

Fencing Systems for Rotational Grazing



Grounding Electric Fences

Tom Cadwallader and Dennis Cosgrove

University of Wisconsin-Extension

GROUNDING ELECTRIC FENCES

By far the most common reason for failures in what appears to be a properly constructed, insulated and electrified fencing system is inadequate grounding.

The Importance of Electrical Flow

Before recommendations can be made as to the best type of grounding system to put on a fence, its important to understand why one is needed and what can reduce its effectiveness.

In an electric fencing system, electricity needs to complete a circuit in order to do its job. The similarity between the electricity that is delivered by the electric company and the electricity that is sent out on an electric fence is that both want to complete the circuit and head home. The difference is that the electricity coming in from the power company needs to be confined within the wires and has a ground rod for protection while the electric fence depends entirely on ground rods as a route for the electricity to return to the energizer. Inadequate grounding for a fence will not only limit the amount of electricity that is able to flow through the system, it will also cause the electricity that does flow to try and find an alternative route back to the energizer, thus creating a stray voltage risk. Even though an energizer has the potential to deliver power, it is the ground return system that provides a safe pathway from the fence back to the energizer and is critical to the success of the entire system. The size of the energizer, the grounding material itself,

soil type and soil moisture can all play a roll in designing an effective grounding system.

The Effect of Soil Conditions on Electric Fence Grounds

There are a variety of recommendations made as to the amount and type of grounding that an electric fence needs in order to provide an adequate flow of electricity. Recommendations can range from as simple as hooking the energizer earth return to an existing metal fence or ground rod to driving in 3 feet of ground for every joule of energizer power. Both recommendations may be right for a particular power unit under some very general circumstances.

However, as stated previously, the actual amount of ground and the design of the grounding system is dependent on several variables. Two important ones are soil type and moisture. Some may remember a simple secondary school science experiment that demonstrated that neither dry sand nor distilled water were very good conductors of electricity. But if you poured the water into the sand it carried an electrical current quite well.

This same principle holds true in grounding a fence system. Regardless of the recommendation, the only area of a ground rod that is able to pick up electricity is that portion that is in moist soil. An eight-foot ground rod that is in six feet of dry sand and two feet of saturated is essentially only a two-foot ground rod. Four eight-foot ground

rods in six feet of dry sand and two feet of saturated are not equal to 32 feet of ground but closer to eight. On the other hand a system may perform beautifully with less grounding than recommended if the rods are placed in a low wet spot that is high in minerals and organic matter.

Knowing the types of soil conditions that are prevalent throughout the time of year that the fence is in operation is extremely important. And like anything, build it for the worse case situation, not the best.

Effect of Energizer Size and Testing the System

There are a number of low impedance energizers on the market today that are designed to deliver as much as 60 amps of electricity onto a fence at the peak of its pulse, and perhaps even more under some circumstances. Considering that this amount of power is more electricity than is flowing through most homes at any given time and is delivered to the fence in somewhere between .0003 and .0005 seconds, the ground rods need a large amount of surface area exposed to moist soil in order to adequately pick up the current.

The larger the energizer in terms of the amount of electricity it is able to deliver, in joules¹, the more effective grounding that is required. The recommendation by some fence manufacturers of three feet of ground rod for every joule of energizer power may be more than adequate under most situations. But, regardless of the recommendation, it is a good idea to check the system periodically. The way to do that is to put a heavy load on the fence by grounding

ft out with a good conductor, such as a metal rod, and then check the voltage on the ground system by hooking a fence voltage tester between a metal stake and one of the ground rods. If anything near or over 1000 volts is flowing between the stake and ground rod, the ground system is inadequate. In the middle of the summer, with dry ground and heavy dew, I have been able to pick up nearly 1500 volts on the ground system of my own fence that was built 25% larger than what was recommended. Ground rods are cheap and ft better to overbuild than underbuild. It won't be a waste of time or money.

Materials to Be Used For Grounding

Most electric fence manufacturers suggest using 1/2 to 3/4-inch diameter, six to eight foot galvanized rods and clamps for grounding. Electric companies on the other hand have typically specified the use of copper for their ground systems. Both will work but there are a few cautions.

First of all, heavily galvanized steel will resist corrosion for long periods of time in a variety of soil conditions but they will lose some conductance when they do corrode. Copper and copper clad steel will resist corrosion indefinitely in the soil and will still maintain good conductance even when corroded. Aluminum corrodes in soil and should never be used for ground connections.

The second thing to consider besides the attributes of the different metals themselves in making a grounding system is the problem of using different types of metals within the system itself.

Regardless of the type of metal used it is more important to use the same type of material throughout the system. Each metal has different properties not only in their ability to conduct electricity but also in how much they expand and contract under large power surges and changing temperatures. If you are using galvanized electric fence wire to carry the electricity back to the energizer from the ground rods it would probably be wise to stick with a galvanized steel system. But remember, if you decide to go with copper, be consistent throughout!

Placing the Ground Rods and Making the Connections

Once you choose the type of metal to be used for the ground rods, and bought enough to adequately ground the size energizer you intend on using, the next step is placement. Here again there are a couple of things to consider.

First of all an effort should be made to try and segregate the electricity that is flowing back and forth to the fence from the main service panel and other circuitry. There is a tremendous amount of electricity flowing and it is wise to try and keep the two Systems separated as much as possible.

The actual placement of the ground rods is dependent on where a majority of the fence is in relation to the energizer. The ground rod system should be thought of as a big antenna. The closer the system is to the area where most of the electricity is expected to flow back from, and the more spread out the system is, the better.

The general recommendation for the distance between multiple ground rods by most fence manufacturers and distributors has been to place the rods about ten feet apart. The National Electrical Code recommends placing rods in multiple ground rod systems twice the length of the rods apart. For example, two eight-foot ground rods should be placed at least 16 feet apart. What is ideal for an electric fence may or may not fall within these recommendations but it is a good place to start. The important thing to remember is to keep the rods spaced far enough and even enough to act as a good electrical "antenna".

Once the rods are in place the next step is to connect them all together. Starting from the energizer to the first ground rod, use properly insulated electric fence lead-out wire designed to handle the large amounts of electricity flowing through the system. This will help segregate the electricity coming back to the energizer from the grounding system of the main service panel and also keep the wire from coming in contact with other metal objects which could them become part of the system and actually carry small amounts of electricity. Aboveground structures can also provide another route for lightening to enter the system.

After the first ground rod it is up to the individual whether they want to make the connections between additional rods with insulated or uninsulated wire. Regardless of what wire is used, always use the same gauge, or larger, wire that is used in the rest of the fence system.

The actual connection between the ground rods and the wires between them is extremely important. From

purely a maintenance standpoint, ground rod connections should be made where they can be easily checked using approved ground rod clamps made of the same material as the metals it is connecting. Every spring a routine maintenance practice should include taking apart the ground rod connections and cleaning them to remove corrosion. Throughout the summer and winter the metals expand and contract continually allowing corrosion to occur that will reduce conductance. A little time and a wire brush can keep the system in good working order.

Conclusion

Electric fencing is a pain barrier. And in order to effectively use some of the newer fencing materials on the market today that allow easy and flexible fencing, the flow of electricity through the system depends on not only adequate power being placed on the fence, but an effective earth or ground system that allows the power to flow unimpeded.

Constructing an adequate ground system is critical to the success of any modern, low impedance electric fence system.