Basic Principles of Electric Fencing for Apiaries and Troubleshooting Guide

Country Blossoms honey

Fred Putnam, Jr.

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This Guide has two parts:

1. Basic Principles of Apiary Electric Fencing: What you need and how to build it.
2. Troubleshooting Apiary Electric Fence Problems

Review Part 1 before using the troubleshooting guide.

Always...

Fence first then get bees!!

Bears will find your apiary.

If they get in, it will be harder to keep them out.

Dogs, noise, and sensor lights are not effective deterrents.

It's much easier to deter well-fed livestock than to deter a hungry bear!

Two basic types of animal fences:

- Deterrent/psychological - Electric – Fence requires an electric current. Usually less expensive and requires less materials and effort to build.

- Physical barrier – Electric current NOT required. Requires heavy duty posts and tensioned wires or heavy metal panels. May still not deter bears (they can climb.)

Electric animal fences can be simple or complicated

This will focus on less complex and less expensive.

The most common electric fence issues are:

- #1+++ Bad/insufficient grounding and bad connections.
- #1++ Lack of voltage monitoring.
- #1+ Poor fence condition - weeds, electric shorts, incompatible materials.
- Wrong energizer.
- Lack of animal “training” (baiting the fence.)

Common types of apiary electric fence wire

Strand – smooth metal or polywire

Each type requires its own unique style of insulator, gate handles, anchors, connectors, etc.

Mixing and matching types =

Tape

Netting:

5’ Deer Quik Fence

Standard 48” high net fences may not be high enough to deter “jumpers.” Use 5-foot-high net.

Basic types of apiary electric fence energizers

- Powered by household current (A/C plug-in)
- Battery powered D/C (sometimes A/C & D/C combo):
  - Automotive or dry cell batteries – replace or recharge when they run low

  - Solar – lead-acid battery that self recharges (most of the year!) with a small solar panel

Energizer specs to deter bears

- Minimum 1.0 output joule (or 1.3 stored joules.)

  More is okay up to a limit.

  A joule is a measure of output power = 1 watt-second. This characteristic is built into the energizer. You cannot measure this, it's not adjustable, and it is not affected by your fence setup.

- Minimum 7,000 volts. More is better – This is what you'll measure.

Basic electric power terminology

Voltage and amperage together determine the amount of power in the flow of electricity.

- Voltage is a measure of the pressure that forces electrons to flow – the ability of the charge to jump across resistance like a bear's fur. The ZAP!!

- Amperage is a measure of the volume of electrons. It is the strength of a current of electricity – that is, how strongly the bear feels the charge. The YOW! - the muscle spasm response!!

Grounding – #1 concern

- Use all galvanized or brass wire & clamps to avoid bi-metal reactions and corrosion (Brass clamps are okay for grounds.)
- Use clamps – no twist wraps.
- Do not use rebar or copper rods as grounds. They corrode, and you eventually lose voltage on the fence lines.

Clamped connections: Yes
Galvanized rod: Yes

Twist wrap connections: No
Rebar: No
Copper rod: No

Photo credit: Wellscroft Fence Co.

The effective grounding radius around a grounding rod is about 5 feet.

Thus, grounding rods should be at least 10 feet apart.

If rods are too close to each other, they can act like one rod which reduces effective grounding.

More on Grounding

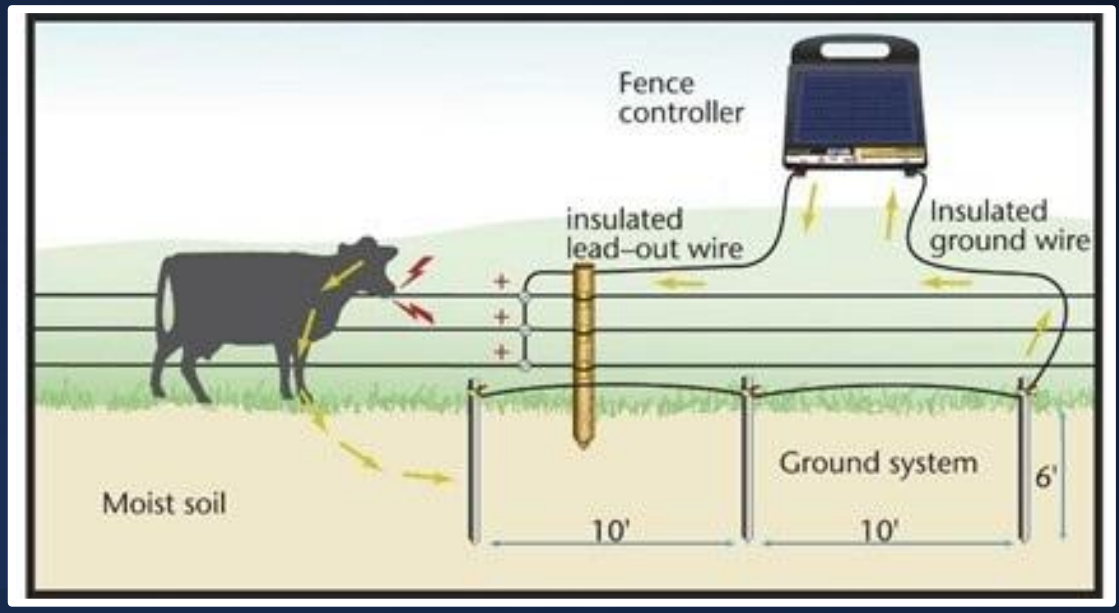
In general, start with three - 3' rods spaced 10' apart or one - 3' rod in a wet spot.

