

Designing Fences for Grazing Systems

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Table 1. Construction costs for woven wire fence (Based on 1,320 ft. fence)

Item	Amount	Cost per unit	Total cost
Wood posts (8-in diameter)	4	\$ 22.00	\$ 88.00
Wood posts (4-in diameter)	57	9.30	530.10
Steel posts (6.5 ft)	55	3.69	202.95
Staples and clips	10 lb	1.80	18.00
Barbed wire	1,320 ft	.037	48.84
Woven wire (48 in)	1,320 ft	.40	528.00
Labor (estimated)	42 hr	13.60	571.20
Total			\$ 1,987.09
Total per foot			\$ 1.51

Table 2. Construction costs for barbed wire fence (Based on a 1,320 ft. fence)

Item	Amount	Cost per unit	Total cost
Wood posts (8-in diameter)	4	\$ 22.00	\$ 88.00
Wood posts (4-in diameter)	57	9.30	530.10
Steel posts (6.5 ft)	55	3.69	202.95
Staples and clips	10 lb	1.80	18.00
Barbed wire	6,600 ft	.037	244.20
Labor (estimated)	39 hr	13.60	530.40
Total			\$ 1,613.65
Total per foot			1.22

Table 3. Construction costs for high-tensile non-electric wire fence (Based on a 1,320 ft. fence)

Item	Amount	Cost per unit	Total cost
Wood posts (8-in diameter)	6	\$ 22.00	\$ 132.00
Wood posts (4-in diameter)	65	9.30	604.50
Staples	10 lb	1.80	18.00
Springs	8	4.50	36.00
Strainers	8	2.50	20.00
High-tensile wire	10,560 ft	0.0225	237.60
Labor (estimated)	32 hr	13.60	435.20
Total			\$1,483.75
Total per foot			1.12

Table 4. Construction costs for high-tensile electrified wire fence (Based on a 1,320 ft. fence)

Item	Amount	Cost per unit	Total cost
Wood posts (8-in diameter)	6	\$ 22.00	\$ 132.00
Wood posts (4-in diameter)	4	9.30	37.20
Steel posts (6.5 ft)	52	3.69	191.88
Insulators	285	.15	42.75
Springs	5	4.50	22.50
Strainers	5	2.50	12.50
High-tensile wire	6,600 ft	.0225	148.50
Energizer (priced over 4 yr)	1 ^a	200.00	50.00
Cut-out switch	1	9.00	9.00
Ground/lightning rods	4	9.00	36.00
Labor (estimated)	18 hr	13.60	244.80
Total			\$ 927.13
Total per foot			0.70

Table 5. Construction costs for electrified polywire fence for interior use (Based on a 1,320 ft. fence)

Item	Amount	Cost per unit	Total cost
Wood posts (4-in diameter)	2	\$9.30	\$ 18.60
Fiberglass posts ($\frac{3}{8}$ -in x 4 ft)	33	1.59	52.47
Insulators	2	.80	1.60
Post clips	42	.25	10.50
Polywire	1,320 ft	.026	34.32
Energizer (priced over 4 yr)	$\frac{1}{4}$	200.00	50.00
Cut-out switch	1	9.00	9.00
Ground/lightening rods	4	9.00	36.00
Labor (estimated)	2 hr	13.60	27.20
Total			\$239.69
Total per foot			\$0.18
Cost of adding 1 strand of polywire (wire, clips, insulators)		35.00	35.00 or .03 per ft

ELECTRIC FENCING

⚡ Inexpensive, energized by a low impedance, high voltage energizer.

⚡ The perimeter fence should be sufficient to allow the confidence that the livestock will not "escape."



WHAT DOES LOW IMPEDANCE MEAN?

- ⚡ **Grounding out is common problem which exists on most electric fence installations, the low impedance fencer is a solid-state capacitor discharge design and has enough power to force the shock through vegetation.**
- ⚡ **The best low impedance fencers have an on-time of less than 100 micro-seconds (100 millionths of a second) with a pulse rate of approximately 55 times per minute.**

Energizer

These Chargers Give A Very High Voltage Pulse Very Quickly, And Will Get The Animal's Attention But It's Not Enough To Hurt It Physically Or Permanently.

Energizer

Stored Energy, Measured In JOULES, Best Describes The Amount Of Energy That An Energizer Is Capable Of Producing.

