The ***Alabama Poultry Engineering and Economics***

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Feature article

What Is the Most Important Part of Your Poultry House Ventilation System?

If you visit many poultry producers on their farms or talk to the live production people and ask the question, what's the most important part of your ventilation system, nine times out of ten the answer will be the fans. Fans certainly are essential, because they provide the airflow that makes the system work. However, the inlets through which air enters the house are at least equally important. And in mild to cooler weather or during brooding, configuration and adjustment of the sidewall or ceiling inlets are even more critical to bird comfort than fan performance is. Yet air inlets and air inlet management are too often taken for granted, misunderstood, and/or mismanaged. In this issue, we will look at inlets in a typical Southeastern U.S. broiler house, covering the basics of how they work and how proper inlet management affects your bottom line.

How inlets work: The first item to get a handle on in understanding the air inlet and its value to poultry growers is what the purpose of the inlet is. The sidewall or ceiling vent box or air inlet is our method of bringing ventilation air into the house when we don't need to be in tunnel and we don't want any outside air flowing directly over the birds. These inlets allow air to come into the house based on the static pressure difference between the outside of the house and the inside of the house.

In mild to cooler weather, air inlet adjustments are critical to bird performance

The first thing we must do if we are going to get good performance out of our inlets is to be sure the house is basically tight. Leaks in curtains, doors and roof ridge (on high ceiling houses) allow air to come into the house by-passing the inlet. Today's growers are sealing up houses with curtain pockets and flaps and chinking up holes. There is a lot of interest in solid sidewall houses as well. The tighter the house the better the inlet performance.

With proper static pressure and adjustment, inlets "shoot" air in high along ceiling for good mixing

A ceiling or sidewall inlet is designed to control the manner in which air enters the house. The inlet functions as an air jet that is supposed to "shoot" air into the building to mix with in-house air, keeping cold air from dropping onto the birds. The higher the static pressure difference between inside and outside, the further the air will shoot in. So in very cold weather when we need the maximum mixing we can close the inlets slightly and increase the static pressure to about 0.08 to 0.10 inches, resulting in maximum velocity and throw into the house. In milder weather we can open the inlets a little more and run at lower static pressure, say 0.05 inches. Here the air won't be thrown into the house so far.

How many inlets are needed: For any given number of fans running there is a correct amount of inlet opening (sq ft) to yield the desired static pressure. In calculating the total number of inlets to be placed on a 40 x 400 or 40 x 500 broiler house, the first question that house designers must ask is, How many 48-inch fans or how much airflow do I want to be able to run through the inlets without going to tunnel? This varies throughout the world (in some locations, tunnel is not even used). In our Southeastern style house a good rule of thumb is to design the house so 50% of the tunnel fans can be run through the inlets.

A good rule is to equip houses so that 50% of the tunnel fans can be run to bring air in through sidewall or ceiling inlets

If our house had four 48-inch fans rated at 23,800 cfm that we wanted to run through the inlets, then we need enough inlets to handle 95,200 cfm. How much air a given inlet will handle at its maximum rating depends on its size. Inlets range from 4 to 8 inches tall and from 36 to 60 inches long. So it is not the number of inlets that matters, it is the square footage total. Another good rule of thumb that works real well on our type poultry house is we need about 15 sq ft of inlet for each 10,000 cfm of fan capacity that will be pulling air through the inlets.

So in our example house we would need 15 sq ft/10,000 cfm x 95,200 cfm = 142.8 sq ft of inlet area. This 142.8 sq ft is for maximum negative pressure ventilation. If we are using 8-inch x 44-inch inlets, they will have an area of about 2.44 sq ft each. So 142.8 sq ft needed divided by 2.44 equals 60 (58.5) inlets for the house. The number of inlets can change based on the size inlet used.

How to manage inlets: The next thing to understand is how to manage these inlets. Basically, we need to adjust the size of the inlet openings to get both the static pressure desired and the airflow throw we need.

