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NEWSLETTER

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

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Tunnel Inlet Doors – A Progress Report

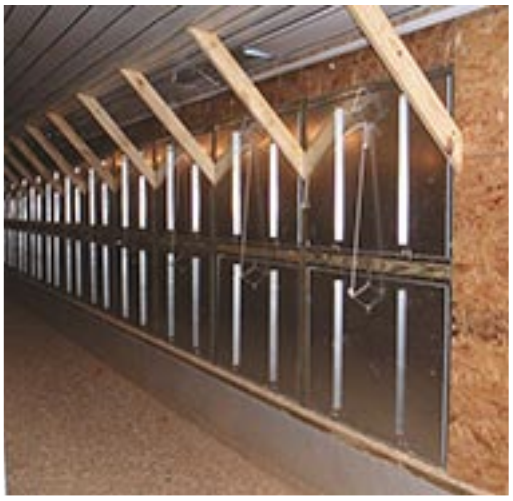
By Jim Donald, Extension Engineer, Jess Campbell, Poultry Housing Technician, and Gene Simpson, Extension Economist, Auburn University

For several years growers have been searching for ways to keep the tunnel inlet end of their broiler houses warm and dry in winter. The traditional tunnel inlet curtain does not have much insulative value (R-1.0) and many curtains are very loose fitting, allowing lots of air leakage. Most tunnel inlets with traditional tunnel inlet curtains are colder than the rest of the broiler house. During brooding, the combination of leakage and poor insulative value causes heat zone brooders in the inlet end of the house to run as much as 30% more than the brooders in the center of the chamber. The result is that the tunnel inlet heat zone often burns more energy than the rest of the brood chamber combined. And during brooding or in full house we have lots of condensation and caked litter in the front of many of our houses because of cold air hitting the warm floor.

Several solutions to this cold end of the house problem have been explored. Temporary interior curtains or insulation panels that can be removed during hot weather have worked well in many instances, but the fact that these temporary fixes have to be removed before the house can go into tunnel poses a risk if there is need to quickly open the inlet in case of power failure or other emergency. Tunnel curtain pockets have worked very well, and when properly installed allow us to get a tight seal on tunnel inlets that are approximately 5 feet tall by 80 feet long. The tunnel curtain pocket still has one drawback, however, and that is the tunnel curtain itself is not insulated.

About three years ago growers and companies began experimenting with hinged insulated doors mounted on the interior of the poultry house that would hopefully provide a better seal and provide at least about R-5 of insulation as well. The concept of the insulated tunnel inlet door made so much sense that several companies jumped in and began developing products with several different design variations. Sets of double doors made of plastic and insulation, single doors made of plastic, doors made with metal and filled with foam, and smaller doors with frames all began showing up on broiler houses across the broiler belt. Many different types of cabling and winching also began to appear. The idea of an 80-foot opening closed with only a curtain attached to a 420 foot long solid side walled poultry house just caused lots of people to jump on the good idea of the tunnel inlet door.

With increasing propane prices, the need to eliminate heat losses is a key factor driving interest in the tunnel inlet door. In addition, the tunnel doors we have observed have exhibited extremely good airflow in hot weather. The door acts as a big inlet and helps direct air up and more towards the center of the house in hot weather. Air patterns for hot weather ventilation for the doors we have looked at were excellent. The dead air spots that have been a common problem in tunnel houses in hot weather are almost entirely eliminated. The value of the doors in the summer seems to be excellent.



The tunnel inlet door, then, is a great idea, and we have seen installations that were working very well. However, we have also seen several problems that must be solved if tunnel inlet doors are to be

Using insulated doors to replace uninsulated tunnel inlet curtains is an excellent idea, and tunnel doors are being installed on many farms across the production area. More widespread adoption will depend on manufacturers and installers finding ways to improve durability and sealing against air leakage. Some models also require removal of knee braces, which may seriously damage the building's structural integrity.

truly successful. The biggest problem is getting the doors installed so they will seal tight and stay sealed over time. To get a good seal on most of the doors we have seen, some very careful framing and carpentry work needs to be done on the house prior to door installation. The installation of the frame is critical. If the frames are off by much more than a quarter of an inch it makes it very difficult for the doors to be completely sealed shut. This is a real problem in retrofit housing. Broiler houses are not often built perfectly square and true, so usually the frame for the doors has to be custom built. Several installers have told us that these frames have to be shimmed out to get them perfectly level and true. If the frames are not true, there are likely to be areas where the doors can leak, even with foam sealer and weather stripping.

This photo of a tunnel inlet door system in open position shows how the doors direct airflow upward as it enters the house, which helps eliminate dead air spots commonly seen with tunnel inlet curtain systems. A possibly serious drawback with this system is that it does not allow knee braces, which may be needed to protect the structural integrity of the house.

