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Poultry Housing Tips

Static Pressure Testing

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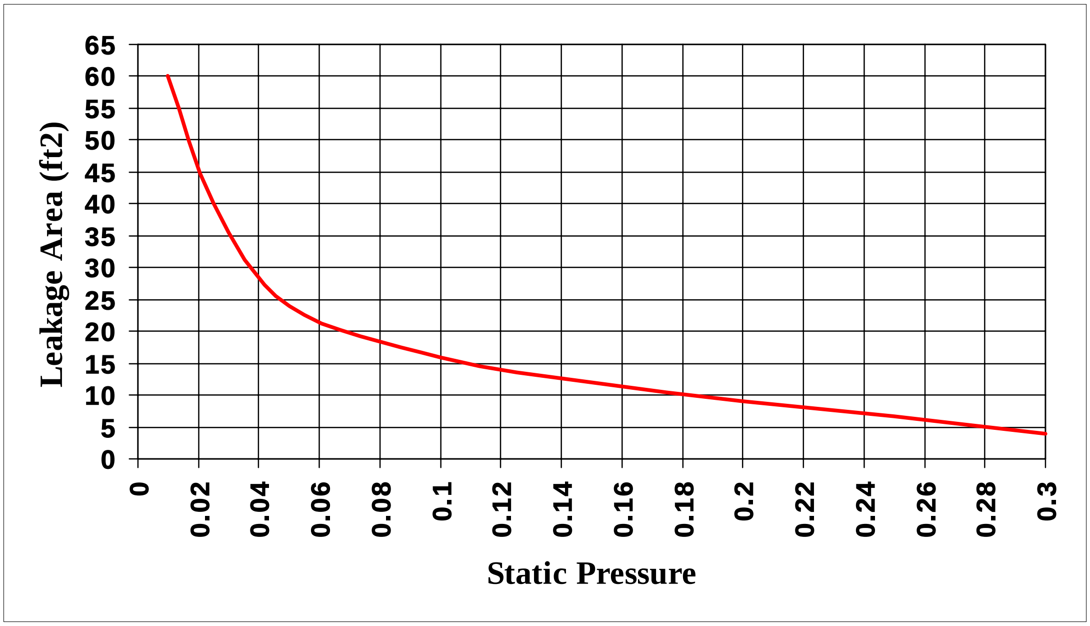

Figure 1. Leakage area Vs. Static Pressure (20,000 cfm test fan @ 0.05")

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 tempered by the warm air next to the ceiling before moving down to bird level. Air entering through cracks or gaps in side wall curtains either when the fans are on or off can lead to drafts, caked litter, and excessive fuel usage. 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, as well as 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 corrective actions can be taken before bird performance suffers and/or heating costs become excessive.

How do you tell if your houses are "tight?" One of the best ways is to conduct a simple static pressure test. A static pressure test consists of turning on a single 48" fan or two 36" fans, with all the inlets and curtains closed, then measuring the resulting static pressure. The higher the pressure, the tighter the house, and the greater the level of control you will have over the environment within your house as well as energy costs. Charts can be used to quantify the amount of leakage based on static pressure test results so you will have a better idea of exactly how big a tightness problem you may have. For instance, if you obtain a static pressure of 0.20" with a 20,000 cfm fan this would indicate that there is less than 10 square feet of leakage in the house (Figure 1). At the other end of the spectrum, a static pressure reading of 0.02" would indicate there is approximately 45 square feet of leakage.

Though using a static pressure test for determining house tightness has served the industry well over the years, there are potential weaknesses. Specifically, traditional static pressure testing doesn't take into account house size or the fact that a fan may move significantly more or less than 20,000 cfm. After all, a static pressure of 0.13" is more desirable in a 500' house than in a 300' house. Likewise a static pressure of 0.13" obtained with two 36" fans that move a total of 18,000 cfm would be superior to if it were obtained with a 54" cone fan that moves nearly 30,000 cfm.

