

ELECTRIC FENCES

Facts, Myths, and Troubleshooting

Why are you here?

- To learn about electric fences
- To learn how electric fences work
- To learn what to avoid
- To have questions answered
- Because you want to make a new fence
- To troubleshoot a fence
- To have some myths dispelled



Who am I?

- Small farmer – 20 years living with livestock and building fences
- Builder of monitoring equipment for electric fences and fence energizers.
- Inventor/Engineer - 37yrs designing and building equipment for the renewable energy industry
- My wife is a livestock advisor for 3 counties – we've heard it all
- I teach workshops on fence building, solar powered water pumping and renewable energy

A few myths

- My electric fence is sparking and will light the grass on fire so I turned it off
- I turned it on the first week, I don't need to leave it on now that the animals are trained right?
- It will kill my animals so I never turn it on.
- I don't need three ground rods, they're too expensive.
- Wood is just as good an insulator as plastic! And way cheaper!
- But the feed store said it works for 50 miles!
- Wire is wire, right?
- It's so expensive! But look, I bought the cheapest one I could find!
- Look it has a light on it, the light should go out if it's not good, right?
- I don't need one of those tester things, do I?

Basics of Electricity

- Voltage - is the pressure that causes current to flow
- Current – is the flow of electrons
- Resistance – impedes the flow of current - restriction
- Analogous to Water – if you have a very long hose with lots of leaks you will never deliver the water you need

Water

- Pressure – causes the water to flow – without pressure there is no flow
- Flow rate – determined by hose/pipe diameter – bigger is better
- Friction – kinks, joints, restrictions

