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Is Shifted Ceiling Insulation Running Up Your Gas Bill?

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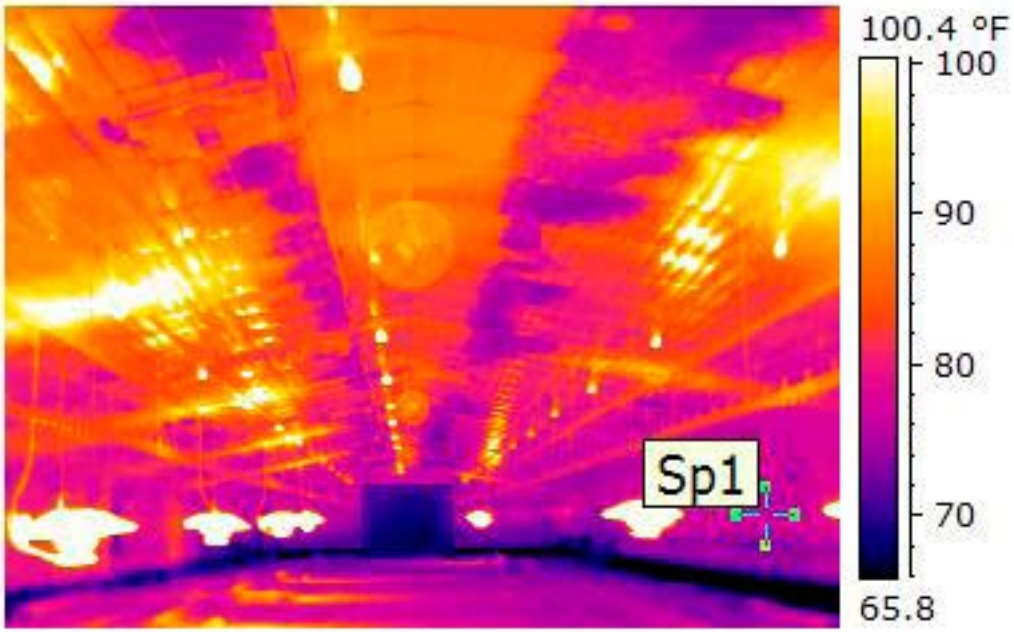
When was the last time you peeked into the attic of your poultry house? Do you know what the insulation looks like? If not, maybe it is time to take a look. Over the years wind, rodents, and gravity coupled with vibrating ceiling material (due to placing negative pressures on the house during ventilation) can take a toll on ceiling insulation, especially those insulated with blown cellulose. Shifted insulation catches many producers off-guard because it is out of sight. If you have areas of uninsulated ceiling it can cost you big bucks on fuel bills. Even with LP prices at $1.30 to $1.50/gal., rearing cold weather flocks in a poultry house with shifted ceiling insulation can quickly run up your gas bill.

How can you tell if insulation has shifted? It is hard to tell from the ground with the naked eye if and where insulation in the attic has shifted. Two primary indicators you can see from the inside of the house are condensation and light. Condensation often collects on uninsulated surfaces when it is cold outside and warm and humid on the inside of a house. If you spot condensation on your ceiling this means for all practical purposes there is no insulation above the area where you see condensation. Due to the condensation, thick layers of dust accumulate on these areas over time, making un-insulated places easier to spot. Another indicator is seeing transparent places in the ceiling material when the lights are dimmed and it is sunny outside.



Thermal images show cooler areas in shades of blue, warmer areas red-orange to white. This picture shows a ceiling that originally had 3.5-inch fiberglass batt insulation installed only over the peak of the ceiling to prevent heat lost due to shifted blown insulation. The batts mostly fixed the problem over the peak but didn't stop the rest of the insulation from shifting, leaving large areas of uninsulated ceiling.

