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Poultry Housing Tips

Environmental controller temperature sensor placement

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A poultry house environmental controller's temperature sensors are in a sense its eyes. In order for the controller to properly control the environment within a poultry house it must be able to "see" what is happening throughout the house. For instance, if a house has only one temperature sensor a controller can only see what is happening in one very small area of the house. This means that conditions in another area of the house may be very different and the controller may not be aware of it. On the other hand, a controller does not need twenty temperature sensors to get an accurate picture of what is happening throughout the house. You could think of it as how many places you personally would have to stand in a house to get a good idea of what is happening. In most cases five or six locations throughout the house would prove sufficient and therefore five or six temperature sensors are required in order for the controller to get a good picture of what is happening over the length of a poultry house.

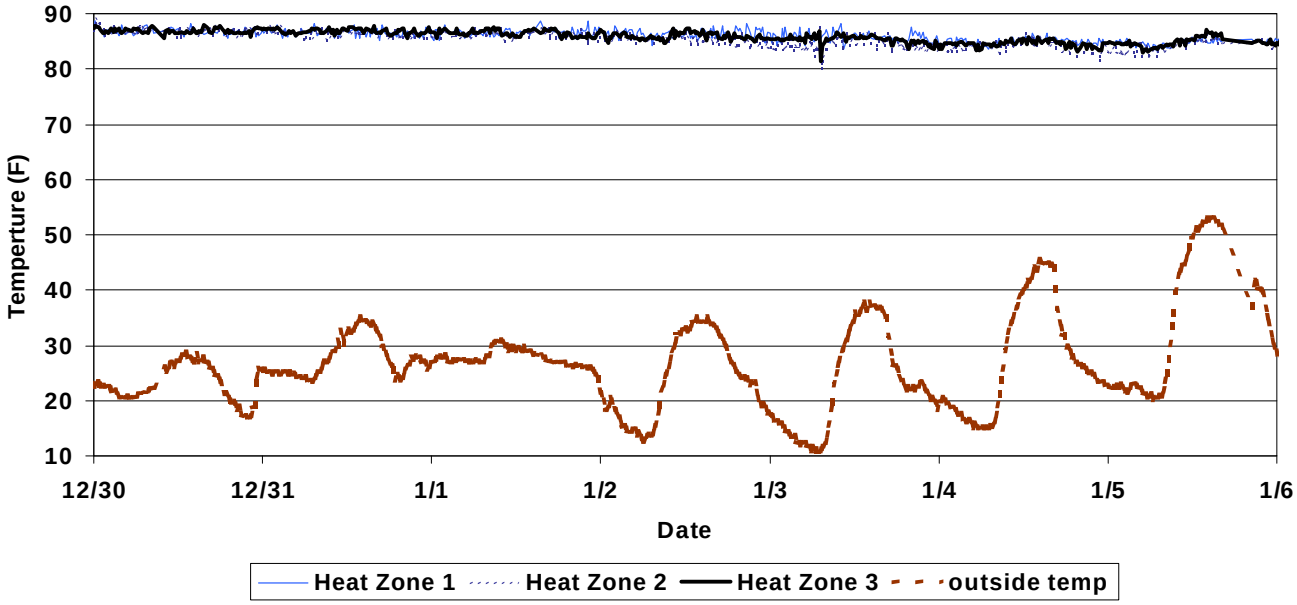

Figure 1. Tight temperature control during brooding

The exact number and placement of temperature sensors in a broiler house is largely determined by the number of heating zones a house has. A heating zone is an area of a house where all the brooders or furnaces are wired together and as a result are controlled as a single unit. For instance, if there were two furnaces on the nonbrooding end of a house and they were wired together that would be a single heating zone and a single sensor would be required. If they were wired individually there would be two heating zones on the nonbrooding end of the house and each would need its own temperature sensor in order for it to be properly controlled.

It is important to note that in most cases it is to a producer's advantage to have brooders and/or furnaces controlled by an environmental controller. When an environmental controller has control over both the exhaust fans and the heating system, producers are better able to maintain tight control over house temperature as well as fuel usage. Studies conducted by the extension engineers and poultry scientists at the University of Georgia found a fuel savings of between 15 and 20% when the brooders/furnaces are controlled by the controller as opposed to being controlled by individual thermostats. Furthermore, temperature variations can be kept within just a couple of degrees during brooding when the heating system is controlled by the environmental controller compared to five to ten degrees when brooders/furnaces are controlled by individual thermostats (Figure 1).

