

SUMMARY "CHAT WITH THE EXPERTS"

Gene Wengert
Virginia Tech
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- Q. What are the variables important in establishing drying quality?
- A. The three kiln variables are RH, temperature, and velocity.
- Q. What's a good method to measure velocities in production kilns?
- A. I use a Bacharach Instrument Company (Pittsburgh, PA), Floret air velocity indicator. I have checked this meter (that costs just over \$100) against our expensive hot wire anemometer and the inexpensive meter checks okay. The meter is 3/4-inches thick so it just fits in the sticker space (leaving air side).
- Q. What's a good method to measure RH and temperature?
- A. A new solid-state device from Cole-Parmer (Chicago, IL), Model 3309-60 that instantly measures RH and temperature (F or C) was demonstrated at the meeting.
- Q. How do temperatures and RH affect shrinkage and warp?
- A. In general, the higher the temperature (without changing RH) the greater the shrinkage and warp. This results because the wood is weaker at higher temperatures and therefore cannot withstand or resist shrinking forces. On the other hand, the lower the RH the drier the wood on or near the surfaces will be and therefore the stronger it will be. Lower RH means less shrinkage and warp, although splitting may increase.
- Q. A series of questions were asked about how to handle casehardening, wood hardness (hard to plane, noisy, and planer splits), and conditioning treatments.
- A. There are several terms that we use loosely that need to be clarified. Casehardening refers to lumber that has tension set in the outer layers. When casehardening lumber is resawn, ripped, or planed unequal amounts on the faces, immediate warp will result. Casehardening does not refer to the shell or case being harder than normal. To relieve casehardening, we use a very high humidity treatment, called conditioning, so that the surface rapidly regains moisture. Equalization is also a humid treatment, usually about 20 to 35 F depression, that equalizes the moisture content within a piece of lumber and from piece to piece in the load. When drying is typically completed (before equalizing or

conditioning), the shell will be extremely dry. Dry wood is difficult to machine (planer sings, energy use is high, and so on). Hence, it is easy to see how casehardening and a dry outer shell are often considered similar (although they aren't). Putting a little moisture back in the surface (equalization) cures "surface hardness;" but a lot of moisture in quickly (conditioning) cures casehardening (tension set).

- Q. When measuring delta T, how should the temperature sensors be positioned?
- A. The exit side of the load has air that rapidly changes from horizontal flow (as it comes through the load) to vertical flow (as it moves upward to the fans). If the temperature sensors are more than a few inches from the edge of the load, because of the upward movement of air, the sensors will actually be reading the temperature of the air exiting from a location somewhat lower than the location of the sensor.
- Q. With variable speed fans, when should the velocity or fan rpm be decreased for best efficiency?
- A. The technical answer is that the fan speed can be reduced as diffusion begins to control drying (rather than surface evaporation). Note that fans running at 80% of maximum, use 1/2 the power (and 1/2 the \$) of fans running maximum. One way to determine this point is when the delta T drops and becomes small. Another way is to consider the delta EMC--when delta EMC is under 3%, fan speed could be lower.
- Q. What's the best reversing interval for fans?
- A. One of the important rules of drying is never let drying lumber pick up moisture. Therefore, with long reversing cycles (6 hours) with wet lumber, when the fans reverse, the previously dry side will now be subjected to much higher EMC and could pick up moisture. The best idea, with wet lumber, is to reverse frequently (2 hours) or not at all.
- Q. In discussing kiln schedules to keep wood temperature cool (maximizing final strength), several people asked about a falling WB schedule they use with constant DB. Is this good?
- A. The wood temperature starts out near the WB and gradually increases to the DB. By lowering the WB, this will tend to keep the wood temperature rather cool during the initial stages. In fact, it would be better to lower the WB than raise the DB. Because the wood is cooler, the WB depression may have to be increased slightly to keep drying rates fast enough.