Energizer

**An Energizer That “Charges”
Out 5,000 To 10,000 Volts
Works For Most Grazing
Situations.**

Fencing: *Energizer* - Test The System



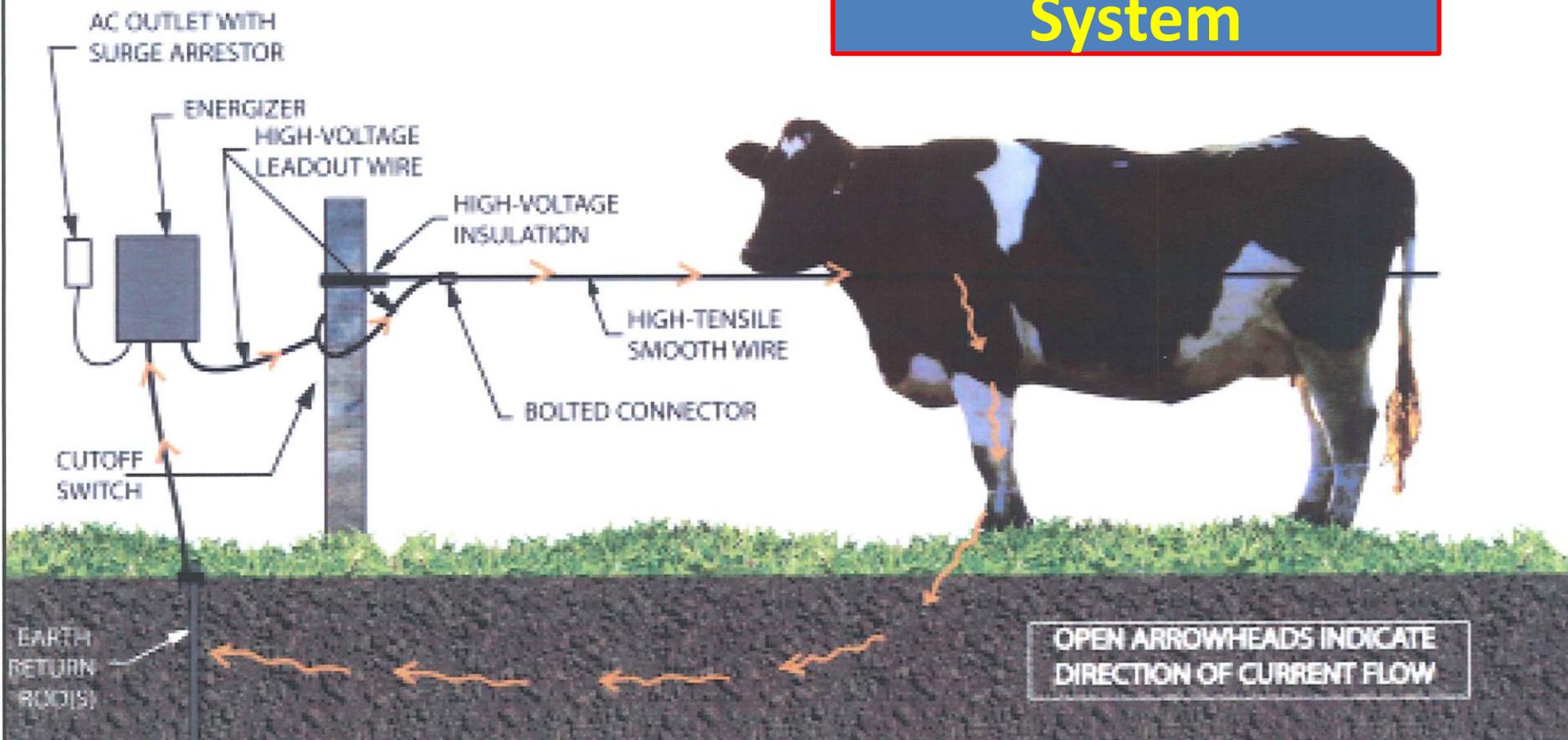
Wiring

**Power From The Energizer
Should Be Supplied To The
Fence Via The Same Size Or
Larger Wire As The Fence
Wire.**

Types of Fencing Circuits

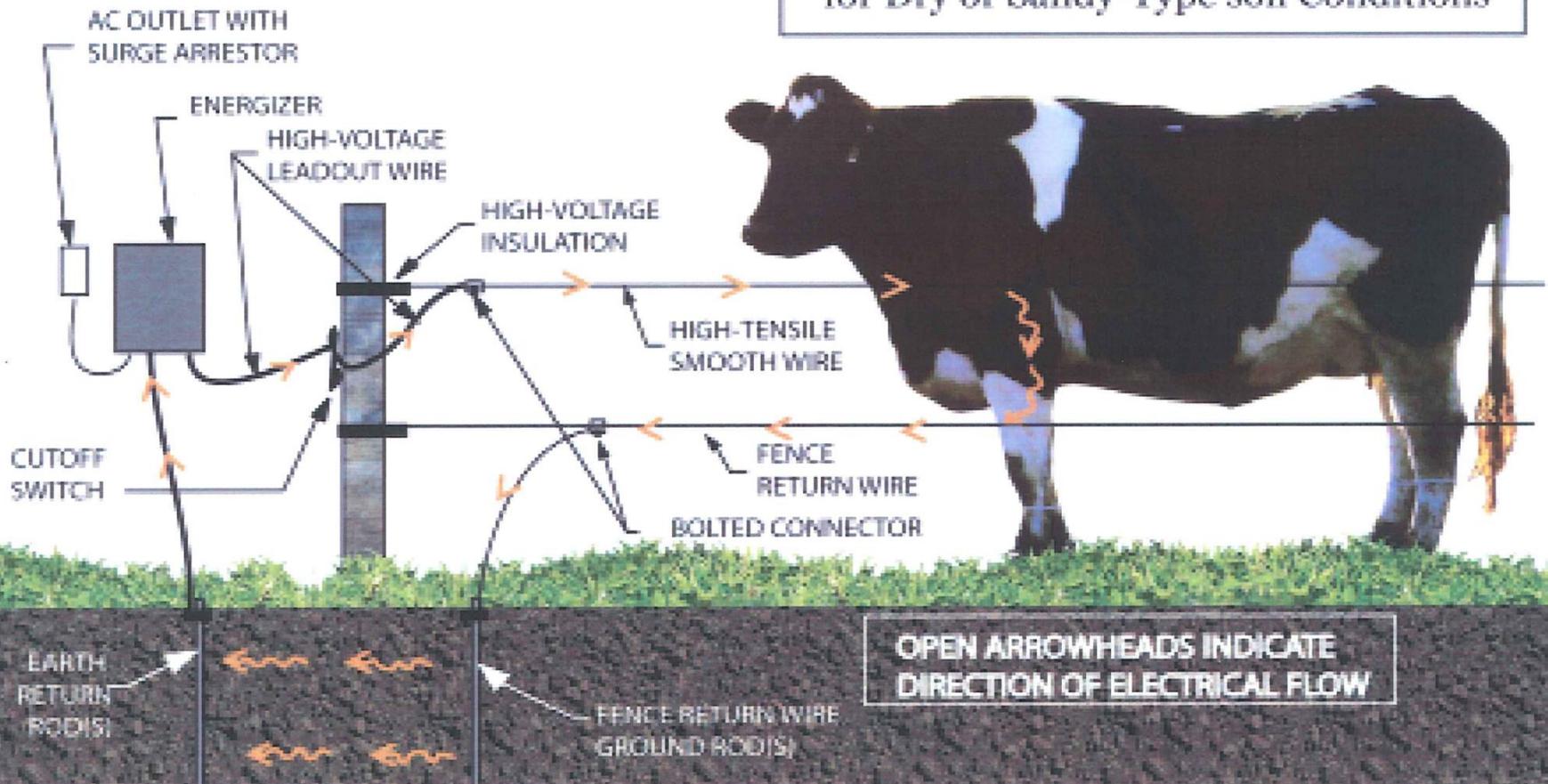
- 1. Earth Return System works best in areas with fairly regular rainfall and green vegetation for most of the year.**
- 2. Wire Return System works best in dry soils and frozen conditions.**

