



# WESTERN PINE ASSOCIATION

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## AIR DRYING AND KILN DRYING - SOME COMPARISONS AND CONTRASTS

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All writers on the subject of seasoning of lumber treat Air Drying and Kiln Drying as completely different entities. To a degree there is justification for the divorcement of the two methods, but in some respects it is a wholly meaningless distinction, the difference between tweedledum and tweedledee. With your forbearance, I should like to point up both the differences and the similarities.

We meet some interesting mental attitudes toward air drying of lumber. It has been practiced since time immemorial whether the producer or user willed it or not. Even when the producer sold his product green and the user applied it green, sooner or later it seasoned in conformity with surrounding use conditions. Short of complete immersion in water, some loss of moisture below the fiber-saturation-point followed inevitably. When it penetrated the skulls of our forbears that lumber would season regardless, due to some mysterious law of God's, some one of the brighter boys among them decided he might improve his made-of-wood article if he let the wood season before he fashioned it into its final form. Presently, he discovered that it would dry more rapidly and uniformly if put on sticks instead of in solid piles, and in some such manner air seasoning was discovered, time and place lost in the mists of the past! Physical laws being unknown, seasoning was an occult act of God, and as such, not a proper field for man's study. That this was a prevailing view is evidenced by the fact that even today, by some people, I am considered a bit impious, daring to go into the yard to find out how it works, why it works and what might be done to improve its working!

Kiln drying has no such sacrosanct background. It is the evil work of man, and I'd say that the kiln operator is frequently suspected of being in league with the devil to boot! To this frame of mind, I'd like to suggest that the physical laws governing the kiln drying of lumber are also God-made and are in fact the same laws that govern air drying, if we have but the wit and imagination to understand them! The only essential difference between air drying and kiln drying is the degree of control we can exercise over the factors which bring about loss of moisture in lumber. In a novel written by Harry Leon Wilson back in the '20s called "The Wrong Twin," he describes some children who have punctured a lemon and inserted a porous stick of peppermint candy. The author goes on to say "One needed but to approximate a vacuum at the upper end of the candy, and the mighty and mysterious laws of atmospheric pressure completed the benign process." I'd like to suggest, gentlemen, that drying lumber in the yard or in the kiln is like sucking lemon juice through a peppermint stick. If we but set up the proper conditions, nature's physical laws will complete the benign process of drying lumber. If we misinterpret, misapply or ignore these laws, the process is no longer benign, but may be most malignant with results all the way from blue stain to honeycomb!

Now let's turn away from generalities and examine some specific similarities. Whether in the yard or in the kiln, heat supplies the energy for evaporation of water. In the yard or in the kiln, as long as water is being evaporated, a drop in air temperature is experienced as a given mass of air progresses through the crosser spaces. If the temperature is relatively high, drying proceeds rapidly other things being equal. Conversely, in cold weather we get slow drying. Air drying isn't even necessarily more conservative than kiln drying. One hundred and ten degrees on a dry, windy day in Albuquerque, Fresno, or Red Bluff is definitely more severe than when a kiln operator starts off a batch of thick Sugar Pine at 100° in the kiln with say 70% R.H.

Humidity, in combination with the attendant temperature, has the same E.M.C. effect in the yard that it has in the kiln. Five percent atmospheric humidity at 110° is just as effective in checking lumber as if the kiln operator were foolish enough and had ventilation enough to set up the same conditions in the kiln. So let's not have any weak argument that air drying is inherently right and "natural," and kiln drying "artificial" and hence inherently wrong. The idea just won't hold water.

Now let's think about circulation for a moment. The only way the required heat for evaporation to, and removal of evaporated water from, a package or pile of lumber in the yard or the kiln can be achieved is by movement of air, or more simply, circulation. Again there is no essential difference between the two locations whether air movement is derived from wind, gravity or motor-driven fans.

To the extent that air drying lumber may be damaged by direct radiation from the sun, we have or may have the same condition in the kiln if we place our heating coils too close to the lumber. We get the same kind of surface and end checking and for the same reason, to wit, local over-heating by radiation.

