Department of Animal Science

# Proper Maintenance of Stand-by Generators Is Critical on Commercial Poultry Farms

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There is never a time when contract poultry growers and poultry company personnel are not concerned about the weather. However, the spring and summer storm seasons always increase the worry for the commercial poultry community. Storms increase the risk of power failure which for a totally enclosed, controlled-environment poultry house can result in catastrophic bird losses in less than 15 minutes. This is an acute risk for near-market-age birds, which are fully feathered and at 8 pounds generate approximately 100BTU/hr (collectively 4 million BTU/hr for 40,000 birds) that must be removed to maintain normal body temperature (Czarick et al., 2023). Thus, in warm weather, power failures can cause the house temperature to increase dramatically in a short period of time, which large birds do not tolerate well. Solid sidewall housing rules out effective cooling using natural ventilation, but even if natural ventilation were an option, there are simply too many birds in the house for natural ventilation alone to prevent catastrophic loss. For this reason, adequately sized and reliable emergency stand-by generators are essential tools on modern poultry farms.

***Figure 1****. Stand-by generator systems are required for modern commercial poultry farms today. Proper maintenance is critical for the system to provide power at a moment's notice in an emergency.*

A stand-by generator system (Figure 1) is remarkable in its ability to monitor incoming power from the utility line and instantly detect when utility power is lost. The system automatically

starts the generator(s) in less than a minute and transfers the power supply from the incoming utility line to the generator(s). This restores power quickly, thereby preventing catastrophic flock losses even with mature birds on a hot summer day. Once utility power is restored, the system automatically switches power back to the utility source and shuts the generator(s) off after a brief cool down period. This invaluable system requires proper routine maintenance to reliably perform properly. Let's take a closer look at the important role stand-by generators and proper maintenance systems play in modern commercial poultry farming.

## Generator system specifications

It is critical to have properly sized stand-by generator(s) to handle the total electrical demand on your farm. Integrators assist growers with determining this load demand as well as the correct generator size for the farm. The key issue is that a standby generator must be able to meet not only the normal operating wattage requirements of a house (or houses) but also the start-up wattage needs, which are much greater (Donald et al., 2000). In a poultry house, electric motors on fans, feed lines, cross augers, etc. make up most of the total electrical load, and electric motors when first switched on will, for a few seconds, require from two to twelve times as much electrical power as they need to run continuously after starting. Experience is a good teacher, and over the years much has been learned from various disasters and flock losses in relation to what works and what doesn't (e.g., aluminum vs. copper wiring, two generators with each carrying half of the electrical load vs. a single generator carrying the entire load). Generator system specifications for a modern 2025 poultry farm may resemble the following:

- Houses should be wired so that the total load is evenly split between two panels that have backup service from two different generators (Figure 2). Even if one generator fails, half the load for the house can be maintained by one operational generator, preventing a catastrophic loss.
- Two generators (minimum of 50 Kw/house): 2 x 100 Kw for each set of 4 houses. Depending on the integrator, larger houses (66' x 600' or larger) may require something greater than a minimum 50 Kw/house generator.
- Each generator must be equipped with a communications box that communicates with the controller.
- Electrician and generator vendors must ensure that stand-by generator(s) will serve the total connected load/start-up load for the farm.
- Stand-by generator systems must be able to start and continuously run the entire farm including all reasonable equipment at the same time (fans, cooling system including cool cells and sump pumps, lights, well pump, feed system, etc.).