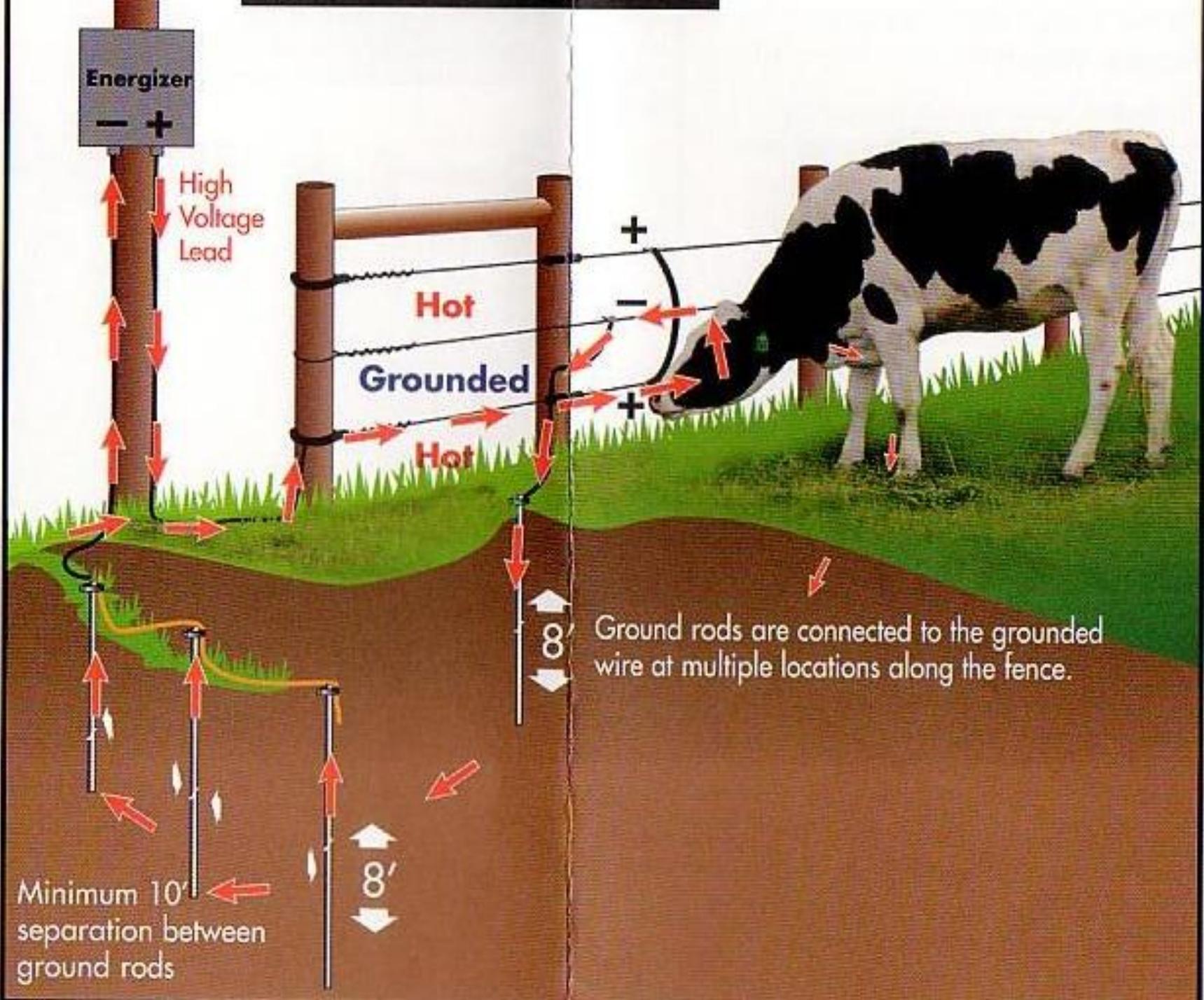
Earth Return System



'Wire' Return System

Two-Wire Continuous Ground Fence
for Dry or Sandy-Type soil Conditions





Energizer

- +

High Voltage Lead

Hot

Grounded

Hot

Ground rods are connected to the grounded wire at multiple locations along the fence.

