The University of Georgia

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Cooperative Extension

Poultry Housing Tips

Poultry House Leakage Estimating Spreadsheet

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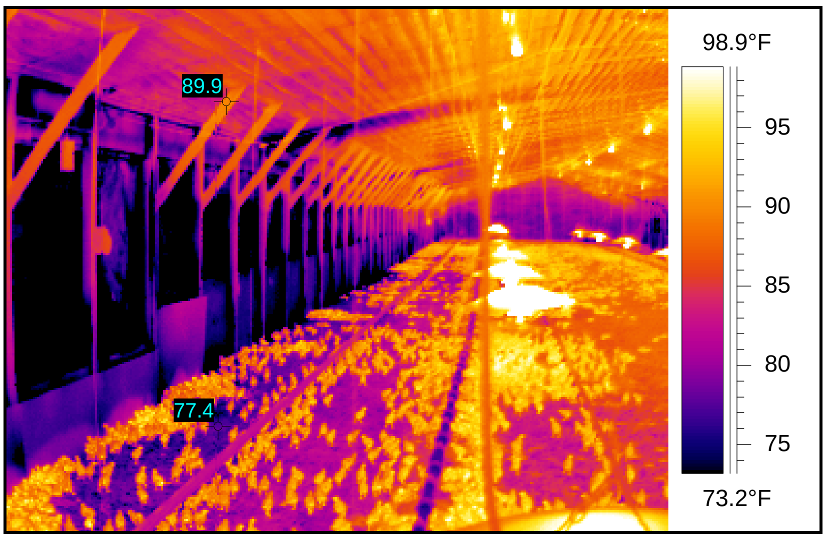

Figure 1. Air entering through cracks and side wall inlets.

Poultry House Leakage Estimator - 2014

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Enter Green Values (do not leave blank)
This spreadsheet is intended to illustrate how poultry house tightness can be estimated though the use of a static pressure test. The spreadsheet will also illustrate how poultry house tightness will determine the amount of fresh air brought in by minimum ventilation fans(s) that will enter through a houses inlets relative to that entering through cracks (unplanned openings). The spreadsheet will not provide precise values, but rather estimates

Poultry House Leakage Test:	
House length (ft)	500
House width (ft)	40
Total fan capacity used in leakage test (cfm @ 0.10")	23000
Static pressure measured (")	0.25
Relative leakage area (ft2 per 1,000 ft2 of house floor space)	✓ 0.41
Total house leakage area (ft2)	8.1

(For the best accuracy if the static pressure obtained during house testing exceeds 0.25", consider using fewer or a lower capacity test fans.)

Minimum Ventilation Inlet Opening Requirements:	
Minimum ventilation fan capacity (cfm)	23000
Number of air inlets to be used	25
Maximum air inlet height/opening (inches)	6.0
Air inlet length (inches)	48.0
Total side wall air inlet area (ft2)	50.0
Total required opening area for specified fan(s) @ 0.10" (ft2)	30.7
Total house leakage area (ft2)	8.1
Total required inlet area @ 0.10" (ft2)	22.6
Percentage of air that will entering through inlets	74%
Approximate required air inlet opening size/height (inches)	2.71

Figure 2. Poultry House Leakage Estimator Spreadsheet

In order to control the environment within a poultry house it is essential that a producer not only controls how much air is entering the house, but where it is entering. For instance, during cold weather essentially no air should enter a house when the fans are off. When the fans are operating, all the air should enter through the air inlets so it can be directed along the ceiling toward the center of the house to insure it is preconditioned by the warm air next to the ceiling before moving down to bird level (Figure 3). Air entering through cracks or gaps in side wall curtains whether the fans are on or off can lead to drafts, caked litter, and excessive fuel usage (Figure 1). During the summer, in order to maximize bird cooling all incoming air should enter through a house's evaporative cooling pads. Air entering through cracks leads to hotter side walls, increased temperature differentials between the pads and fans, and poor air speed distribution, all of which can reduce weight gains and increase feed conversions. To minimize the problems associated with air leakage it is essential that poultry producers are aware of how tight their houses are so that corrections can be made before bird performance suffers and/or heating costs become excessive.

