

Poultry Engineering, Economics & Management

Newsletter of the National Poultry Technology Center, Auburn University

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

Produced in cooperation with the U.S. Poultry & Egg and Alabama Poultry & Egg Associations
Issue No 88, September 2015

Attic Inlet Ventilation: Lessons Learned

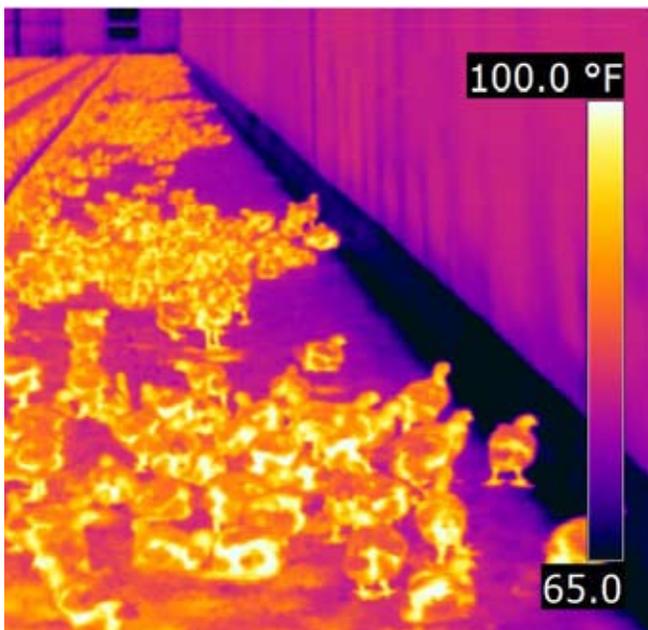
By the National Poultry Technology Center Team, Auburn University

The need to reduce fuel use in modern poultry housing is unquestionable. There are many ways to accomplish this goal. In recent years the use of attic inlets for cold weather ventilation has taken hold in many areas as one possible way to decrease fuel usage. The theory is relatively simple: The sun provides solar heat that gets trapped as heated air in the attics of dropped ceiling poultry houses. This heated air can then be used via attic inlets as a heat source in lieu of propane or natural gas heaters. To put it in terms we all can understand – “Woo Hoo! Free Heat!”

It is true heat gathers in the attics of poultry houses, and that heat can sometimes be captured and used. But that simplistic answer does not tell the whole story. In several years of research and observation, we at the NPTC have seen and heard from many growers who have had serious problems using attic inlets – including a lack of real fuel savings, wet litter and cold air drafting on birds, and even possible structural damage. Still, some growers seem to have a good handle on attic inlets and report positive results.

We conclude that attic inlets are not just an “install it and forget it” beneficial technology. There are many different varieties and installation options for attic inlets, many considerations to be taken into account and pitfalls to be avoided. In deciding whether to install an attic inlet system, it is imperative for growers and integrators alike to understand the potential downsides of this technology and to realistically weigh all the potential benefits against the cost and management requirements for successful use.

A grower who already has attic inlets must fully understand both the capabilities and shortcomings of his particular system. Growers who have had the best success with attic inlets are those who have done their homework and have been willing to properly manage their attic ventilation system.



One commonly reported problem with attic inlets is drafting of cold air onto birds. This thermal image shows birds feeling a cold air draft that has run down the sidewall from the attic inlets.

This problem is likely to arise whenever attic inlets are run at too high a static pressure; and when attic air temperature is too far below the target temperature setpoint. It is worse in narrow houses and houses that use bi-flow inlets.

In this case we found static pressure too high, 0.09 inches when it should have been around 0.04 inches. In addition, attic air temperature was 46°F, warmer than outside air but too far below the 70°F house target for that day.

As a safe general rule, attic inlets should not be used at all unless attic air is within 10-15 degrees of house target temp (or higher). Static pressure needs to be kept low to get good air mixing high in the house and avoid throwing attic air down sidewalls and onto birds.