Static pressure control machines on inlets ease the management job and keep inlets automatically adjusted

Managing inlets manually is a well-nigh impossible job. Each time a fan came on and went off an inlet opening adjustment would need to be made. That is why the static pressure inlet control machine was invented. The SP inlet control machine senses the static pressure in the house and then opens or closes the inlets to achieve the proper opening that will produce the static pressure desired – and thus produce the airflow pattern desired. These machines work very well and have greatly benefited our industry.

One aspect of inlet management, however, does need to be taken care of manually, and that is deciding how many of our installed inlets will actually be used. We install enough inlets to handle half the total installed fan capacity, but when we are using only one or two fans, as in brooding, we also need to cut back on the number of inlets that will open. The reason for this is that if we are using too many inlets for the number of fans running, the static pressure machine will have to choke the inlet openings down too far in order to maintain static pressure and we will lose the airflow "throw."

Inlet opening adjustment is critical to getting good airflow and mixing, keeping cold air from dropping onto birds

This has been observed on farms in the last few weeks. With all inlets in use, running only one 48-inch fan results in the static pressure machine opening the inlets only about ¼ - ½ inches, and the air just sort of leaks into the house at the inlets and then falls to the floor. We don't get any air mixing because we haven't gotten any real air stream with any air velocity. This leads to wet litter, high humidity, ammonia, high fuel usage and poor air quality.

For these inlets to flow air properly they must open a minimum of 2-3 inches for a sidewall inlet or 1-1½ inches for a ceiling installed inlet. To get this during the early days of a growout when we are using only one 48-inch fan (or two 36-inch fans) at most, we need to latch closed every other inlet in the brood chambers (and all the inlets in the growout end). Now we are allowing 15 evenly distributed inlets in the brood chamber to respond to the inlet machine. We would unlatch more inlets in the brood chamber only if we anticipated needing to run additional fans.

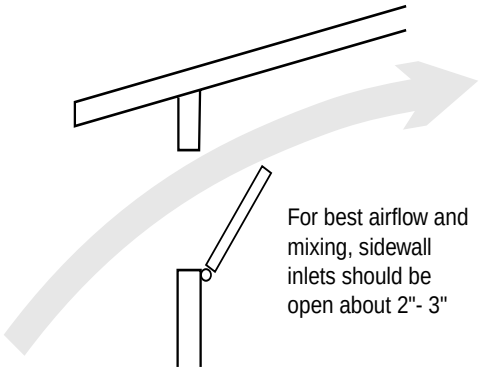
Number of inlets that should be used or latched closed depends on how many fans will be coming on

After turnout we typically need to unlatch more inlets in the growout end as more fans are used, and then finally as we get some age on the birds we unlatch them all. A good rule of thumb in a tunnel house is we need to have about 15 operating inlets for each 48-inch fan that we expect to be brought on during that phase of the growout or that prevailing weather.

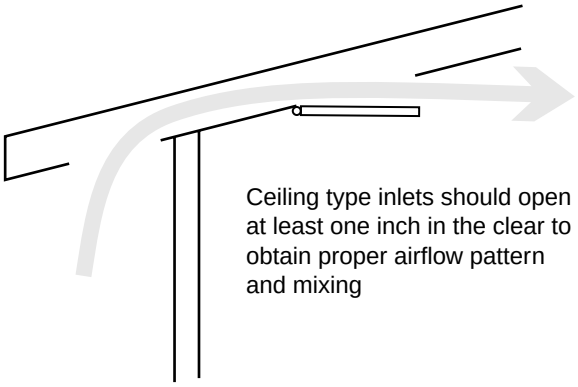
A common problem: One problem often seen in the field is obstructions to airflow being placed directly in the airstream of the inlet. For both ceiling and sidewall style inlets we are trying to achieve high air velocity so we can throw or shoot the air into the house. We want to get the air flowing as smoothly as possible and attach the jet to the ceiling so it can travel to the center of the house. If when our house is built we allow water lines or electrical lines to be strapped to the ceiling right in the path of the airflow we are really hurting our ability to mix air properly. Builders need to be told about this and alternate locations for these utilities need to be worked out.