- Generally, at least 6 feet of grounding rod per joule of energizer output unless soils are wet (need less) or sandy or droughty (need more.)

Connect grounding rods by daisychaining each rod together

- One continuous unbroken wire connecting all grounding rods to ground terminal on energizer.)

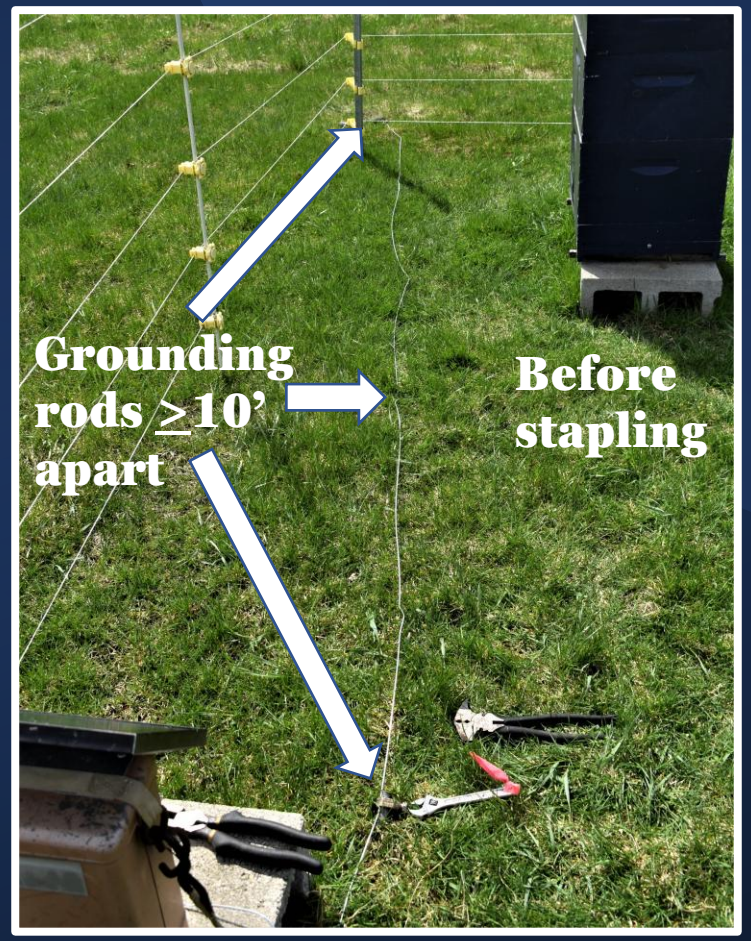
Might need more rods in droughty or shallow soils. Less in wet spots.

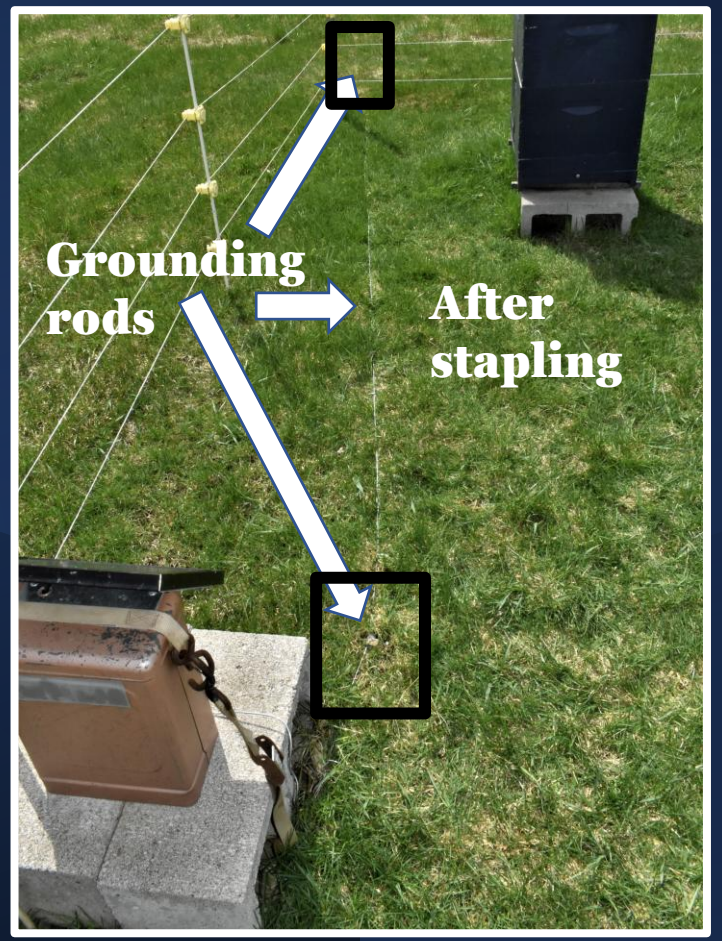


Grounding rods at least 10 feet apart.

