists in placing the wood in a retort or kiln, where the air is usually heated by means of steam coils. Circulation of the air is provided for in various ways, either by blowers, or by cooling the air on the sides of the kiln, or by drawing in air through vents in the bottom of the kiln and permitting the hot air to escape through vents in the top. Such treatment results in removing the water from the wood in much shorter time than open-air seasoning and in addition warms the wood for the entrance of the preservative. Wood so heated is, however, liable to check and warp seriously or case-harden, thus becoming weak and brash. For the treatment of small products of comparatively high value, this method gives very satisfactory results, but for

dimension stock or products, it has little to commend it.

Next to open-air seasoning, seasoning in saturated steam is in most extensive use in the United States as a means of drying wood for the injection of preservatives. When properly done this method give quick and satisfactory results. Its chief advantages are the ease, quickness, and comparative cheapness with which the water can be drawn from the wood, the warming of the wood prior to its impregnation, and the sterilizing of the wood. When this method is practiced, a large storage capacity for wood and a large stock on hand are not necessary. Furthermore, "rush orders" can be taken care of and dangers peculiar to open-air seasoning are avoided. If steamed at too high temperatures or for too long a period, considerable injury may result to the strength of the wood. Steaming wood, in itself, does not remove water from the wood. On the other hand, it may add water, as shown in Table 34. In practice, to remove the water a vacuum is drawn. This lowers the boiling point of water and materially hastens the rate at which it leaves the wood.

Structural timbers, when seasoned for the injection of preservatives by the use of saturated steam, are loaded on cylinder cars or "buggies" and run into the treating cylinder, which is then closed and live steam admitted. The pressures used are about 20 to 40 pounds per square inch. The wood is kept in the steam bath for various periods, depending upon the judgment of the operator. It ranges from about 2 to 3 hours for ties to 10 hours or even more for piling. Tests made at the U. S. Forest Products Laboratory indicate that 5 to 8 hours are required to heat ties to the center by this method. After the steam bath, a

vacuum of 24 to 26 inches is drawn in the cylinder by means of a pump, and at the end of this period, the wood is ready for injection with the preservative. The length of time the vacuum is held varies greatly, but is usually from 1/2 to 2 hours. Nothing is gained by holding it after the wood has once reached a temperature below which no further heat units leave the wood.

Artificial seasoning is the process by which lumber is dried using fabricated devices such as a kiln. Regular wood seasoning is done by air-drying in conditions below 18 percent moisture. Multiple advantages to having wood artificially seasoned relate to the quality, strength and cost of the wood.

When you are using a natural drying process, you are at the mercy of the weather to give you ideal wood-drying conditions. This could take a lot more time and delay the sale or productive use of your wood. By using artificial seasoning with a kiln, you reduce the time necessary to dry your wood. This means that you can move it out quickly. The time factor is especially important for large lumber companies.

Saving time saves money by allowing you to sell your wood faster and to prepare room in your storehouse for more wood. In addition, shipping costs are often directly related to the weight of shipments. If you have dried the wood and reduced the moisture content, your wood will actually cost less to ship.

With the natural drying method, you cannot control the exact level of heat that you wish to use on your wood. Using artificial seasoning, you can adjust the temperature, as you need to. This will allow you to prevent drying degrade, which can sometimes occur when temperatures are too high.

Wood that has been artificially seasoned gains several qualities when it loses its moisture. Wood tends to increase in strength as it is seasoned. It is also easier to work with as it has less of a tendency to split, shake or warp. This means that the wood will be safer when it is used in machines. In addition, when wood has high moisture, it is problematic to paint or varnish, but when it is seasoned, the paint job can be much easier.

Many different elements can damage wood, including potential rotting, parasites, fungi and insects. Artificial seasoning will dry up the sap that creates an environment for fungi and parasites to live in. In addition, the high temperatures used in artificial seasoning will kill most if not all of the living organisms that are in the wood. Lastly, lower moisture content will prevent the chance for dry rot or any other type of fungal infection in the wood.

References

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