***Figure 2**. Newer poultry farms often have two stand-by generators and automatic transfer switches, each wired to carry half the load for each house, which greatly reduces the risk of catastrophic flock losses.*

- Each stand-by generator must be programmed to exercise for the same 1-hour period every week, during which time power must actually transfer from the utility to the generator successfully.
- Each stand-by generator must be supplied with a minimum of three days of fuel supply in one tank per generator provider fuel consumption requirements.
- Each stand-by generator engine must provide a minimum of 1.7 horsepower for every Kw of generator capacity.
- Each stand-by generator must have a block heater with power supplied from a dedicated circuit at a generator shed subpanel.
- Each stand-by generator must be equipped with a manual starting switch that bypasses the electronic controls in case of a circuit board failure.
- Each stand-by generator must have a battery conditioner or battery charger installed to keep the battery fully charged.
- Each stand-by generator must be grounded with its own 8-0’ x 5/8” copper clad ground rod and additionally connected to the entire farm system ground network. This ground must be tied to an Ufer ground encased within the generator shed concrete slab.
- Each stand-by generator exhaust must be run outside of the generator shed, and the pipe must not be in contact or near studs, rafters, sheet metal or other materials that could possibly overheat and catch or cause a fire in the generator shed. An eight-house broiler farm in Tennessee suffered a catastrophic loss several years ago when a generator shed caught fire.
- There must be no more than two houses per 400-amp transfer switch. Transfer switching must have automatic sensing and automatic transfer capability.
- Each house must have two 200 amp disconnects installed on the feeder wires. Commercial grade fused or breaker disconnects must be used.
- There must be two additional sets of power wires that supply two service panels (200-amp minimum) from the main breaker; these extra power supply wires supply the generator shed for generator accessories, lights, service outlets, and supply power for water storage and well pumps on the farm. These service panels and feeder wires must be sized to meet the power load to be served.
- All feeder wires must be connected to equipment under lugs inside electrical equipment. Absolutely no wire splices are allowed unless in an approved box and under lugs. Absolutely no split bolts allowed for splicing feeder wires. All premises wiring must be copper.
- All wiring to be installed in accordance with industry standards and local code regulations if required. All electrical equipment must be double checked and equipment tested prior to the integrator final approval; only then will chicks be placed on the farm.
- Each stand-by generator must be serviced by a professional generator service technician on a yearly basis with a full inspection conducted.

## Tune-up tips


***Figure 3**. A stand-by generator (foreground) and automatic transfer switches (background) must receive proper maintenance to perform efficiently when needed.*

As we head into spring storm season and with the heat of summer and the threat of summer thunderstorms soon to follow, it is vital to maintain the stand-by generator system (Figure 3) and to ensure that all its components are in good working order; this greatly reduces risk during a major power outage. Farmers like to do things themselves, but keep in mind that electricity is dangerous, even deadly. Think safety first and make sure any electrical system is de-energized before working on it. Before completing any stand-by generator maintenance, ensure that the generator's power is locked out and tagged out to prevent any unintentional start-ups. UT Extension recommends that you use only a trained generator service technician for repair or maintenance work on your farm's stand-by generator(s). In addition, have a good relationship with an electrician that can inspect your wiring, main panel boxes, lug connections, etc. Campbell et al. (2022) offer the following tips for poultry farm generators and electrical systems.

### Main Disconnect

- Spare breakers and fuses must be on hand in the generator shed in case one is damaged or is blown. Plan ahead as some of these items are often in short supply or take an extended amount of time to acquire.
- A trained or licensed electrician should inspect the internal components of the disconnect to make sure that there are no signs of wear or damage that may cause a failure.
- All main supply wire connections should be verified for tightness.
- These units are often installed outside and must be checked to make sure that no water enters the box from the weather head.

### Generator service

- The next time you are between flocks, run the stand-by generator system under load for a few hours to verify all is working correctly
- Visually inspect and load test batteries and clean terminals at least once a year. A good battery is critical, so test cycle the stand-by generator(s) weekly and verify the generator starts promptly and runs smoothly.
- Fuel, oil and air filters should be changed yearly regardless of condition. Keep spare fuel filters on hand as recommended by your generator service technician. A clogged fuel filter could mean disaster in an emergency.
- Keep generator radiators clean. A clogged radiator will not allow the engine cooling necessary to keep your unit running under load. Use a flashlight and take a few minutes

to inspect the fan side of the radiator to locate potential problems such as damaged heat fins.