Durability of the door hinges has also been problematic. Hinges on some of the early models we have seen did not hold up very well over time. The continuous opening and closing of the doors fatigued the hinges and many of them split. When the hinge splits, the total weight of the door forces the door out of square, leaving large cracks to leak.

Another issue with the doors is difficulty in keeping the doors pulled up tight when in the closed position. We have to remember that in the wintertime these doors are subject to the static pressure of the fans pulling against them, thus trying to tug them open. Also, if there is a strong wind blowing outside the full force of the wind will be exerted against the doors and be working against the closing mechanism. Some companies offer thumb latches to secure doors in the closed position, but again this might prove to be a problem should we need the doors to open in an emergency situation. Some growers that have the double door system are electing to latch their bottom door shut and not installing latches on or not latching the top doors. In the single door installations it would be possible to latch every other door for wintertime emergency operation.

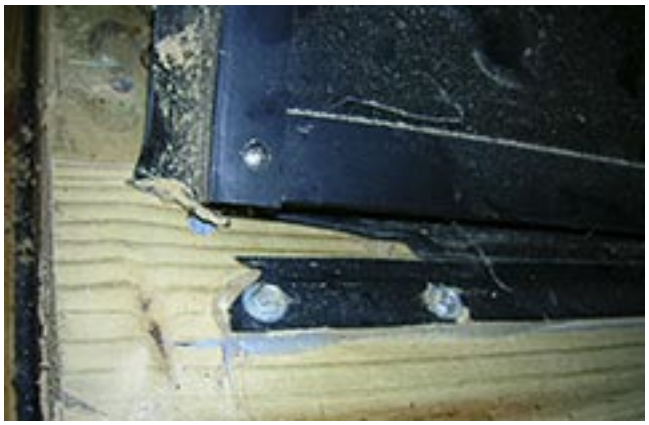
In smoke tests with good inlet curtains versus good tunnel inlet doors we observed more leakage in winter conditions with the doors. In houses with poor inlet curtains, of course, the door was an improvement. But, the fact that a good tunnel inlet curtain would beat a tunnel inlet door in tightness was a concern. If you look at the insulative value of the doors in combination with the additional leakage, we may actually be going backwards in net energy savings if we don't get a good tight installation with our tunnel inlet doors. The example on page 3 (facing page) compares two houses on a cold day, one with the tight-sealing tunnel inlet curtain (with pockets) and one with a tunnel inlet door system that does not seal very tightly. The purpose is to get an idea of whether the positive value of the added insulation we get with the doors balances the negative value of the kind of air leakage we have seen in many current models of tunnel inlet doors.

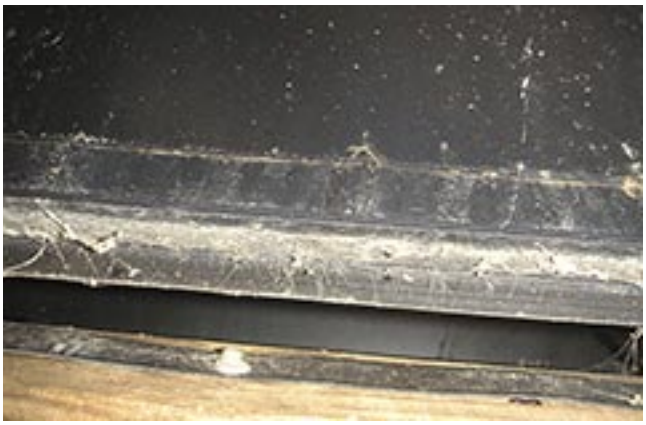
The assumption is that with otherwise identical houses, the one with the tunnel inlet curtain achieves a 0.25 static pressure, with an R-value of 1.0, and the tunnel inlet door house achieves a static pressure of 0.15 but has an R-value of 5.0. When you run the numbers on the example, you see that on a winter day in full house with an outside temperature of 30°F and we want 80°F in the house, the insulating value of the tunnel inlet door saves

Knee Braces and Tunnel Inlet Doors

Before you build or retrofit your houses with tunnel inlet doors, be sure to consider any modifications to the house that may be necessary. Knee braces which stabilize the poultry house are needed throughout the house in many structural designs. Many insurers are now requiring that knee braces be installed throughout the building to protect its structural integrity. Some tunnel door designs do not allow a convenient place for knee brace installation, and many growers have elected to just leave them out, not realizing the long term problems that this may cause. The building will be subject to structural leaning or racking in heavy winds and may be subject to shifting over time. In addition, not having knee braces at the tunnel end may make it more difficult for you to insure your poultry house. So before you decide on a tunnel door, make sure the design accommodates knee braces or that knee braces are not necessary for your buildings. In the long run, there will most likely be a requirement for knee braces in most new poultry house designs.