A Grounding Example

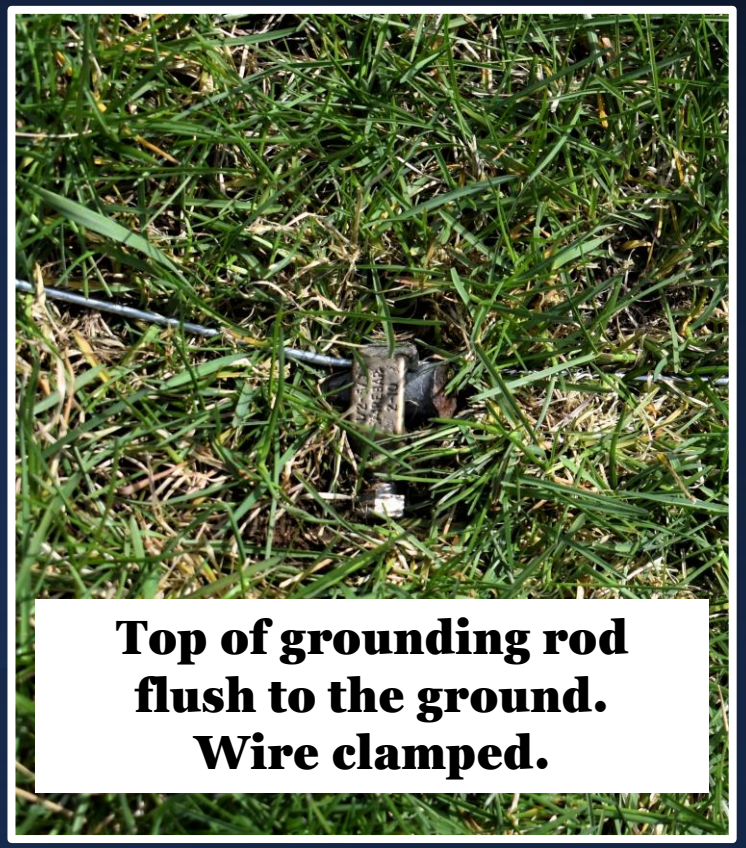
3’ long rods spaced >10’ apart connected together with 12.5-gauge galvanized wire





A Grounding Example – cont

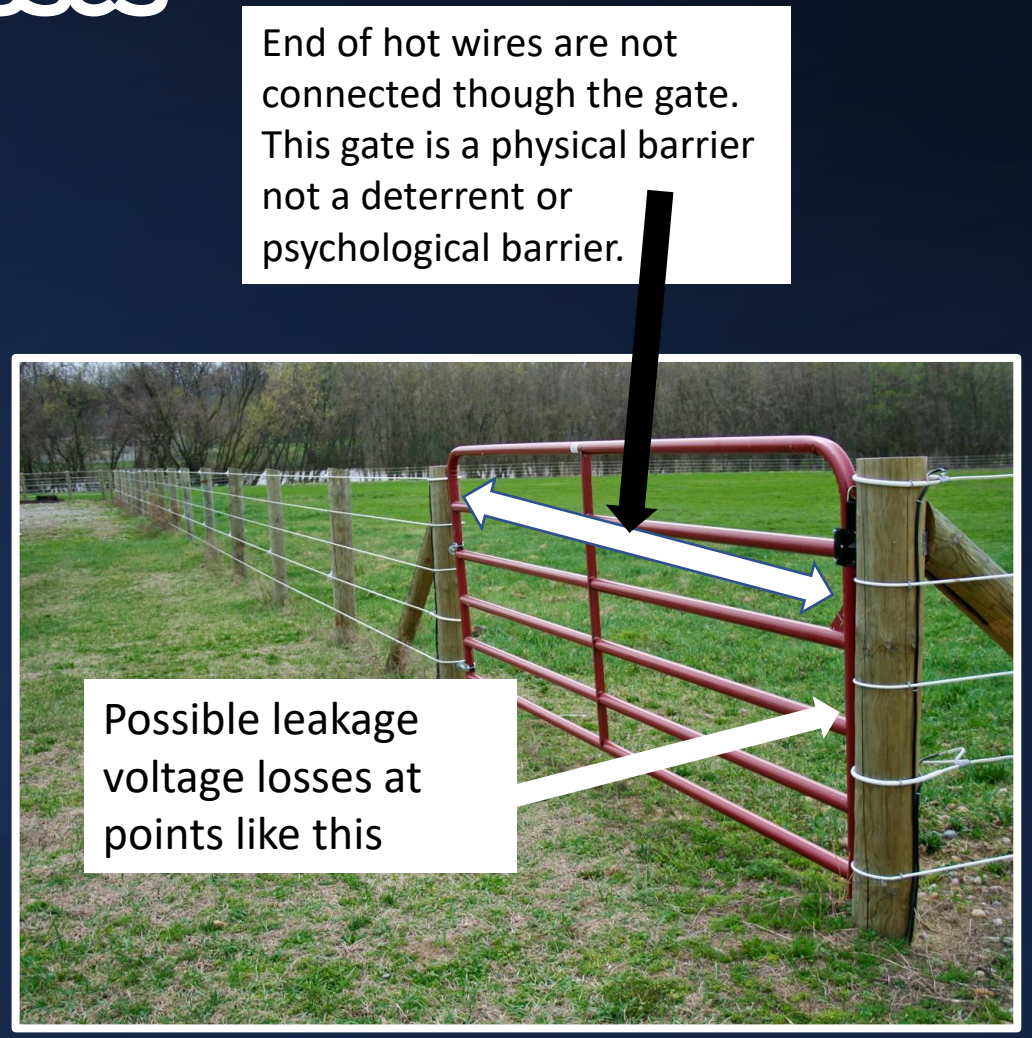
One continuous wire from farthest grounding rod to energizer – "daisychained"



