The **Alabama Poultry Engineering and Economics**

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Feature article

Cardinal Rules for Wintertime Broiler House Ventilation

We receive many calls and emails from growers asking questions about how to manage wintertime ventilation. Growers want to keep flock performance up, but don't want to burn any more heating fuel than necessary, and they ask what factors or methods are really important to reaching this goal. In this issue, therefore, we are departing somewhat from our usual format to bring you a special presentation that we feel will be very useful to growers as we approach the coldest part of the year. The following key points briefly outline what industry experience and university research have shown to be the cardinal rules for wintertime broiler house ventilation. On this page, we are listing the briefest one-sentence versions of the rules, so you can see all of them at a glance. On the inside pages, you will find more complete but still concise explanations. On page 3, we present examples of how to do the simple arithmetic to determine proper fan timer settings.

1. **Seal all house air leaks: a loose house cannot be properly ventilated.**
2. **Insulate before you ventilate: good growing conditions cannot be maintained in a poultry house in cold weather if we have no way to keep the heat in.**
3. **Set the fan timer for the right minimum ventilation rate, according to bird age.**
4. **Increase fan timer settings (the *minimum ventilation* rate) each week from day one through catch.**
5. **Maintain minimum ventilation settings no matter what the outside or inside conditions are, so that adequate ventilation will be available if temperatures drop below the thermostat setpoint.**
6. **Bring cool outside air into the house high above the birds, with enough velocity to mix with warm inside air before contacting birds.**
7. **If wet litter and/or ammonia becomes a problem, increase the minimum ventilation rate (fan timer settings).**
8. **If increased minimum ventilation rate does not solve a wet litter problem, add a small amount of heat.**
9. **If the house gets too dusty and litter is too dry, reduce the minimum ventilation rate.**
10. **If a house gets too warm, look at the thermostat setting, not the fan timer setting.**
11. **Adjust and reset backup thermostat settings, curtain drops, and alarms from day one to catch.**

Energy-Saving Videotape Now Available

Now available from Auburn University: *Wintertime Broiler House Ventilation for Reduced Fuel Costs.* This 42-minute video details energy saving methods and best wintertime ventilation techniques. Contact Jim Donald, Biosystems Engineering Dept., 228 Tom E. Corley Bldg., Auburn University, Alabama 36849 (334-844-4181). More information on the tape is available on the Auburn University poultry website www.poultryhouse.com.

Cardinal Rules for Wintertime Broiler House Ventilation

1. **Seal all house air leaks.** You cannot properly ventilate a loose house. We want all air to come in through the inlets, not through leaks and cracks. Cold air falls, and cold outside air leaking through cracks, curtains, holes and any other unwanted opening drops toward the floor, causing condensation, wet litter, cake and poor bird performance. Test house tightness by static pressure: with all doors, curtains and inlets of the house closed and one 48-inch, 20,000-cfm fan turned on, we should be able to pull a negative static pressure of 0.15 inches. If the number is lower than 0.15, too much air is coming through leaks and cracks. The higher the number from the static pressure test the tighter the house.

2. **Insulate before you ventilate.** We cannot maintain good environment in a poultry house in cold weather if we have no way to keep the heat in. Ceiling insulation should be approximately R-19. Check your insulation for tears, holes and places where insulation may have shifted and there is no insulation at all. Consider insulating end walls, end doors and other parts of the house that are not currently insulated.

