WHAT'S NEW IN DRY KILNS FOR THE 1980's

Lyle Carter
Lumber Systems, Inc.
Portland, Oregon

The drying process uses the majority of the energy required in producing dried lumber. Due to the increased energy costs brought about in the 1970's we must find more efficient methods of drying lumber in the 1980's. These more efficient methods will use less petroleum-based energy. They also may use less electrical energy. These improved efficiencies will continue to develop in the following areas.

1. Better Buildings

With ever-increasing energy costs, the economics of thicker kiln walls becomes feasible. Since the start of the pre-fab design, the typical panel thickness has gone from 1-1/2" to 2" and in some areas is up to 3" and 4". As the panels get thicker, more attention must be given to the panel joints and penetrations. A significant amount of heat is lost through the conventional extrusion-type panel joint. This can be demonstrated by touching the panel and then touching the joint while the kiln is operating. The outside extrusion batten is always hotter than the panel. In order to reduce this heat loss and eliminate the inside and outside extrusion (whose only purpose is to hold the panels), we have designed a different joint. It has the advantage of no unnecessary battens, the skin on the panel seals the joint, and number of surfaces to seal have been cut in half. The clinching system used on our panels requires no rivets and leaves a flat surface for sealing.

2. Better Fans

Electrical energy is a substantial portion of the total energy consumed in moving the air through the lumber. Higher electrical costs as well as the need for high velocities have moved people to more efficient fan systems. Such a system uses six (6) bladed aerovent fans on a line shaft with copper "split" roller bearings. This fan system develops approximately 900 ft./min. on 8/4 material.

One disadvantage of this fan was the solid hub. It must be slid down the shaft for installation or removal. With the help of Aerovent, Lumber Systems, Inc. has produced a split hub fan for line shaft applications. Even though two blades were removed to allow for the split, comparable performance to the six (6) blade can be attained by adjusting the blade angle.

3. Kiln Controls

More sophisticated kiln controls promise to help improve drying efficiency. I think the main advantage of the new family of kiln controllers is the ability to control the kiln conditions by sensing the conditions in the wood rather than by a function of time. These same controllers can sense when the wood (being sampled) reaches the desired condition and stops the drying cycle or starts the conditioning cycle. This saves fuel, reduces over-drying and degrade.

4. Better Vent Systems

The first step in better vent systems has been taken at many mills in the form of modulating vents, which throttles the vents open only as required rather than popping the vents wide open and drawing in large quantities of outside air which must be heated by the kiln heat system. Modulating vents are important to the kiln for the same reasons modulating steam valves are very important. They smooth out the call for steam, allow the boiler to respond to the load, and allow the vents to work with the heat system rather than producing a vent-heat-vent cycle.

In order to understand the normal vent operation we must understand and accept the following:

A. Water from the lumber must be vaporized into the kiln air.
B. Vapor is a gas (the difference is arbitrary), "Basic Thermodynamics," Skrotzki.
C. Gibbs-Dalton Law states, "Gases occupying a common volume each fill that volume and behave as if the others were not present."
D. The air-vapor mixture must be exhausted and drier air must be brought in. For each cubic foot of air exhausted, a cubic foot of fresh air must be brought in.

When we analyze a typical drying schedule, we find that approximately 70% of the energy (heat) brought into the kiln is exhausted out the vents as an air vapor mixture, which at times will be as hot as 240°F dry bulb temperature.

This tremendous source of energy can be used in one or more of the following ways:

A. Pre-heat kiln incoming air.
B. Pre-heat boiler make up water.
C. Ducted to other kilns for humidity and heat reducing the need for steam.
D. Heat water or plant areas.
E. Source of heat for heat pump type applications.

These are not new ideas; however with the higher fuel costs of the 1980's, I am confident we will begin to see these concepts being put to use.

5. Waste Wood Burners and Energy System

Generally speaking, if we use less petroleum-based energy, we are going to burn mill waste or hog fuel. We are working with a couple of new approaches to the waste burner problem.

A. The first is a system which uses a heat exchanger in the combustion chamber which heats air for the dry kilns.

This unit at Evans Lumber in Mississippi provides heat for two (2) kilns. All products of combustion go out the stack.

B. The second burner system is constructed of Olivine concrete panels with steel frames. Over 80 of these incinerators are operating. The unique thing about this system is the ability to use the products of combustion to heat rock and store the heat for later use. This system stores the "heat" not "fuel." Typical system consists of one burner and two (2) rock towers. While the burner is storing heat in one tower, the kiln is drawing heat from the other.

The heat storage capability of the Olivine rock is determined from the following data:

--Specific Heat = .21 BTU/LB °F
--Density of crushed rock = 100 LB/FT^3 of storage
--Maximum rock temperature = 1600°F
--Minimum rock temperature = 600°F
--Rock working temperature range = 1000°F

.21 x 100 x 1000 = 21,000 BTU/FT^3 of storage.

A rock tower 15 feet in diameter x 24 feet high can store 89,064,000 BTU's under these conditions.

Another Olivine burner system heats water for log steam vats at Alpine Veneer, Cle Elum, Washington. The products of combustion are drawn off the top of the burner and drawn up through a rock tower as water is circulated downward through the rock. The result is that 1,000 GPM of water is heated from 110° to 140°F, saving the mill over $1,000.00 per day in fuel oil.

Both the air heat burner and Olivine burner are less sophisticated and less expensive than other models, making them more attractive for the smaller operation.

These are the improvements and changes we see developing in the next few years.