Top of grounding rod flush to the ground. Wire clamped.

Dead ends & Leakage voltage losses

- Dead ends are okay; wires do not have to connect back onto each other. Circuit is from the hot wire through the animal into the ground and back to the energizer through the grounding rod.
- Leakage voltage losses: Occurs when electricity is transferred from an electrified wire through the air or an insulator to a grounded object that is not in direct contact with the wire.



Leakage voltage loss

- Use correct insulators – If insulators are too short on metal posts, it's possible to have leakage voltage loss – voltage is drained away when wire or tape is very close to a grounded metal object even though the line is not touching the metal object.

Leakage voltage loss

Possible leakage loss with short insulator on metal post

Use 5” standoff insulators on metal posts

Use 5” Lock Jawz or similar on woven wire

Leakage losses not an issue with plastic, wood, or fiberglass posts

Leakage voltage loss data

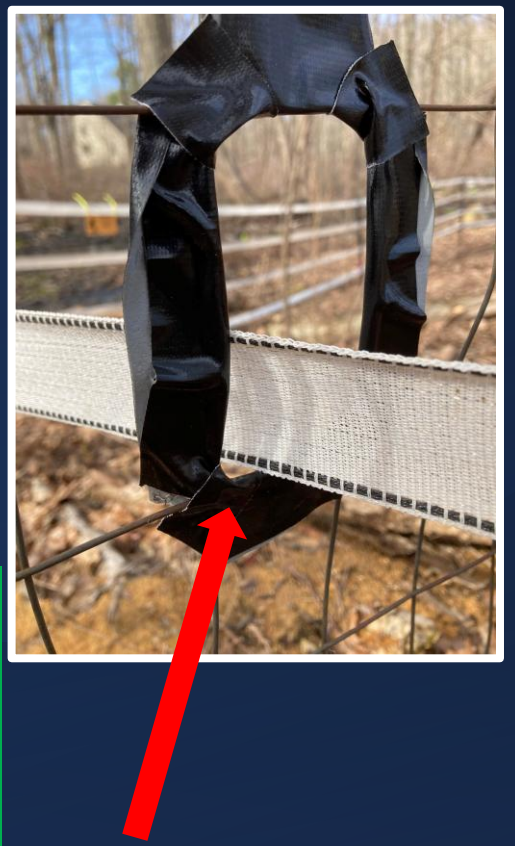
Distance from wire	Leakage voltage reading (volts) Fern Lake	Leakage voltage reading (volts) Sudbury
36”	---	680
12”	~1,000	~1,000
6”	~1,700	~1,500
3”	~2,000	~2,000
1”	~2,500	~2,400
½”	~3,000	~3,500

Leakage losses usually only an issue if:

- **Insufficient grounding**
- **Bad wire connections**
- **Energizer not powerful enough.**

i.e. voltage was already reduced

Tape passes through woven wire fence.



Short insulator.
Wire close to metal post.

A few tips..

- Put up the electric fence first, then get bees.

  Or get a box of Kleenex and be ready to use them.

- Keep tension on lines or net but not too much.

- Keep the weeds out of your fence. Weeds will short out the fence especially when wet from dew or rain.

Can use mulch but too much can insulate the ground.

More tips...

