## COMMON SENSE APPROACH TO OPERATING DRY KILNS WHEN BOILER CAPACITY IS LIMITED

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It seems that no matter how large a boiler is installed to heat dry kilns, there often seems to be a problem in producing enough steam to meet demand. The reasons are many but a few of the more common ones are:

1. Leaky doors and old wood roofs on kilns.
2. Poor maintenance and poor condition of steam heating system.
3. Inefficient condensate system.
4. Poor boiler maintenance or adjustment.
5. Improper use of steam sprays.
6. Lack of planning of kiln start-ups, temperature increases.

Let's go over these problems one at a time:

1. Leaky doors and roofs--The practice at sawmills, in years gone by has been to replace wood roofs only after one of the roof boards has fallen and killed the operator. Door panels are not changed until the mill owner sees the kiln foreman enter the kiln through a hole rather than waste time prying open the inspection door which has been rammed 342 times by crib loads. More and more mills are purchasing prefab roofs and doors for their masonry kilns. Fuel savings and more productive kilns are the result every time, and with a good capital payout!

2. Poor maintenance of the steam heating system is like trying to win a race while having a heart attack. If steam can't get into the heating coils, or if condensate can't get back out, not much drying is going to take place. Proper maintenance of valves, infeed lines, coils, drain lines and traps is so obvious, we'll take no more time to discuss it.

3. An inefficient condensate system only means that you're asking your boiler to work harder than it has to. If the condensate is cold by the time it reaches the boiler, the boiler has to make up that much more heat to do the same job. If water is lost from the condensate system through leaks, fresh and cold water must be added, using more fuel and water treating chemicals.

4. Poor boiler maintenance takes care of its share of problems. If the inside of the boiler tube is covered with 1/4 inch of scale and the outside is covered with 1/4 inch of soot, not much heat is going to get from the fire side to the water side because of these insulating layers. The result; more fuel and fire, but less steam.

5. Improper use of steam sprays--let's get one thing straight here--steam sprays are for humidifying in the kiln. Their sole purpose is to maintain or raise the wet bulb temperature. Using the steam

spray to bring the kiln up to dry bulb temperature is not only wasteful, but it helps to deteriorate kiln equipment and often adds to lumber staining problems. Using the steam spray to raise dry bulb temperature requires 20 percent more fuel just to heat the cold water added to the system, not to mention the greatly added load and shock to the boiler. If you have steam sprays running in two or three kilns, you may find your boiler loaded beyond its capacity; and remember, if your steam coils can't bring your kilns up to temperature--alone--you haven't got enough heating coils. Some kiln manufacturers still haven't learned this.

6. Lack of planning of kiln start-ups, temperature increases--Assuming all of the foregoing procedures have been faithfully followed, the last one is probably the most important of all, and only you the kiln foreman, can bring it about--plan kiln start-ups and temperature increases carefully. Bringing a kiln up from a cold start is much different from raising a schedule from 170° to 180°, but it's not much different from conditioning with the steam spray on full blast for 12 hours. If we could visualize what kind of steam load we're creating each time we turn a set-point knob on our kiln controlling instruments, we could spread out steam demand more evenly and keep the boiler producing steam without the constant feast or famine of steam.

Before we go any further, let's look at some illustrations to demonstrate a very important characteristic of steam heated systems (Figure 1).

First, heat always flows from a hotter object to a colder object. Think of it this way: when you touch an ice cube, it feels cold because heat has just left your finger. If you now touch your face with your finger, your face senses cold because heat is leaving it to go to your finger. Just the opposite happens if you touch a light bulb. So now we have it--heat only moves in one direction--toward something colder, something which does not contain as much heat.

Another fact--more heat will flow between two objects as the difference in temperature becomes greater (Figure 2). One more illustration--try to think of the heating coils as a boiler in reverse (Figure 3). On the left, fire heats the water to boiling, steam is produced and goes through the pipe to the control valve and then through the heating coil. The heating coil is 250°F. Air on the fan side is 100°F. When the fan blows the 100° air over the coils, heat from the coil travels to the air and heats it to 180°.

At the same time, when so much heat leaves the coil, so much condensate (water) is formed. The more heat that leaves the coil, the more condensate is formed, and the more steam re-enters the coil from the boiler. The water goes out the trap, leaving the steam behind in the coil, and is reused in the boiler. So, you can see the heating coils are a boiler in reverse, i. e., the boiler boils water to steam and the steam coils dissipate heat, cooling the steam back to water.

Keep in mind, if no heat is lost from the steam coils, no condensate will form, and no new steam will enter the coils (Figure 4).

The previous condition is, of course, impossible to reach in a

lumber dry kiln. But, say, you have a temperature of 200° in the dry kiln (Figure 5).

We may have steam flow, but not as much. But start-up a kiln on a 30° day and we have a real steam load (Figure 6).

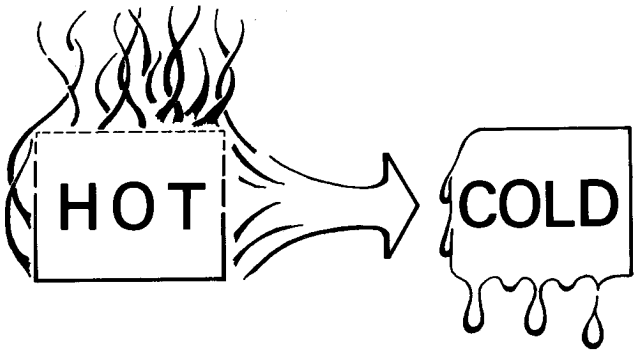
All along we have been using 250° as steam temperature, which happens to be the temperature of steam which is at 15 PSI pressure. Steam at 10 PSI is 240° and steam at 5 PSI is 227°; steam at 0 PSI at sea level is 212°.