Lessons Learned:

- **All attic inlets have potential leakage problems. Improper installation and poor management can make things worse.**

Careful attention must be paid to how attic inlets are installed. All attic inlets are pre-formed, with “flat and square” mounting surfaces coming out of the factory. However, they are often installed in a frame built quickly that is not so flat and square. This situation provides ample opportunity for cracks and misalignment that allow air leakage both into and out of the attic. In the winter we don’t want the warm, moist air from the brood area leaking into our attics and in the summer we don’t want the super-heated air from our attics leaking into the brood area we are trying to keep cool.

Poor management can also lead to serious leakage problems. Attic inlets should be monitored to make sure none get stuck in the open or “not quite closed” position. Some attic inlet systems are actuated by machine and work with the controller to improve ventilation efficiency. This can be a good thing, but if attic inlets pre-open before fans come on, they instantly allow warm, moist air to flow freely up into the attic with every minute cycle. This is wasteful of heat as well as detrimental to the attic – which brings us to the next point.

- **Unless properly installed and managed, attic inlets can contribute to structural damage by allowing warm and moist house air to enter and condense on trusses, roof metal and insulation.**

Poultry house attics are made up of trusses built with untreated lumber, put together with press fit truss plates. Thermal expansion and contraction combined with moisture fluctuations can cause these truss plates to loosen over time. This loosening weakens the structural integrity of the trusses, with the potential of eventually causing a failure and subsequent collapse. Also if moisture from warm brood air condenses at night in a cold attic, moisture forming on the metal and wood is likely to begin dripping onto the attic insulation. We have seen some pretty significant evidence of wet insulation in attic inlet houses. A more worrisome issue we have seen is roof metal corrosion on the underside in some attic inlet houses. These are slow, easily-overlooked processes that nevertheless have potential to seriously affect a grower’s return on investment.

- **Attic inlets are only beneficial when there is usable heat in the attic. Successful cold weather usage requires close and consistent management.**

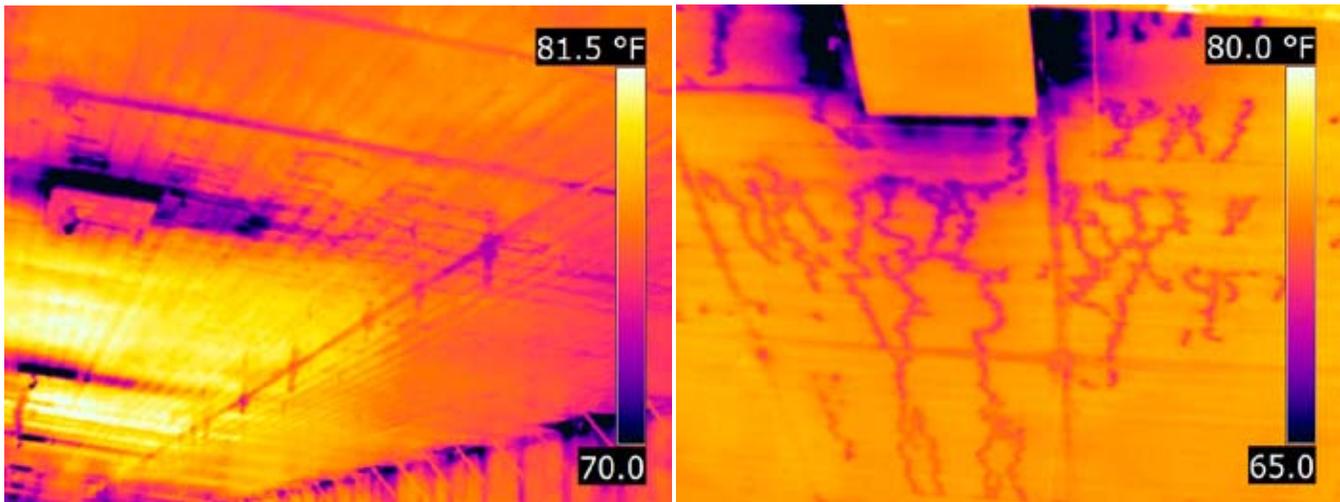
It is true that the sun heats attic air. It is also true that the sun is not always out when we need heat, therefore there is not always heat in the attic. When it is nighttime and 30 degrees outside, the attic air should be within 2-3 degrees of outside air temperature. If there is any significant amount of heat in the attic at this time, it is an indication of either insufficient insulation or serious leakage problems. The answer then would not be trying to recapture that heat, but to eliminate its loss in the first place. To be usable, attic air must be both warmer than outside air, and warmer than or at least within 10-15 degrees of the house target temperature.