Minimum 10' separation between ground rods

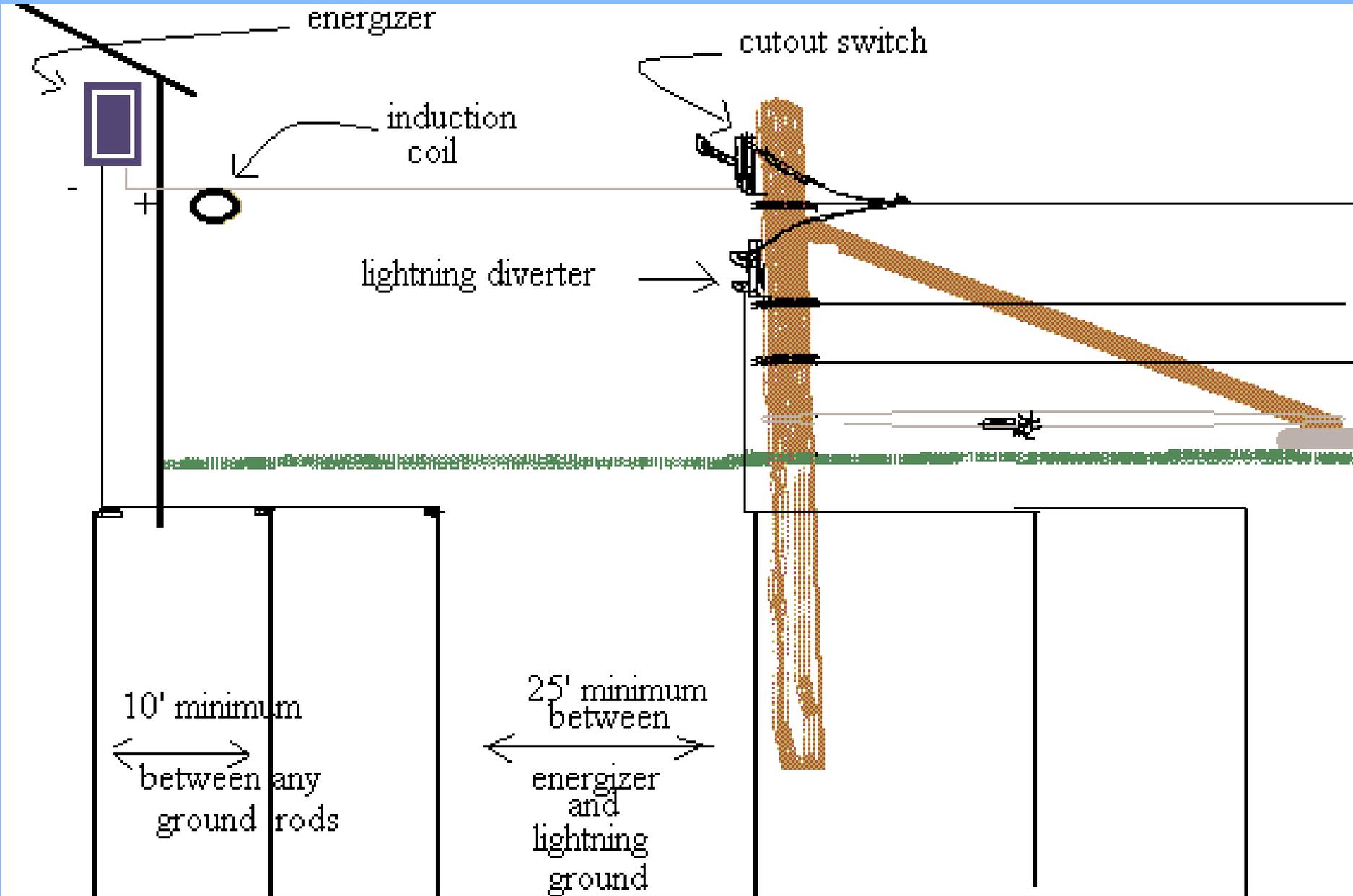
Grounding

**Improper Grounding Will Cause
An Electric Fencing System To
Fail.**

Grounding

- **All Fencing Systems Will Require More Than One Ground Rod.**