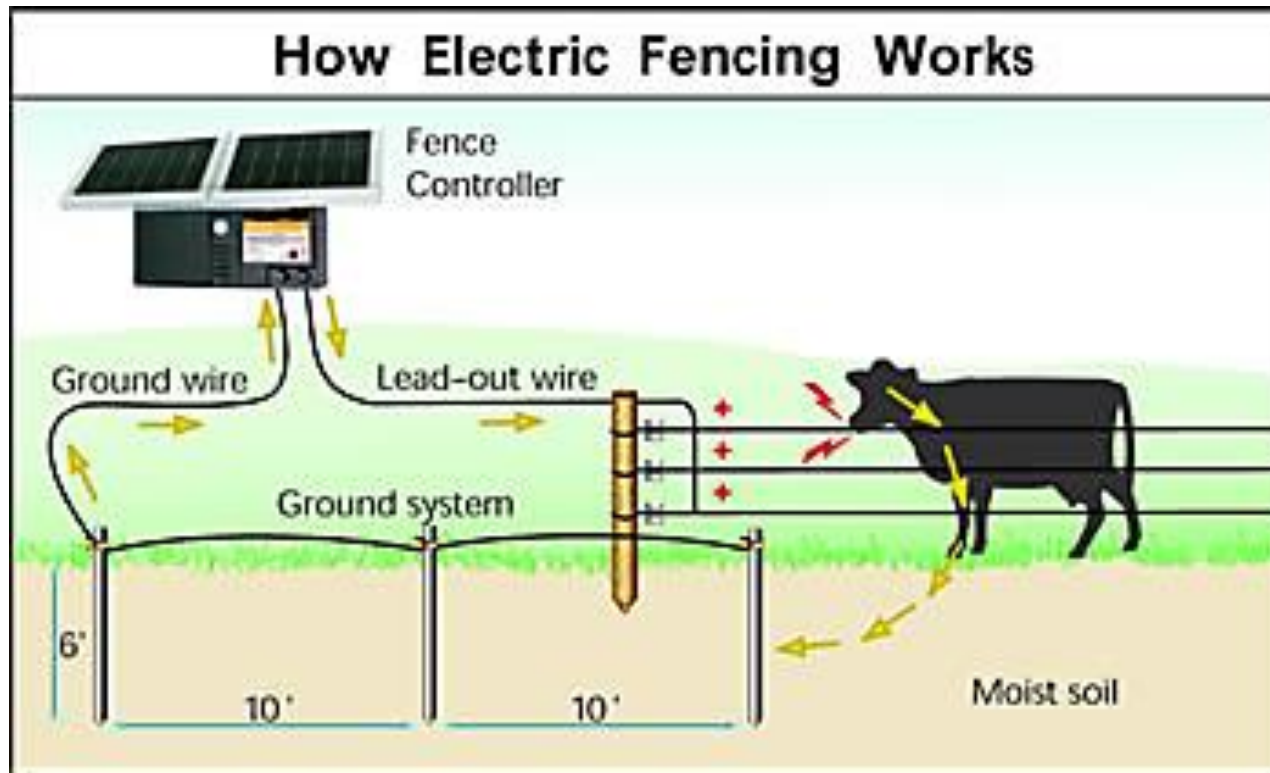
Basics of using water or electricity

- Source
- Pipe or hose to convey it where we want to use it
- Joints that don't leak or have high resistance (friction)
- As few holes or leaks as possible (waste and pressure loss)
- If we are concerned about time – the size of the pipe or hose matters – smaller hoses deliver less water and at a lower pressure

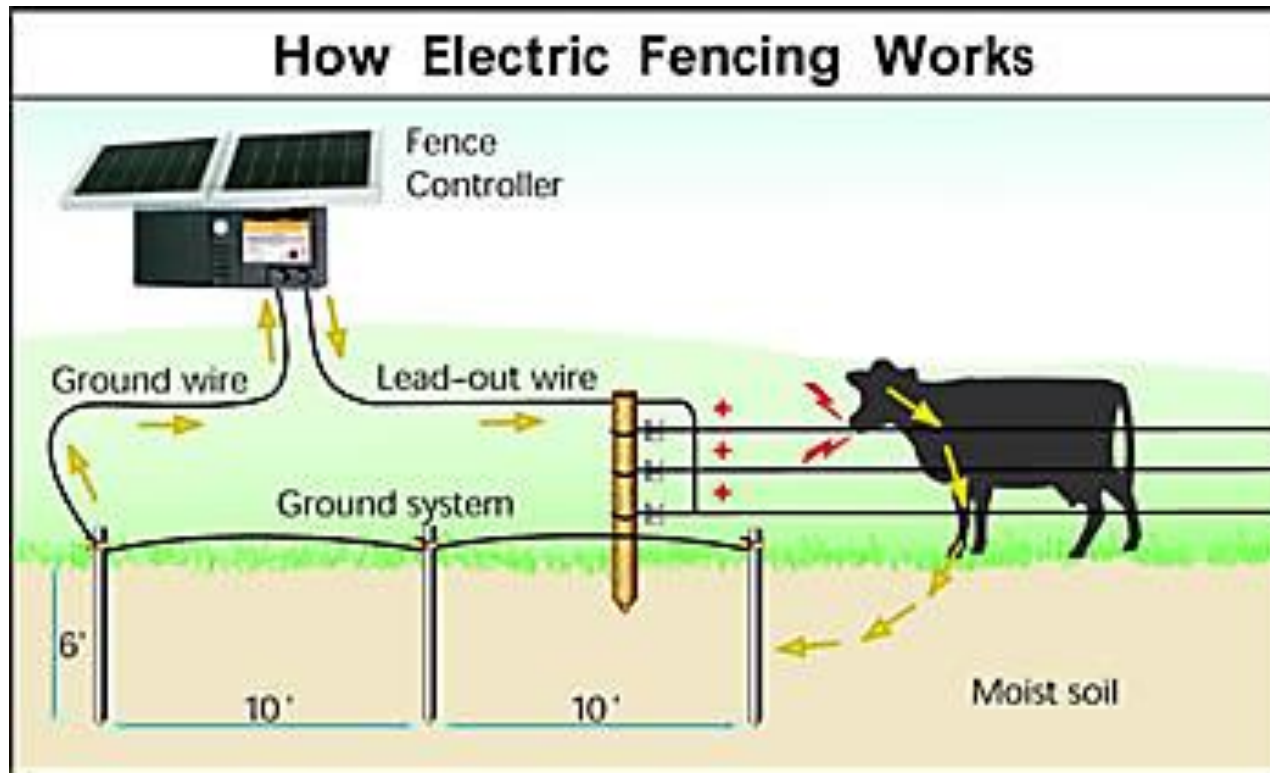
There are 5 elements to a working fence

- 1) Energizer or Fence Charger – device that delivers a dose of electricity (charge) to startle and discourage an animal from touching the fence.
- 2) Fence Wire or other type of metallic conductor to carry the electric charge from the energizer to the animal.
- 3) Insulators which hold the wire connecting the energizer to the fence wire and keep it from making contact with anything other than the animal.
- 4) Animal which contacts the fence and has hooves or feet touching the soil of the earth
- 5) Earth ground rod(s) – returns the electric charge from the earth to the energizer

Can you find the 5 elements?



