

Fencing FACTSHEET

GROUNDING SYSTEMS FOR ELECTRIC FENCES

The majority of electric fence problems relate to grounding concerns. This factsheet looks at the two methods of system grounding commonly used and how to test a grounding system.

THE EFFECT OF SOIL CONDITIONS

Electric fences are designed so the animal will complete the electrical circuit upon touching the fence wire. This forms the closed circuit required for electrons to flow. For simplicity, the standard electric fence uses the earth as the “return” leg of the circuit. This is only effective if the conductivity is good, as in moist soil.

If the soil is dry, frozen or snow covered the conductivity is reduced which reduces the effectiveness of the electric fence. For areas that

receive 24 inches or less annual precipitation (or where the precipitation is poorly distributed throughout the year), a “wire return” system should be used.

GROUNDING IN MOIST EARTH CONDITIONS (Earth Return)

This is the standard grounding situation as shown in Figure 1. The moisture in the earth is sufficient to allow a flow of electrical current that will ensure a shock occurs. The critical component is the soil

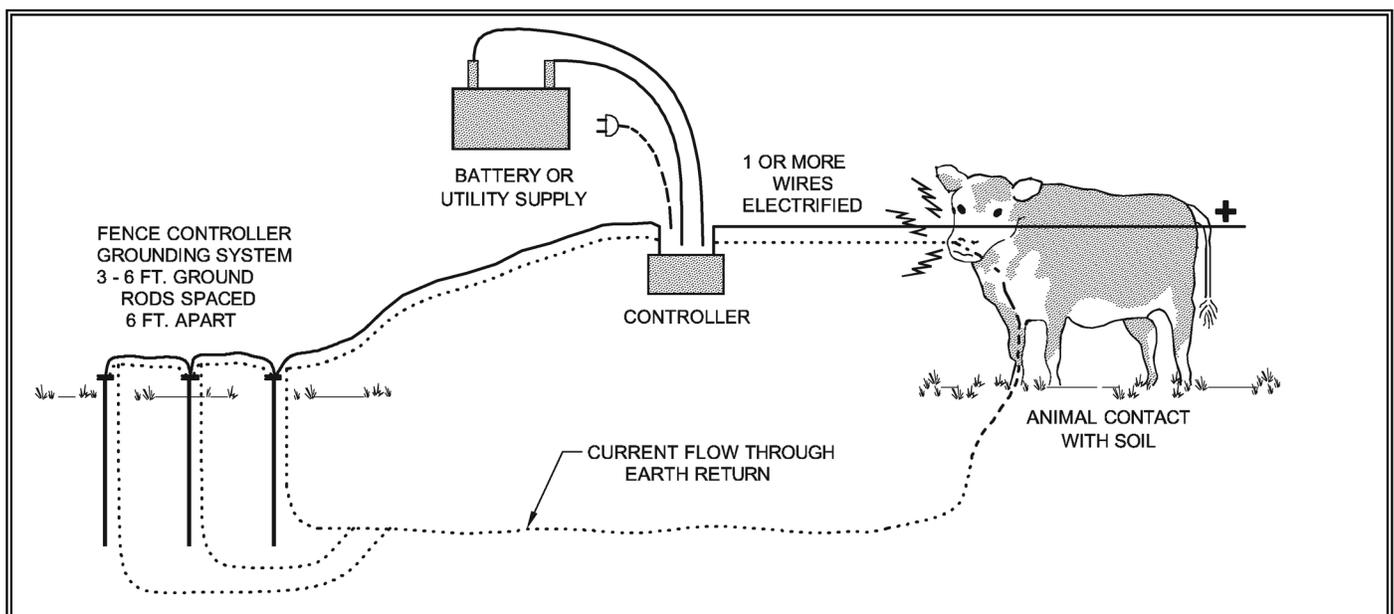


Figure 1

Grounding in Moist Earth (earth return)

contact of the grounding rods. They connect the earth return current flow to the controller and must have good soil contact to ensure this flow is not restricted. This requires:

- For safety reasons, a location for the grounding system that is at least 7 feet from any other electrical or telephone grounding system and from any building foundation (especially a dairy barn) or underground water piping
- A location where the wiring cannot be easily damaged or disconnected by livestock or machinery (see below regarding burial)
- A minimum of 3 galvanized steel earthing rods, driven into moist earth; (these need not be located right at the fence controller but must be at a moist earth location)
- A separation space between the rods of 6 feet
- A continuous length of wire for connection between the rods and the controller
- A standard electrical grounding clamp (noncorrosive) for each rod/wire connection.

A grounding system that will meet the Electrical Code for grounding uses the following standard electrical components:

- Galvanized steel ground rods, 6 feet x 5/8 inch diameter,

- Brass or copper clamps, and
- #6 bare copper wire from rods to controller.