3. **Set the fan timer for the right minimum ventilation rate, according to bird age.** Be sure all fans are controlled by a single timer. The ventilation rate needed usually ranges from about 0.10 cfm/bird in week one to about 0.90 cfm/bird by week eight. In week one, for example, with 24,000 birds, you would need one-tenth of 24,000, or 2,400 cfm on average. We say "on average," because you can't run a 2,400 cfm fan. You use the timer to run, say, two 10,000-cfm 36-inch fans the percentage of time needed to average out at 2,400 cfm. You find the percentage needed simply by dividing the cfm's needed by the cfm capacity of the fans you will be running. In this example, 2,400 cfm divided by 20,000 fan cfm's equals 0.12. You multiply that percentage times the five minutes in the timer cycle, and set for 36 seconds run-time out of a five-minute cycle (36 seconds on-time out of 300 seconds = 0.12). Never ventilate with less than two 36-inch fans. Single 36-inch fan ventilation usually will not yield a high enough static pressure to ventilate properly. Heat moves toward fans, so ventilating with a single 48-inch fan concentrates heat in that end of the house. Running two or more minimum ventilation fans helps maintain temperature uniformity, and that will boost flock performance.

4. **Increase fan timer settings (ventilation rate) each week from day one through catch.** Fan run-time must be increased weekly to handle the increased moisture birds give off as they grow. As noted in Rule #3, the rate needed typically increases from about one-tenth a cfm per bird to almost a full cfm per bird. Note that having a properly set minimum ventilation timer is just as important at the end of the growout as it is in the beginning of the growout. Later in a growout, thermostat control usually will override the timer control most of the time. However, the minimum ventilation timer must remain properly set to take care of air quality if and when higher temperatures no longer trigger thermostat control.

5. **Maintain minimum ventilation no matter what the outside or inside conditions are.** Without at least the minimum ventilation rate, inside air quality will deteriorate and litter moisture and ammonia problems will occur. The amount of house heat lost because of minimum ventilation is small, and well spent to avoid moisture problems. Remember also that you can and must ventilate even if a cold rain is falling outside. When cold air is heated its moisture holding capacity increases. When air is heated 20 degrees its relative humidity will be cut about in half, and therefore its ability to pick up water just about doubles. The cold air we bring into the house in the wintertime gets warmed up and dried out, so it is able to carry excess moisture out of the house through the ventilation fans. The only way to remove moisture from the litter in a poultry house is through ventilation.

6. **Bring cool outside air into the house high above the birds, with enough velocity to mix with warm inside air before contacting birds.** Doing this well requires a tight house operating in the static pressure range of around 0.10, and it requires properly designed and adjusted air inlets. It takes a static pressure of approximately 0.10 inches to throw air 20 feet to the center of the house. Static pressure controlled vent boxes do the best job. Getting a good "jet-stream" of incoming air along the ceiling avoids chilling birds and the mixing action improves heating fuel usage efficiency by preventing

CALCULATING MINIMUM VENTILATION FAN TIMER SETTINGS

Typical Recommended Minimum Ventilation Per-Bird Rates

Exact rates vary with breed and sex; check with company for specifics applicable to your operation. Rates given here are for temperatures from 30-60F; lower temperatures call for slightly lower rates, and higher temperatures slightly higher rates.

WEEK	DAYS	CFM/BIRD
1	1 - 7	0.10
2	8 - 14	0.25
3	15 - 21	0.35
4	22 - 28	0.50
5	29 - 35	0.65
6	36 - 42	0.70
7	43 - 49	0.80
8	50 - 56	0.90

Fan Timer Setting Calculation

FIRST, calculate the total cfm's needed, according to age of the birds:

Total cfm = cfm/bird needed times number of birds in the house

Example: In Week 2, with 0.25 cfm/bird needed, and with 24,000 birds in house

0.25 cfm x 24,000 birds = 6,000 cfm needed

SECOND, since we don't have a 6,000-cfm fan to run full time, we calculate the percentage of time fans need to run in order to average out at the total number of cfm's needed:

Percentage of time = cfm needed divided by cfm capacity of fans used

Examples (using fan combinations commonly run for minimum ventilation):

1. **Using three 36-inch fans, and assuming 10,000 cfm per fan capacity, we will have 30,000 total cfm, and will have to run them one fifth or 20% of the time:**

   6,000 cfm divided by 30,000 cfm = 0.20 = 20%

   (check: 0.20 times 30,000 cfm = 6,000 cfm)