The problem with ventilating with attic inlets when there is insufficient heat in the attic stems from one main issue: Cold air being thrown away from the peak of the ceiling by attic inlets acts differently from cold air being thrown up into the peak of the ceiling from perimeter sidewall inlets. When using sidewall inlets, we use high static pressure to throw cold air UP the ceiling INTO the hot air in the peak, mixing it and warming it before it impacts the floor and birds. Attic inlets throw air away from the heat sink in the peak toward the sidewall. If this air is too cold, and since it is not fighting gravity, this air retains its speed, flowing down the sidewall and rolling onto the warm floor of the house, drafting birds and causing caked litter. The higher the static pressure and the narrower the house and the colder the attic air temperature, the more pronounced this undesirable effect will be.

Attic inlets work well only if attic air is warm enough, and they work best at low static pressure, typically in the 0.03 - 0.06 inches range for narrow houses, and up to 0.10 inches in ultra-wide houses. For many growers, many of the problems they have with attic inlets can be solved by simply finding a way to close them at night when there is no heat there to recover anyway.

- **Attic inlet systems should include a way to close vents in the non-brood area of the house.**

Just as is the case with perimeter inlets, if a grower during brooding cannot or does not close the attic vents in the non-brood area of the house, then he will be forced to double the minimum ventilation rate in order to adequately ventilate the brood chamber where the birds are. Drawing equal air from the non-brood half and the brood half at the usual minimum ventilation rate results in only ventilating the birds at 50% the required amount. This is the cause of many of the wet brood areas we see in attic inlet houses.



Attic Inlets Leaking or Stuck Open Cause Heat Loss & Moisture Condensation in Attic:

The thermal images above show a non-directional attic inlet that has been stuck in the opened position for an unknown period of time. As a result, heat escapes the house, extending heater run times. Even more important, the dark areas and lines on the ceiling show wetting of insulation and ceiling material. Allowing warm, moist bird chamber air to leak into the attic and contact the cold metal roofing results in condensation forming on roof and truss members and dripping onto the insulation and ceiling material.



Condensation on Roofing and Attic Lumber Can Threaten House Structural Integrity:

Photo on the left shows condensation covering the roof metal and wetting the lumber purlins of a newer house directly above and around an attic inlet stuck in the opened position. The picture on the right shows the prolonged effects of moisture in an older house that has been exposed to condensation for several years. If you have attic inlets, it is a good idea to periodically inspect the attic for signs of damage. Obvious signs of long-term damage in an attic, as in the picture on the right, can be seen anytime. In a newer house, you have to catch the house in the right conditions on a cloudy day or at night when there is heat and moisture inside the house. For example, do an attic inspection on a cold night when the house is in brooding mode to see if condensation is forming above attic inlets.

➤ **Because of the disparity of times when there is actual recoverable heat in the attic and need for that heat in the house, attic inlets have not proven to be huge gas savers.**

This aspect is absolutely weather dependent. If a grower experiences a winter where there is much sunshine and his flock rotation is favorable, he can gain some significant savings. However if his rotation is such or the weather is such that he is brooding during rainy, cloudy days, he could go a winter realizing no savings at all. To make sure fuel is not actually being wasted, growers must do everything possible to prevent leakage and to make sure that in-house temperature sensors are not being exposed to cold attic air during minimum ventilation cycles. This can cause heating systems to run after each minimum ventilation cycle and result in excessive fuel use. Smoke testing for flow is always advisable.

➤ **Attic inlets can provide useful ventilation benefits in milder weather – spring and fall conditions.**

During these times, attic inlets have been shown to be “ventilation enhancers.” By mixing some heated air from the attic with the milder outside air, ventilation rates can be increased overall. This can be done in winter but it is much more difficult and fewer opportunities exist when compared to the milder seasons.

