Stray Voltage in Broiler Breeder Hen Housing

Compiled by the National Poultry Technology Center at Auburn University In Cooperation With Utility Provider Professionals (Additional Work Continuing)

1.0 What is Stray voltage?

Stray voltage is a voltage resulting from the normal delivery or use of electricity on a multi-grounded power distribution system. The voltage exists between two conductive surfaces and can be felt by a person or an animal if the two surfaces are contacted at the same time. Stray voltage is typically not considered hazardous but can be problematic in certain locations, including dairy farms, poultry layer barns, swimming pools and boat docks. In such locations, the animal or human that is exposed to the stray voltage can receive a small shock or tingling sensation. In poultry layer facilities, if a hen that is ready to lay her egg receives a shock or tingle when contacting both the floor and the nest, she may be reluctant to enter the nest, and as a result, lay the egg on the floor. Floor eggs cannot be salvaged for many reasons and are considered lost eggs. Elevated levels of stray voltage on laying nests are known to decrease egg production by as much as 10%, a very serious economic problem for the poultry industry.

2.0 How does a farmer know if his or her hens are experiencing stray voltage?

Behavior of hens is probably the best indicator of a potential stray voltage problem. Two key indicators are:

1) Hens that do not want to enter the nests
2) the number of floor eggs exceeds industry standards.

There are other potential causes of floor eggs, such as shadows, lighting issues, and environmental issues, but stray voltage should certainly be considered. Additionally, once hens are affected by stray voltage, reduction or elimination of the stray voltage may not immediately correct the behavior of the hens with respect to nesting. Once hens are shocked or tingled, they may be reluctant to ever go back in the nests. This means they will continue to lay eggs on the slats or on the floor until the end of their production cycle. For this reason, if stray voltage is the source of the problem, it is imperative that the stray voltage be reduced or eliminated before the next flock of hens is placed.

3.0 What is the best way to check for stray voltage?

Stray voltage can be measured between the metal nests and a ground rod driven in the earth near the nest (1-3 feet away). A true RMS digital voltmeter is typically used as the instrument for measurement. A Fluke 117 or equivalent or higher grade meter should be used.

1. Drive a temporary ground rod through the slat area into the earth.
2. Create a clean bare shining spot on the metal nest, free of dirt.
3. Place one voltage probe on the ground rod, the other on the metal nest, and read the voltage.
4. If the voltage is 1.0 volt or less, no action is recommended.
5. If the voltage exceeds 1.0 volts, a further investigation should be undertaken. Obviously, the higher the voltage, the greater the urgency.

Typically, it is best to involve a qualified electrician when investigating the source of stray voltage. There are cases where the voltage being measured is mainly induced. Induced voltages (sometimes known as phantom voltages) rarely cause harm. A qualified electrician can use a true RMS voltmeter and a burden resistor or Fluke SV225 stray voltage adapter to discern normal stray voltage from induced voltages. See pictures 1, 2 and 3.

It's also advantageous to measure the stray voltage at the utility service entrance. This is accomplished in a similar fashion to the procedure noted above. In this case, the voltmeter is used to measure the voltage between the utility neutral/ground and a remote driven ground rod. The remote driven ground rod should be roughly six feet away from the utility service entrance ground. It is recommended that a qualified electrician and a utility engineer assist in conducting these measurements. See pictures 4, 5, 6 and 7.

4.0 What are remedies on poultry farms?

Stray voltage solutions are often complex and stray voltage can come from many sources, both on and off the farm. In many cases, the problems result from several simultaneous sources. For this reason, it is impossible to include every possible scenario in this summary. A team approach is recommended to optimize the evaluation and the team would typically consist of the grower or farm owner, poultry company management and technicians, a qualified electrician, and the electric utility representative.