- Fuel age, condition and the tank are extremely important. Spring is the time to evaluate the fuel in your system. Is it fresh, do you have enough, and do you have any backup fuel in case of an emergency? Check with your generator service technician about using fuel additives to maintain fuel quality and prevent problems caused by prolonged fuel storage.

### Automatic transfer switch

- Exercise each transfer switch under load when you are between flocks to make sure it works. You and anyone who might need to transfer emergency power on the farm must know how to do this safely. Label all switches and electrical boxes to help with this process.
- Have all wire connections, including grounds, checked by a trained or licensed electrician. Safety is your first priority. Inspect and have a professional repair or replace items as needed to ensure proper operation.
- Some electronic and internal components on these units may be hard to source, so don't wait to repair them if you know you may have an issue.
- Any unused holes in the exterior box must be covered with metal to keep insects, pests, birds and snakes out of the transfer switch. Animal remains, nests and trash are often found inside transfer switch boxes. Such foreign items pose a short circuit risk and could cause the transfer switch to malfunction in an emergency.

### Main Panel

- Every farm should have at least one spare main breaker in stock in case one fails with birds present.
- All main wire connections should be inspected for tightness and visual signs of damage
- At least one spare breaker of each size (single and double pole) should be on hand for quick replacement in an emergency.
- All unused holes must be covered with a metal blank, and every panel should be cleaned out or vacuumed to eliminate dust and debris buildup.

### Alarm system

- Don't take a chance on a weak battery keeping you from getting an alarm. Promptly replace any battery that shows sign of failure or fails a load test.
- Test sirens and the power failure call system regularly to make sure they are operating properly.

## Point of failure categories

Do not take stand-by generator maintenance for granted and never think that disaster can't happen to you. An evaluation of all catastrophic losses across several poultry complexes by Brothers (2020) yielded valuable information on the causes of catastrophic bird losses (Figure 4). The data indicated there are some more common point-of-failure problem areas defined as follows:

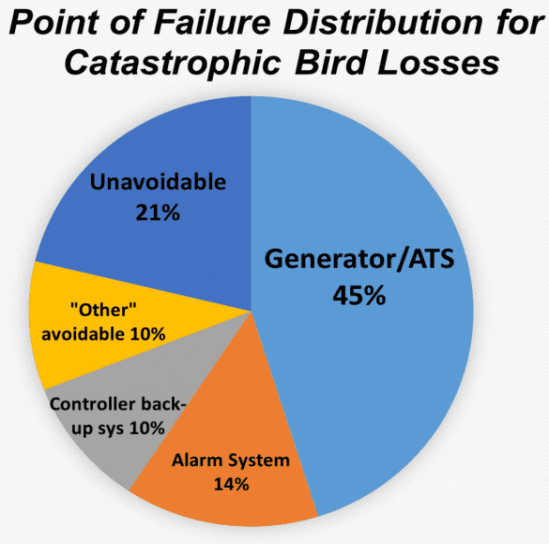


***Figure 4.*** *Analysis of catastrophic losses over two years for approximately 300+ million square feet of housing space. Catastrophic loss in this case is defined as an event resulting in several hundred or more birds dying at once, not related to disease.* Source: Brothers (2020).

- **Generator/Automatic Transfer Switch**. Any loss stemming from failure of the generator, automatic transfer switch or associated switches, and disconnects used for emergency power delivery.
- **Alarm System**. Any loss when the alarm system did not function or was not set properly, preventing growers from being alerted on time.
- **Controller Backup System**. Any loss that should have been avoided if the house controller's backup system had worked as expected.
- **Other Avoidable**. Losses where some form of mismanagement or simple equipment failure occurred but did not involve the three systems listed above.
- **Unavoidable**. Natural disasters or random equipment failures that could not have been foreseen or avoided (i.e., lightning strike, tornado, etc.).