Unless there is something touching the fence which is also touching the ground, it is an open circuit.



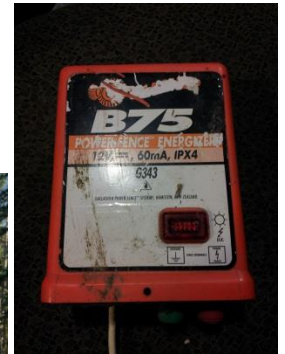
Energizer / Controller / Charger

- Modern fence energizers deliver a pulse of energy with a high voltage for a very short period of time. (150-300uSec) millionth of a second!
- Akin to the snap of a whip – there is very little energy stored. It is a psychological deterrent – not physically damaging like barb wire.
- The pulses are at a set rate of about 1 second intervals to limit the total energy
- The energizers can be powered from either 120VAC (household power) or battery power with or without solar



Types of Energizer

- AC powered – 120v – uses less than 10W of electric power to produce high voltage pulses on the fence.
- DC powered – 12v (typical) internal or external battery (Deep cycle battery) – produces high voltage pulse on the fence – tends to be less powerful than an AC powered energizer.
- Solar Powered – uses a solar panel – built-in or standalone to power an internal battery which powers the energizer. The solar power keeps the unit charged up during the day and the battery provides energy at night.



Energized Wire – Rope – Mesh - Tape

- The wire is the delivery system for the energy from the energizer / charger to the animal.
- Think of it as a conduit to transport the charge to the animal
- Larger diameter conductors are better than small
- The fence conductor(s) are made of metal.

Material	Conductivity	Cost
Copper	Excellent	Highest
Aluminum	Very good	Medium
Steel	Ok - Good	Lowest

To deliver equivalent shock: Diameter and Wire Material Matter

	Copper	Aluminum	Steel
Gauge of Wire	Length	Length	Length
20 AWG	400 ft	250 ft	62 ft
17 AWG	800 ft	500 ft	125 ft
14 AWG	1600 ft	1000 ft	250 ft

Every 3 gauges down (-) doubles the conductivity of the wire.

Examples of wire – and polyrope



Insulators – keep the fence from shorting

- Fence conductors – wire, polyrope, braid, mesh – need to be supported by an insulating material and secured to the fence posts
- Insulators perform two functions:
 - 1) Mechanical support and tension on the wire to keep it from sagging
 - 2) Electrical insulation - with sufficient margin that it does not break down or arc over – which reduces the amount of charge available to shock an animal
- Electric fence insulators must be rated for at least 10,000V in order to prevent arc over or insulation failure particularly when wet

Insulators

- Most modern insulators are plastic
- Black plastic has the highest UV resistance (carbon sunscreen)
- White plastic has highest visibility
- Yellow is most affected by UV