However, common remedies to reduce or eliminate normal stray voltage include:

1. Reduce the stray voltage on the power system (utility). Utilities can sometimes balance load, improve grounding and reduce the return impedance of the power lines to lower the stray voltage.
2. Correct any grounding and bonding issues within the facility.
3. Request the utility to install a neutral isolator at the service entrance. The neutral isolator has limitations, but can isolate the primary neutral from the secondary neutral up to the design limit of the isolator. If the design limit of the isolator is encroached upon by the voltage across the isolator, the isolator will allow some stray voltage to pass.
4. Isolate the metal nests from other conductive surfaces that are bonded to the electrical building ground. These components often include:
    a. the egg collection table, which is bonded to the electrical system ground through the motor plug.
    b. The metal cables supporting the nests, which are sometimes touching building steel or connected to the collection table.
    c. Non-conductive sleeving of egg belt near collection table.
    See Pictures 12, 13, 14 and 15.

Note: a quick test to determine if the egg collection belt drive motor ground terminal is transferring the stray voltage to the nests via the conveyor trough is to observe the voltage between the nests and the temporary driven ground rod as mentioned in section 3.0. If unplugging the egg belt drive motor reduces or eliminates the stray voltage, then the voltage is being transferred via the drive motor equipment ground and total isolation of the nests has not been achieved. See Pictures 8, 9, 10 and 11.

5.0 What are the next steps to resolve the problem?

What can/should the grower do?

- Be aware that the problem can exist.
- Carefully monitor floor/slat egg numbers.
- Learn how to monitor stray voltage between the nest and the earth and do it on a regular basis (weekly).
- Have a qualified electrician inspect the electrical installation when problems arise.

What can/should poultry integrator do?

- Understand the concept of stray voltage and the potential sources of stray voltage.
- Know that cooperation from the grower, electrician and utility may be required to fully investigate and remedy the problem.
- Include stray voltage monitoring in routine inspections and reporting requirements.
- Thoroughly investigate all potential causes of increased floor and slat eggs.

What can/should the electrician do?

- Insure that the facility electrical system is wired according to local codes and standards. The National Electric Code offers excellent guidance with respect to wiring practices for various types of facilities. However, the National Electric Code is primarily a safety code. Facilities that are fully compliant with the NEC may still have stray voltage.
- Insure that the building service entrance ground is adequate, using “ufer” grounds when possible.
- Check compliance with respect to the service entrance neutral-to-ground bond.
- Insure that sub-panel neutral buses are isolated.
- Check all neutral and ground terminations for good, tight connections.
- Attempt to balance loads on power panels to reduce neutral current.
- If shockers or electric fence chargers are present at the facility, be certain these devices are not contributing to stray voltages and currents.

How can the utility help resolve this issue?

- Understand that having stray voltage on breeder hen nests is a real problem to the poultry industry.
- From a utility distribution standpoint, be sure that return current on the distribution system is optimized, that distribution lines have adequate pole grounds, and that there are no poor primary neutral connections on the feeder lines.
- Insure that no adjacent facilities in the area are contributing to stray voltage (e.g., a high impedance fault at a neighbor’s well pump).
- With respect to neutral isolators, understand the capabilities and proper installation methods, and insure that the voltage across the device is not encroaching on the device’s blocking limit
- Insure that other utilities are not bypassing the device (i.e. telephone shield, cable television shield, metal pipes, etc.)

