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NEWSLETTER

Critical Information for Improved Bird Performance Through Better House and Ventilation System Design, Operation and Management

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Preventing Common Electrical Problems That Can Cause Catastrophic Losses

By Jim Donald, Extension Engineer, Jess Campbell, Poultry Housing Technician, and Gene Simpson, Extension Economist, Auburn University

The long hot summer weather is just about over in the broiler belt. Most of our tunnel houses continue to perform extremely well, and in talking with growers throughout the broiler belt we have found that most who upgraded to high tech tunnel houses are satisfied as to how much easier the new technology has made their job of providing the right temperature and other conditions for maximum bird performance. There is, however, one particular kind of problem that we see too often: Smothered birds caused by unexpected loss of electrical power, especially in some older solid wall or even partially solid walled houses. Poultry houses and the equipment in them have evolved through the years, but in too many cases the electrical systems have not kept up with the technology upgrades that have been made to the rest of the house.

Many growers are living with a false sense of security and think that just because the power is on and the equipment runs in their houses that their electrical system is in good condition. The reality is that there are many houses operating with electrical systems that are close to causing a catastrophic failure. Learning about the importance of a properly sized, installed, and maintained electrical system will help prevent system failures. A tripping breaker or hot power panel is telling us that something is wrong. In an environmentally controlled house, regular electrical maintenance has to be part of the production program.

Quality power starts with planning the electrical service. We are beginning to get a handle on using properly sized transformers, service wires, and electrical service panels for newer facilities (see our book *Poultry House Construction Guidelines* at www.poultryhouse.com). However, a large number of houses built and wired some years ago seem to be extremely vulnerable to electrical system failure, which can lead to a significant loss of birds. Numerous field visits and reports from electricians indicate that there are four electrical components in older houses that especially should be examined on a yearly basis as a means of preventing losses. These areas are wires, connections, panel boards, and breakers.

Wires

Main feeder wires are the electrical conductors that deliver electricity to our poultry houses. When these wires are overloaded they begin to heat up and exceed the temperature rating of the insulation that protects them. Repeated overheating of insulation causes it to become brittle and break apart so that the conductor is likely to short circuit if it comes in contact with the metal enclosure or another conductor.

Another problem with electrical feeder wires is they are often directly buried in the ground and not installed in protective conduit. Heavy truck traffic over driveways will often cause shifting of the surround-

Electrical panels with covers removed and fans blowing on the breakers to keep them cool – sure signs of an inadequate electrical system that is likely to fail abruptly. Proper equipment and maintenance helps prevent such nasty surprises.

ing fill dirt. Over time the insulation is damaged and the conductor fails. Buried feeder wires should be installed in protective conduit to eliminate such problems. There is no quick fix for failure of a feeder wire to a poultry house. Excavation has to take place and new materials need to be assembled and installed.

Also, special attention should be taken when retrofitting older houses with new tunnel fans and equipment. Sometimes the older 100 amp rated feeder wires are reused to feed 200 amp panels (as seen in photo at right) that supply the new more powerful equipment. The old conductors are not rated to handle the new load but will work or get by for a while. The correct action is to replace the wires serving the panel. This is an expensive fix and is often not done. Have a qualified electrician size these new feeder wires and use copper if at all possible.

What's wrong with this picture? New electrical service and panels are being installed to handle the increased electrical load of an upgraded environmental control system – but the old wires leading from the panels are not being replaced. They will be undersized and likely to fail.

Electrical Connections

Photo set #1 on the facing page shows right and wrong ways to connect two or more wires together. The wires in the left photo were connected using a split bolt connector. Over time the resistance of the connection increased, the junction began to heat up, and the two conductors burned apart. This could have been aggravated by moisture causing corrosion of the aluminum, or by unequal expansion and contraction of the metals. Whatever the specific cause, the split bolt connector splice failed. Since this failure was downstream of the generator, power to the poultry house being served by that set of conductors was lost. As stated above, there is no fast fix for a failed lateral to a poultry house. Split bolt connections have been commonly used in retrofitting electrical systems to join old buried conductors to new panels. They are often protected by electrical tape and might even be buried or hidden in a piece of electrical conduit. This makes them difficult to inspect. Most likely sooner or later these connections will give trouble. If you have them in your wiring system you need to plan to replace them.

The right-hand photo shows how main electrical connections should be made in a protective junction box where the wires can be fastened by an electrical lug kit that can be torqued to meet the manufacturer's recommendations using a torque wrench. These connections are far more reliable and can be easily inspected and maintained. The lug kit assures a good metal to metal contact with minimal electrical resistance. Heating of connections made in this manner should not be a problem.