The best way to find out for sure if insulation has shifted is to visually inspect the attic through access holes in the ceiling. If you have never done this or can't remember when you did it last, now is the time to check. You may be surprised at what you find. Ceiling insulation should be checked on a yearly basis to make sure it has not shifted or blown away. Be careful when you do this because litter can sometimes unexpectedly shift under a ladder and cause it (or you) to fall. It is best to stick at least 36 inches of ladder above the hole framing in the ceiling and have someone hold the ladder while you are climbing up to the attic. Checking ceiling insulation alone is not recommended

What is R-value anyway?

Speaking of insulation, what is an R-value anyway? An R-value is a number that indicates how well a material resists heat flow. Higher R-values slow the rate of heat loss and so will help keep more heat inside your houses during cold weather between minimum ventilation timer cycles. So the higher the R-value in the ceiling, the greater the insulating effectiveness and less heat lost from the ceiling. Blown cellulose and fiberglass batt insulation are both rated at approximately R-3.2 per inch of material thickness. Six inches of blown cellulose or fiberglass batt insulation will both provide about an R-19 insulation value. Most new houses are constructed with a minimum of R-19 attic insulation in the southern regions of the U.S. and more insulation, typically up to R-30, in colder climates.

How much heat loss might shifted and settled insulation cause in an older house?

Costs incurred by not replacing insulation? Let's consider a typical scenario: A 40 X 500 house has about 20,000 sq ft of floor area and about 20,000 sq ft of ceiling area. If during brooding there is a 60-degree F temperature difference from inside to attic (30°F outside and 90°F target temperature inside the house), 20,000 sq ft of uninsulated ceiling (R-1) would lose 1,200,000 btu's per hour. The same ceiling insulated to R-19 will lose only 66,157 btu/hr.

But that is on day one when the house is new. After 10 years the insulation may have shifted approximately 2 feet away from the peak of the ceiling in both directions, so there is a 4-foot by 500-foot or 2,000 sq ft strip of uninsulated ceiling where the insulating material shifted away, and this R-1 strip at the same 60-degree F temperature difference will lose about 120,000 btu/hr. Because of compaction over the years, the insulating value of the remaining 18,000 sq ft of insulated ceiling might have dropped to around R-10, so this area will lose about 108,000 btu/hr at the 60-degree F temperature difference.

The total rate of heat loss through the entire ceiling with the combination of shifted and un-shifted ceiling insulation would then be about 228,000 btu/hr. In other words (or numbers, that is): after 10 years the ceiling loses 3.5 times the amount of heat each hour of a cold weather day than it did the day it was built.

How can I tell how much poor insulation is costing me?

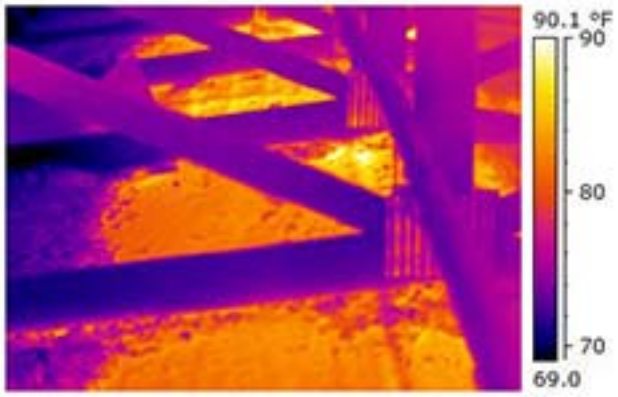
Looking at how much that heat loss costs in the additional propane needed to maintain house temperature: We will need to supply an additional 164,843 btu/hr (228,000 btu/hr – 63,157 btu/hr = 164,843 btu/hr). Since propane provides 92,000 btu's per gallon, that means we will be burning an extra 1.79 gallons per hour (164,843 btu/hr/92,000 btu/gal = 1.79 gal/hr). At $1.40 per gallon of propane, that means spending $2.50 more per hour per house, $60 more per day for each house, and if we have four houses we will be spending $240 dollars more per day for the 4-house farm.

If this same scenario is looked at after a 7-day period, the grower cost in heat lost through the 4-house farm ceilings would be $1,680.00 in gas at $1.40/gal.