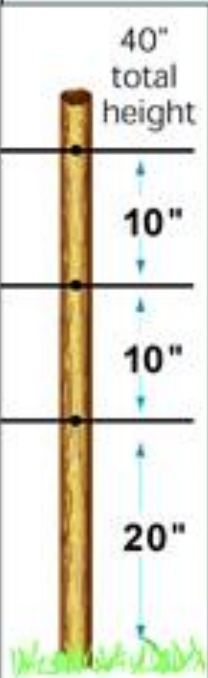
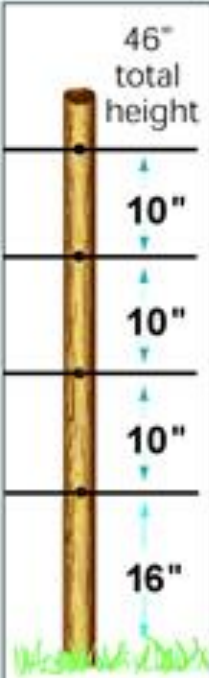
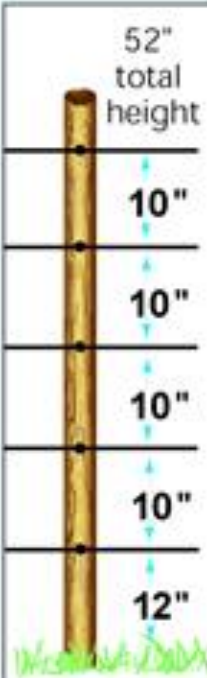
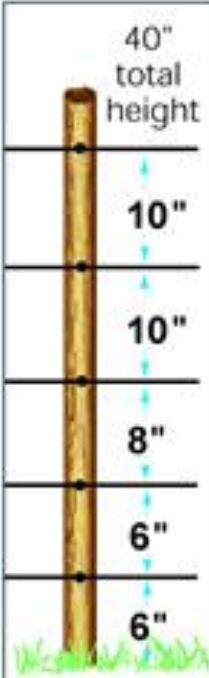
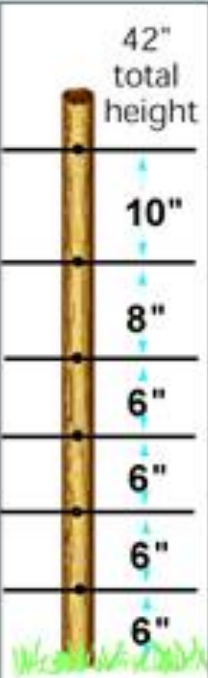


Polyrope fence with insulators

- Wire goes on the side you are trying to control
- Warning sign faces out



Each animal need is different

Electric Fence Wire Height and Spacing					
 40" total height 10" 10" 20"	 24" total height 10" 8" 6"	 46" total height 10" 10" 10" 16"	 52" total height 10" 10" 10" 10" 12"	 40" total height 10" 10" 8" 6" 6"	 42" total height 10" 8" 6" 6" 6" 6"
3 Wire Cattle, Horses, and large animal fence	3 Wire Hog fence	4 Wire Cattle, Horses, and large animal boundary fence	5 Wire Feedlot, Horse, boundary fence	5 Wire Predators, Cattle, Deer, Sheep or boundary fence	6 Wire Predators, Cattle, Deer, Sheep or boundary fence

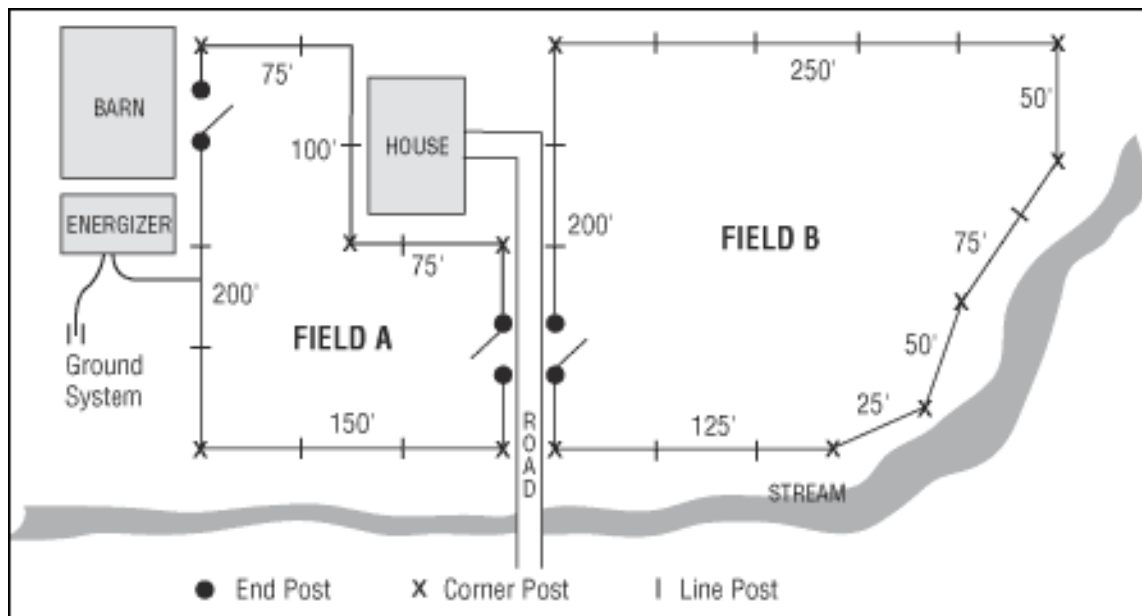
What is your goal?