One of the keys to making zone-controlled heating work is getting the right number of brooders or furnaces in each heating zone. For instance, if furnaces are used for brooding there should be one heating zone for every furnace. Four furnaces in the brooding end, four heating zones and therefore four temperature sensors. When it comes to radiant brooders there should be a maximum of five brooders per heat zone. Therefore, in a house with fourteen radiant brooders on the brooding end there should be a minimum of three zones of radiant brooders (four or five radiants per zone) with one temperature sensor per zone. In the case of conventional brooders there should be a maximum of seven brooders per zone. In many modern broiler houses there may be over 22 brooders in the brooding end of the house, requiring that the brooders would have to be placed in four heat zones.

There are two reasons why the heating system should be broken in to zones. First, in most cases you do not want more than 200,000 Btu's/hr of heat capacity coming on at one time (one furnace, five radiant brooders (five X 40,000 Btu's/hr = 200,000 Btu's/hr) or seven conventional brooders (seven X 30,000 Btu's/hr = 210,000 Btu's/hr)) because you can easily overheat the house and cause the exhaust fans to come on to cool the house back down. For instance, let's say you wanted 90^{O}F in a house with 26 conventional brooders. The house temperature drops to 89^{O}F and the controller turns on all 26 conventional brooders at one time, putting nearly one million Btu's of heat into the house almost instantaneously. The house temperature will rise back to 90^{O}F very quickly and by the time the controller turns the heat back off, the house temperature could rise to 92^{O}F or more, causing the exhaust fans to come on to cool the house back down, leading to excessive fuel usage and drafty house conditions.

The second reason for the heating system to be broken up into zones is the fact that different areas of a house need different amounts of heat. For instance, the brooders/furnaces often have to run more in the tunnel curtain area of the brooding end than the brooding curtain area because the tunnel curtain is often larger and leakier than the brooding curtain. On the other hand, brooders/furnaces have to run less in the center of the brooding area than at either end, because the brooders/furnaces in the center do not have to contend with cold air leaking in from around the brooding curtain or tunnel curtain. As a result, if all the brooders were controlled off a single sensor in the center of the house the birds in the center of the house would be comfortable but those on the ends would be cold, because the heat would not run enough to keep the ends of the brooding area warm. Conversely, if all the brooders/furnaces in a house were controlled off a temperature sensor near the tunnel curtain the birds in this area of the house would be comfortable, but the birds in the center of the house would get too hot because less heat is required in the center of the house than the ends.

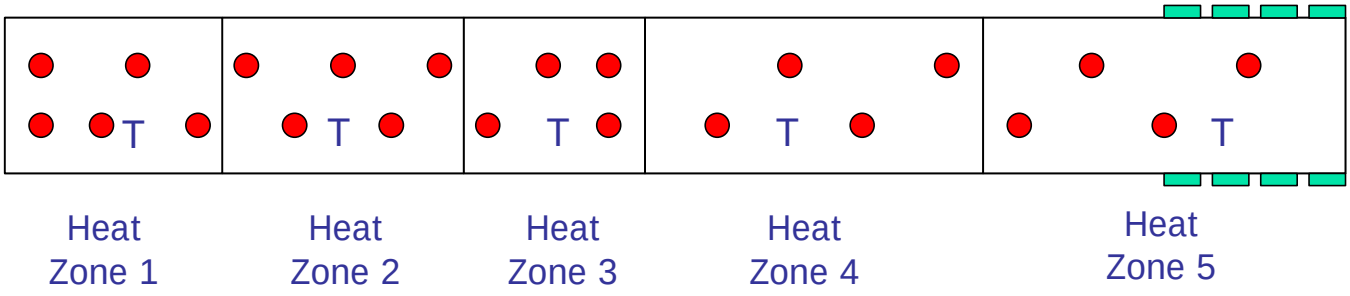

Figure 2. 500' broiler house with radiant brooders.

