Aviagen™ Turkeys

Technical Bulletin

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Preventing Common Electrical Problems

Jim Donald, Extension Engineer; Jess Campbell and Dennis Brothers, Poultry Housing Specialists; and Gene Simpson, Extension Economist; National Poultry Technology Center, Auburn University

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 farmers 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, see Photo 1, indicates something is wrong and must be repaired. In an environmentally controlled house, regular electrical maintenance has to be part of the production program.

Quality power starts with planning the electrical service. However, a large number of houses built and wired some years ago and not maintained are extremely vulnerable to a system failure, which can lead to a significant loss of birds. These areas are wires, wire connections, panel boards and breakers.

Wires

Main feeder wires are the electrical conductors that deliver electricity to our 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 the insulation causes it to become brittle and break apart and the conductor will short circuit if it comes in contact with the metal enclosure or another conductor.

Another problem with electrical feeder wires is that they were often directly buried in the ground and not installed in protective conduit. Heavy truck traffic over driveways will often cause shifting of the surrounding 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 turkey house. Excavation has to take place and new materials need to be assembled and installed.

Also, special attention should be taken when retro-fitting older houses with new tunnel fans and equipment. Sometimes the older 100 amp rated feeder wires are used to feed 200 amp panels that supply the more powerful equipment, see Photo 2. The old conductors are not rated to handle the new load but will work or get by for a while. The correct

Photo 1: *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.*

action is to replace the wires serving the panel. This is an expensive fix and is often not done. Have a qualified electrician size and install new feeder wires and use copper if at all possible.

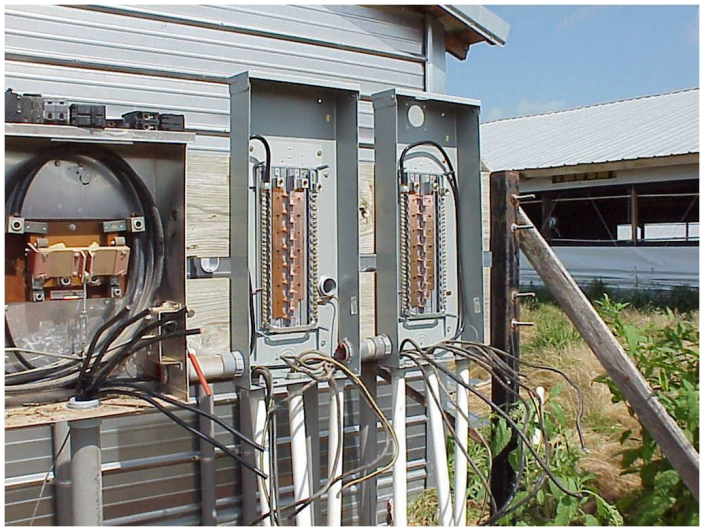

Photo 2: *What's wrong with this picture? New electrical service and panels are being installed to handle the increased electrical load of an upgraded environmental control system – but the old wires leading from the panels are not being replaced. They are now undersized and likely to fail.*

Electrical Connections

Photos 3 and 4 show the right and wrong way to connect two or more wires together. The wires in Photo 3 are connected using a split bolt connector.

Photo 3: *Wires incorrectly connected with a split bolt connector.*

Over time the resistance of this 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 the failure was down stream of the generator, power to the turkey house being served by that set of conductors was lost. As stated previously, there is no fast fix for a failed feeder to a turkey house.

Split bolt connectors have been commonly used in retro-fitting 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 cause trouble. If you have them in your wiring system, you need to plan to replace them.

Photo 4 shows how electrical connections should be connected in a protective junction box where the wires can be fastened by an electrical lug kit that can be torqued to meet the manufacture'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.

