

## Fence systems and Grounding Systems: some practical advice

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There are two different types of electric fence systems: the *all live system* or *ground earth return system* and the *earth return wire system*. They should be used in different conditions as follows:

### *All live system* or *ground earth return system*

This system has all the fence wires "live" (Fig. 1) and the circuit is completed when the animal touches one of the wires. The electrons then flow through the animal into the ground and back to the energizer. This system should be used where there is relatively even rainfall and where there is some green vegetation most time of the year, or in areas with high conductive soils. *The all live system* has much lower maintenance requirements than the *earth return wire system*.

### *Earth return wire system*

The *earth return wire system* (Fig 2) overcomes the problem of dry non-conductive soils, not allowing sufficient current to flow back to the energizer or making contact with animal feet. The fence should have live and earth wires. By touching both live and earth wires on the fence, the animal receives the full shock. The earth wires should be connected to a number of ground pegs at every kilometer approximately. Connect the ground (neutral) wires on the fence to the main ground using insulated cable.

These secondary ground rods also help to give

protection against lightning damaging the energizer and they assist in eliminating shocks on gates through the current taking an alternative route. This system has the disadvantage of requiring a high standard of construction and maintenance because if the live **and** earth wires come in contact through faults, the fence is ineffective.

### Your grounding system must be perfect!

Without any grounding system, the pulse could not complete its circuit, so it would be completely ineffective and there would be no shock on the fence. The grounding system of the energizer is like the antenna of a radio. The bigger the antenna, the better the reception. The same is true for electric fences: a high powered energizer requires a large grounding system to collect the large number of electrons from the soil. Soil is not a good conductor so the electrons spread out and travel over a wide area.

Dry soils have a very high resistance so if possible, choose an area which is damp all the year.

In areas with highly conductive moist soil all year round, three two meter long, 25 mm in diameter, galvanised pipes or galvanised ground rods driven into the ground 3 meters apart should suffice (see earth rule in the box below).

Ensure that they are at least 10 meters from any power supply earth peg, underground telephone or power cable!

- Thinly electroplated items soon rust and then create resistance. They should NOT be used.
- Where the wire from the energizer to ground rods

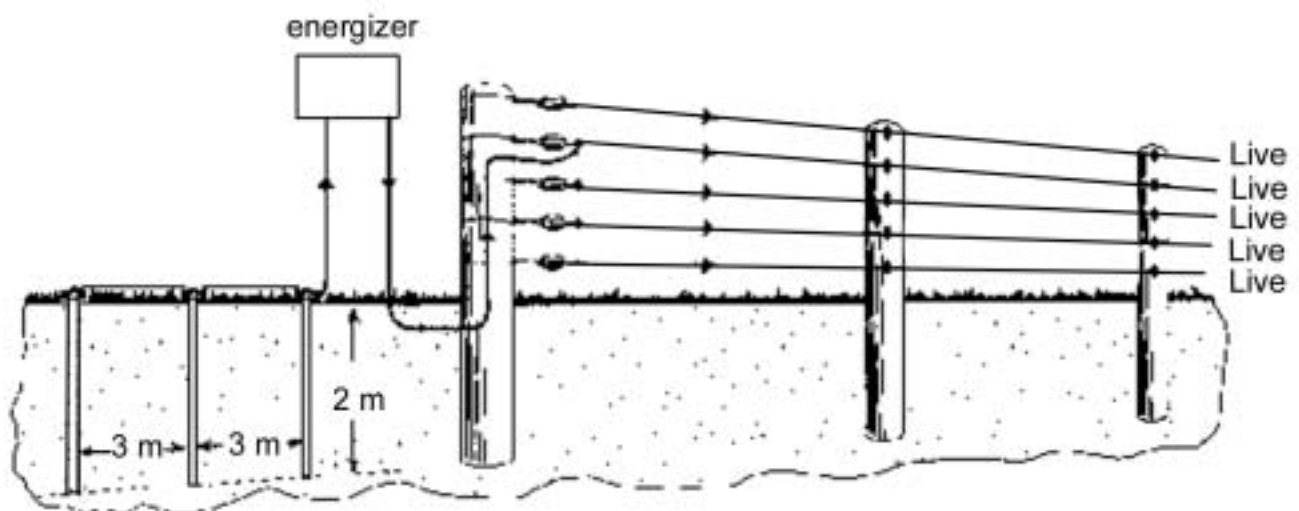


Fig. 1: Scheme of a all live system or ground earth return system.