The payoff: In houses with poor inlet management, as much as 15 to 20 degrees difference in floor and ceiling temperature have been observed. Good inlet management can keep this temperature difference to 5 degrees. The dollar benefits start with the fact that saved fuel costs keep money in your pocket. Houses with poor air mixing will use 20-25% more fuel. Plus the combination of temperature and air quality from day one is probably the most significant factor in broiler flock performance. Extreme temperatures can be devastating during the brooding period especially. Too cold conditions dramatically impact the ability of young birds to get adequate feed and water, and if early growth is slowed the performance losses cannot be made up during the life of the flock. The bottom line is that proper management of air inlets to provide birds the temperature and air quality they need is absolutely essential for getting top returns.

Good inlet management saves on fuel costs and helps grower maintain top flock performance

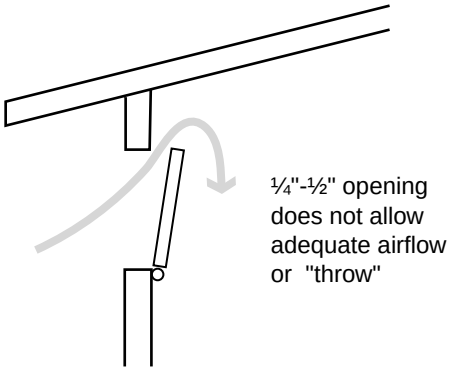


Proper sidewall inlet opening

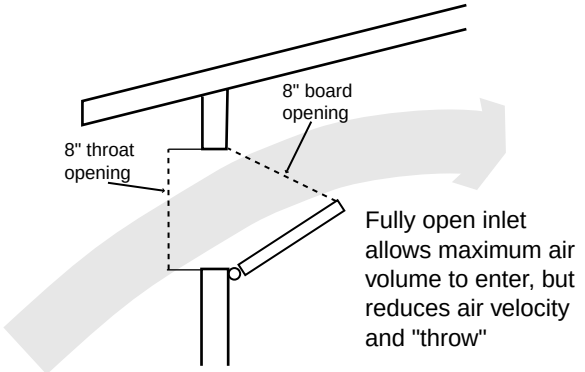


Proper ceiling inlet opening

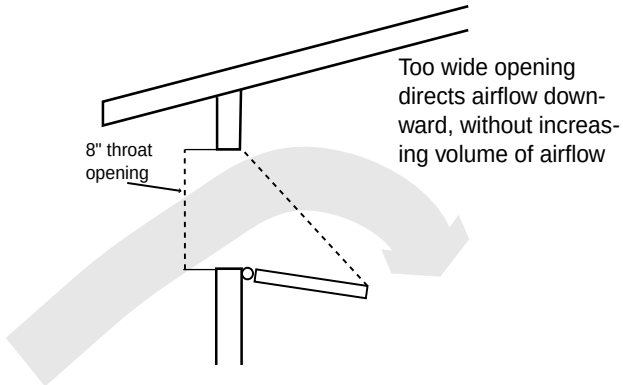
▲ **Proper inlet adjustments are critical –** We need the right amount of air coming in, and we need enough air velocity to throw the incoming cold air across the ceiling to mix with warm inside air. This prevents cold air from dropping onto birds and promotes good floor-to-ceiling air temperature uniformity. We should have no more than a 5-degree difference from bird level to ceiling.