As seen in Figure 4, almost half (45 percent) of these losses were caused by problems with the generator, automatic transfer switch and associated switches. Most of these losses could have been avoided with better system maintenance.

## Common sense

Do not overlook the simple everyday commonsense things. Check the fuel supply on a regular basis. A typical 100-to-130-kilowatt generator can burn 5 to 8 gallons of diesel fuel per hour, depending on the load (Tabler et al., 2018). If the generator only runs a 1-hour exercise cycle each week, that is not a lot of fuel, even over several months. However, if a storm comes through and knocks out power for 24 hours, the generator may burn 100 to 200 gallons of fuel in a 24-hour period. Many poultry farm generator systems have 300- to 500-gallon fuel tanks. How many growers keep the fuel tank at least two-thirds full at any one time? In the event of an ice storm, tornado, a vehicle taking out a power pole or some other disaster that knocks out power for an extended period, how long will it take to get additional fuel? If fuel stations are without power, will you be able to get additional fuel?

A good rule of thumb is to fill the tank when it reaches the half-full mark. Some fuel suppliers may not deliver less than 100 gallons of fuel, but most will deliver an order of 100 to 150 gallons or more. Sediment pick-up and clogged fuel filters are always a concern. To help reduce sediment aspiration, fuel pick-up lines should not extend to the bottom of the fuel tank. There is less risk that sediment will be picked up and pulled into the fuel filter if the fuel lines only extend to within 6 inches of the bottom of the tank. Keep the location of the fuel pick lines in mind when you check the fuel level.

Be onsite when the generator powers on for its weekly exercise run cycle. Does it start quickly and smoothly? If it seems like the starter is dragging or the battery is barely turning the engine over, you have a problem that requires immediate attention. Observe critical items like wiring, belts, hoses and fuel lines for age and wear. Look for bird nests in the radiator grill and exhaust pipe. Starlings can completely fill the exhaust pipe with nesting material and eggs in between weekly generator exercise cycles. Consider installing a cap over the exhaust pipe if one is not present (Figure 5). Rats and mice can chew wiring. Mud daubers can build nests that, because of their weight, can pull loose electrical control wires.

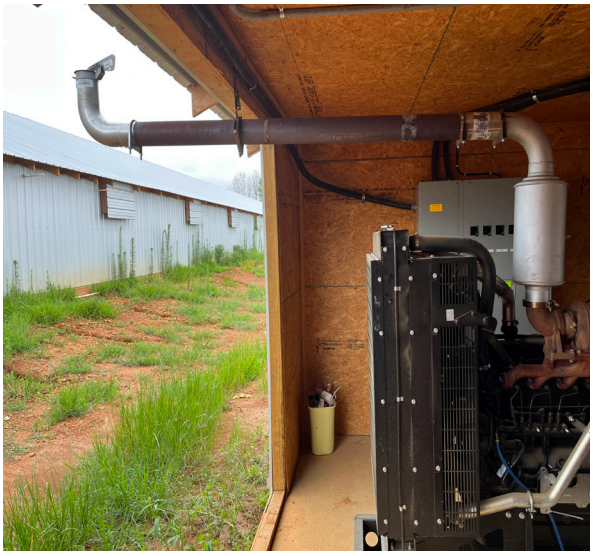

***Figure 5****. A cap over the exhaust pipe will prevent birds from building nests in the pipe.*

## Summary

Your stand-by generator system is a critical and necessary part of growing chickens today that cannot be neglected. You may only rarely or never need it. However, when you do need it, the system **MUST** work flawlessly. Thus, think of your backup power system as an inexpensive insurance policy in which you invest your time and effort because catastrophic losses associated with generator failure can be financially devastating. Be aware of necessary tune-up tips and keep the system in peak condition. Have the system inspected at least yearly by a qualified generator service technician. Be proactive and protect the investment you have in your poultry farm. A few hundred dollars spent on inspections, maintenance, repairs and spare parts could prevent a devastating partial or total flock loss should an emergency occur.

## References

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