Insulation replacement costs and payback? For the typical older 40 X 500 house that has lost about half of its original R-19 ceiling insulation value, it costs approximately $3,000 to hire a crew to add an average of 3 inches of blown cellulose over the entire ceiling. (Some areas of the ceiling will need 6 inches and some only 1 inch of insulation added to get back the desired 6 inches to achieve an R-19.) The cost would be $12,000 for a 4-house farm to re-insulate. So, $12,000/$240 day = 50 days to recover the money spent on replacing the insulation in the ceiling using this example.

What if it hasn't shifted but it is thin, say only about 2 inches deep? Two inches of blown cellulose will have an insulating value of R-6. which will mean about 200,000 btu/hr lost through the ceiling. With R-19 only 63,157 btu/hr is lost, so an R-6 loses almost 3 times the amount of heat as an R-19 under

This thermal photo was taken from the attic of a house looking at the back side of the ceiling material. Orange-to-red areas show heat escaping from the house where blown-in cellulose insulation has shifted away from the peak.



Photographs above were taken in north Alabama in a house about 10 years old. Notice the bare ceiling material in the middle of the house and the exposed lumber at the bottom of the trusses, showing that the blown-in insulation has not only shifted but thinned out. If your insulation looks like this a new insulation job should be at the very top of your list of things to do.

Six inches of blown cellulose or fiberglass batt insulation yields about an R-19 insulation rating and should just cover the bottom 2X6 lumber of the ceiling trusses. If the ceiling material is sagging, then the top of the lumber may be exposed, but not too much. When installing new blown-in insulation, the best way to make sure you get enough insulation is to ask the insulation installer how many bags it will take to re-insulate the houses, then ask to count them after the job is done in each house to ensure that is how much was used. When blowing cellulose, water must be added during the process to activate the binder in the product. If adequate water is not added, binding of the material will not be complete and the insulation material will be more prone to shift and to settle, becoming compacted and losing insulating value.

these conditions. An R-6 ceiling, especially if there are no bare areas, is certainly better than an uninsulated ceiling and may be better than an R-19 with significant areas where the insulating material has shifted and left bare ceiling. Still, re-insulating houses with little or thinned insulation will significantly reduce heat losses and propane usage during cold weather.

If R-19 is good, what about R-30? Increasing the thickness of ceiling insulation from the typical R-19 to an R-30 does further reduce heat loss. However R-19 is sufficient in most parts of the broiler belt in the U.S., primarily in the warmer climates, and yields a quick payback. Ceilings insulated to R-30 are typically recommended in colder regions of the U.S. Using the 60-degree F temperature difference with an R-19 ceiling, the heat lost each hour is 63,157 btu/hr. With an R-30 ceiling the heat lost would be 40,000 btu/hr.

The R-30 ceiling reduces the heat lost every hour by 37% but costs an extra $2,000 per house to install just the insulation, and additional ceiling bands are recommended to support the extra insulation installed above the ceiling material. Most installers recommend bands on 4-inch centers for R-30 instead of 6-inch centers for R-19 ceilings. $2,000 per house on a 10-year old farm in southern regions could be spent better on something else, like stir fans or house tightening.

What is the best insulation to use for ceilings in brand new housing? When building a new 40 X 500 house the increased cost to have a 6-inch fiberglass batt attic vs. a 6-inch blown cellulose attic is about $4,000. Fiberglass batts do not shift or settle. Blown cellulose is the cheaper way out, and fiberglass batts are the quality way out. If growers and companies believe the price of fuel will increase during the next 20 years, the best economic decision is to use fiberglass batt insulation in the ceilings.

Take Home Point

Bare spots and thin insulation are very big problems in most of the Broiler Belt. Fixing the problem is relatively easy and has a very short payback period. Some growers burn an estimated 50% of their annual fuel in the two cold weather flocks each year due to the extreme outside conditions and extended brooding periods. The colder the outside temperatures get, the more valuable good ceiling insulation becomes. Yearly inspections must be done to ensure ceiling insulation is in place before cold weather arrives.

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 six times a year, or as needed to address emerging or special issues. 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. Published by:

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