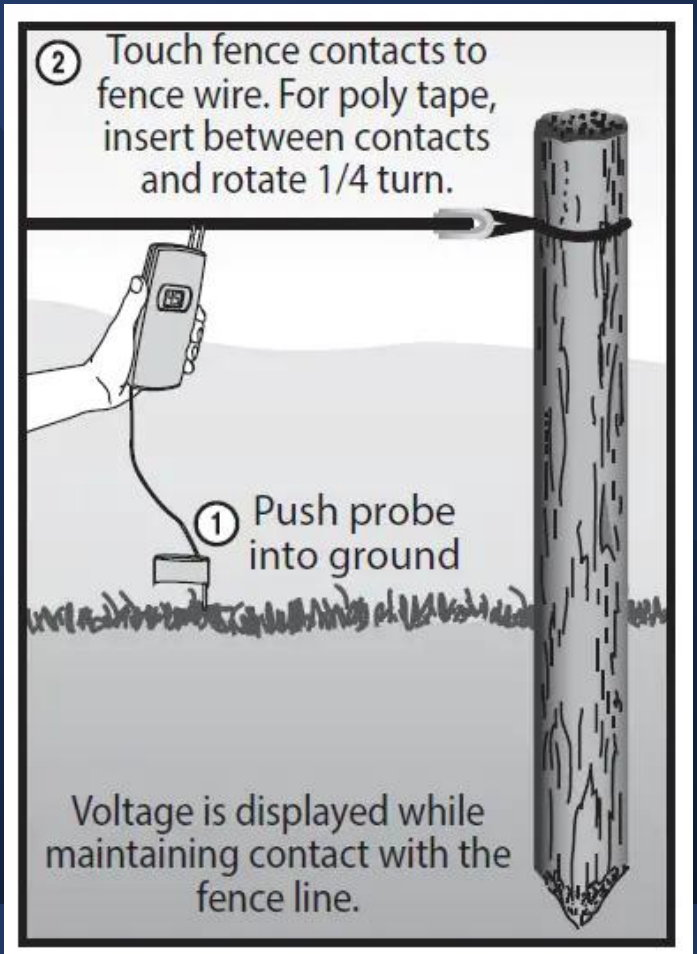
- Get a good digital voltage tester (not a multi meter) and check the voltage after every visit.

- Keep your fence on 24/7/365. Bears do not reliably den up all winter any longer.

Issues happen that may not be visible: shorts, bad battery, beekeeper forgot to turn the energizer back on!

Measure voltage with an electric fence tester

Fence voltage tester with a soil probe:



Inductive voltage tester.

Touch point to fence.

Building the fence:
General apiary guidelines

- Locate solar charger panel in a sunny spot INSIDE the apiary.
- Enclose an area large enough to create a 6’ distance between hives and fence to avoid “reach in” damage.
- Keep fence (and apiary) at least 20’ from woods lines – bears like to hang out in that “protected” space between woods and apiary (does not apply to treelines in the middle of fields.)

Building the fence – General tips

- Energizer inside fence facing south – Mount on a post in snow country
- No guy wires or other supports outside the fence – if needed, keep corner supports inside the apiary fence so bear will not become tangled in them.
- The grounding rod(s) can be located outside the apiary fence but staple the grounding wire to the ground.

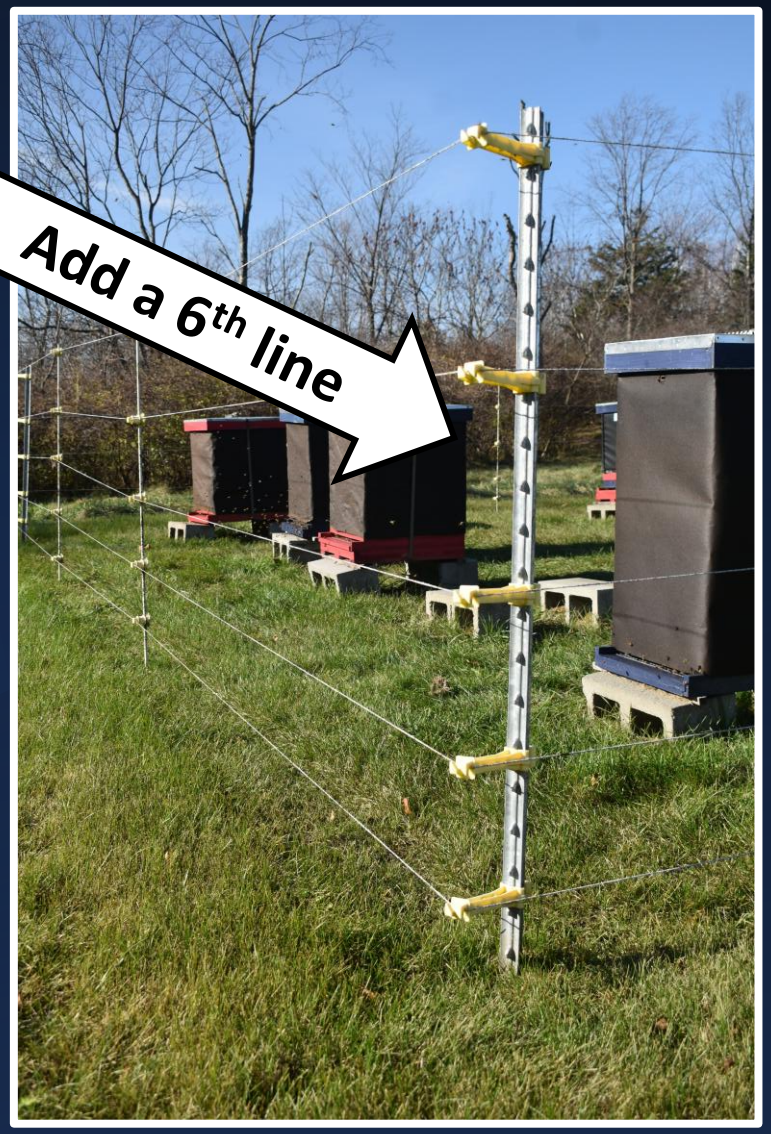
Building the fence: Wire or tape, or woven wire

Wire, polywire, or tape – min. 5 lines, 6 lines preferred

- Bottom line 5”-6” above ground to repel skunks and keep bears from digging under.
- 2nd line 8-12” above the bottom line.
- Top line 5 feet above ground (or at the top of a 6-foot t-post.)
- Other lines equally spaced between.
- Intermediate support posts follow terrain but at least every 8 feet.

