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WHAT IS THE BREAKPOINT?

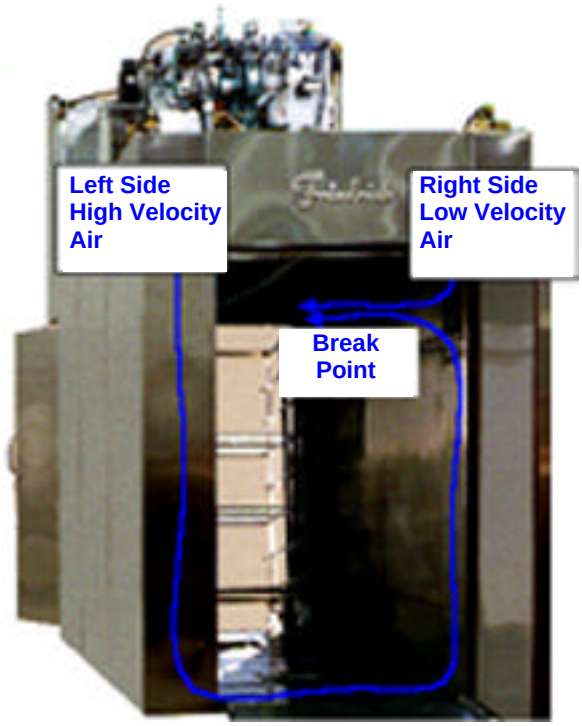

Figure 1

FORMING THE BREAKPOINT

In the latter part of the 1950's a brilliant concept was employed that revolutionized ovens in the meat processing industry. This was the use of alternating dampers in forced-air ovens that is still in use today. Air from a single fan could now be delivered to product on racks that filled large cook chambers.

In the twelve years I spent balancing smokehouses I found that the function of the alternating dampers is generally misunderstood or not understood at all.

In short, the sole function of the alternating dampers is to deliver air to the product through what is known as the ***BreakPoint.*** In fact, all factors related to cook time, skin formation, color, temperature uniformity and yields come back to the proper formation of the ***BreakPoint*****.**

How these variables are affected will be discussed and made clear to the reader in future Tech Tips.

For now it is important to understand how the ***BreakPoint*** is formed.

The alternating dampers are slowly rotating inside the air supply duct. That is, air leaving the fan is being delivered to the nozzles as shown below.

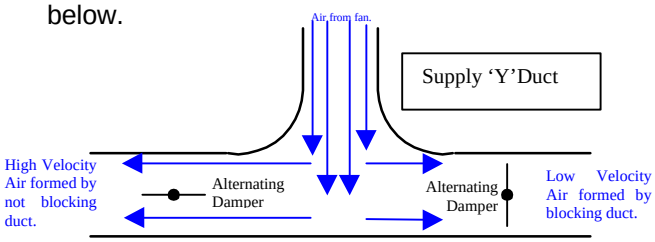

Figure 2

As they rotate, the dampers alternately set up High Velocity Air on one side of the oven and Low Velocity Air on the other side. Shown in both Figures 1 & 2, the High Velocity is on the left side and the Low Velocity Air is on the right.

As shown in Figure 1, the left side High Velocity Air travels down the wall, across the floor and up the right side wall. The Low Velocity Air leaves the right side nozzles and travels a short distance before colliding with the High Velocity Air. At this point the air breaks toward the center of the oven forming the ***BreakPoint*****.** When formed correctly the ***BreakPoint*** has enough velocity to penetrate through much of the product before the air is drawn back to the return duct and the suction side of the fan. The air in the ***BreakPoint*** is the air that cooks your product!

Many factors can contribute to, or prevent, the proper formation of the ***BreakPoint*** and these will be explored in future additions of Tech Tips along with its effects on cook time, color, temperature uniformity and yields.

TIP OF THE DAY

Keep your alternating dampers so that they are 90° to each other, +/-3° or one sprocket tooth, as shown in Figure 2.

TECH TIP #2

MORE ON THE BREAKPOINT!