One way to improve the accuracy of a static pressure test is to first establish a tightness goal in terms of leakage area per 1,000 square feet, then take into account the amount of air moved by the fan used in the test. Though the maximum acceptable leakage area would likely vary from location to location, a conservative starting point is 0.65 square feet of leakage area per 1,000 square feet of floor space. For instance, for a 40' X 400' house the maximum acceptable leakage area would be 10.5 square feet (0.65 ft^2 X 16,000/1,000 ft^2). For a 50' X 500' house, 16.25 square feet of leakage area would be acceptable.

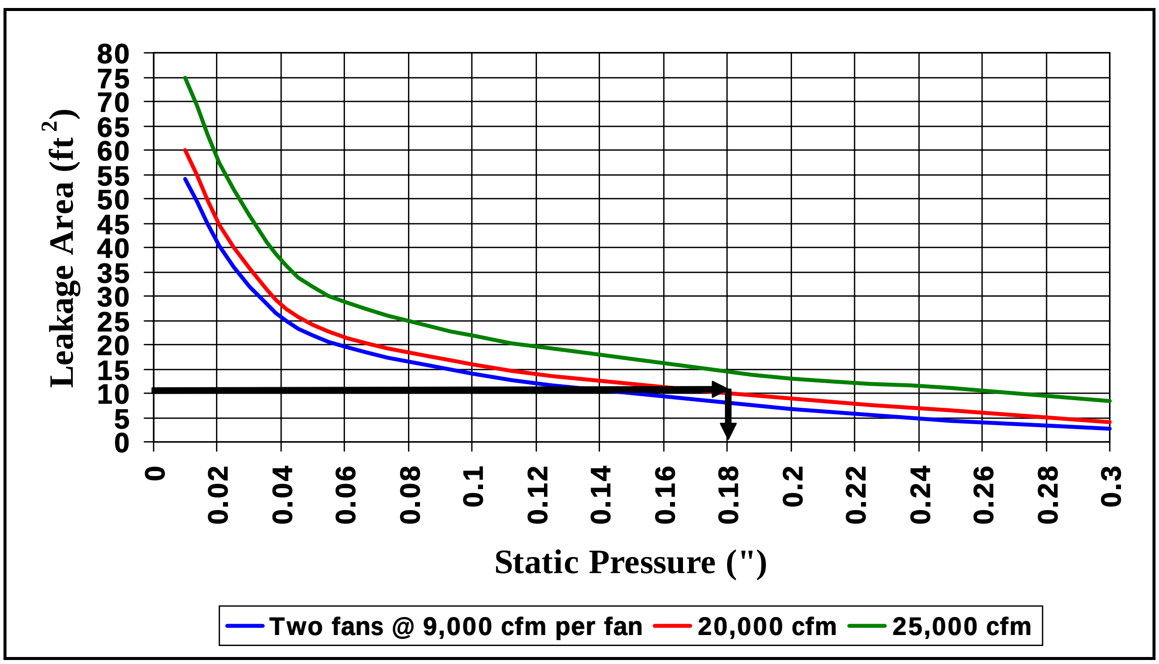

Figure 2. Leakage area Vs. Static pressure for a variety of fans.

Once a maximum acceptable amount of leakage area is determined, a static pressure curve like the one in Figure 2 could then be used to determine the appropriate static pressure that could be obtained with fans of different air moving capacities. For instance, for a 40' X 400' house with 10.5 square feet of leakage area (0.65 ft^2 X 16 ft^2) a 20,000 cfm fan should generate a static pressure of at least 0.18" (Figure 2). For a 50' X 500' house, maximum acceptable leakage area is 16.3 ft2. If a 25,000 cfm fan was used to check house tightness, the resulting static pressure should be at least 0.16". Keep in mind these are minimum values; new housing or retrofitted houses should typically produce higher static pressure readings.

To make the determination of the appropriate static pressure reading for any house using a wide range of exhaust fans, the chart in Figure 3 was developed. For instance, let's say you had a 16,000 square foot house and you wanted to use a fan that moved 22,000 cfm for the static pressure test. From the chart you could quickly determine that you should be able to obtain a static pressure of at least 0.20". If you used a 24,000 cfm fan, you should be able to obtain a static pressure of at least 0.24".