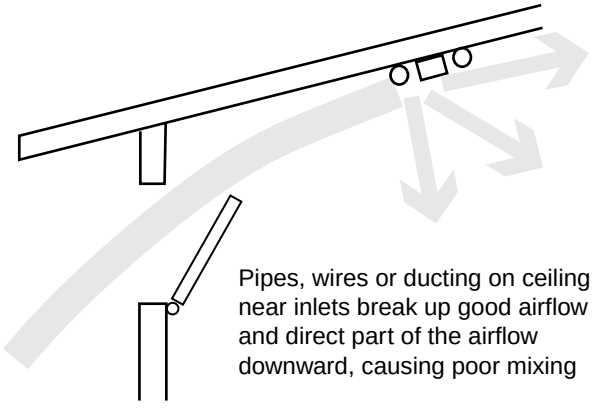
Too small inlet opening



Inlet fully open



Too wide inlet opening



Obstructed inlet

▲ Improper inlet management results in not enough air coming into the house, or the airflow being directed downward or blocked, or air not coming in fast enough – any or all of which prevent good mixing in the house “upper atmosphere” and result in poor conditions for bird performance.

ENVIRONMENTAL MANAGEMENT FROM DAY-OLD TO MARKET OFFERS THE NUMBER ONE OPPORTUNITY FOR IMPROVED PROFITABILITY IN BROILER PRODUCTION.

Keys to Successful Use of Sidewall and Ceiling Inlets

Getting top performance from a broiler flock depends largely on doing ventilation right – and air inlet management is absolutely the key to providing the right environment during the critical starting and early growth phases. Here are the top points to keep in mind:

1. For inlets to work properly a poultry house must be tight.
2. Most poultry houses in the United States rely on negative pressure to flow air into the house during cool weather or brooding operations. The inlet is the tool to make this happen properly.
3. Inlets control direction of air movement, velocity of air entering the house, and thus air mixing. In cold weather, inlets are the tool to help blend cold outside air with warm inside air to save fuel and maintain precise temperatures. Good inlet management prevents all the hot air from being in the top of the house.
4. Curtain openings and board cracks are not good inlets because they are too large, not uniform and do not do a good job directing air flow.
5. Static pressure inlet controllers work well to provide good airflow "throw" into the house under changing conditions, but only when the number of inlets available is matched to number of fans that will come on. All inlets on a house are to be used only for maximum power ventilation mode. During brooding and cold weather, a large number of the inlets are not only not needed, they must be closed off to assure good airflow.
6. Inlets must be open approximately one inch for a ceiling inlet and two to three inches for a sidewall inlet if we are to get the proper airflow patterns from the inlet. If your poultry house has all inlets opening one-quarter to one-half inch you need to latch closed every other inlet and then the remaining inlets will open twice as far.
7. Inlets opened beyond the "fully open" position (opening at tip of board equal to inlet throat opening) don't increase air flow. Too wide board openings tend to direct air downward toward the birds, which would be acceptable only for older birds and very mild or warm weather.

Grower Educational Seminar Planned

At its annual meeting this year, the Alabama Poultry & Egg Association will offer a seminar for growers titled Managing Ventilation Systems for Temperature Control and Maximum Pay. The presentation will focus on the practical understanding growers need to achieve the best possible temperatures for optimum returns. Topics will include a review of the ways ventilation systems can be managed under different types of weather conditions, and discussion of temperature monitoring devices and how they can be used to help you manage your house.

The Grower Educational Seminar will be held on Saturday, June 3, at 3:30 p.m. at the Sheraton Birmingham hotel. In addition to the seminar, the convention will include election of grower representative(s) to the AP&EA board of directors and announcement of the 2000 Alabama Poultry Farm Family of the Year. Refreshments will be served and door prizes will be awarded. For more information, call 800-254-2732.

ALABAMA COOPERATIVE Extension SYSTEM

The Alabama Poultry Engineering and Economics Newsletter provides up-to-date information on topics of interest to poultry production personnel, focusing on most effective and efficient uses of modern technology and equipment, with a special emphasis on economic implications. The Newsletter is published six times a year, or as needed to address emerging or special issues. Contact: Jim Donald, Extension Biosystems Engineering, 228 Corley Bldg., Auburn University, AL 36849-5626, (334) 844-4181, fax (334)-844-3548, jdonald@acesag.auburn.edu. Published by:

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