- Primary perimeter fence – high tensile, multi wire or polyrope
- Secondary fence – field fence with electric on top
- Horse fence
- Cross fencing
- Strip grazing
- Mesh fence for poultry or goats



Plan your fence

- Perimeter
- Corner posts – wood or t-posts
- Line posts – t-posts, wood posts,
- Temporary Gates – spring gates, polyrope gates,
- Any obstacles – water troughs, feeders



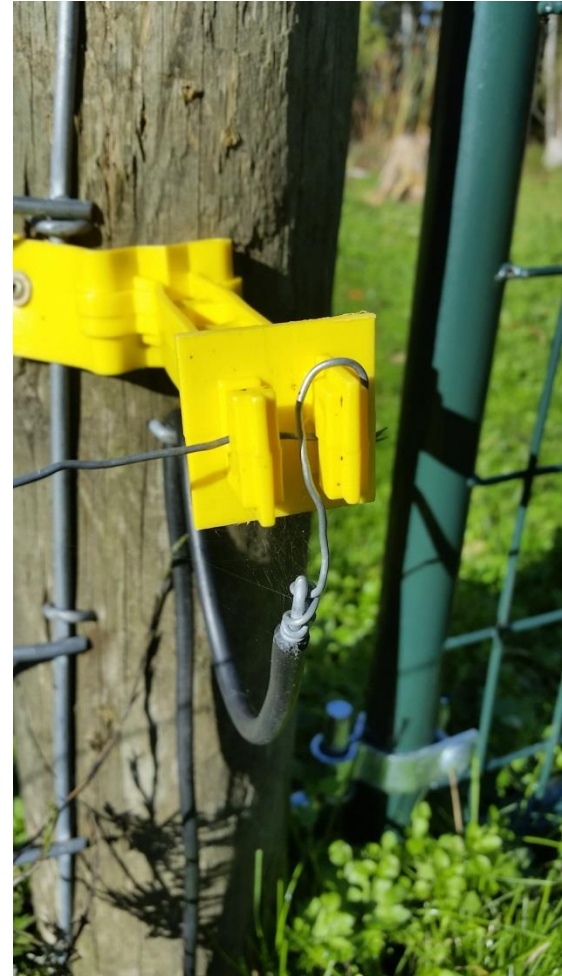
Post spacing

- Electric only: Poly rope – smooth wire – 12-30 ft between posts
 - Corner posts – t-post or wood 4" min
- High tensile electric – 33-60 ft – stays at 12-16 ft
- Field fence with electric on top – 8-16 ft between posts – line post every 75ft, t-posts every 15ft
 - Corner posts – 6" min diameter – braced at 8-12ft from corners and at gates
 - Line posts 4-6" diameter



