

Stopping Lightning and Other Electrical Problems That Can Kill Birds

Most poultry companies have made the move to solid sidewall and near solid wall houses with small curtain openings. These enclosed houses are tighter, more energy efficient, easier to heat and cool, and easier to ventilate than the large curtain sided houses that were built just a few years ago. One of the biggest challenges with these modern houses is how to keep birds alive in the event of a utility company power outage or on-farm electrical problems.

The solution to electric utility outage is automatic-transfer standby generators, which are now standard on most poultry farms, to supply power until the utility restores service. However, on-farm electrical problems continue to trouble many farms. Proper farm wiring, proper electrical grounding, and lightning protection are three areas that are widely misunderstood and often overlooked. Defects in any of these can leave a farm or a house without electricity and cause catastrophic losses in a very short time even if there is a properly operating generator on site. The purpose of this newsletter is to detail what must be done to insure you have a properly installed and operating electrical system that will not bite you in your pocket book. The information presented is especially relevant to new construction but also useful in inspecting and renovating installed electric systems.

Proper Electrical Wiring

The first principle to observe in protecting against electrical problems is that installation of electric system components and wiring should be done in accordance with the National Electrical Code (NEC) and other local codes, and should be done by a certified electrician. Typically, the utility company will bring power to a central location on the farm, where the main service equipment and metering equipment is located. It is a good idea to not set a permanent power pole closer than 20 feet to the first house to be served and this should be on the opposite side of the house from the feed bins or tanks. In most instances, all feeder wiring from the poles to houses should be run underground and buried at least 2 feet deep, depending on local codes. It is good practice to use conduit for buried power lines, for protection against mechanical damage.

Emergency generators are a must, but we will not go into detail on generators in this issue. See newsletter #8, *Emergency Power for Poultry Production* (November 2000), at www.poultryhouse.com

Individual Poultry House Wiring

Power should be delivered to the center of the house. Most experts recommend that the main service panel for each poultry house be located in a separate control room located adjacent to the middle of the house. This gets the service panel out of the bird chamber and by

A certified electrician should test grounding rods with a ground-resistance meter to make sure that electrical resistance to earth ground is not more than 25 ohms. Poor grounds such as this one, reading 54 ohms, can allow lightning to seriously endanger flocks.



being in the center of the house, helps reduce the length of the circuits to the ends of the house.

Panel size should be checked by a competent engineer or electrician, but a recommended minimum would be a 200-amp, 40-breaker panel similar to a Square D QO type. In some locations, it is permitted to omit the main breaker to this panel, provided it is properly protected by a breaker at the main service to the farm where the laterals to each house begin.

A manual disconnect switch will be required if the main breaker is omitted. Local codes will dictate if this is acceptable design.

Circuits can be sized to serve more than one fan per breaker, but it is best to run one fan per circuit to allow individual control of the fans. Separate circuits are commonly run to the tunnel inlet machine, vent box machine, electronic controller, and alarm system. Be sure to remember all inside or outside receptacles, as well as any mercury vapor or outside lights that need to be supplied.

All wiring should be in conduit and in compliance with the National Electrical Code. There is no place for exposed Romex wiring in modern poultry houses.

Lightning Protection and Grounding

Proper installation and grounding of the electric service and all electrical and electronic equipment are essential for safety, reliability of equipment, and protection from lightning damage. Experts say that 90% of all lightning damage can be eliminated if the electrical system on the farm is properly grounded. Proper grounding is more important today than ever, because modern poultry houses are equipped with electronic equipment such as controllers, alarm systems, and/or telephone dialers, items that were not common on farms 10 years ago. These electronic devices must be installed and grounded properly or serious damage to the devices will result from surges and lightning strikes. Because the energy associated with a lightning strike is so large, it does not take a direct hit or strike to damage electrical equipment.

The key to achieving minimum susceptibility to lightning is outlined in the three steps below. Some of this information is somewhat technical, so be sure you deal with someone, either your electrician or your power supplier, who is knowledgeable on these items. Your electrician and power supplier are invaluable to you in being sure you get a properly installed and grounded installation.

1. Notify your power supplier well in advance and make certain that you tell them that you need a service to your farm that will be well grounded so as to minimize the effects of lightning. They have sophisticated meters and equipment that can check how well

farms are grounded. They should check the grounds on their system as well as those on your system.