Although a smaller wire size may be adequate, a #6 wire may be directly buried which is a good method to protect the system from damage. The grounding rods can be driven 6 or 8 inches below the earth surface, say into a small dug depression. The wire can be laid into a shallow trench, clamped to the rods, then buried. The wire may be buried all the way to the fence controller.

Note that where this controller ground is near a building with an electrical service, the wire from the ground rods to the controller should be insulated to avoid 'cross grounding'.

In addition to this main grounding of the fence controller, secondary grounding of the nonelectrified fence wire(s) may be done as explained for the "wire return" systems.

GROUNDING IN DRY EARTH CONDITIONS (Wire Return)

In dry, frozen or snow covered conditions the earth return system is not sufficient to ensure current flow that will produce a shock. In these conditions, one or more fence wires are used for the return circuit to the fence controller (in addition to the earth grounding of the fence controller) as shown in Figure 2.

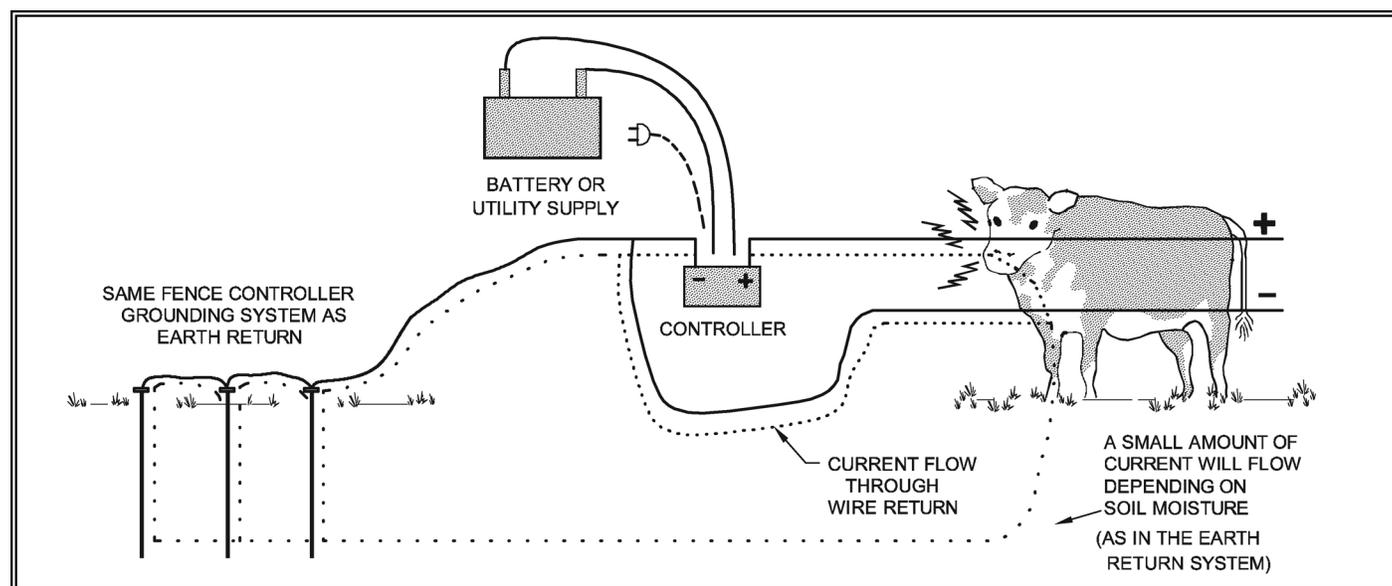


Figure 2

Grounding in Dry Earth (wire return)

This method ensures a circuit when the animal touches both an energized wire and a grounded wire (in semi-wet conditions, some current may also flow via the earth return). A shock then occurs even in these poor earth return conditions (i.e. dry, frozen or snow covered).

The nonelectrified fence wire(s) are connected to the main fence controller grounding system **as well as** to single groundrods located approximately every 1/2 mile along the fence line (more frequently in very dry conditions). These ground rods are the same as the main grounding rods. To ensure the animal can easily contact a “hot” wire and a grounded wire and thereby receive a shock, alternating fence wires may be electrified and grounded. However, while being more effective, it may cause maintenance problems as any debris that may contact the fence wires will more easily short out the circuit than if contacting a “hot” wire and the earth.

SALT CORE GROUND RODS

For very dry sites the main ground rods may have high resistance to current flow. This can be greatly reduced by using the following technique (which adds salt around the ground rods to increase the soil conductivity and a clay material to hold moisture):

Auger or dig 3 holes for the ground rods that are at least 3 inches diameter by 4 feet deep, spaced 35 feet apart

- Fill each hole with a wet slurry of 2 parts Bentonite (a clay material sometimes called “driller’s mud”) and 1 part coarse salt
- Place a 4 foot by ½ or ¾ inch diameter stainless steel tube down the center of the hole (stainless because of the corrosive nature of salt)
- Cover the area with an inch or two of sand to reduce evaporation.