Typical Schedule

<u>DB</u>	<u>WB</u>	<u>Dep</u>
150	140	10
160	140	20
170	140	30

Alternate Schedule

<u>DB</u>	<u>WB</u>	<u>Dep</u>
150	140	10
150	128	22
150	116	34

Tom Kimberly
The Foxboro Company
El Monte, California

- Q. How many zones do you need?
- A. As few as practical to properly dry the lumber, i.e., 2 if two are adequate, 4 if four are adequate, 12 if twelve are adequate.
- Q. Do you need a moisture measuring device?
- A. No. Moisture content of the lumber is continuously computed on a per zone basis.
- Q. What do you use to measure temperature?
- A. Precision, matched RTDs (resistance bulb thermometer). Accuracy is mandatory when taking small differences in big numbers.

Robert W. Try
Consultant
Sherwood, Oregon

- Q. When stacking two packages side by side on kiln carts, should the chimney between the packages be straight or tapered in at the top?
- A. The chimney should be tapered in at the top to prevent short circuiting of air through the top of the load. This method of loading also helps stabilize the load.
- Q. Which is the best method of venting, pressure venting (opening the vents on the pressure side only) or conventional venting (opening all vents)?
- A. Conventional venting is probably the best method in most cases. When only the pressure side vent is used, make-up air must come in the same opening through which humid air is being vented. This causes pressure changes in the kiln which induce leakage into the kiln at the doors and other undesirable areas.
- Q. How does air flow through the load vary when vents are open?

- A. Air flow through the load will decrease when the vents are open. Several changes occur when the vents are opened. The pressure drop across the fans will decrease, the fan volume and HP will increase, some will bypass (enter one vent and exit the other without passing through the load), the pressure drop across the load will decrease, reducing the flow (velocity) through the load. Wind velocity and direction will also influence velocity.
- Q. How should random length packages be loaded to present air bypassing through the ragged end of the package?
- A. The preferred method would be to box pile the lumber with the longer lengths on the outside. If this is not practical, then place adjacent packages with even ends opposite.
- Q. What accuracy is required when measuring air flow through the load?
- A. The accuracy required would depend on the purpose of the measurement. To accurately determine fan volume or for TDAL calculations, $\pm 50^{\circ}\text{F}$ would be satisfactory. For general purpose and comparison between kilns or charges, $\pm 100^{\circ}\text{F}$ would be adequate.

Frank W. Cook
F.W. Cook and Associates, Inc.
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- Q. Is air velocity significant in lumber drying?
- A. A possible oversimplification could be answered as follows:
1. Dry bulb temperature brings the water to the surface of the board.
 2. Wet bulb depression and the volume of air passing over the board removes the moisture.
 3. The higher the air velocity the greater the air volume. The greater the heat transfer to the board and the less temperature drop across the lumber load.
- Q. Is high air velocity needed throughout the kiln schedule?
- A. Normally not. The drying rate slows about the 40% moisture content position and slows materially at and below fiber-saturation or 25% moisture content. Variable speed fans and split speed fans are worthy of consideration.
- Q. Is the average moisture content a true and significant drying tool?
- A. The average moisture content without data as to the range of moisture contents and their percentage of the ranges is of little value in analyzing the quality of drying.

Q. Is the package stacking and package loading on the kiln trucks of material importance?

A. Proper package stacking and proper placement on the kiln trucks is of considerable importance. Using 100% as the total value we rate as follows:

Proper package stacking	30%
Proper package placement	30%
Actual kiln drying within the kiln	40%

Q. Which is best, a line shaft fan system or a cross-shaft fan system?

A. Both types if properly designed, installed and maintained are good practical air moving devices. Normally the desired air velocity through the sticker courses will determine the type to be used. Lineshaft design is good up to about 800 feet per minute--above 800 feet per minute will normally require the cross-shaft design.

Q. Do you recommend noting the recording chart with the target or desired wet and dry bulb settings?

A. Yes, very strongly. Noting the chart with the desired or target temperatures and comparing them to the recorded temperatures is the first and basic step in trouble shooting potential kiln problems.