Woven wire should be 5’ high like Deer Quik fence

- Insulators on outside of posts.

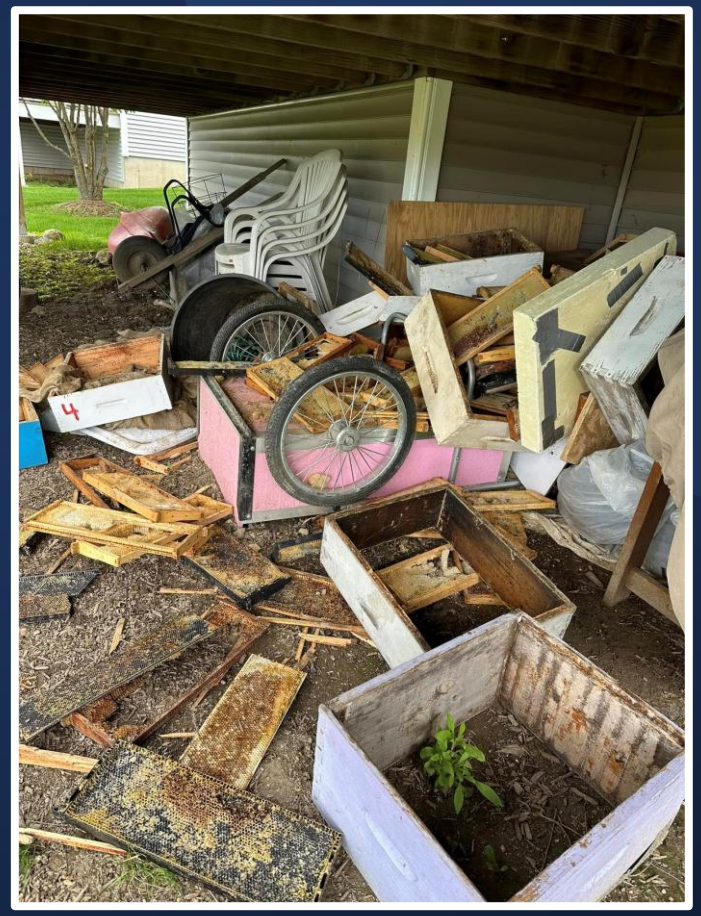


Why the top line should be 5 feet high

Video of bear easily jumping over 42” high fence and tearing the cover off an unstrapped hive.

Other little bear tricks

Destroying your unused equipment when you're not home!



Digging under your electric fence!

Building the fence: What you'll need

- Enough wire, polywire, or tape to run 5 or better yet, 6 lines, or;

- 5 foot high netting for whole perimeter – 4-foot net may not be high enough to deter jumpers.

?

Corner posts – wood posts or metal t-posts. T-posts that are 1.33 lbs. per foot are the stiffest and galvanized posts will not rust.

Building the fence: Netting

Netting 5’ tall (Deer Quik Fence)

Standard 4’ netting may not be high enough to deter jumpers

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Special note..

Never combine barbed wire with an electric fence!

Building the fence: What you'll need

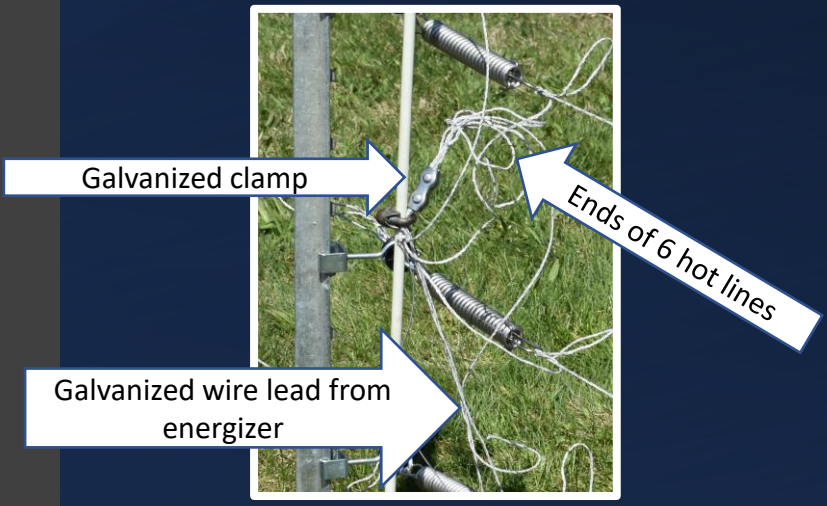
- T-post driver (if you use t-posts)
- In-line support posts (plastic or fiberglass or can use t-posts)
- A good grounding kit – three 3' galvanized rods, galvanized wire, and brass or galvanized clamps (Field Guardian kit with non-corroding brass clamps made for the purpose.)
- Garden staples for grounding wire (optional)
- Correct insulators:

Building the fence: What you'll need

- Energizer

1.0 output joules or greater. (1.3 stored joules or greater.)

