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Poultry Housing Tips

Air Speed Distribution in Tunnel-Ventilated Houses...Part 3 Layer Houses

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As discussed in the previous newsletters in this series, in order to insure uniform bird cooling in a tunnel-ventilated house air speed throughout the house needs to be as uniform as possible. Side wall smoothness and equipment installation can have a significant effect on air flow patterns within a tunnel-ventilated broiler house and therefore affect bird cooling. Though broiler houses make up the majority of tunnel-ventilated houses, tunnel ventilation is also widely used in broiler-breeders and commercial layer housing to maximize bird cooling during hot weather. Though in general, tunnel-ventilated broiler breeder and commercial layer houses are similar in design to broiler houses, there are differences which provide additional illustrations of how house layout and equipment installation affects air flows in tunnel-ventilated houses.

Figure 1. Totally enclosed breeder house.

Figure 2. Curtain-sided breeder house

Broiler Breeder Houses:

Recently air velocity and temperature measurements were taken on the slats and scratch area of two broiler breeder houses approximately 100 feet from the tunnel fan end wall. Both houses were 40' X 400' with dropped ceiling and equipped with eight 48" fans. The primary difference between the two houses on the farm was that one was curtain-sided while the other was totally enclosed. In the curtain-sided house, air speed on the slats, two feet from the side wall, was approximately 180 ft/min, while in the scratch area it was over 500 ft/min. Air temperature on the slats two feet from curtain was approximately five degrees hotter than in the scratch area. In contrast, air speed two feet from side

wall in the totally enclosed house was 360 ft/min and in the scratch area 450 ft/min. Air temperature on the slats was only one degree hotter than in the scratch area. Birds on the slats appeared noticeably cooler in the totally-enclosed house than in the curtain-sided house.

In breeder houses, there tends to be significant differences between air speed in the slat area and the scratch area due to the relative openness of the scratch area which encourages air flow down the center of the house. In the totally enclosed house, the smooth side walls help to keep the difference in air speed between the scratch area and slat area to a minimum. In the curtain-sided house, the side wall posts discouraged air flow along the wall leading to very low air speeds in the vicinity of the curtain. The combination of radiant heat from the curtain, leakage and low air exchange rates on the slats leads to higher air temperatures. Five degrees of temperature differential is significant, but when lower wind chill is taken into account, the effective temperature for the birds on the slats is likely ten degrees higher than for those in the scratch area.

The difference in air speed between the slats and the scratch area in breeder houses is also a function of how much room there is between the slats and the ceiling. Houses with very little room between the slats and the ceiling, (five feet for example) tend to show more difference in air speed between the scratch area and slat area than those houses with six and a half feet. The trick is, of course, that a lower side wall will reduce the cross-sectional area and thus increase air speed, but if the side wall is too low, it can adversely affect air speed uniformity.

Other factors, such as type and size of knee braces, as well as, drinker type (bell vs. nipple) can also affect the magnitude of the difference between the air speed on the slats and the scratch area. Large knee braces, like exposed studs and posts, can discourage air from flowing along the side wall. Bell drinkers offer yet another obstruction to the flow of air along the side wall, further increasing the difference between the speed of the air on the slats and the side wall.

Figure 3. Breeder house with down the center

Though not very common in the U.S., a type of breeder house that tends to have very uniform air speed is one with the nests and slats in the center of the house and the scratch areas on the side walls. With the slats in the center of the house and the scratch areas near the side walls, the relative “openness” of the house is very similar from side wall to side wall. As a result air speeds tend to be more uniform. Though exposed studs/posts can reduce air flow on the side wall, the fact that the nests are in the center tends to balance out the effect by making the center of the house less conducive to air flow.

Commercial Layer Houses:
Another example of how air flow wants to take the path of least resistance is in commercial layer houses. In many layer houses, the birds are kept in cages on the second floor of a two story house while manure produced by the birds drops down through the open floor and is stored on the ground floor. The typical tunnel-ventilated "high rise" house will contain over 100,000 birds and require a large number of fans. Tunnel fans are usually placed in both end walls of the house and evaporative cooling pads in the center.


Figure 4. Evap. pads in commercial layer house


Figure 5. Tunnel fans in end wall


Figure 6. Ground floor in layer house.


Figure 7. Upstairs in layer house


Figure 8. Manure collecting downstairs

Though the air only enters the house on the second floor of the house, it quickly moves to fill the entire cross-sectional of the house. Due to the relative openness of the ground floor compared to the second floor where the birds are located, ground floor air velocities tend to be 20% to 30% higher than those measured in the aisles on the second floor. This difference tends to decrease over time as manure produced by the birds piles up downstairs reducing the difference in relative "openness" between the first and second floors.

Due to the fact that air exchange rates are faster downstairs and there are no birds present, there is very little heating of the air as it moves from the pads to the fans as compared to the second floor. Since there tends to be very little mixing of the upstairs air with the downstairs air, the air exiting the fans on the ground floor is typically three to five degrees cooler than that exiting the fans on the second floor (Figure 9).

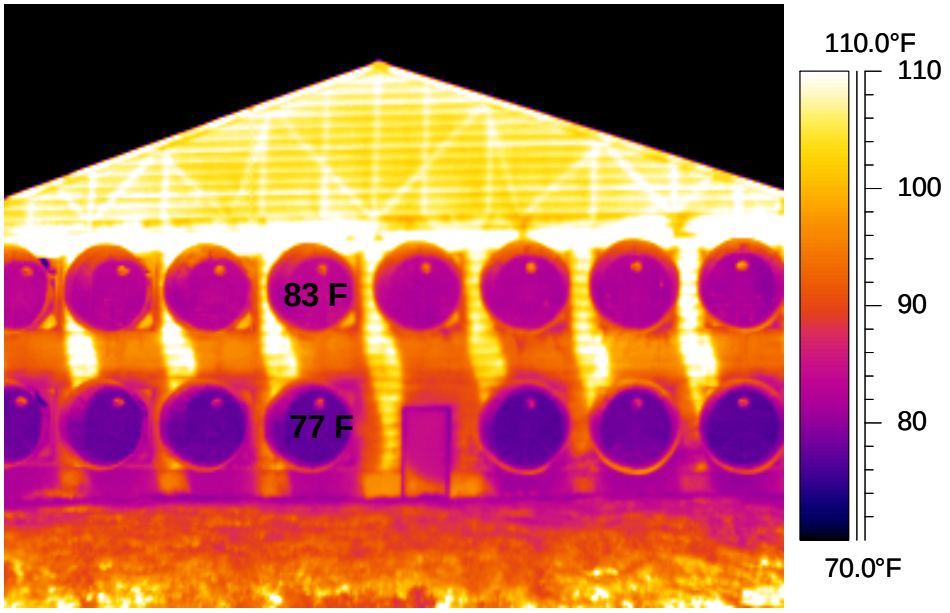

Figure 9. Thermal image of commercial layer house exhaust fans.

As you might suspect, air speeds tend to be higher near the ceiling than in the aisles where the birds are. There are also significant decreases in air speed from the center of the aisle as you move toward the cages. Whereas the air velocity in the center of the aisle may be 600 ft/min+, air velocities within six inches of the cage are closer to 300 to 400 ft/min. Air velocities within the cages themselves tend to be minimal i.e, 100 ft/min or less.

Bottom line, air wants to follow the path of least resistance. Any practical measures you can take to minimize obstructions, especially in areas where birds reside or spend time, will increase effective cooling.

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