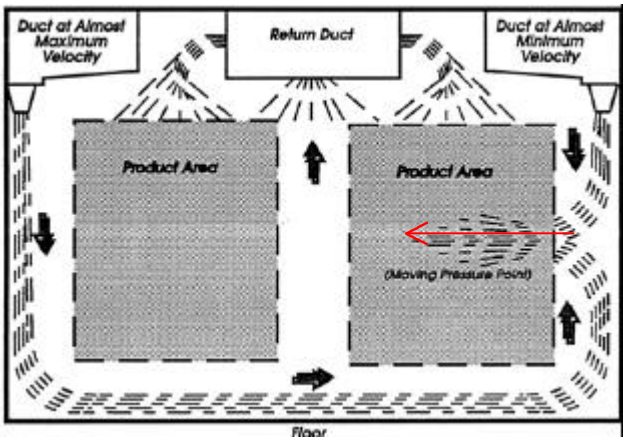

Figure 1

MOVEMENT OF THE BREAKPOINT

Again, I have illustrated the formation and position of the B***reakPoint*** (also known as the pressure point) in Figure 1. This illustration shows how the air is hugging the walls and floor in order to collide and head towards the center of the house, penetrating the product. The cycling or rotation of the alternating dampers causes the ***BreakPoint*** to move. As the right damper begins to open, the low velocity increases on the right side. At the same time, the left damper is beginning to close, reducing the high velocity on the left side. As a result the ***BreakPoint*** begins to move down the wall in the direction of the green arrow as shown in Figure 2 below.

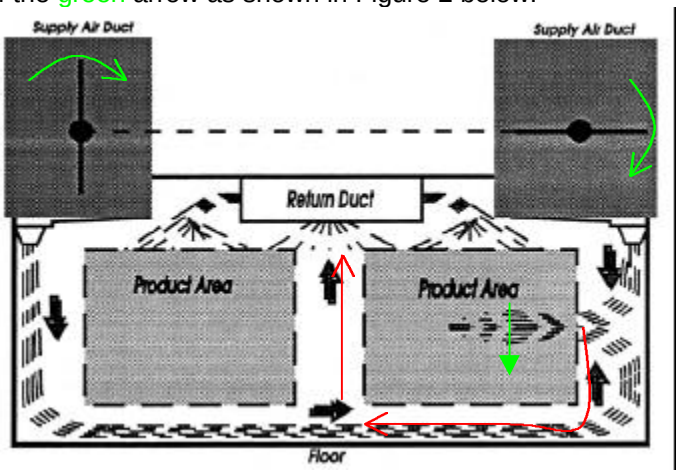

Figure 2

As the rotation of the dampers continues, the ***BreakPoint*** will move to the bottom of the wall, then across the floor. For example, when the dampers are at 45° angles in the supply ducts, the air velocity from both sides will be the same, and the ***BreakPoint*** will be on the floor, in the center of the oven, blowing upwards as shown by the red arrow in Figure 2. As the ***BreakPoint*** traces the path of the red arrow, it has been penetrating the product area on the right side from all angles. From the wall as it traveled down and up through the product as it moves across the floor to the center. As the dampers continue to open on the right side and close on the left, the ***BreakPoint*** continues to move across the floor and then up the left wall. This cycle is repeated over and over again as the alternating dampers constantly rotate.

FUNCTION OF THE BREAKPOINT

It is very important to understand that the air in the ***BreakPoint*** is the air that cooks your product. Or, at least, is 90% responsible. It does this by delivering heat to all parts of the product area. By virtue of its velocity, the air in the ***BreakPoint*** wipes away a cold layer of air surrounding the product and replaces it with hot air. The heat in this air is then transferred to the product via conduction. So, by controlling the ***BreakPoint*** most of the balance of the cook is controlled. Granted, the return ducts have some affect, as does turbulent air that strays from the BreakPoint. But these are far less important. All of these conditions will be discussed in detail, but for now it must be understood that the BreakPoint and its motion make or break uniform cooking.

TIP OF THE DAY

If your alternating dampers are driven by chain, make sure the chains are very tight. Slack will allow the dampers to jump causing the BreakPoint to jump as it moves.