We have now seen some of the exact similarities between the kiln and yard. Let's take a look at some of the differences. Outdoor temperature in the Western Pine region may vary from a -30° or -40° to +120° F. What can we do about it? Mostly nothing beyond trying to pick a relatively warm sunny yard site in a normally chilly region, although transportation from and to the mill usually fixes the yard location regardless of other considerations. Consequently, we have to take whatever temperature, humidity and circulation conditions the climate, the millsite and the Weather Bureau hand us. In a kiln of adequate design and steam supply, we can control with a high degree of accuracy the temperature we must have for good, fast and consistent drying. None of the laws of evaporation have been changed, but, through our own ingenuity, we are able to correct the iniquities of the weatherman. If we overdo temperatures, we can create conditions far more damaging than outdoor weather, but that would be mere foolishness. We don't have to go to extremes unless management demands 100M' per day from a 50M' capacity battery of kilns.

Again, outdoor humidity varies from about 1 percent to saturation (or even super-saturation on a foggy day.) There is nothing inherently right about such a range in humidity. Quite the contrary! In the kiln we can, again through our own ingenuity, control relative humidity at almost any desired level by variable ventilation or the judicious use of live steam. Once more we haven't changed the rules, we've merely learned to control, if you please, another of nature's mechanisms for evaporation of water from wood. True, if we go hog wild and violate the needs of the lumber, we can set up far worse conditions in the kiln than the yard at its worst, but that would prove nothing but our own folly.

Finally the matter of circulation. There is no need to dwell upon the effect of wind variation between a dead calm and a 75 m.p.h. windstorm and the vagaries of that wind (or lack of it) in the yard. In the kiln we have learned how to set up a constant south wind of just the right temperature and humidity, and, if desirable, we can in good kilns change it to a similarly efficacious north wind in three minutes. Again, if we do foolish things and try to put a N-S wind through a pile that requires an E-W wind, we get into trouble far worse than the same error in orientation of yard piles. To argue that this makes yard drying the better is to argue that horse and buggy transportation is better than that by automobile because with the former we cannot go so fast and hence don't splatter our brains over as big an area when we hit something. We can be killed quite as dead by Dobbin as by Dodge Brothers, but we can, if we're good drivers, get around a lot faster in a Dodge.

In pointing out the ease of getting "good drying weather" the year around in the kiln, I do not wish to create the impression that in the yard we are completely at the mercy of the elements. Not so, by a long shot! Weather at any geographical location does follow a somewhat predictable pattern though I must admit I am no great admirer of the Weather Bureau's ability to call its shots. We do know that summers are warmer than winters, summer humidities lower than their winter counterpart and by studying Weather Bureau records, or, if necessary, by making our own observations, get a pretty good idea of normal wind movement. Against these variables we can orient piles correctly, increase and decrease pile spaces, select optimum crosser sizes, dip lumber in blue stain preventives (of which we have several good ones), provide roofs against moisture and sun damage, bulk lumber once it is dry and generally conduct our yards in accordance with the needs of normal seasonal changes, but, in an off year, we may take a licking in degrade because the weather does not conform to climate. Only when all possible normal corrective measures are taken can the yardman feel that "conditions beyond his control" are responsible for the yard degrade that may occur.

It is not my purpose, here, to say how lumber is to be kiln dried nor how it may best be air dried. I want to emphasize just two things. (1) Yard drying and kiln drying are more remarkable for their similarities than for their differences, and (2) the yard superintendent should be as good a technical man as the kiln operator. Unless the yard boss is as well-informed on the physical laws involved in drying, as is the kiln man, and can use them to help him in his job, he isn't doing, in fact can't do, his part in the adequate preparation of lumber for the market. As a matter of common sense, in many plants, shouldn't a top-notch "seasoning superintendent" (to give him a title) be responsible for both yard and kilns? I think so. Even as there is more to kiln drying than loading and unloading the kilns, there is more to air drying than putting up stickered piles of green lumber and tearing them down again a couple of weeks or a couple of months later. The difference in each case is savvy of how and why lumber dries. To do a good job, in the yard or the kiln, requires a lot of knowledge of physics, and a goodly supply of horse-sense, plus intense application to the task.