The ground wire is clamped to these tubes as before. To ensure continued low resistance, these salt core ground rods can be watered during drought conditions.

TESTING THE GROUND SYSTEM

The earth return system of grounding a fence controller relies on the soil moisture conditions for current flow and these conditions change throughout the year. To ensure continued fence performance, a yearly grounding check should be made, preferably at the driest season the fence is being used. The following procedure should be followed (see Figure 3):

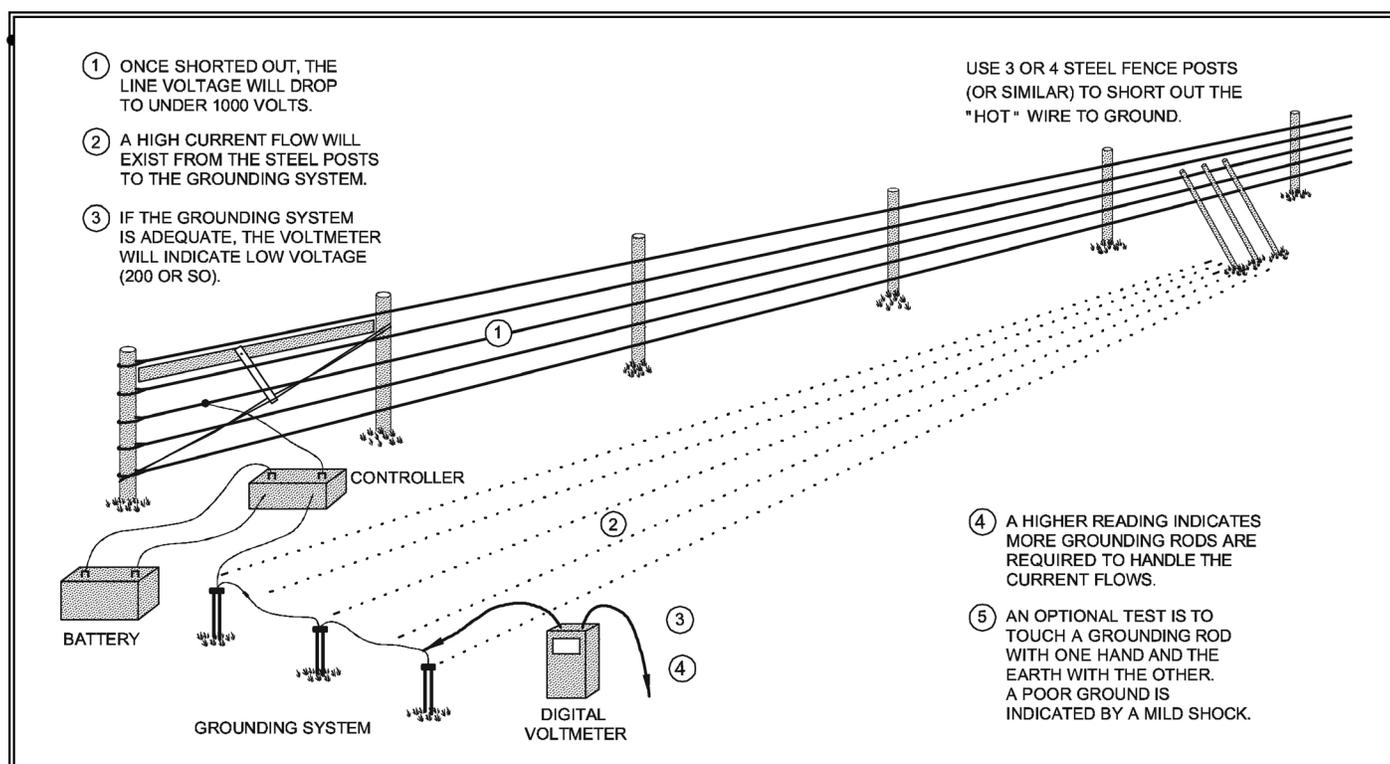


Figure 3

Testing a Fence Grounding System

- About 300 feet from the controller connection to the fence, use 3 or 4 steel fence posts (or similar steel material) to create a dead short from an energized wire to the earth
- This will reduce the fence line voltage to less than 1000 volts and put the grounding system under load with a high flow of electrons trying to get through the soil back to the energizer
- Using a volt meter (suitable for electric fences), measure the voltage between the ground wire to the controller and the earth at least 3 feet from any ground rod
- If the grounding system is adequate the flow will all be handled by the ground rods and the meter reading will be very low (200 volts or so)
- A higher meter reading will indicate the grounding system cannot handle the flow and more ground rods are required
- Add another ground rod and repeat the test.

(An optional method is to skip the meter and simply grasp a ground rod with one hand and touch the earth with the other hand. A poor ground is indicated with a shock, the severity of which will depend upon the condition of the grounding system. This is not recommended except for the foolhardy.)

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