

# *The Poultry Engineering, Economics & Management* **NEWSLETTER**

**Critical information for Improved Bird Performance Through Better House  
and Ventilation System Design, Operation and Management**

Auburn University, in cooperation with the U.S. Poultry & Egg Association

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## **Feature article**

# **Dealing With Uneven House Temperatures in Winter**

In wintertime, it can be a challenge to manage heating and ventilation to provide consistently good growing conditions for our birds. One of our main goals is to maintain house air temperatures within plus or minus 2 degrees F from end to end or side to side of the house. But on visits to broiler houses across the U.S. Broiler Belt we see many houses with temperature differences of as much as 8 degrees from one end of the house to the other. Many growers now have installed electronic controllers, which may have as many as 5-6 temperature sensors, and this gives a convenient way to quickly check the range of house temperatures. All you need to do is look at the "current conditions" screen on the controller to see exactly what is happening in the house. In one modern house, for example, with five-week-old birds in cold weather, we recently saw a brood end temperature at 79°F and the tunnel fan end at near 70°F.

In some cases, the temperature variation will not be a smooth end-to-end difference. We see many houses with temperature at the tunnel inlet end around 5 degrees or so below target, but the rest of the house on target. Another scenario is to see both ends of the house too cold, but the center section close to the target temp.

Large temperature differences cannot be tolerated, because it means that only a small number of chickens will be in that small area of the house where the temperature is actually right for best growth. In addition, large differences of temperature in modern houses means large differences in litter quality and air quality, which further aggravate bird health and performance problems. For sure, a large number of birds will be experiencing less than desirable conditions, and we will not be getting good value from the gas we burn or the feed consumed. The effect at settlement will be staggering.

**Too many growers allow uneven house temperatures to severely hurt flock performance.**

## **Causes of Uneven House Temperatures**

Growers often ask if changing the fan run time or some other ventilation or heating management adjustment will eliminate uneven house temperatures. For sure, fan run time is not the problem causing uneven conditions. And trying to correct the problem by running heat in the too-cool areas would be a too-expensive band-aid. One cause of uneven house temperatures is the effect of concentrated bird body heat if

birds crowd into one area instead of spreading out evenly throughout the house. Installing migration fences is a simple solution to this kind of problem.

**Uneven temperature is often caused both by air leaks and by vent box inlets not opening uniformly.**

A more severe problem, which is also much more commonly seen, is created when outside air is allowed to come into the house in a non-uniform manner. Ideally, we want outside air to enter the house only – and evenly – through the vent boxes. This requires that we have properly calibrated and adjusted inlet box openings and that we allow no significant amount of air to come in through unintended

openings such as unsealed cracks, dirty fan shutters, or unflapped curtains. If there are too many air leaks, and/or if the inlet boxes are not adjusted properly and uniformly, air flow will not be uniform and house temperatures will be uneven.

In wintertime ventilation, the importance of the air inlet box cannot be overstated. We strive to eliminate air leaks into the house so that the inlet machine can control where and how air enters the house. The minimum ventilation timer controls the quantity of air entering the house during the ventilation cycle, and the vent box inlets determine how fast and how uniformly ventilation air enters the house.

Let's examine some facts about air inlet box management:

- ✓ The air inlet box functions like an air nozzle. Its purpose is to shoot a high velocity air stream to the center of the house, thus warming the incoming air and keeping cold air off the birds.
- ✓ It takes approximately a 0.10 static pressure AND a proper inlet opening size to get an air stream that will shoot 20-22 feet into the center of the house.
- ✓ There is a proper minimum opening size for air inlets. If you run vent boxes at less than this size opening you will not get good air throw or velocity from the inlet. This opening is 1-1½ inches for sidewall inlets and about 1 inch for most ceiling air inlets.
- ✓ The number of air inlet boxes actually in use must be matched to the number of fans actually running, in order to get the proper inlet opening size. A rule of thumb is to have about 15 operating air inlets for every 48-inch fan that will be running. If too many inlets are being used, the inlet machine will have to choke them down too tightly in order to maintain static pressure, and air will only dribble into the house. This means that all inlets must have a close-off latch and the grower must manage and match operating inlets to the number of fans that will likely run during the day.
- ✓ To get good end-to-end temperature uniformity in a house, the number of inlets operating and the opening size of each inlet must be uniform from one end of the house to the other.

**Air inlet opening size is critical for good airflow – and all operating inlets must have the same opening size.**

Air leaking into the house through cracks, unsealed sill plates, loose or dirty fan shutters, curtains without flaps, etc (sometimes even open doors!) will defeat the inlet machine and vent boxes no matter how well they are managed and adjusted. And in wintertime, the parts of the house where the leaks are worst will be the coldest. A temporary fix may be to close an air inlet or two in that area of the house to balance the air flow. However, this will be a poor fix at best. A leaky house cannot be properly ventilated and will not provide uniform good growing conditions for the flock.

