WHAT GOES INTO PROCESSING A DRY KILN ORDER?

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I appreciate the opportunity to be with you today and wonder how many of you have heard this old poem about a lumber man:

The fellow stood at the Golden Gate,
His head was bent and low.
He meekly asked the Man of Fate
The way that he should go.
"What have you done," St. Peter asked
"To gain admittance here?"
"I've been in the lumber business,"
He said, "For many and many a year."
St. Peter opened wide the gate and
Gently pressed the bell.
"Go right inside and choose your harp,
You've had your share of hell."

I remember a handsome Scotch chap who used to get into the Davenport Hotel over in Spokane quite often. He was a good spender and a good tipper. Both management, bellhops, chamber maids, waitresses and all liked to see him come, not only for his spending, but also for his cheerfulness. He brightened their day. One time he was gone a lot longer than usual and every one was glad late one afternoon to see him register into a beautiful room on the top floor. About an hour later after he'd freshened up he called the assistant manager and asked if he would do something for him. He wanted 16 double martinis brought up on 4 trays by four bellmen, another bellman to bring up a pail, another bellman, two nice kiln dried pieces of sugar pine about 4" x 4", 20 to 24" long with a good sharp knife. And the assistant manager was to bring up a beautiful shapely girl about 25 with only a scanty see thru gown on with a coat around her. The assistant manager was flabbergasted, repeated order; the Scotchman said "Right on, how soon can you fill the order?" A moment of silence, "In about an hour." Good, said the Scotchman. Timing just right, an hour later, there was a knock on the door and as the door opened, "Come in" said the Scotchman. The Scotchman was reading in a large easy chair. He was in light slacks, slippers and dressing jacket open at the neck; he asked that the 16 double martinis be set on a table close by, the bucket to one side of the chair and sugar pine blocks and knife on another table close by. He tipped the bellmen handsomely and they left just as the assistant manager walked in with a beautiful woman on his arm, coat wrapped around her which she opened to display a very scanty exceedingly see thru gown; she was beyond a doubt a gorgeously proportioned person. Beautiful as a picture. Wonderful, said the Scotchman, but as the assistant manager turned to go, he stopped and said to him, I don't understand this order; I'm confused. No problem, the Scotchman said,

you see after I drink those 16 double martinis, I don't know whether I'll want to piddle, widdle, or diddle.

I'm sure that you have heard of the Tri Star L-1011, the Lockheed passenger jet that competes with the Douglas DC-10 and the Boeing family of jets. A short time ago, I was flying on a Delta L-1011 in the south eastern U.S. and took a Delta system map from the pocket in the seat in front of me. On the back of the map was printed several interesting excerpts of which the L-1011 was one. Do you know that there are 700,000 aluminum rivets, 580,000 titanium fasteners and 5,000 stainless steel fasteners used in the construction of the Tri Star; nearly a mile of hydraulic tubing is used. The electrical system contains enough wire to stretch nearly 100 miles and the system generates enough electricity to serve the needs of 170 average single family dwellings. Over 14,000 companies in 45 states and 5 foreign countries have participated in the Tri Star building program. This was all very interesting to me and I wondered why a little behind the scenes handling of a dry kiln order wouldn't be interesting to you. What goes into the processing of a dry kiln order, how many states and countries do the parts come from and other behind the scenes information. When we receive an order for a dry kiln, it goes into engineering and the details are checked against the specifications and requirements set forth in the quotation. As we know the most efficient system of drying moist materials consists of:

1. A circulation of a certain volume of warm air over or through the moist material.
2. Removing the moisture added to the air from the drying material.
3. Heating the same air by steam coils or other means and again passing it over the material.

The quantities of heat and air required to evaporate a given weight of water per hour are the basic problems to be solved in the design of any drier. In comparison with drying problems, where moisture removal is the only factor, kiln drying of wood is a complex process, for if drying conditions (temperature, humidity and circulation) are not properly controlled, the wood may be injured and its value depreciated. These drying conditions must be so adjusted that the moisture gradient in the wood will not exceed that which is safe for the species and thickness of stock being dried. In other words, drying conditions and weight of water to be evaporated per unit of time cannot be selected at random. The selection of proper drying conditions and time of drying is a complicated problem by itself and must be treated separately. Therefore, let us assume that the weight of water to be evaporated per hour from dried stock as well as drying conditions are given. What are the species of lumber to be dried and we go into an even more indepth investigation than we used when quoting.

Of course hand in hand with the species comes the moisture content green and dried, the cut, is it to be 4/4, 5/4, etc., and the amount of each, the width, the length, then the stacking procedures, the load size, the mixture (like heart and sap), sticker thickness size.

Really, we must design the dry kiln to meet four basic systems; three were mentioned earlier, temperature, humidity and

circulation. We add ventilation as the fourth and any good dry kiln is designed to bring all four of these systems into efficient operation for the conditions that they are designed for.