- **Fencing Manufacturers Characteristically Recommend At Least Three Ground Rods Per Energizer.**

Installation of a Low-impedance Energizer.



Grounding

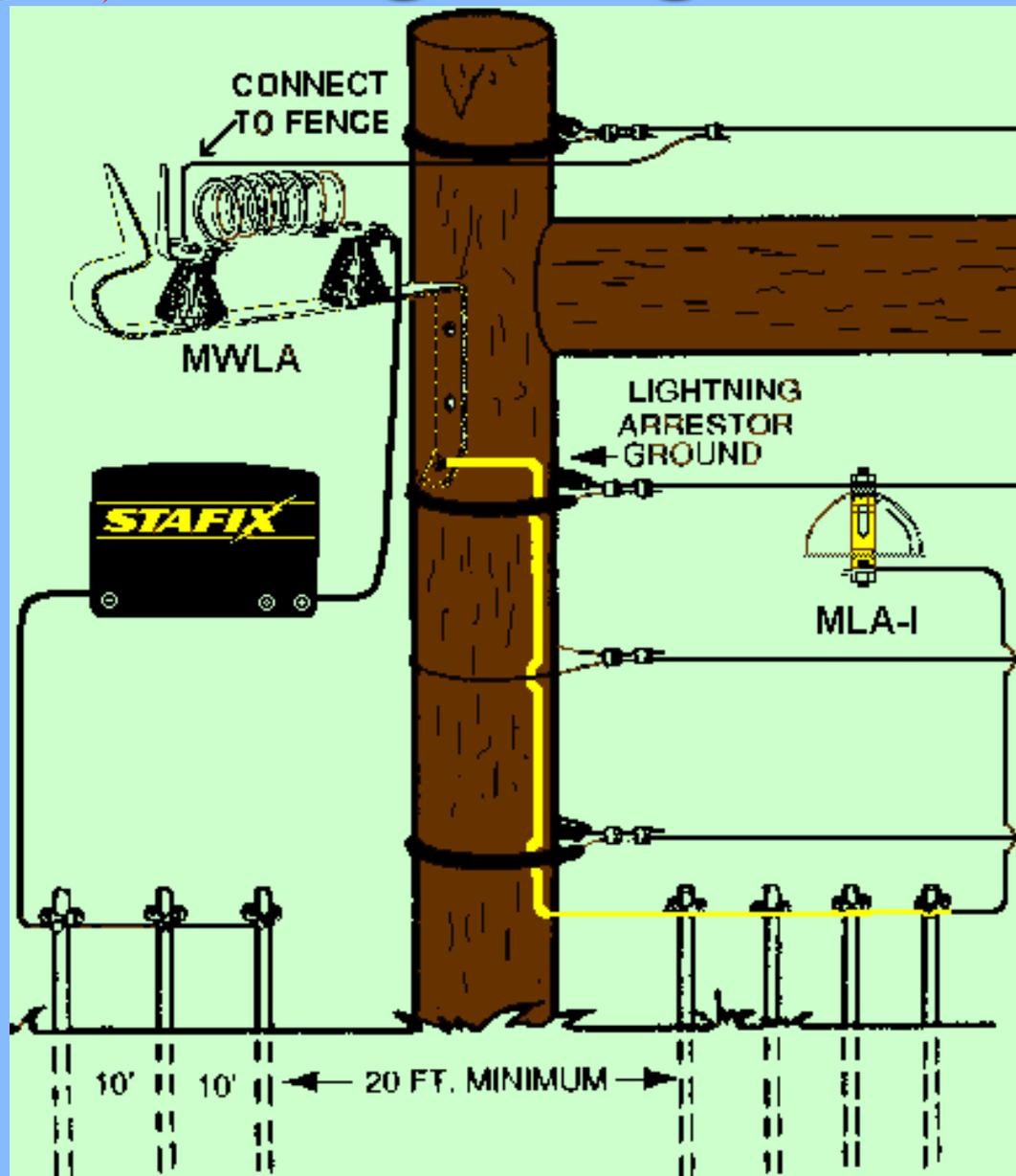
**Fencing Manufacturers
Characteristically
Recommend 3 Feet Of Ground
Rod Per Joule Of Energy
Released From The Energizer.**