**Flaps on tunnel inlet curtains are essential. Also, unused tunnel fans must be sealed to stop air leaks.**

A serious and too-commonly seen problem that causes the tunnel inlet end of the house to be a lot colder than the rest of the house is having tunnel inlet curtains without flaps. Installing flaps on tunnel curtains is absolutely essential for maintaining an even and on-target house temperature. Another source of air leakage that is also commonly seen across the Broiler Belt is fan shutters on unused tunnel fans that are not covered or are not sealing properly. This will cause the fan end of the house to be colder, although the degree of chilling is usually less severe than will be caused by an unflapped tunnel curtain.

## **Inlet Machines and Vent Adjustment**

Improperly adjusted inlet openings are also too commonly seen in U.S. broiler houses. A properly installed and maintained inlet machine and cabling system is a key ingredient for good temperature uniformity. There are many variations of machines and cabling systems that have been installed over the years. Whatever the type machine, wear and especially cable stretch over time will cause non-uniformity in the opening size of vent inlets. When initially installed, all vents will open the same. But as cabling stretches, vents nearer the machine will open more than vents farther away. The result will be uneven temperatures, warmer nearest the inlet machine and colder as you get farther away from the inlet machine.

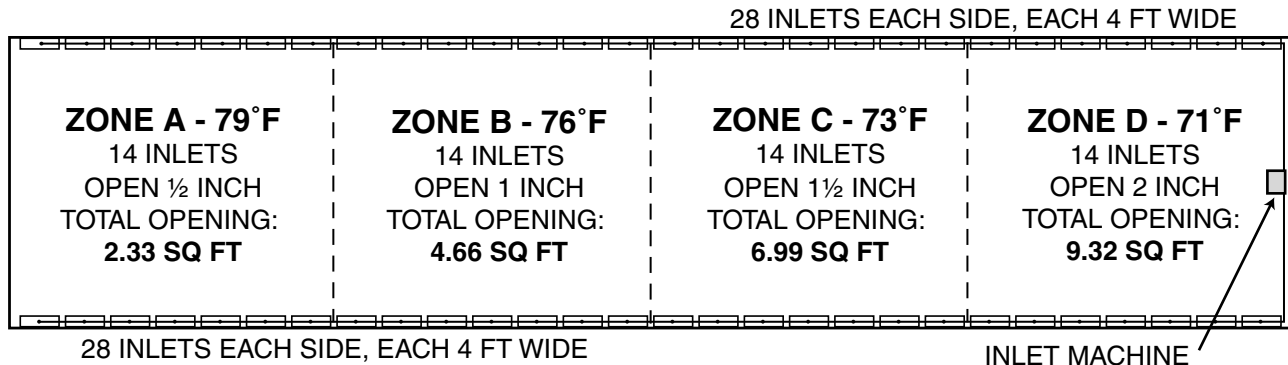
**Aircraft cable stretches over time, requiring frequent adjustment of vent box inlet openings.**

Following are some important facts to keep in mind for good inlet machine and vent box management:

- ✓ Aircraft cable stretches a lot more than high tensile fence wire. Solid rods don't stretch much at all. If possible, and on all new houses, avoid using aircraft cable to open and close inlets.
- ✓ Frequent checking of vent box openings is required to make sure they are all opening uniformly. Cabling zoom nuts and strings at vent boxes will need to be adjusted periodically to maintain uniformity.
- ✓ Since cable runs will be only half as long, houses with inlet machines located in the center of the house will have less cable stretch and inlet non-uniformity than houses with inlet machines on end walls.
- ✓ Larger diameter pulleys with bearings and grease fittings in them put less stress on inlet cables, and therefore cause less stretching and cable breaking.
- ✓ 90-degree turns in inlet system cables are best handled with chain and sprocket kits.