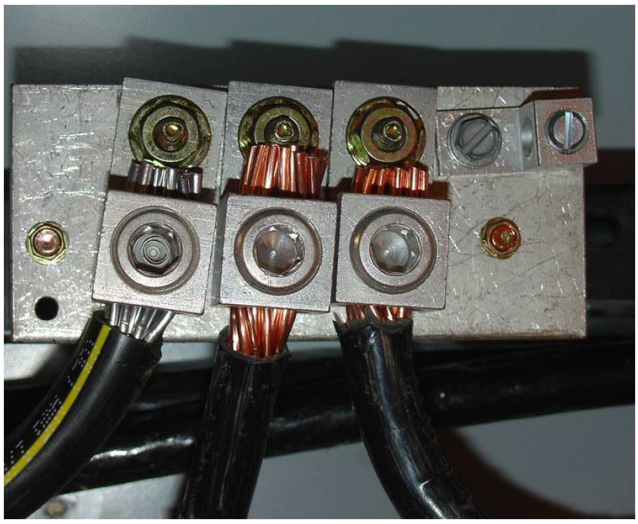

Photo 4: *Wires correctly connected in a protective junction box.*

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 installed 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 5 shows a panel in a 15 year old house that has a hot spot heated up to nearly 170°F (77°C). The problem is not easily noticeable to the eye, but shows up clearly in an infrared photo, see Photo 6.

Photo 5: 15 year old panel with a 170°F (77°C) hot spot.

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).

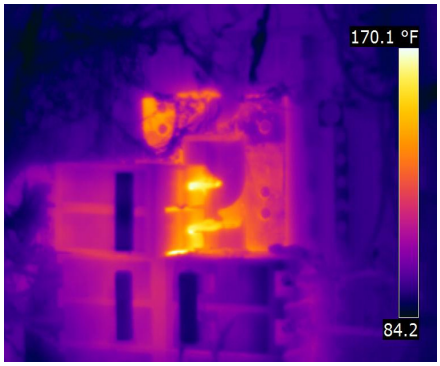

Photo 6: Infrared photo of 15 year old panel with a 170°F (77°C) hot spot.

The panel board should be replaced with a commercial grade model properly sized for the connected loads.

Main Breakers

Most molded case circuit breakers are designed to operate at a maximum temperature of 104°F (40°C). If the breaker is in a panel or enclosure that is hotter than the maximum temperature 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 Photo 1 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 always needs to be changed is a sign that something much worse is wrong. Photo 7 shows an over-heating circuit breaker, operating at about 130°F (55°C). It was caused by using a poultry house panel to feed electricity to a second poultry house.

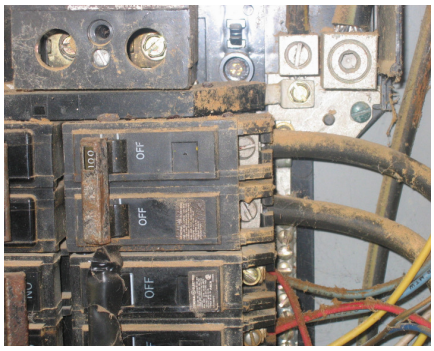

Photo 7: Overheating circuit breaker.

An infrared image as shown in Photo 8 is a good way to detect overheating breakers. A simple infrared temperature gun can tell you the temperature, it just doesn't paint the thermal image.

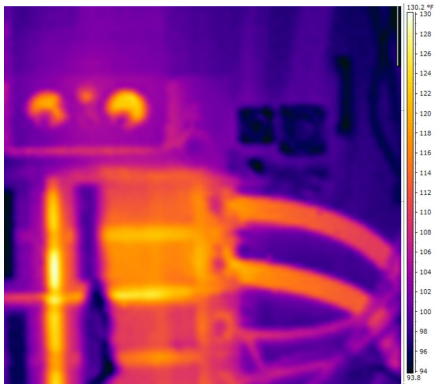

Photo 8: Infrared photo of overheating circuit breaker.

We are frequently 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 subject to high heating and constantly used as switches to turn loads on and off may need to be changed.

Grounding

Good grounding is essential for any turkey house. Grounds must be of proper size, proper location, have low resistance, and should be tested when installed and as part of a regular maintenance program.

Most grounding problems occur when the initial grounding system does not meet National Electrical Code (NEC) requirements of 25 ohms or less. Solid acorn style grounding lugs hold up longer over time and should be used to connect ground wires to ground rods instead of 2-piece connectors that screw together.

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 turkey 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 full 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 importance of electrical inspections and maintenance on older farms cannot be emphasized enough. 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 electrical 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 details might just save you a farm of turkeys.

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

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. This is what causes heating. In a circuit with 10 amperes of current flowing through too small wires or connections that add only 1 ohm of resistance, approximately 100 watts of heat could 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 installed correctly and kept tight.

Aviagen Turkeys, Inc. 31186 Midland Trail, East • Lewisburg, West Virginia 24901• USA • Tel: +1 304 793 2680 • Fax: +1 304 793 2684 • turkeysinc@aviagen.com • www.aviagen.com