6.0 What are the economics associated with this issue?

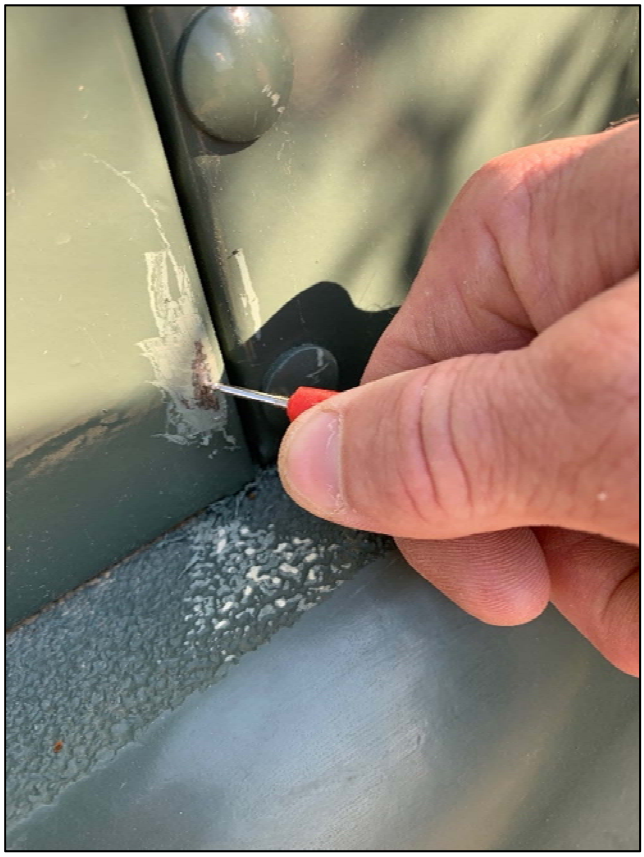
Lost hatching egg production negatively impacts the profitability of both the grower and the company. As a conservative example, assume that a single 40’ X 500’ breeder house with 10,500 hens is expected to produce roughly 6,000 hatching eggs per day, and a stray voltage problem results in 480 floor eggs per day (roughly 8%). If correction of the stray voltage problem decreased floor eggs to only 120 per day (roughly 2%), there would be a net reduction of 360 floor eggs (30 dozen) per day over the 280 day lay period. Correcting this loss would yield 8,400 dozen more viable hatching eggs produced during the flock. If the grower’s pay is 50 cents/dozen for hatching eggs and only 10 cents/dozen for floor eggs, the grower’s income would increase by 40 cents/dozen, or approximately $3,360 per flock. If the company’s cost is $2.60 per dozen eggs, the company’s return from correcting this problem would be $21,840. Thus, there are very substantial financial incentives on the part of all parties to recognize and remedy stray voltage issues.