2. **Using two 48-inch fans (assuming 20,000 cfm per fan capacity), we will have 40,000 total fan cfm capacity, and will have to run the fans 15% of the time:**

   6,000 cfm divided by 40,000 cfm = 0.15 = 15%

   (check: 0.15 times 40,000 cfm = 6,000 cfm)

3. **Using one 36-inch and one 48-inch fan, the percentage will be the same as in example 1 (20%) because the total cfm capacity of the fans used is the same, at 30,000 cfm**

THIRD, using a five-minute timer, we find the run-time setting by multiplying the percentage of time needed by the total fan timer cycle of five minutes:

Examples:

1. **Using three 36-inch or one 36-inch plus one 48-inch fan,**
   0.20 times five minutes = one minute on out of five minutes

2. **Using two 48-inch fans,**

   0.15 times five minutes = 0.75 minutes on, or 45 seconds on out of five minutes

Recommended Timer Setting Adjustments for Conditions

Slight ammonia = +15 seconds
Heavy ammonia = +30 seconds
High moisture = +15 seconds
High dust = -15 seconds

warm air produced by birds, furnaces and brooders from rising to the ceiling and staying there. Mixing fans in the house can also help promote temperature uniformity and reduce fuel usage.

7. **If wet litter and/or ammonia becomes a problem, increase the minimum ventilation rate.** This means increasing the fan run-time. Birds deposit about 2 pounds of water into the house for every pound of feed they eat. So there is a lot of water deposited into a poultry house during a growout. Fecal material plus excessive moisture causes ammonia, and this is worse when litter moisture is high. Proper ventilation is the only way to remove the moisture from the litter. Growers who have tried to operate minimum ventilation fans using a humidistat to turn fans on and off have found this does not work. Humidistats can't hold their accuracy in the environment of today's poultry houses. A good rule of thumb to judge litter moisture content is to squeeze a handful of litter. If it sticks together tightly and remains in a ball, it is too wet. If it sticks together only slightly, it has the proper moisture content. If it doesn't hold together at all, it is too dry.

8. **If increased ventilation rate does not solve a wet litter problem, add a small amount of heat.** Sometimes when a house has slick litter, more fan run time may not solve the problem. This usually means the house needs a little more furnace or brooder heat to help lower the humidity and thus facilitate moisture removal. It may be possible to dry out a house by slightly increasing fan run time during the warmest part of the day when humidity is low. If this doesn't work heat must be added.

9. **If the house gets too dusty and litter is too dry, reduce the minimum ventilation rate.** This situation usually means we are over-ventilating, and calls for lowering the fan on-time setting.

10. **If a house gets too warm, look at the thermostat setting, not the fan timer setting.** The minimum ventilation timer setting is for moisture removal and air quality, not temperature control. When we need to make it cooler in the house, a thermostat or controller temperature setpoint is used to override the ventilation timer and add more ventilation. In this mode we are now ventilating at a higher rate for temperature control purposes, and fan operation is determined by the thermostat or controller setpoint. Do not confuse this with minimum ventilation, which is timer-operated.

11. **Adjust backup thermostat settings, curtain drops, and alarms from day one to catch.** It is possible even in wintertime to lose birds due to high heat and high humidity if power fails or fans fail to operate. With larger birds, just a few minutes in a totally enclosed house with no ventilation can elevate temperatures as much as 20 degrees F, causing suffocation and death. Protect yourself and your birds by maintaining recommended backup settings throughout the growout. A good rule of thumb is to set backups and alarms at ten degrees above and below target temperature.

ALABAMA COOPERATIVE Extension SYSTEM

The Alabama Poultry Engineering and Economics 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: Jim Donald, Extension Biosystems Engineering, 228 Corley Bldg., Auburn University, AL 36849-5626, (334) 844-4181, fax (334)-844-3548, jdonald@acesag.auburn.edu. Published by:

Jim Donald, Extension Engineer
Auburn University

Mike Eckman, Extension Poultry Scientist
Auburn University

Gene Simpson, Extension Economist
Auburn University