Panel Boards

Many houses built 10-15 years ago were wired with 100 amp or less rated electrical panels. Ventilation was natural and electrical loads were much smaller than those experienced in today's houses. Most panels installed were lighter duty ones – that is, not designed for continuous loads at or near their rated maximums. These non-commercial type panels are acceptable for residential use, but when placed in a poultry house with 8-12 fan motors and other motors running, they will most likely not hold up well over time. Circuit breakers that snap into aluminum bus bars often do not make good connections. Over time these connections degrade and develop resistance to current flow, causing heat build-up in the breakers and panels. Photo set #2 (opposite page) shows a panel in a 15 year old house that has a hot spot heated up to nearly 170°F. The problem is not easily noticeable to the eye, but shows up clearly in the infrared photo. The connection of the breaker to the aluminum bus of the panel has deteriorated and is the cause of the problem. Eventually, the hot spot will melt or burn through, causing loss of power (or worse, a catastrophic fire). The panel board should be replaced with a suitable commercial grade model.

What causes wires, electrical connections, breakers, and panel boards to get hot?

Answer: Normally, electrical current (amperes) flows with very little resistance through wires, connections, breakers, etc, to the load to be served. But too-small conductors or poor connections add resistance to current flow, so the electrical current has to do extra work to get through, and this is what causes heating. In a circuit with 10 amperes of current flowing through a too-small wire or bad splices or joints that add only one ohm of resistance, 100 watts of heat would be generated. Heat in electrical circuits increases as a function of the square of the current flowing, so that if the circuit is overloaded to 20 amperes, 400 watts of heat would be generated. Doubling the current flow, in other words, produces four times as much heat. This is why it is very important not to overload circuits and to minimize unnecessary resistance by choosing wire size and type correctly, and making sure all junctions and connections are done correctly and kept tight.

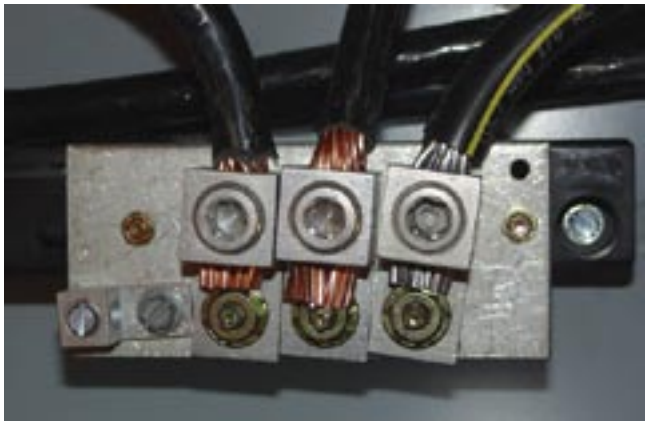


Photo set #1. Connecting high-current wires with a split bolt connector, as shown in left photo, is very likely to cause problems eventually. Over time the resistance of the connection increased, the junction began to heat up, and the two conductors burned apart. The right-hand photo shows the safe way to connect wires, in a protective junction box where the wires can be fastened by an electrical lug kit that can be torqued to meet the manufacturer's recommendations using a torque wrench. This type of connection is far less likely to overheat and fail.

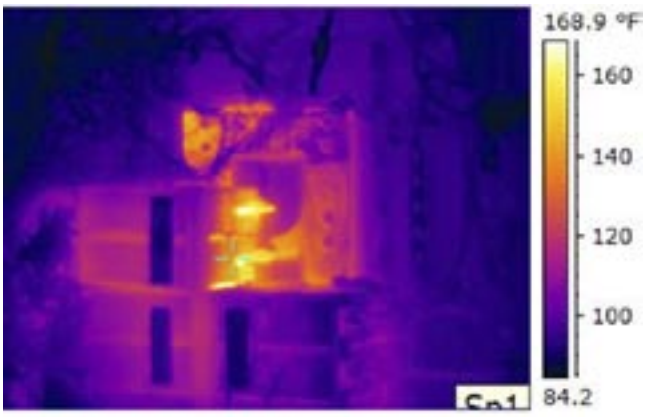
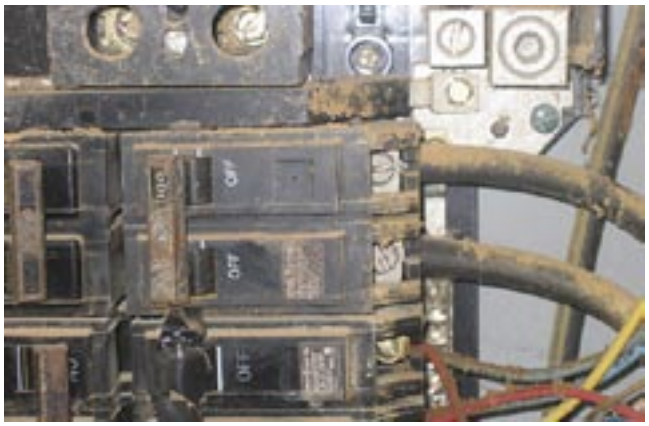