Designing the dry kiln is a complex problem because more than one species of lumber is to be dried. The four systems must be designed for species that give up the most moisture per hour to be efficient. As you know some species of lumber at the start of drying can give up 3% of free moisture per hour; some 2, 1-1/2, 1, 3/4. We have found that in high temperature drying 240°F DB and 205°WB that at the start of drying some species of lumber will give up as much as 10% moisture content the first hour but this drops off rapidly in the second hour and could be 9, 8, 7, 6 or 5%.

We must know and study many variables to design for these conditions. We investigate the weather conditions in the area where the dry kiln is to be built. We go to the U.S. Weather Department and obtain this information. We not only want to know the temperatures day and night, summer and winter, but also the humidity in the air because there is a lot of difference in the BTU's required to heat dry air and humid air.

In our calculations for a good balanced dry kiln system, we want to know the

weight of water to be evaporated per hour (pounds/hour)
weight of the material to be dried in lbs/hr.
relative humidity, %
specific humidity, grains per lbs. of dry air
moisture content of the lumber
enthalpy of air - vapor mixture. Btu/lb. of dry air
temperature of the air, °F
temperature of the material, °F
quantities of heat BTU/hr
fractions of total air in the mixture
density of the air, lbs./ft^3
enthalpy - Webster tells us "Thermodynamics a quality associated with a thermodynamic system expressed as the internal energy of a system."

Expressed in BTU's in addition to this information, we must know the heat transfer of the radiation that we will use. The thicker and longer the fin could result in less heat transfer, depending upon the volume of air passing thru the fins. We must know the air volume; in addition to all of this, we must know the details of the dry kiln building. Prevailing wind, how the buildings will be placed in relationship to the wind. All of this information is placed into formulas to come up with the basic quantities of radiation, circulation, ventilation and humidification that will balance into a good high potential quality and high production dry kiln.

Of course, down thru the years we have developed rule of thumb estimates and simple formulas; down thru the years in my talks, I've always tried to give you a rule of thumb in dry kiln design -- one now -- one then. I'm going to give you one now that I've heard many ask about over the years. I've never heard an answer before. How much steam does it take to condition lumber -- as a rule of thumb we use 45 pounds of steam per thousand board feet of holding capacity to condition lumber. However, for each order we run the information thru the time tested calculations

that I've outlined earlier and in my opinion that's the manner in which all dry kiln orders should be handled. This information is then used to write up the manufacturing order for purchasing, manufacturing and shipping. Parts are checked carefully and inspected to see that they meet specifications -- a shipment of motors for in-kiln service will have one or two picked from random and taken apart to see that bearings, leads, wiring and general construction are up to our specifications. Fan blades and parts are weighed before assembly and only those parts of the same weight are used in each fan.

There is a continuing effort to upgrade designs, machinery, jigs, fixtures, even the most up to date plant lighting and electrostatic air filters to keep plant air cleaner than outside air. These all help to produce a better product. Boxing, crating, loading onto trucks for shipping is important. How many times have you received parts that are damaged due to improper loading and strap, chain or cable placement.

Ample drawings are sent to the jobsite to properly install and start the dry kiln. Experienced engineers are available to help in start up and follow thru on the first charge or two of a new dry kiln.

These are all very important, and first drying should be under the eyes of our engineers to see that all parts of the equipment operate in the manner for which it was designed.

Getting back to the L-1011, I've roughly gone thru the number of companies that supply us parts for dry kilns such as steel companies, aluminum companies, pipe, valves, fittings, etc., and I come up with a minimum of 30 companies located in 27 states and one foreign country. I haven't had the time to dig out the footage of steel fasteners, etc. I did take a fast try at 3 items for 100 - 48" dry kiln trucks, 800 feet of channel side frame, 1000 inches of axles and 5,400 inches of roller bearings. Our average roller bearing stock to fill orders placed end to end would stretch about 10 miles -- 2 miles of channel -- etc. So you can see like many other products your dry kiln is a complex, multi-state, international product, involving many people.

In closing, I'd like to leave you with a story.

"A teacher asked her class at the start of the school year to get up and give their full names. Came to Gonzales and he said Jesus Christ Gonzales. Teacher said now what is your real name -- JCG -- Teacher didn't believe him and sent a note home. Next day note came back and said Jesus Christ Gonzales. Several weeks later, Superintendent of Schools and board members visited the school and listened in several classes. Finally into Gonzales class. Teacher said now each student is to give a word and spell it, like Mississippi, Albuquerque, etc. Came to Gonzales, hippopotimos. Teacher said "Jesus Christ, you can't spell hippopotamus." The Superintendent, angry, hit desk with fist and said "God dammit, give the boy a chance."

I want to thank you for giving me a chance.

Are there any questions?