Photo at left shows one of the benefits of tunnel inlet doors, the ability to throw air to the center of the house in summer ventilation, eliminating most of the dead air spots too often seen in tunnel curtain houses. Most of the reports we have seen on tunnel inlet doors in summer operation are favorable. Smoke test photo at right, however, of the bottom of a tunnel inlet door that is supposedly completely closed, shows a common problem of current inlet doors, poor sealing that allows cold air to come in during cold-weather minimum ventilation.





A major problem with many of the tunnel inlet doors that use considerable amounts of plastic is fatiguing of the plastic hinges over time. Either due to poor installation or poor manufacturing, some of the hinges are not holding up. Photo at left shows an obviously cracked hinge. Right photo shows a one-inch crack that developed along the entire length of a continuous hinge. When we purchase tunnel inlet doors we are hoping to achieve some serious tightness and insulation in our houses. Leaks like this cannot be tolerated.

Example Heat Losses – Poor-Sealing Tunnel Doors vs. Tight Tunnel Curtains

House: Typical 42 ft x 500 ft solid wall house with 5 ft x 80 ft tunnel inlet openings
Conditions: 30°F outside, inside target temperature 80°F

	Tunnel Curtains	Tunnel Doors
Insulating value	R-1.0	R-5.0
Direct heat loss (surface area ÷ R-value x temperature difference)	40,000 Btu/hr	8,000 Btu/hr
House tightness (static pressure, higher is better)	0.25	0.15
Estimated air leakage coefficient (lower is better)	0.20	0.30
Air leakage heat loss (coefficient x temp difference x sq ft floor area)	210,000 Btu/hr	315,000 Btu/hr
Total heat losses	250,000 Btu/hr	323,000 Btu/hr

Conclusion: If a tunnel inlet door system allows air leakage typical of many currently installed models, its net heat loss will be 73,000 Btu/hr more than a typical properly installed tunnel curtain system (with curtain pocket). Although the insulating value of the doors can reduce direct heat loss by 32,000 Btu/hr, tunnel inlet doors not sealing tightly can lose 105,000 Btu/hr more because of air leakage than a good tunnel curtain system. A net heat loss of 73,000 Btu/hr equates to a little more than three-fourths of a gallon of additional propane per hour to be paid for.

Note: These are engineering calculations for just one situation addressing problems observed in some houses in the field, and should not be interpreted as true of all tunnel inlet door systems.

us about 32,000 Btu's per hour, compared to the tunnel curtain house, or about one-third gallon of propane per hour. However, the tunnel door loses 105,000 Btu's per hour compared to the curtain house because of its greater air leakage. In other words, in this situation we are likely to be losing 73,000 Btu's per hour more with the tunnel doors installed than with a good tunnel inlet curtain.

We note that these are engineering calculations for just one situation, and in the real world there will be variations in how systems actually perform. And again, we have seen houses in which recently installed tunnel inlet doors seemed to be performing very well indeed. However, the example is representative of many tunnel inlet door conversions we have seen in the field. For example, one of the farms that we looked at with an integrator representative said that they had been able to achieve a 0.22 to 0.25 static pressure on houses with properly installed tunnel inlet curtains. But on the same houses with tunnel inlet doors, the best static pressure they could achieve was about a 0.15. So with the insulated doors in place they actually sacrificed a significant amount of house tightness, which definitely will result in increased heat loss in cold weather.

The Bottom Line

Prices vary on tunnel inlet doors and installation, but in general the cost of doors is more than the cost of a tunnel inlet curtain. On several farms we looked at, installed tunnel inlet doors on both inlets, including framing and the machine to open and close the doors, cost about $6,800 for an 80 foot inlet. The cost of a dog house and a tunnel curtain setup with a machine to open and close the curtain was about $5,600. So the tunnel door installation on a new farm costs about another $1,200, and we don't get the dog house.

However, there are many reasons why a tunnel door that seals properly will be economically justified and why these doors will then quickly become part of a standard broiler house. This is why there are now many companies working on the concept of tunnel doors.

On the other hand, our observations in the field and the analysis we have done here tell us there is no place for a tunnel inlet door that does not seal properly. It will do us more harm than good in the cold winter months.

So what should you do if you are considering tunnel inlet doors? The concept is excellent and we believe ultimately that the bugs will be worked out. However, be an informed buyer. Before you buy you should look at some doors that have been installed for at least a year. Remember poultry houses move and shift over time and so doors won't get any tighter or better as time goes by. Talk to folks who have them and talk to the folks who have done the installation. It is important for us to spend our money wisely.

U.S. Poultry & Egg ASSOCIATION

This newsletter is produced in cooperation with the U.S. Poultry & Egg and Alabama Poultry & Egg Associations, as part of their commitment to poultry industry education. We appreciate their support and are proud of our relationships with these organizations.

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Jim Donald, Extension Engineer, Auburn University

Mike Eckman, Extension Poultry Scientist, Auburn University

Gene Simpson, Extension Economist, Auburn University