FLEXIBLE KILN BAFFLES

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A challenge of good kiln design has been to direct the air flow to the areas where it will do the most good. Air that short circuits through gaps in the overhead baffles or that passes up through the chimney between units without going through the second unit is wasted (Figure 1). Air wasted in this manner not only causes uneven drying, but also relates directly to the drying time required for a charge.

The question of how to stop air flow through the chimneys has been discussed and addressed in many ways. At Idaho Forest Industries our first approach was to pinch the top of the chimneys closed by leaning the boom of a fork lift against the top courses of each unit (Figure 2). While this method did a fair job of shutting off the air flow, it also caused some problems. The first problem was damage to the edge boards on top. Even the best of drivers cannot always avoid degrading lumber when shoving it with a heavy, greasy boom.

FIGURE 1. Air short-circuits through the chimney, bypassing the second unit.
This approach also was time consuming for the drivers, and the rounded off shape at the top of the charges caused disruption in the air flow through the top three courses, often leaving them wet. A second solution we tried was to lay sheets of plywood across the top units. While this did a very good job of blocking the flow through the chimneys, it was also time consuming, and left the top course wet every time. The plywood sheets began delaminating after only a couple of uses so the cost of continuing this method would have been prohibitive. The last approach we took to chimney closing was to place 5/4 x 14 inch boards down the center of the charge. This method did a good job of blocking the air flow without leaving the top courses wet, but was very time consuming, as placing the boards properly took a very fine touch from the fork lift driver. One small error and the board would be laying at the bottom of the chimney instead of across the top.

The problem of air flow through the chimneys exists only in kilns baffled on just one side. Our next approach was to question why kilns were being built with only one side baffled. The answer to this is cost. Sheet metal baffles are very expensive to have built and installed. Sheet metal baffles also have to be raised and lowered for each charge. The consequences of forgetting to raise the baffles, or having a baffle fall back down after it has been raised is serious and expensive damage to the baffle, not to mention what it does to the lumber.

The annual cost of maintaining the baffles in our kilns, which were only baffled on one side, averaged almost $700.00 per kiln. Often, due to the down time required to replace damaged baffles, we would run kilns with baffles missing. This is obviously not a good practice. When I suggested we baffle both sides of all our kilns to eliminate the chimney problem I was told we would do it if I could develop an inexpensive, indestructible, kiln baffle (Figure 3).

The way we chose to define the term indestructible was a baffle that could be left in place without raising and lowering, which could contact the incoming lumber charges without being damaged, or causing damage. Inexpensive was defined as "less costly than sheet metal."

Our first attempt at making a better baffle was to hang sheets of woven plastic from the fan deck, with lengths of iron pipe sewn into the bottoms for weight. The obvious flaw in this technique is that any weight sufficient to keep the plastic in place while the fans are running is also heavy enough to drag boards off the tops of the units. The result was a lighter, cheaper baffle, but one that still needed to be raised and lowered for each charge. This experiment was not left in the kiln long enough to assess the woven plastics durability in hot humid environments.

Our second trial was with the clear plastic material commonly used to block the wind through open doorways in the winter. This material turned stiff and brown after the first charge, and was observed to be almost three inches longer than when we had installed it. After four charges it suffered a total melt down. Another problem with this material was that the strips tended to twist as the units were pushed in under them, leaving gaps that allowed much unwanted air flow.

Several other materials were tried with similar results. They either could not stand the heat and humidity, or did not maintain their air tightness after the charge.
had been loaded. Finally we tried a high density plastic brush material. This met all the requirements for a durable, inexpensive baffle. The polyethylene bristles are dense enough to stop air flow up to 750 fpm (Figure 3) using our standard design, and higher fan speeds using a denser brush. The baffle consists of a ten-gauge steel sheet with two layers of bristles attached. The steel portion remains higher than the door frame so that no contact can be made with any lumber that fits through the door. The bristle portion hangs down fourteen inches from the steel and usually contacts the lumber with the bottom three to six inches.

This allows the charges to be pushed into the kilns without raising the baffles out of the way. The bristles sweep across the units as they are moved beneath them. The flexibility of the brushes allows them to mold to the tops of the units, forming a better seal than could ever be achieved with sheet metal baffles. If a tall unit is loaded next to a shorter unit, the bristles bend back farther on the tall unit, and less on the short unit, maintaining a tight seal. With the old sheet metal baffles a tall unit would keep the baffle from contacting the short unit, allowing leakage. Because of the low cost and zero maintenance needed for these baffles they can be installed on both sides of the kiln, eliminating the need to block off chimneys.

FIGURE 2. Pinching the chimneys closed, damages lumber and creates areas of uneven air flow.
An unexpected benefit of this type of baffle was reduced warp in the top two or three courses. Our theory is that increased air flow through the gaps in the old sheet metal baffles caused small areas of drier wood bordered by wetter wood in the top courses. That of course results in warp. With a constant seal down the full length of the charge these drier spots are eliminated and the warp is decreased.

The results from using this type of baffle were so impressive that within four months of our first full scale test all of the baffles in all of Idaho Forest Industries' kilns had been replaced with the brush type baffle. Idaho Forest Industries builds this type of baffle in eight foot long sections for retrofitting into kilns with the old type baffle. Installation is very easy as they can be welded or bolted to the angle iron braces that hold up the fan deck in most kiln designs. It should be noted that both U.S. and Canadian patents covering all aspects of this design have been applied for and are pending.

Many benefits can be gained from changing over to flexible baffles. Air flow in the kilns can be directed through the lumber where it does the most good, instead of over the tops of the units. This results in faster more consistent drying. The consistent seal down the length of the charge reduces degrade due to warp in the top courses. The need to pinch, or otherwise close off the chimneys is eliminated, saving fork lift time and reducing damage to lumber. Kiln change over time is shortened by eliminating the need to raise and lower the top baffles for each charge. This is also a safety issue as boards often fall off units when the baffles are raised. Last, kiln maintenance costs are reduced due to the durability of flexible baffles. The original kiln in which grass skirt baffles were tested had its first anniversary in March. The baffle material is still as pliable as the day it was installed. No loss of fiber, or any other degradation has occurred. Indications are that this type of baffle will have a very long, maintenance free, life.

**Flexible Baffle Advantages**

1. Better air flow through units reduces drying time.
2. Quicker kiln change overs.
3. Lower maintenance costs.
4. Eliminates need to pinch chimneys closed.
5. Follows contours of unit tops to form continuous seal.
6. Less warp in top courses due to more even drying.
FIGURE 3. The solution: Two flexible baffles block air flow across the top without adding to kiln set-up time.