Lightning Arrestor System

This System Consists Of

- **A Choke Or Inductive Coil**
- **A Diverter**
- **A Grounding System That's Separate From The Fence Energizer's Grounding System.**

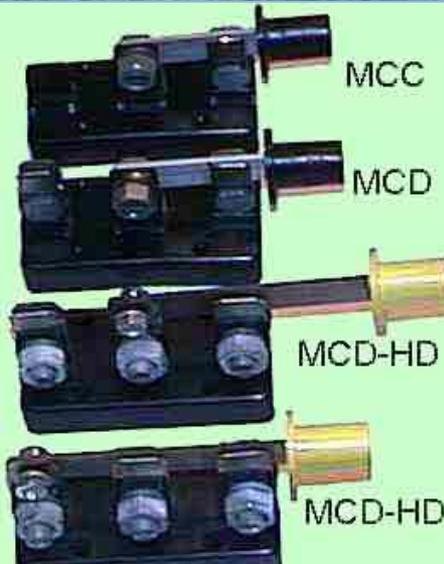
Fencing: *Lightning Protection*



Lightning Arrestor System

To Be Most Successful, The Choke Or Inductive Coil Should Be Installed Between The Energizer And The Fence.

FENCING



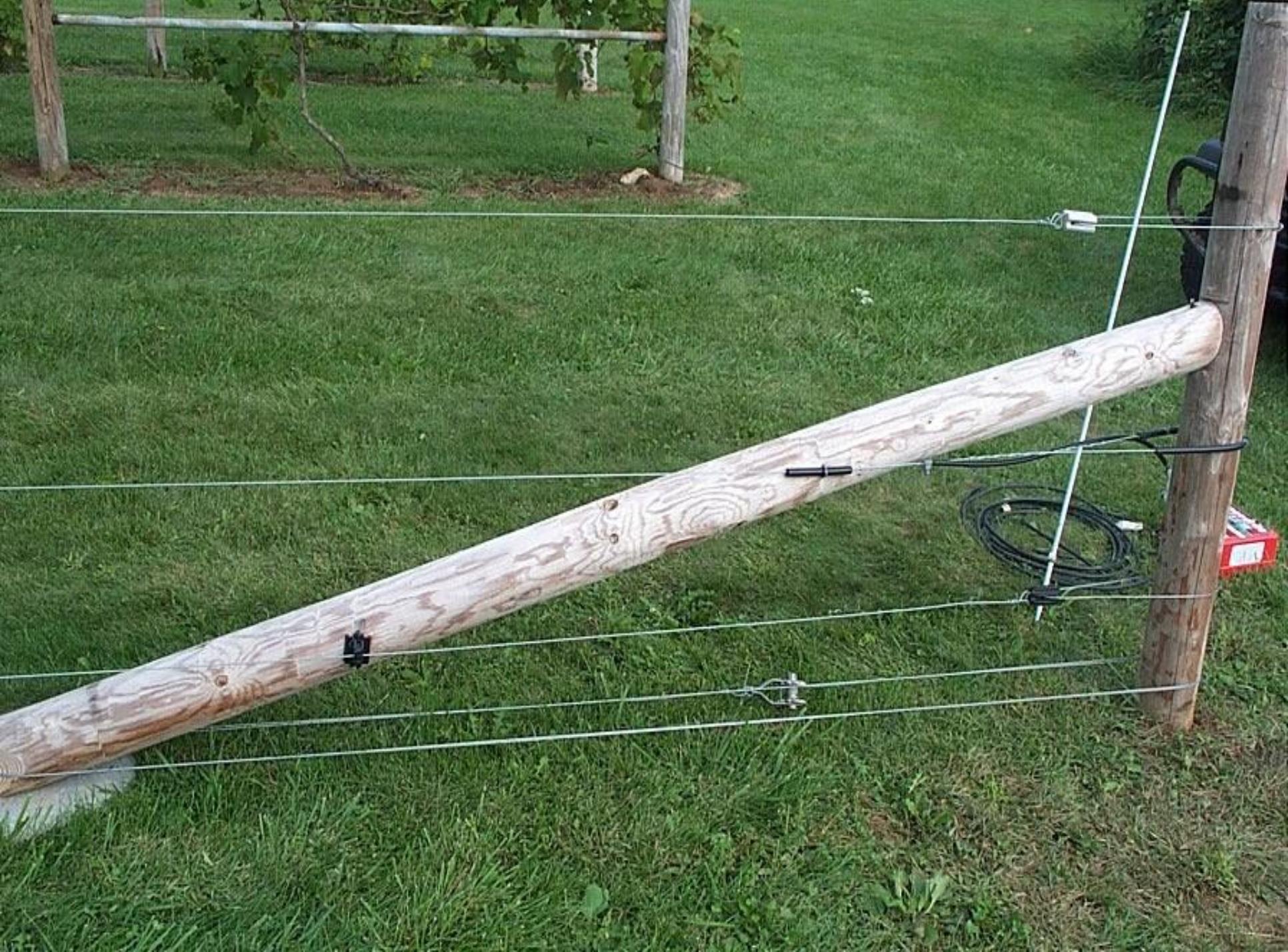
Fence Wire

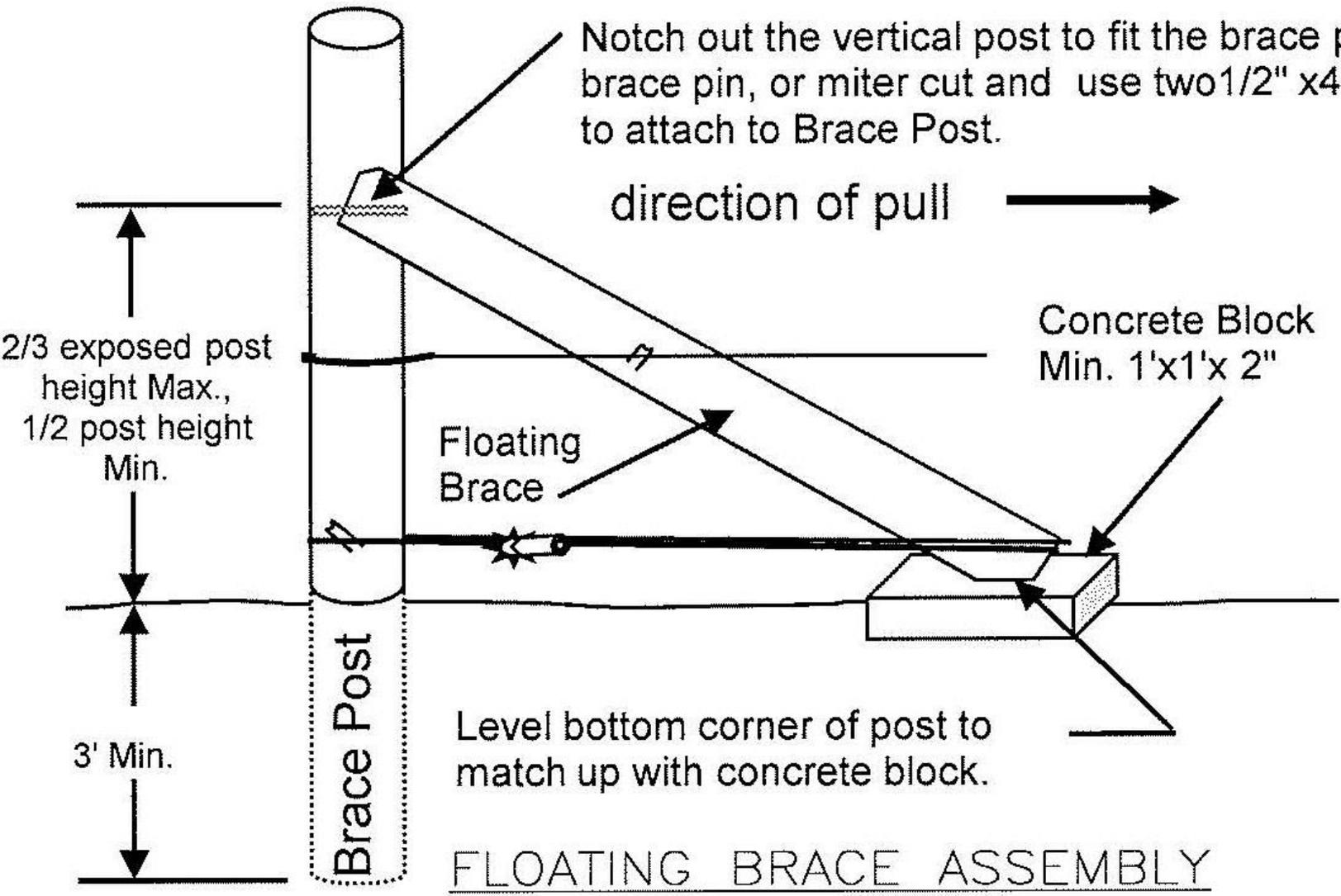
**12.5-Gauge Or Larger HIGH
TENSILE STEEL With A Minimum
Tensile Strength Of 140,000 Psi
And Class III Galvanized Or
Aluminum Coating**