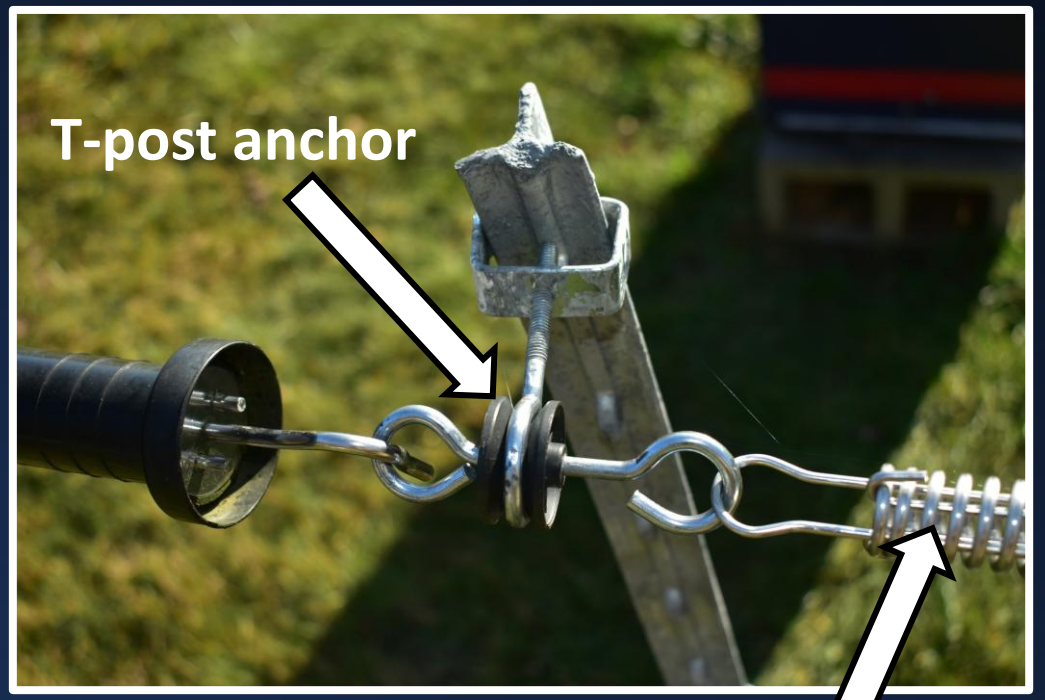
- A gate: A net gate or wire gate handles and loop anchors or other anchors.
- Clamps for wire leads from energizer to charged lines.

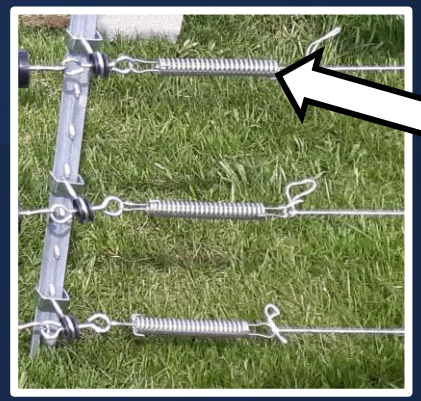


Building the fence: Gate

One option: Spring loaded gate handles,

t-post anchors, lightweight spring tensioners.





Lightweight spring tensioner

Gateways: Inexpensive options

Maintain the fence: Weed control

Photo courtesy of Bruce Cheever

- String trim under bottom wire.
- Weed barrier like cardboard, roofing paper/shingles, geotextile, crushed stone, old carpet, or commercially available landscape edging.

Photo courtesy of Vaughn Collins

Some final thoughts...

- Place a warning sign on the fence.

- Bait the fence.

- Strap the hives as a last line of defense

3,000 lb. break strength

Mann Lake carries galvanized metal banding straps that a bear cannot tear.

Avoid cheap lightweight ratchet straps.

So, what does all of this cost? (Approximate)

Expense item (does not include spare parts)	Approx. Cost
• Energizer (AC or solar/battery 1.0 or more output joules)	• $110 (AC) -$350 (solar)
• Grounding kit (Field Guardian)	• $60
• Insulators, t-posts & line posts, 6' corner t-posts 1.33 lb./ft., line posts, clamps	• $100-$140
• Wire–polywire (400') or Deer Quik Fence net (5'x100')	• $35-$150
• Gate handles (anchors & springs optional)	• $30-$80
• T post driver (optional but very helpful)	• $55
• Voltage tester (digital inductive or probe)	• $35-55
Total	$425 - $890

Winter Prep and Winter Electric Fence Maintenance

Wnter fence actions

- Raise the bottom line(s) on a wire fence to prevent snow and ice from pinning it to the ground.

- Check solar energizer batteries – Dec. & Jan.