Gates and getting under obstacles

- Gates are a challenge
 - Consider buried insulated wire



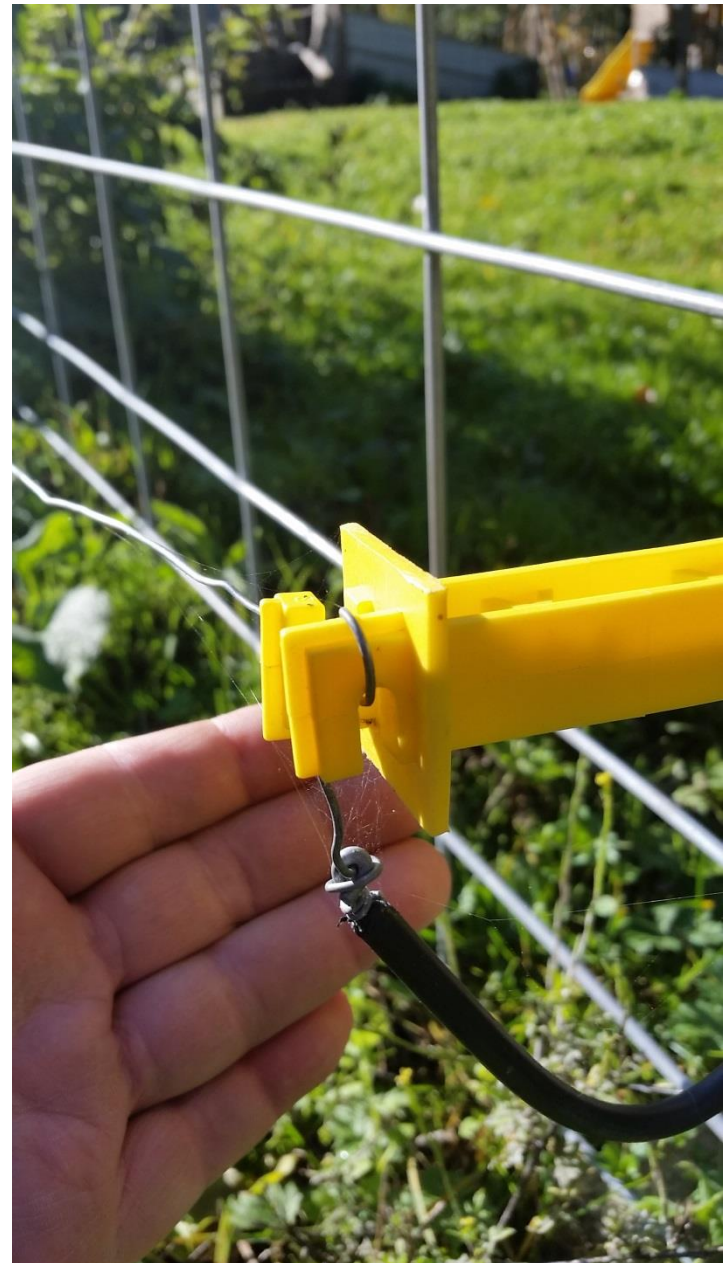
Keep it tight

- Use tensioners to keep wire tight – especially polyrope and polytape which stretch



Connections

- Any wires between the energizer and the fence must be connected together
- They can be connected by twisting, crimping, or bolting
- Beware of corrosion – dissimilar metals will corrode which degrades the joint



Better connections

- Avoid using loosely twisted wires
- Use split bolts or crimp connections for wire-to-wire joints
- On ground rods – use brass or bronze ground clamps