Picture 1

Picture 2

Picture 3

Picture 4



Picture 5

Picture 6

Picture 7

Picture 8

Picture 9

Picture10

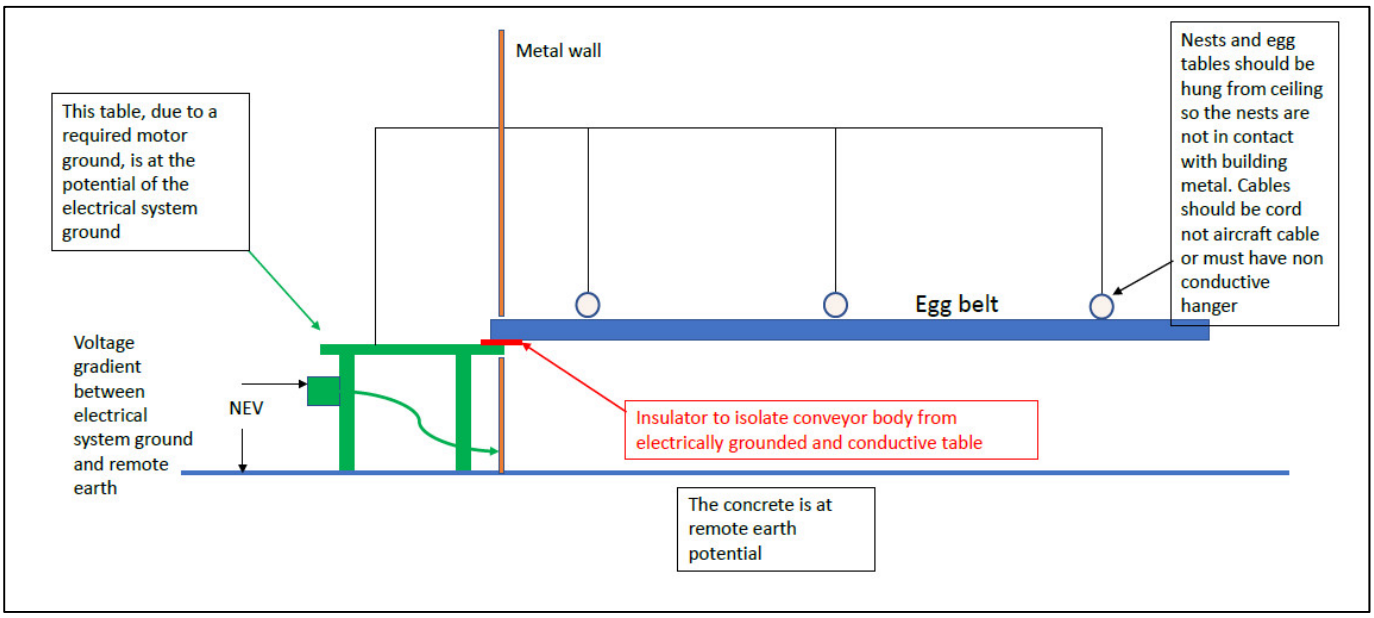
Picture11

Picture 12 - Conductive Nest Cable

Picture 13 - Non-conductive Nest Cable

Picture 14 - Non-conductive Cable Insert

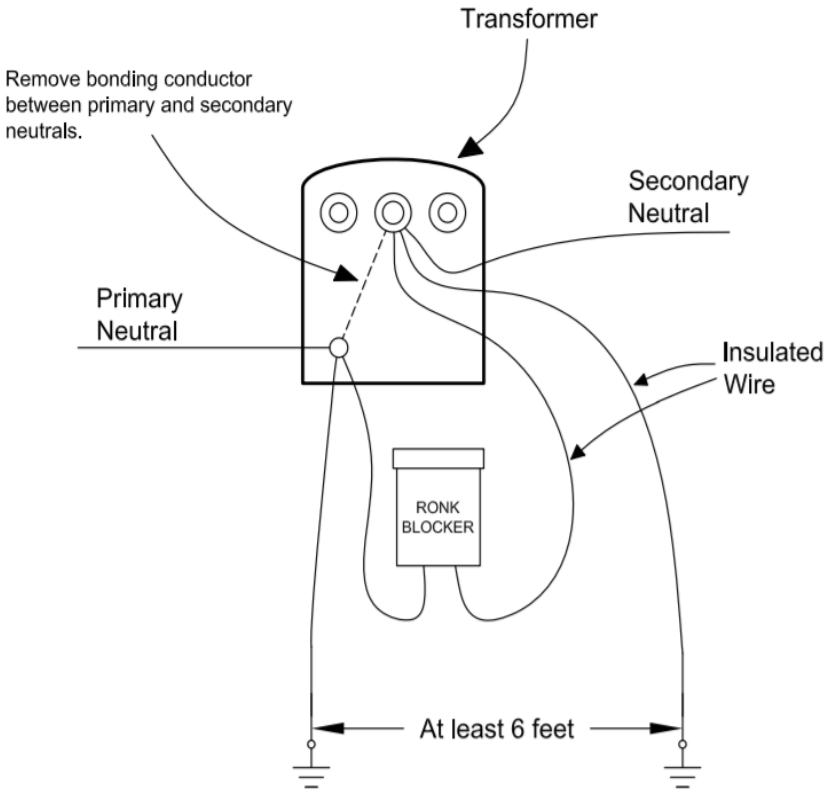
Picture 15 – Non-Conductive Belt Sleeve



Typical Neutral Isolator Installation

(Source: RONK Electrical)

- Must be installed by utility on service transformer to facilities
- Ronk offers an 11volt and a 22volt model; the short circuit rating is different for the devices
- If the voltage across the Ronk approaches the rating, it will start passing some current. Since the device is a saturable reactor, it is best to operate on the lower end of the rating



For additional information, visit: www.poultryhouse.com

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