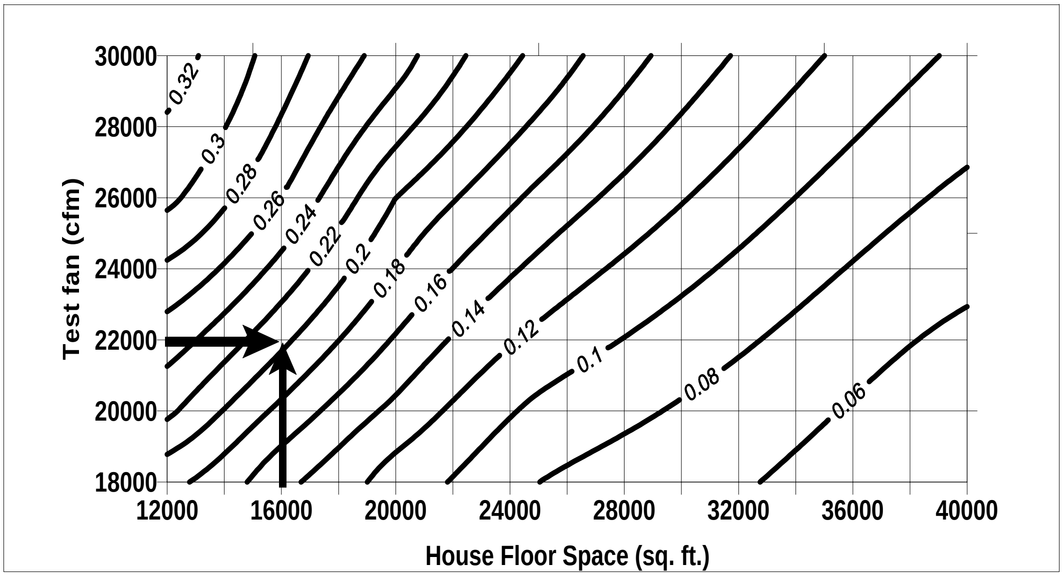

Figure 3. Minimum static pressure test reading based on fan cfm and house floor space.

Putting a precise dollar value on what leakage costs a producer is difficult if not impossible. The difference between inside and out temperature, wind speeds, bird age, proximity of a house to other houses, and of course fuel price, all figures into the cost of heating a house on any given day. The other problem is that a static pressure test only determines house tightness when the fans are on. With curtain-sided houses, leakage can increase significantly when the fans shut off because the curtains are often no longer being pulled up against the side walls. Figure 4 illustrates the theoretical amount of heat that is lost through leakage during a 24-hour period (20,000cfm fan @0.05"). The chart assumes a constant three mph breeze hitting the side of the house, an 80ºF inside temperature and an outside temperature of 30ºF. The red line is for a totally-enclosed house or one that the curtains are constantly held against the side of a house with a curtain pocket where leakage does not change when the fans shut off. The green line illustrates what can happen to the same house if leakage were to increase by a factor of three when the fans shut off. As you can see you can have a house that gets a high static pressure reading when the fans are on, but if the curtains are not held tightly against the side of the house, fuel usage can soar.

Figure 4. Fuel usage vs. Static pressure (loose curtain vs. totally enclosed/curtain pocket)

One of the most important characteristics of these curves to notice is that the relationship between leakage area/heating cost and static pressure is not linear. Whereas, increasing the static pressure reading from a 0.02" to 0.04" through house tightening indicates that you cut leakage by 17 square feet (40%) and theoretically would experience a similar reduction in heating costs, increasing the static pressure reading from 0.14" to 0.16" indicates that leakage area was reduced by two square feet or by roughly 15%. Though you should always strive for as high a static pressure reading as possible, the largest fuel savings are associated with taking a house that can barely obtain a static pressure and working on it until you can obtain a pressure in the double digits.

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