Our eastern snow is conductive!
Lines in snow will short out your fence.

Testing by Cheever and Putnam during winter 2023, 2024, 2025, 2026 with voltage tester probe in the snow (snowpack was the grounding medium), stepping on it like a bear compacting the snow:

- Minimum voltage found: 6,500 volts
- Typical voltage: 8,000 to 10,000 volts (max tester reading)

No need for two-line (alternating hot-ground-hot-ground) setup during winter in New England.

Wnter fence actions

May need to remove deep snow accumulations on solar panel and raise lines further.

Mounting the energizer on a post reduces snow accumulation on solar panels.

Summary of apiary electric fence specs and management 1

- ✓ Energizer minimum 1.0 output joules.
- ✓ Fence voltage minimum 7,000 volts. Most energizers with 1.0 output joules will have put out 10,000 volts or more .
- ✓ Check voltage with electric fence voltage tester after every apiary visit (do not attempt to use electrician's voltage tester.)
- ✓ Grounding rods galvanized
- ✓ Grounding rods at least 10 feet apart at least 3 feet long – no copper or rebar/steel grounding rods. Grounding rods located in a wet spot are ideal.
- ✓ All wire connections clamped with galvanized or brass clamps designed for electric fences – No twist wire connections.

Summary of apiary electric fence specs and management 2

- ✓ Fence height: Top line at least 5 feet above ground to deter "jumpers." Netting should be "Deer Fencing" style 5 feet high.
- ✓ Fence lower line height: 6-8" above ground to prevent digging under and deter skunks.
- ✓ Corner posts resist bending.
- ✓ Post spacing - In-line support posts located at all high points and low points in terrain and no more than 8 feet apart.
- ✓ Fence at least 6 feet from hives to prevent "reach-in."
- ✓ Maintain lines and netting free of grass and weeds.
- ✓ Solar energizer placed in sunny location inside apiary fence with pane facing south.

Summary of apiary electric fence specs and management 3

- ✓ No guy wires or guy posts on outside of fence (inside apiary fence only.)
- ✓ Insulators on metal posts at least 5" long to reduce leakage voltage losses.
- ✓ Do not mix barbed wire and electrified fencing.
- ✓ Fence lines should be snug; they do not need to be super tight.
- ✓ Keep lines/netting free of grass and weeds.
- ✓ Raise lines/net up out of snow.

Part 2 – Troubleshooting Guide

Review Part 1 before using this guide.

Diagnosing Apiary Electric Fence Problems

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02/25/2026

Issue: Low voltage

Determining low voltage

Electric fence energizers have voltage indicators. Some kinds have gauges. Others have flashing lights – red often meaning an issue. These are crude indicators of voltage and serve to tell you if something is wrong.

Note that energizers with flashing lights might be hard to see in bright sun requiring you to shade the indicator light.

The steps below call for measuring voltage with a probe or inductive electric fence tester as noted in Part 1:

Probe style

Inductive

Issue: Low voltage	
Possible cause	Action
Unclamped or corroded wire connections	• Check and tighten wire connections at energizer. • Check connections on grounding rods and attachments to fence line. Clean any corroded connections. • **Clamp all unclamped wire connections.**
Insufficient grounding – grounding rods too close to each other or not enough ground rods	• Ensure grounding rods are at least 10 feet apart. • Add grounding rod(s).
Insufficient grounding – Soils are dry due to lack of rainfall. Soil depth limited due to bedrock, basal till hardpan, or other kind of shallow dense soil layer.	• Add grounding rods. • Insert rods as deeply as soils will allow. • Replace short insulators with minimum 5" standoff insulators on all metal posts to reduce leakage losses.

Issue: Low voltage	
Possible cause	Action
Insufficient grounding – grounding rods are copper or steel that can corrode.	• Replace steel or copper grounding rods with galvanized rods.
Electrical shorts	• Check every place where a wire could touch a metal post. • Check fence perimeter for broken insulators allowing wires to touch posts. • Remove vegetation growing into lines or netting or pull lines/netting up out of snowpack.

Issue: Solar energizer low voltage to almost none	
Possible cause	Action
Battery dead or nearly so.	• Recharge or replace battery (solar energizer battery life is usually 5 years or less.) Check the date stamp on the battery.
Energizer electronics failing	• Go to next slide.

Issue: No voltage (battery is good w/ solar)

Possible cause	Action
Energizer not turned on (solar/battery powered) or not plugged in (AC)	• Check to be sure energizer is turned on. • Check to be sure energizer is plugged in (AC)
Energizer electronics have failed	• Check voltage directly on + and – terminals of energizer with an electric fence tester. Remove wires to lines/netting and grounding rods first. Touch the ground probe (the one you push into the soil) to the negative terminal and the hot probe (the part that would normally touch the fence) to the positive terminal. • If zero or near zero, electronics have failed. Replace electronic charging unit on models with user replaceable electronics (sometimes called circuit board, PCB board, or lighting board.) Send other models to dealer to replace electronics.

Basic Apiary Electric Fence Principles and Troubleshooting Guide

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"I don't think the new electric fence is engendering the fear we intended."