➤ **The most effective and trouble-free way to use attic inlets is to dry out houses between flocks.**

Although this is the opportunity we see fewest growers taking advantage of, if there is ample sunshine attic inlets can provide super-heated air to do an outstanding job of drying litter between flocks. Some of the best, driest, most consistent litter packs we have seen have been accomplished by running two 36-inch fans all day through attic inlets. During these times, we are not worried about air flow patterns or over-heating the houses. The more hot air ventilated through the house, the more moisture we are removing before the next flock arrives. If you have attic inlets, use them for this purpose if nothing else.

Bottom-Line Summary

1. Think of attic inlets primarily as “ventilation enhancers,” not “gas savers.” While attic inlets can, when managed properly, provide some fuel savings, overuse of attic inlets is likely to result in poor in-house conditions that can hurt flock performance and may cause wet litter and even structural damage.
2. Use attic inlets only when there is sufficient heat in the attic and birds need that heat. A good rule of thumb is to use them only when attic air is warmer than outside air and within 10-15 degrees of target set point or higher. For example, outside temperature is 40°F, target is 70°F, attics during minimum ventilation could start at 55°F or higher. This reduces chance of drafting chickens, but requires close management.
3. Keep in mind that attic inlets work best at low static pressure. Try to stay in the 0.03 - 0.06 inches range for narrow houses, up to 0.10 inches in ultra-wide houses.
4. Make every effort to minimize air leakage – both directions. We do not want to waste usable heat or allow warm moist air going into the attic where it will condense, wetting insulation in the ceiling and leading to structural damage. Nor do we want super-heated air leaking into a house we are trying to cool.
5. Whenever weather conditions are favorable after catch and before new chicks arrive, make full use of attic inlets to dry out litter. This practice requires little or no management supervision, making full and effective use of that “free heat” in the attic to provide improved conditions for the next flock.

Thanks to the following for their support of Extension poultry engineering, economics and management programs at Auburn University:

Diamond

Aerotech/Munters.....	888-335-0100
Agrifan.....	800-236-7080
Cumberland.....	217-226-4401
Hired Hand, Inc.....	800-642-0123
Port-A-Cool.....	800-231-9940
Porter Insulation Products.....	800-999-0430
Poultry Litter Treatment-PLT.....	800-379-2243
Reeves Supply.....	888-854-5221

Platinum

DIVERSIFIED / ROTEM.....	800-348-6663
Pro-Tech, Inc.....	www.pro-techinc.com
Tabor Group Inc./aglights.com.....	540-989-7383

Gold

Chore-Time.....	574-658-4101
J&R Builders/Farm Systems.....	205-594-5994
Multifan/Vostermans Ventilation, Inc.....	800-458-5532

Silver

Alabama Farm Credit.....	877-681-6087
Aviagen.....	800-826-9685
CoolAir.....	904-389-1469
Dandy/G&M Sales.....	800-222-4166
Detroit Radiant Products Co.....	800-222-1100
Double L Group.....	800-553-4102
Ellison and Ellison.....	770-427-8929
First South Farm Credit.....	800-955-1722
IVESCO.....	800-643-3064
Lewis Brothers.....	912-367-4651
Space Ray.....	800-438-4936
VALCO.....	www.val-co.com



ALABAMA COOPERATIVE EXTENSION SYSTEM

The *Poultry Engineering, Economics and Management 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 as needed to address issues of concern to the industry. Contact: Jess Campbell, National Poultry Technology Center, 226 Corley Bldg., Auburn University, AL 36849-5626, (334) 844-3546, fax (334) 844-3548, jesscamp@aces.edu. The NPTC team:

Jess Campbell Poultry Housing Specialist	Dennis Brothers Poultry Housing Specialist	Jim Donald, Professor and Extension Engineer	Gene Simpson, Professor and Extension Economist	Jeremiah Davis, Assoc. Professor Biosystems Engineering

Issued in furtherance of Cooperative Extension work in agriculture and home economics, Acts of May 8 and June 30, 1914, and other related acts, in cooperation with the U.S. Department of Agriculture. The Alabama Cooperative Extension System (Alabama A&M University and Auburn University) offers educational programs, materials, and equal opportunity employment to all people without regard to race, color, national origin, religion, sex, age, veteran status or disability.