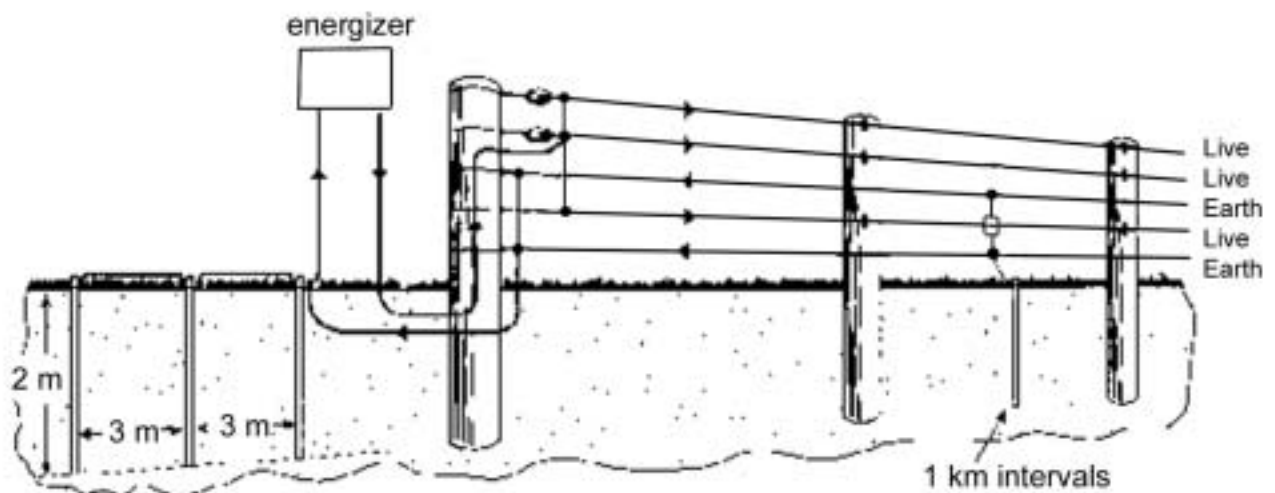


Fig. 2: Scheme of an earth return wire system.

is likely to come in contact with soil, yards, water-pipes or buildings, use insulated cable.

In soils which dry out severely and have a low mineral content, an absorbent clay and salt system should be used. Salt is highly conductive and also attracts and holds moisture. Trials by Gallagher have shown a ten fold improvement by using this system.

#### Earth Rule 1 2 3 3

- 1 = One continuous wire to join pegs
- 2 = Galvanised earth pegs must be two meters long
- 3 = Minimum of three 2 m pegs
- 3 = Minimum of three meters between pegs

#### Testing the ground system

If your fence is not giving the shock you expect, it is most likely to be your ground system. Always check the ground first. The ground is half the effective circuit in an electric fence system.

The main causes of an ineffective ground are:

- Insufficient ground rods
- Badly connected wires or wires of different metal types joined together
- Poor connections to the ground rods
- Ground rods too close together
- Ground rods not long enough

Depth is important to good grounding as it ensures that part of the ground rod is always in damp soil.

#### Testing the ground earth return system (see Fig. 3)

1. Test the current in a distance of 100 m from the energizer. There should be at least 4000 Volts (No 1 in Fig 3).
2. Create a dead short by placing enough steel stakes against the fence line to reduce the voltage to 1000 volts or less. These stakes should be at least 100 m from the ground system (No 2 in Fig 3).
3. Connect one clip from your digital voltmeter to the last ground rod. Connect the other clip to a small stake placed in the ground at least 1 m from any other ground rods (No 3 in Fig. 3)
4. The reading on the voltmeter should be 0.3 kV or less. If it is greater than this, the ground system is inadequate and more ground rods will be need to be added.