Photo set #2. The section of the electrical panel board shown on the left is an actual picture of where the breaker snaps into the bus bars. Note the extreme heat marking shown near the breaker stab-in terminals. The infrared photo of this panel on the right shows this area to be at nearly 170 degrees F. This is a residential-duty panel in an older house upgraded to full tunnel, and the panel cannot handle the added electrical load. The solution is immediate replacement of the panel and breakers with commercial-rated equipment.



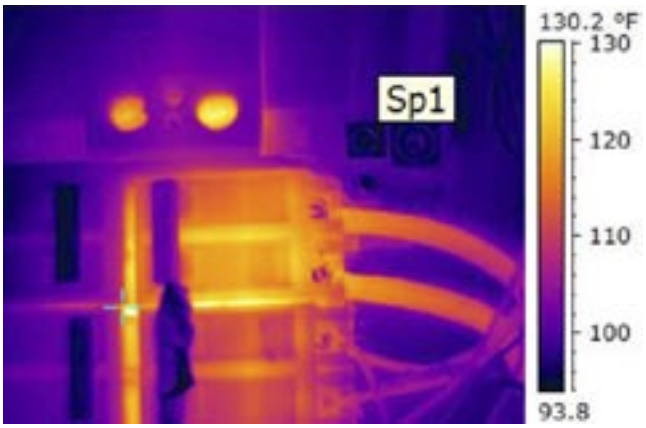


Photo set #3. Photo on left shows a 15 year old 150-amp power panel in a poultry house. The infrared photo at right shows the breaker is heated to about 130 degrees F, which means it is likely to fail or trip prematurely. The reason is that this breaker is feeding a second poultry house! Power should never be fed through one poultry house to another, but only from the farm main service.

NOTE: The photos on this page were all taken on farms that have standby generators. These problem areas were all in locations downstream of the generator. The generator can not supply power if the conductors, breakers or panelboards fail. Some growers do not realize how their farm wiring has put their flock safety in jeopardy.

Main Breakers

Most molded case circuit breakers are designed to operate at a maximum temperature of 40°C, which is 104°F. If the breaker is in a cabinet or enclosure that is hotter than 104°F, then the breaker is likely to trip prematurely, even if there is no electrical current overload. The cause of overheating may be a defective breaker or problems with wiring or connections. Many growers remove panel covers or even blow fans on breakers to keep them cool, as shown in the photo on page 1. A properly sized circuit breaker snapped into a quality panel with copper bus bars and the correct wire properly connected to the load won't need to be cooled by a fan or have the cover removed. This is a tell tale sign that you need to have a knowledgeable electrician take a look at your farm. A breaker that needs continual or frequent changing is a sign that there is something much worse wrong. Photo set #3 on page 3 shows an over-heating circuit breaker, operating outside its designed temperature range at about 130°F, caused by using one poultry house panel to feed electricity to a second poultry house. An infrared image as shown in photo set #3 is a good way to detect overheating breakers, but a simple infrared temperature gun can tell you what the temperature is, it just doesn't paint the thermal image.

Often we are asked how often breakers and main breakers should be replaced. This is a hard question to answer. A well designed electrical system should require little or no changing of breakers. Older units that have been subjected to high heating and constantly used as switches to turn loads on and off may need to be changed.

The Bottom Line

In industrial applications where loss of power is very critical, electricians are called upon routinely to inspect wiring, breakers, panels, and connections. A tunnel ventilated house should be considered a similar type of facility and should be evaluated for electrical integrity on a yearly basis. This evaluation should be done when the house is under at least 50% of its load and it is best to do it during a fully loaded situation. Breakers, wiring, panels, and connections should be evaluated by a qualified electrician or technically trained individual. A temperature gun, volt meter, and a flashlight are very effective tools for finding troubled areas in any electrical system.

The issue of electrical maintenance on older farms cannot be overlooked. It is just as important to focus on using a qualified and competent electrician to do your work as it is to have the better equipment installed. Many electrical failures can be avoided with preventative maintenance. Find a qualified electrician and have him look at your wiring system. Pay extra attention to panel boards, breakers, connections, and wires. Remember that a breaker costing $30 to $50 is protecting a house full of birds worth thousands of dollars. Paying attention to these details might just save you a house of birds.

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Jim Donald, Extension Engineer, Auburn University

Mike Eckman, Extension Poultry Scientist, Auburn University

Gene Simpson, Extension Economist, Auburn University