Solid Grounding

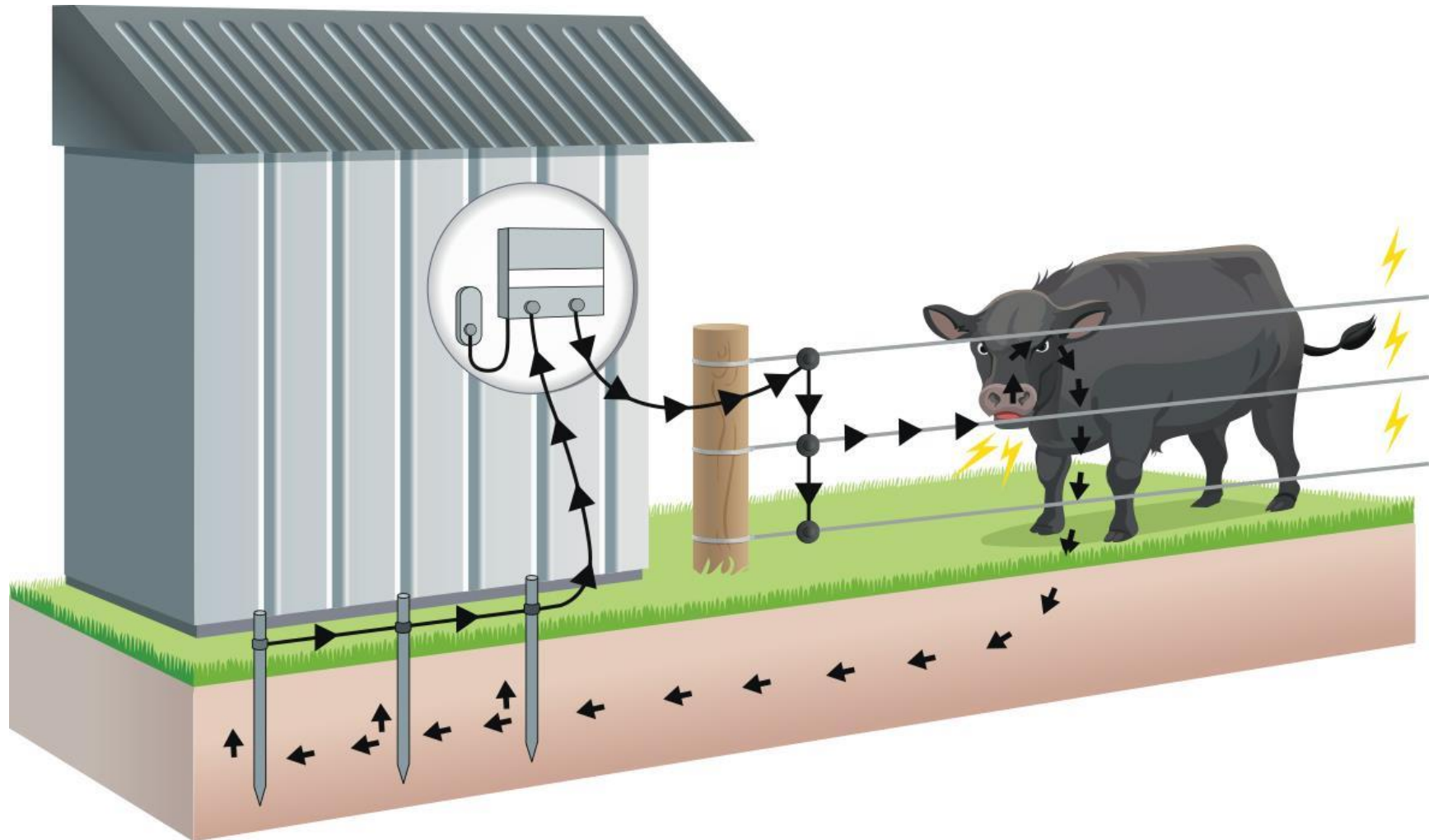


- Grounding is the most common failure of an electric fence, second to poor quality wire connections
- A good grounding system is not difficult, but is rarely implemented
- We live in an area where there are few grounding problems because we tend to have moist soil
- Permanent fence rule: 3 ground rods – 10 ft apart, 6 ft deep, 40 ft from any other ground rods.
- Joule rule – 3 ft of good soil contact per Joule of energizer – minimum of 3 ft for any system
- Portable or temporary systems need at least one good rod

Ground rods



Now its time to test it!



Test it – how long can you go?



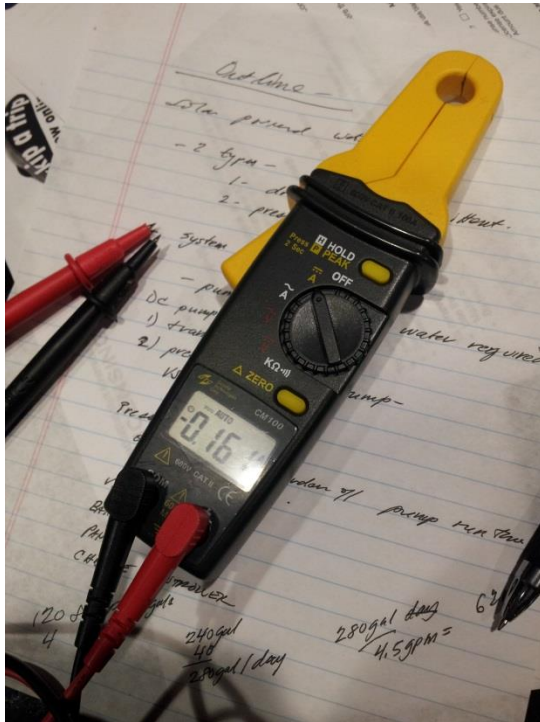
Tools – to test and troubleshoot

- There are some tools you must have
- There are some tools that make things easier
- Must have fence voltage meter
 - \$13 - \$30



Additional tools

- Wire tracer – good for finding open circuits
- Fence tester – will find shorts
- Volt meter – for testing batteries and solar



Measure the voltage

- Turn on the fence – with the energizer disconnected.
- Connect the fence – make sure the voltage is still very close to what it was while unconnected. Minimum is 2000V peak – otherwise you have a short somewhere
- If the voltage is substantially lower than you started, beginning at the energizer begin to measure the voltage drop. Rule of thumb – 100V per 300ft

What's wrong with this picture?



Maintenance needed – vegetation steals energy from the fence



I don't see nothin... wrong.



Back to the myths:

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