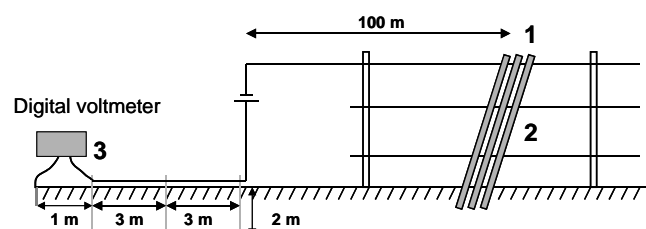
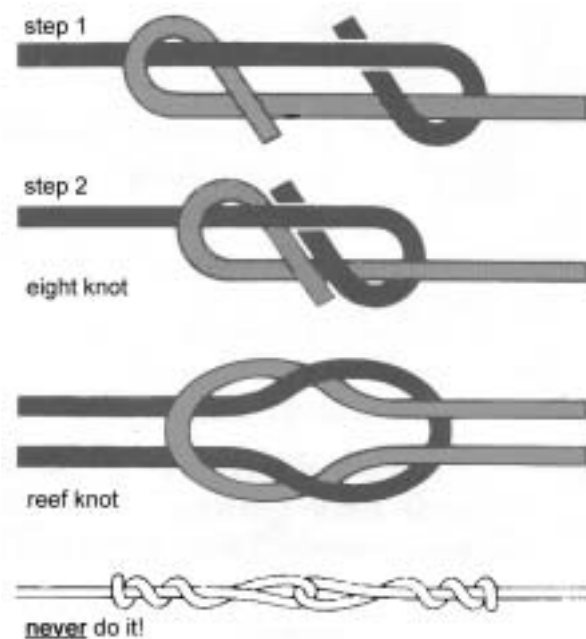


Fig. 3: Sketch of how to test a ground earth return system.

## Some important points to remember when setting up an electric fence

### Wire joints

Incorrectly joined wires can be a major cause for power leakage. When joining wires in the middle of a fence, use joint clamp. They cost almost nothing but help to improve the functionality of the fence enormously. If you have to do a knot, use either a *figure eight knot* or a *reef knot* (Fig. 4). Never join the two ends of the wires with a simple knot. You lose too much energy (the resistance can be equal to one kilometer of wire).



**Fig. 4:** Knots you should use to joint wires in the middle of a fence and knots you must never use.

### Marking high voltage fences

You must clearly mark these high voltage fences with warning signs so that people don't walk into them or touch them. Young children can be severely hurt or even killed if they touch the fence with a vital part of their body (e.g. neck when trying to crawl under the fence). Providing clearly marked crossing points with stiles or gates will be vital for long fences in heavily trafficked areas.

### Diameter of wires

Use at least 2 mm wires. The bigger the diameter, the better the conductivity, the more powerful the whole system. Two wires together will halve the resistance and three will reduce it to only 1/3.

### Problems and limitations of electric fences

There are several factors that can have a negative influence on your electric fence system resulting in a reduced output:

- Inadequate grounding system
- Bad or corroded connections on the earth return or live wires
- Long lengths of thin wire
- Long distances of single wire fences
- Rusty wire
- Untrained animal standing on dry insulating soil or stone and touching only the live wire
- Leakage through poor insulation or excessive vegetation growth on the fence
- Broken wires

### Faults to look out for

If there is no electricity in the wires or only a little, check the following things:

- Is the energizer switched on?
- Is the leadout wire connected to the energizer and the fence line? Is there a break in the leadout?
- Is the earth wire connected to the energizer and ground rods?
- Is there a break in the ground?
- Is there a dead short on the fence line?
- Are there any faulty or broken insulators?

Always check the voltage at the energizer first.

To check if the energizer is faulty, disconnect both the leadout and the ground wires and test the energizer without any load. If the energizer is reading below the manufacturer's specification there could be a fault with the energizer.

Check the grounding system according to the description above.

If no fault is discovered with either the energizer or the ground system, check the fence line.

The use of a digital fence tester (see Marketplace on p. 18) makes the job of finding faults enormously easier.

The readings will continue to drop until you reach or pass the fault. After the fault, the readings should remain constant (remember there may be more than one fault).