So let's look at the example of a house with 14 radiant brooders in the brooding end and eight on the nonbrooding end. The radiant brooders on the brooding end would be broken into three groups and those on the nonbrooding end two groups. Therefore, three temperature sensors would be required on the brooding end and two on the nonbrooding end (Figure 2). If the house were 500' long (brooding on the nontunnel fan end of the house) the first temperature sensor should be placed approximately 30' to 40' from the tunnel inlet end wall. The second sensor should be placed in the center of the brooding area and the third temperature sensor should be placed approximately 30' to 40' from the brooding curtain. The two sensors in the nonbrooding end should be installed approximately 60' from the brooding curtain and 60' from the tunnel fan end wall (Figure 3). The temperature sensors for the heating zones near the end wall and brooding curtain should be placed within 40' of the end wall or brooding curtain in order to keep these areas warm. The further these sensors are from the end wall or brooding curtain, the colder these areas will be. Again, if the controller cannot "see" what is happening in these cold spots the heat will not come on when it is needed.

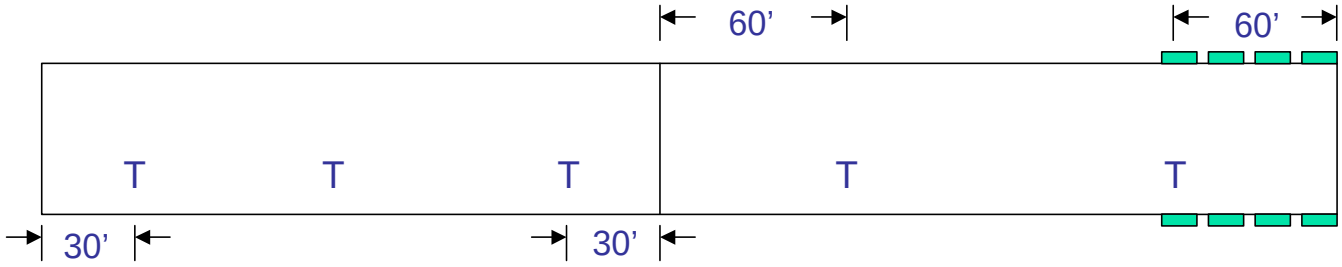

Figure 3. Temperature sensor location in a 500' house with radiant brooders

If the house had 26 conventional brooders on the brooding end and two furnaces on the nonbrooding end, four heat zones would be required on the brooding end and two on the nonbrooding end (Figure 4). A fourth sensor would of course be required on the brooding end and the non brooding end would not have to be changed. The position of the first and third sensors would not be changed, nor would those on the nonbrooding end. The biggest difference is that there would now be two sensors controlling the heating system in the center of the brooding area instead of one.

Could you break up the brooders into even smaller groups, i.e., three brooders per zone? In order for this to be done the controller would need to have a large number of temperature sensors. For instance, in the case of 500' house with conventional brooders the controller would need to have 12 sensors just to control the brooders on the brooding end of the house. The biggest obstacle to this is that most controllers are only capable of having six temperature sensors. But, the fact of the matter is that there is little advantage to having more than four heating zones in the brooding end of a house.

Figure two is an example of where the radiant brooders on the nonbrooding end could have easily been broken into smaller zones, producing three zones instead of two (two zones of three brooders and one of two (Figure 5)). This

would probably offer slightly better control over air temperature in the nonbrooding end, but would of course increase wiring cost. Typically, producers find that whereas three zones are a must in the brooding end, two zones in the nonbrooding end are adequate.

Another factor to consider when placing temperature sensors is that it is very important that the sensors are not placed to near to the brooders or radiant brooders. The radiant heat coming of a brooder will cause the sensor to indicate that the air temperature is higher than it actually is, leading to lower than desired air temperatures. For this reason temperature sensors should be placed half way between adjacent brooders or radiant brooders which may require slight adjustments in the exact position of the temperature sensors. For similar reasons, in houses with furnaces it is important that the sensors are placed on the opposite side of the house from the furnaces. If placed too close to the furnace the controller will turn the furnaces off prematurely.