2. The National Electrical Code prescribes acceptable standards for wiring farms and farm buildings. Poultry farms usually have the main farm service panel at the meter pole, where there will be disconnects for electric lines going to each poultry house. The standby generator and automatic transfer switch are also usually located at or near the meter pole.

It is very important to have a good, single-point electrical ground connection at the electrical service and generator. The NEC allows alternative grounding devices and methods in some circumstances, but grounding is usually done by driving one or more Code-approved metal rods into the ground, with properly sized wire securely connecting the rods to each other and to both the metal casings of all equipment and the grounding circuit of the electrical service.

All grounding devices must be tested to make sure they offer not more than 25 ohms electrical resistance to earth ground, as recommended by the NEC. For houses with electronic controllers, you ideally would like to see less than 5 ohms resistance to ground. Your power supplier can help you with this. If the resistance tests high, you may need to install additional ground rods.

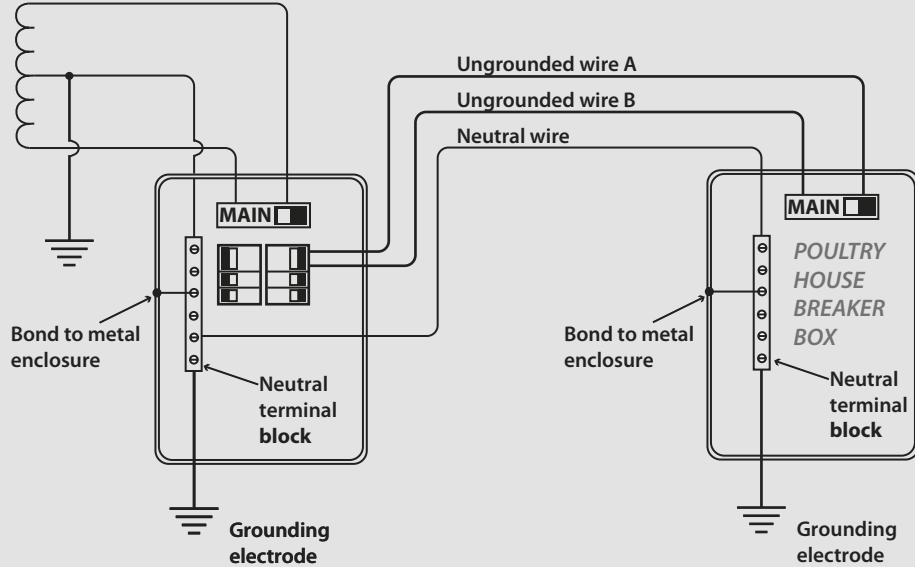
Anywhere we have several pieces of equipment to ground to the earth, we want what is called single point grounding. This is very important to help minimize lightning damage. Do not have separate rods for alarms, dialers, telephone lines, and electrical panels. Multiple rods must be tied together or bonded regardless of their distance apart.

3. To run electricity to your individual houses, wires should be run underground from the central meter pole and generator shed location to each poultry house panel. The NEC allows for this to be done in either a 3-wire or 4-wire system. Your electrician will understand these two options.

Option 1: 3-wire system (see illustration) – Two hot conductors and a neutral are taken to each poultry house. The ground block and neutral block in the house panel are tied together and bonded to the enclosure, and a ground rod is driven at each house. In this scenario, each house is considered a separate electrical system, and we will have single-point grounding for each house and all its electrical and electronic equipment. While this practice has been commonly used for many years, having separately grounded houses can lead to problems, especially with controllers or alarms that are networked (tied) together. If a 3-wire type system is used, *it is essential to install proper surge or lightning protection devices on all alarms, dialers, and controllers.*