What we have learned is that kiln start-ups are more severe than later schedule changes. And raising a schedule from 190° to 195° is much less severe on the boiler than raising the schedule from 100° to 105°. And, since a steam spray line is essentially an open pipe into the kiln, it doesn't depend on condensing steam in a fin pipe. Therefore, the steam spray is a most severe steam consumer, regardless of temperature in the kiln.

So, if you're finding yourself a little stretched in your steam flow--

1. Check the condition of your equipment, as mentioned earlier.
2. Use your steam spray more wisely, and
3. Plan your kiln schedules and start-up loads so that the boiler has a chance to keep up.

One last point, if a boiler is struggling to keep up, any further increases in steam flow end up in decreasing the steam pressure, which in turn, decreases steam temperature. You end up with less steam flow (because of less pressure) and colder steam (also because of less pressure). No wonder your boiler is flat on its back.




**HEAT MOVES ONLY FROM HOT TO COLD**

Figure 1

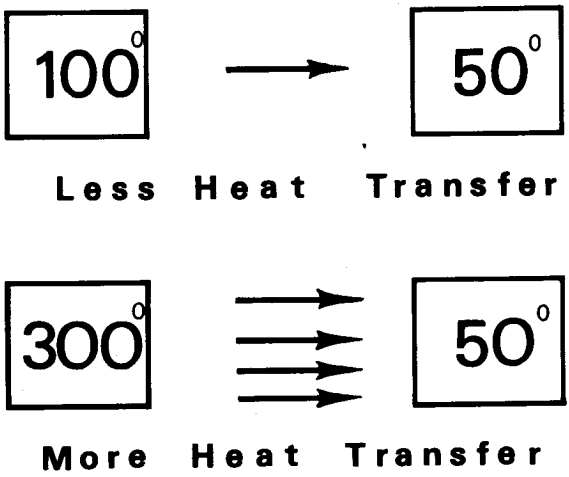



Figure 2

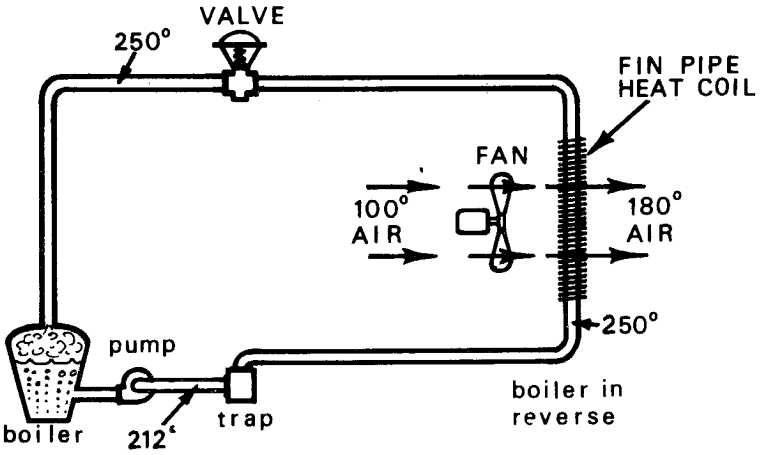



Figure 3

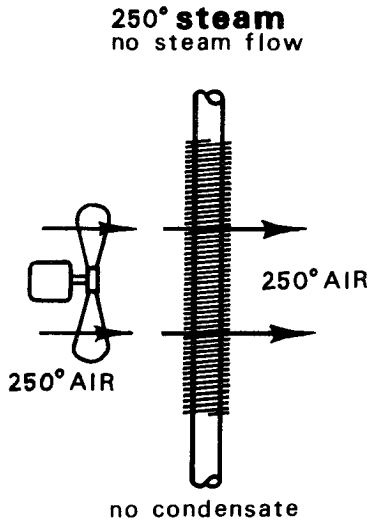



Figure 4

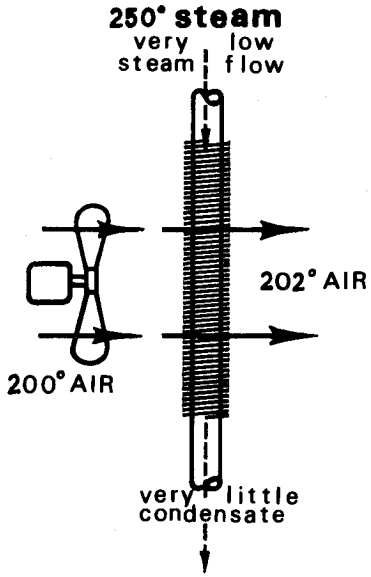



Figure 5

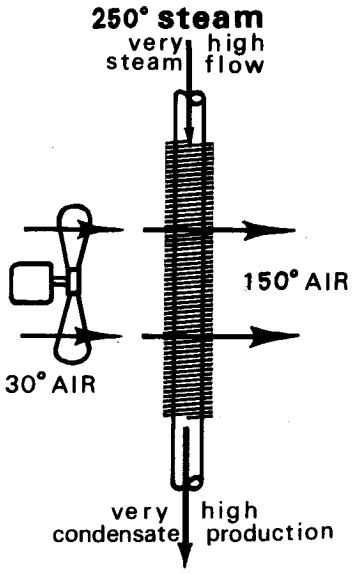



Figure 6