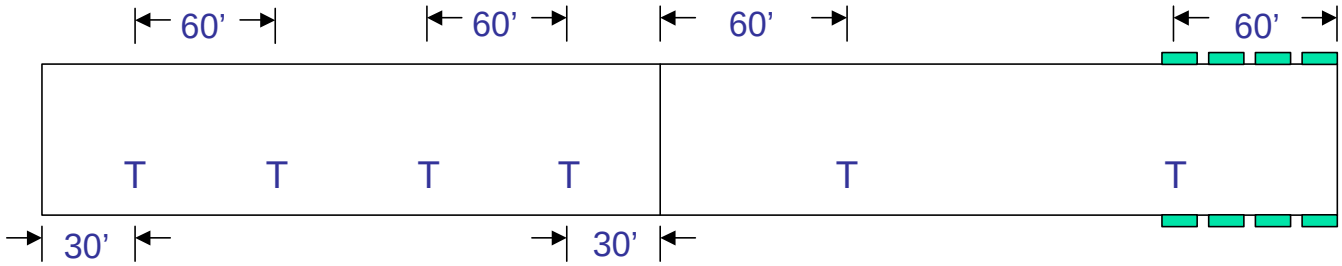

Figure 4. Temperature sensor placement in a 500' house with conventional brooders on the brooding end

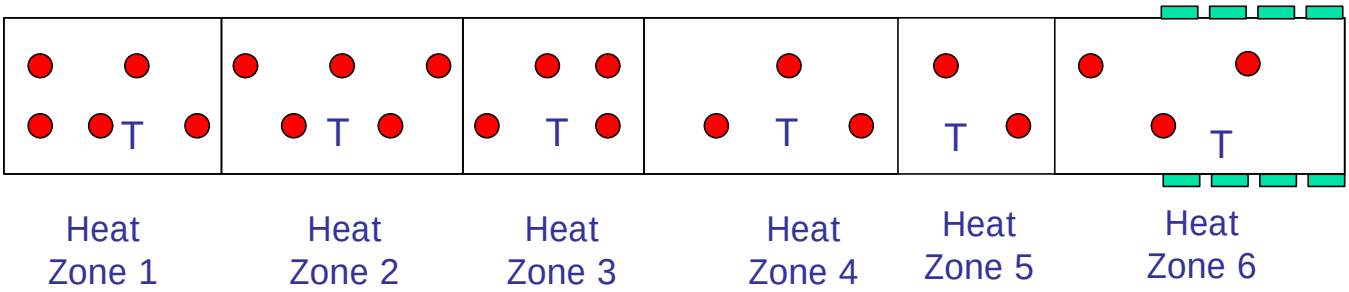

Figure 5. 500' broiler house with radiant brooders with three heat zones on the nonbrooding ends.

Since the air temperature tends to be lower on the side walls than on the center house it is important that the temperature sensors are placed on the outside water line or the feed line. If placed in the center of the house the controller will not know that it is colder on the side walls and therefore many of the chicks near the side wall may be a little too cold while those in the center will be at the desired temperature. Of course, when the temperature sensors are placed near the side wall you might end up with the scenario where the center of the house is a couple of degrees above the set point but when it comes to brooding chicks most recommended brooding temperatures should be considered minimum. Young chicks are more tolerant of the house being a couple of degrees too warm than too cool.

For similar reasons it is very important that the temperature sensors are able to be placed within six inches of the floor during brooding. Hot air produced by furnaces and/or brooders quickly rises to the ceiling and as a result the further you move from the ceiling the colder the air temperature. As a result if the sensors are placed a few feet off the floor it is very likely that the controller will think the temperature of the air is as much as five degrees cooler than it really is at bird level. Bottom line, the sensors need to be placed where the chicks are, not where you are. As the birds get older the temperature sensor should be raised so they cannot damage it.

There are a couple of different options if you have an extra temperature sensor. In house with circulation fans the extra sensor can be placed at the ceiling in the center of the brooding area and used to control the circulation fans. The circulation fans can be set to operate whenever ceiling air temperature is 10 degrees above the desired room temperature. Another option would be to place the extra temperature sensor outside so that you can keep up with outside temperatures to evaluate how good your heating and ventilation system are doing. For instance, by comparing inside and outside temperatures you can see if your evaporative cooling pads are cooling as much this summer as they were last.

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