## EFFECTS OF STRETCHED INLET MACHINE CABLE ON INLET OPENING SIZES AND HOUSE TEMPERATURE

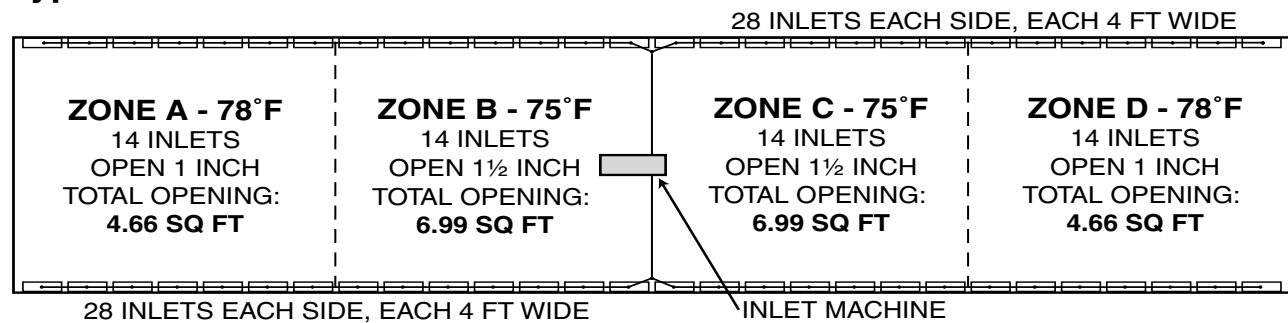
### A. INLET MACHINE LOCATED AT END OF HOUSE



When 500 feet of cable stretch, the effects are most pronounced at the far end of the cable. With the inlet machine at the end of the house, inlets closer to the machine open wider than inlets farther away. In this house, four times as much air is flowing into the house in Zone D than in Zone A, so it is much colder at the Zone D end of the house than at the other end of the house, where very little air is being brought in. The problem can be corrected by re-adjusting each inlet's cable connector for proper opening size.

### B. INLET MACHINE LOCATED AT CENTER OF HOUSE

#### Typical Effects of Inlet Box Cable Stretch - Inlet Machine on End Wall



When the inlet machine is mounted in the center of the house, cable runs are only half as long to reach the farthest inlet, so the differences in inlet openings will be less pronounced, and the temperature differences will be smaller. The uneven temperature effects from cable stretch seen when the inlet machine is placed in the center of the house will be cooler temperatures in the center and warmer temperatures at each end.

**CAUTION:** Diagrams above assume a very tight house. That is, the temperatures shown are what would typically be seen, but only if little or no air is leaking into the house through unflapped tunnel inlet curtains or unsealed fan shutters. If tunnel curtains are unflapped or fan shutters are not sealed, temperatures in the ends of the house will be cooler. Conditions shown in diagram B (inlet machine located in the center) are not often seen in the field because house-end air leaks commonly cause lower temperatures at the house ends, counteracting the effects of cable stretch. However, even if the house temperatures may appear to be fairly uniform, the combination of air leaks and out-of-adjustment inlets will create poor air-flow so that air quality will be very poor and flock performance will suffer.

**CONCLUSION:** In the poultry industry, there are many variations in how inlet machines and vents are cabled and operated. Regardless of the type system you have installed, you must make sure that all operating vent box inlets are opening the same AND all sources of air leaks are sealed in order to maintain good growing conditions throughout the house.

## Most Commonly Seen Wintertime Airflow and House Temperature Problems

**#1 Problem:** Cold tunnel inlet end of house, rest of house okay. Wet litter and chilled birds in tunnel inlet end of house.

**Likely Cause:** Excessive air leaks around the tunnel inlet curtain, most often seen when tunnel inlet curtain does not have a flap installed. Wet litter is caused by condensation and lack of air mixing.

**Steps to Correct:** Be sure tunnel inlet curtain has flap and is well sealed. Many new houses do not have tunnel inlet flaps. Consider closing a few air vents in that area. If ventilating with only 48-inch fans, consider adding a 36-inch exhaust fan at the tunnel inlet end to move heat toward house end door. Stirring or paddle fans might help air mixing.

**#2 Problem:** Warm, stuffy brood end of house. Birds chilled in too-cool tunnel end. Heat trying to run in off end. Air quality poor and wet litter in brood end.

**Likely Cause:** Improper air inlet openings, usually caused by cable stretch, with inlet machine located at far end of house (see diagram on page 3).

**Steps to Correct:** Inlets must be recalibrated and adjusted so all 56-60 inlets in the house open the same amount. When inlets don't open at least 1½ inches (sidewall inlet) or about 1 inch (ceiling inlet), air will not throw to center of house. Check also to see that static pressure is at or near 0.10 inches.

**#3 Problem:** Low temperature near tunnel fans in cold weather. Sensors read as much as 5 degrees too cold.

**Likely Cause:** Most common cause is excessive air leaking into house through unused tunnel fan openings.

**Steps to Correct:** Shutters on fans that will not normally be used in winter should be covered with plastic or their cones covered with a bonnet. In negative pressure ventilation, poorly sealed fan openings allow backdrafting of outside air into the house. As many as 50% of the tunnel fans should be covered at the start of the growout. Also clean and check proper sealing of shutters on all fans that will be used in minimum ventilation.

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