The traditional method of measuring poultry house tightness is to conduct a simple static pressure test. In a static pressure test all the inlets, curtains, and doors are closed and one or two exhaust are turned on. To obtain the most accurate results, the air moving capacity of the fans should be capable of moving as close to one cfm of air for every square foot of floor space as possible. For instance, in a 20,000 square foot house either one fan that moves 20,000 cfm (@0.10") or two fans that move 10,000 cfm (@0.10") would ideally be used when conducting the static pressure test. If you don't know how much air your fans are supposed to move you can find out at BESS Labs website (www.bess.uiuc.edu). The higher the static pressure obtained during the test the tighter the house is, and the greater the level of control a producer will have over both the environment within a house and energy costs.

Traditionally, houses have been divided into three tightness level groups based on their static pressure test results:

Very loose houses	= 0.05 or less (Figure 1)
Moderately tight houses	= 0.10" - 0.13"
Very tight houses	= 0.20" or greater (Figure 3)

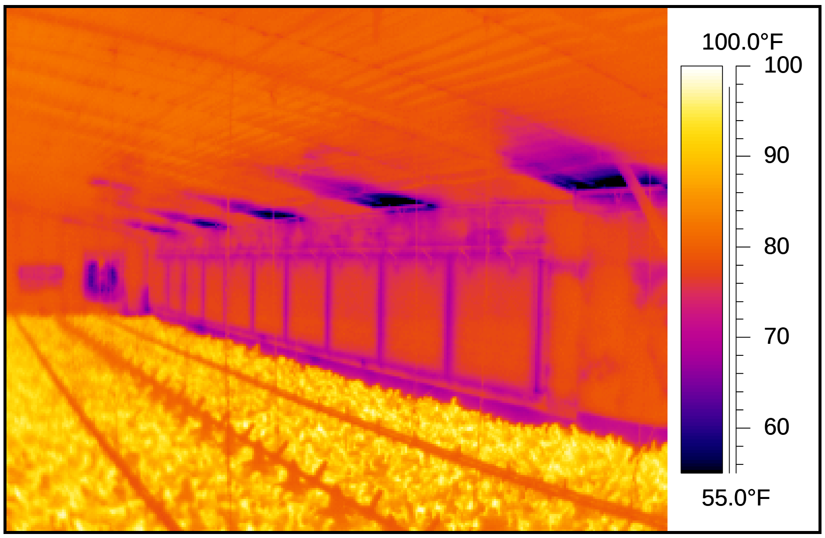

Figure 3. Fresh air entering only through air inlets (very tight house)

Questions often arise related to static pressure test results: What does a static pressure test value really mean? How much tighter is a house that obtains a 0.06" vs 0.12"? How does a static pressure affect my ability to ventilate my house during cold weather? What do I do if the air moving capacity of my static pressure test fan(s) does not meet the one cfm/ft^2 of floor space requirement? Recently, an Excel spreadsheet was developed to help answer these questions as well as others related to house tightness testing (Figure 2). The spreadsheet requires the user to input a house's length, width, the air moving capacity of the exhaust fan used in the static pressure test, and the amount of static pressure generated during the test.

From this information the spreadsheet will calculate the following:

1) **Relative leakage area.** The amount of leakage area (ft^2) for every 1,000 square feet of floor space. The relative leakage area is divided into four classes (from worst to best).

   - ● Greater than 1.2 ft^2 of leakage per 1,000 ft^2 of floor space (Figure 1)
   - ● Between 0.65 ft^2 and 1.2 ft^2 leakage area per 1,000 ft^2
   - ● Between 0.48 ft^2 and 0.65 ft^2 leakage area per 1,000 ft^2
   - ✔ Less than 0.48 ft^2 per 1,000 ft^2 (Figure 3)

   These relative leakage areas would roughly correspond to tradition static pressure test values of

   - ● Less than 0.05" pressure (Figure 1)
   - ● Between 0.05" and 0.13"
   - ● Between 0.13" and 0.20"
   - ✔ Greater than 0.20" (Figure 3)

   The relative leakage area allows the tightness level of different size houses to be compared to each other.