Utility transformer

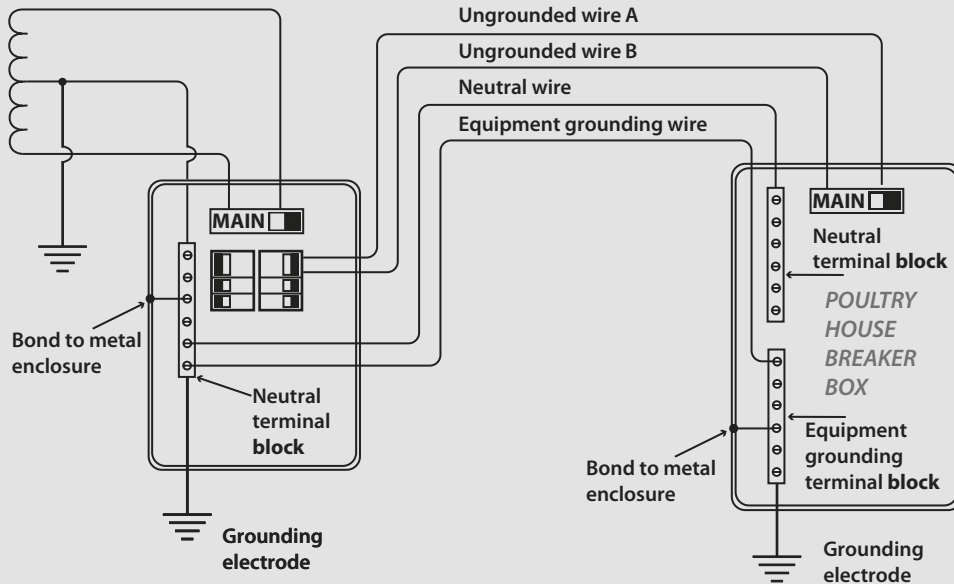
3-WIRE GROUNDING SYSTEM



In a 3-wire grounding system, two hot wires and a neutral wire are taken to each house. The neutral and equipment grounding wires are tied together at both the central pole and generator and at each house. This is the older way to achieve good grounding and is acceptable, although the 4-wire system affords an extra measure of protection for sensitive electronic equipment. If you use the 3-wire system, having good surge and lightning protection devices on all electronic equipment is even more critical. At all grounding rod locations, it is essential to check for acceptably low resistance to earth ground. If necessary, additional rods should be driven and all rods bonded together.

Utility transformer

4-WIRE GROUNDING SYSTEM



In a 4-wire grounding system, two hot wires, the neutral wire, and a separate equipment grounding wire are taken to each house. The neutral and equipment grounding wires are tied together only at the central meter pole and are kept separate at all houses. The 4-wire system is more expensive, but affords an extra measure of protection for sensitive electronic equipment. Installing surge and lightning protection devices for electronic equipment in addition is also recommended. As in a 3-wire system, it is essential to check for acceptably low resistance to earth ground at all grounding rod locations. If necessary, additional rods should be driven and all rods bonded together.

Option 2: 4-wire system (see illustration) – In this system, within each house service panel the ground block and the neutral block are kept separated. A ground rod is driven at each house but tied only to the grounding block of the service panel, and a fourth wire from the central meter pole is run to each poultry house and tied to the grounding terminal block and rod. This provides single-point grounding for the house. Looking at the farm as a whole, the grounds and the neutral are tied together only at the central meter pole, so in effect we achieve single-point grounding for the entire farm.

In theory, the 4-wire system will minimize surges from lightning and large differences of voltage called ground loops. However, there are extra costs involved, and for the system to be safe, it must be properly put in (including properly sized wire) and maintained.

Whether you choose a 3-wire or 4-wire system, you should adhere to the following as much as possible:

- ✓ At whatever locations necessary to ground equipment, be certain to adhere to single point grounding at that location. Tie all equipment to a common rod.
- ✓ Work with your electrician and power supplier. Be sure you have a low resistance to earth at every ground rod. If you don't, take corrective action.
- ✓ Use surge protection devices (SPD's), especially on all controllers, alarms, and dialers. This also helps prevent lightning surges from travelling from one house to another, and is especially important if you choose 3-wire service.
- ✓ For more safety from lightning damage, consider wireless communications to network controllers and alarms. Many companies are introducing wireless technology and other innovative ideas to minimize the damage that can be caused by lightning.
- ✓ Be sure all clamps, ground wires, and rods are maintained over time. Don't neglect your grounding system.

Bottom Line

The one-time additional cost of a first-class electrical system with lightning/surge devices providing the best protection against catastrophe may be several hundred dollars per house. That is cheap insurance against the risk over time of losing an entire flock to a lightning strike or on-farm electrical malfunction. Just remember: *Without proper grounding, any amount of money spent on lightning and surge protection equipment will be wasted.*

By Jim Donald, Extension Engineer and Professor & Jess Campbell, Poultry Housing Technician, Auburn University



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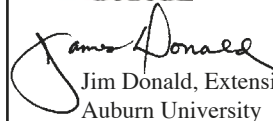
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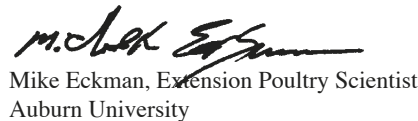
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