2) **Total house leakage area.** The total leakage area in the house (ft^2)

Once the leakage area is determined the user can then input variables related to how the house is operated during minimum ventilation, specifically the number and size of the side wall inlets used and the air moving capacity of the fans used for minimum ventilation. From this information the spreadsheet will calculate the following

1) **Total available side wall inlet area.** The amount of opening available to the fans when the side wall inlets are wide open (ft^2).
2) **Total opening required by the minimum ventilation at a static pressure of 0.10".**
3) **Total leakage area.** The total leakage area in the house (ft^2) which was determined from the results of the static pressure test.
4) **Total required side wall inlet area.** The total side wall inlet area required is determined by subtracting the leakage area from the total opening area required by the minimum ventilation fan(s).
5) **The percentage of air that will enter through the side wall inlets during minimum ventilation.** The percentage of the fresh air brought in by the minimum ventilation fans that will enter through the air inlets; the remainder will enter through cracks scattered throughout the house. For instance, during cold weather in a house with young chicks if a producer were to use a minimum ventilation fan capacity of 1 cfm per square foot of floor space the following would be the percentage of air that would enter through the side wall inlets:

   ● Greater than 1.2 ft^2 of leakage per 1,000 ft^2 of floor space = < 12%
   ● Between 0.65 ft^2 and 1.2 ft^2 leakage area per 1,000 ft^2 = 12% - 50%
   ● Between 0.48 ft^2 and 0.65 ft^2 leakage area per 1,000 ft^2 = 50% - 70%
   ✔ Less than 0.48 ft^2 leakage area per 1,000 ft^2 = > 70%

   The goal is to have at least 50% of the fresh air the minimum ventilation fans bring into a house during cold weather enter through the side wall inlets.

   It is important to realize that the percentage of fresh air that enters through the inlets can be increased by increasing the minimum ventilation fan capacity. Though on the surface this may seem like a good idea, the fact is that the greater the fan capacity used during minimum ventilation, the more house temperature will vary, which could lead to chilled birds and increased fuel usage. Furthermore, operating more minimum ventilation fans in a loose house doesn't solve the problem that a lot of air will be entering the house through the cracks and not the inlets. Ideally, minimum ventilation/timer fan capacity should range over the course of the flock between 1 and 2 cfm per square foot of floor space. It is important to note that though the recommended minimum ventilation fan capacity is between 1 and 2 cfm per square foot of floor space, this does not mean that the fans would have to run constantly to meet the required minimum ventilation rate to control air quality. Generally, the minimum ventilation fans would be operated off an interval timer and the amount of fan runtime would be determined by monitoring the air quality in the house (i.e, relative humidity, carbon dioxide, ammonia, etc.).
6) **How much the side wall inlets will need to open during minimum ventilation.** Though the ideal inlet opening size required during minimum ventilation will vary with the type of inlet, ceiling smoothness, house width, inside/outside temperature difference, etc. it typically ranges between one and three inches. What the user will find using the spreadsheet is that the tighter the house, the greater the amount of air that will enter through the inlets, the greater the inlet opening size, the better the minimum ventilation system will work during cold weather.

In order to control the environment and energy costs during cold weather it is vital that as much of the fresh air brought in by the exhaust fans enters through the inlets and not cracks. It is only the air that enters through the side wall inlets that will move along the ceiling and warm up before moving down to bird level. The Poultry House Estimator Spreadsheet is a simple tool that helps to illustrate the value of static pressure test results when it comes to evaluating the effectiveness of a producers minimum ventilation program.

This spreadsheet, along with others, can be found at https://www.poultryventilation.com/spreadsheets.

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