(Fence 382 – WI FOTG)

FLOATING DIAGONAL BRACE







Notch out the vertical post to fit the brace post and use brace pin, or miter cut and use two 1/2" x 4" lag screws to attach to Brace Post.

direction of pull →

2/3 exposed post height Max.,
1/2 post height Min.

Concrete Block
Min. 1'x1'x 2"

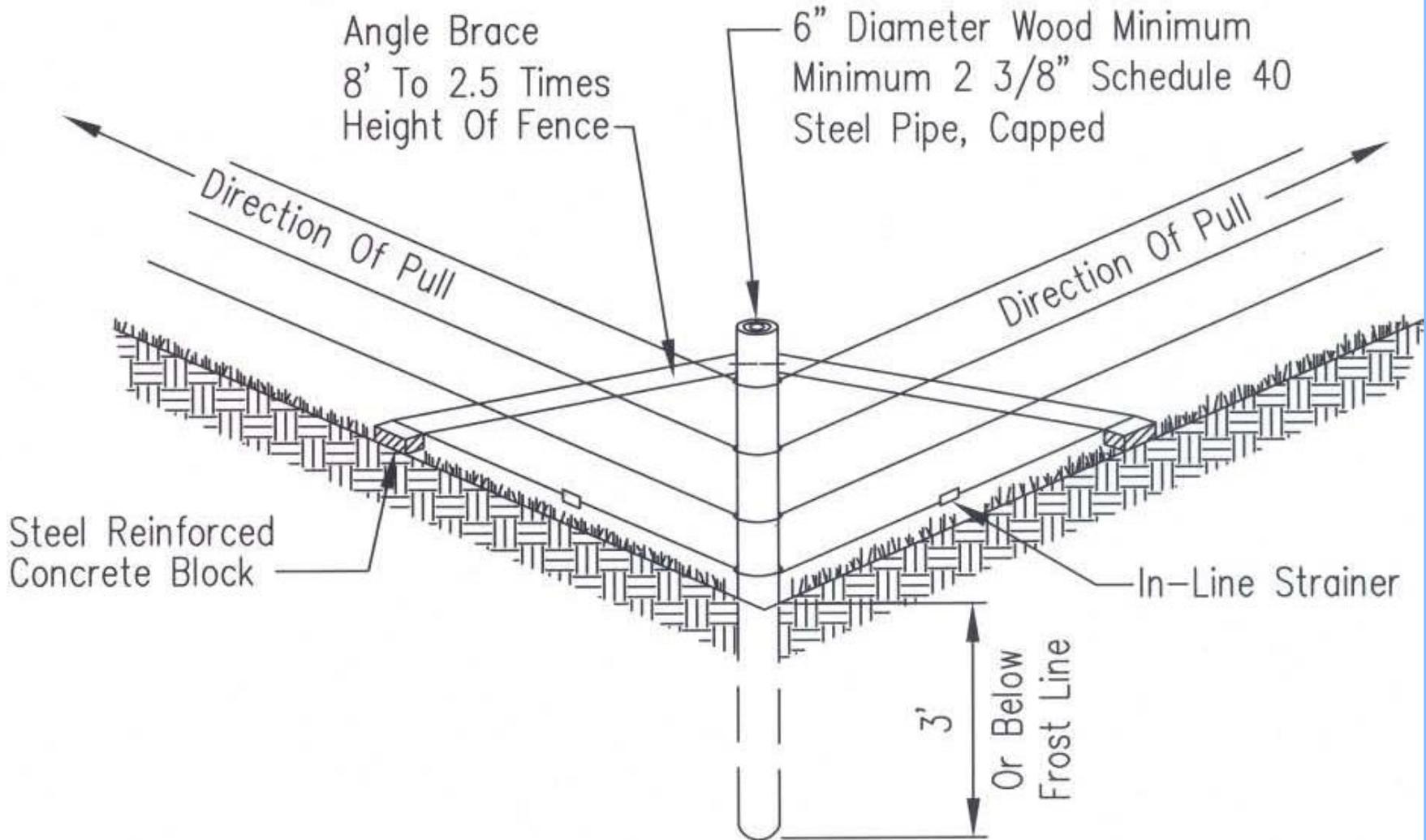
Floating
Brace

3' Min.

Level bottom corner of post to match up with concrete block.

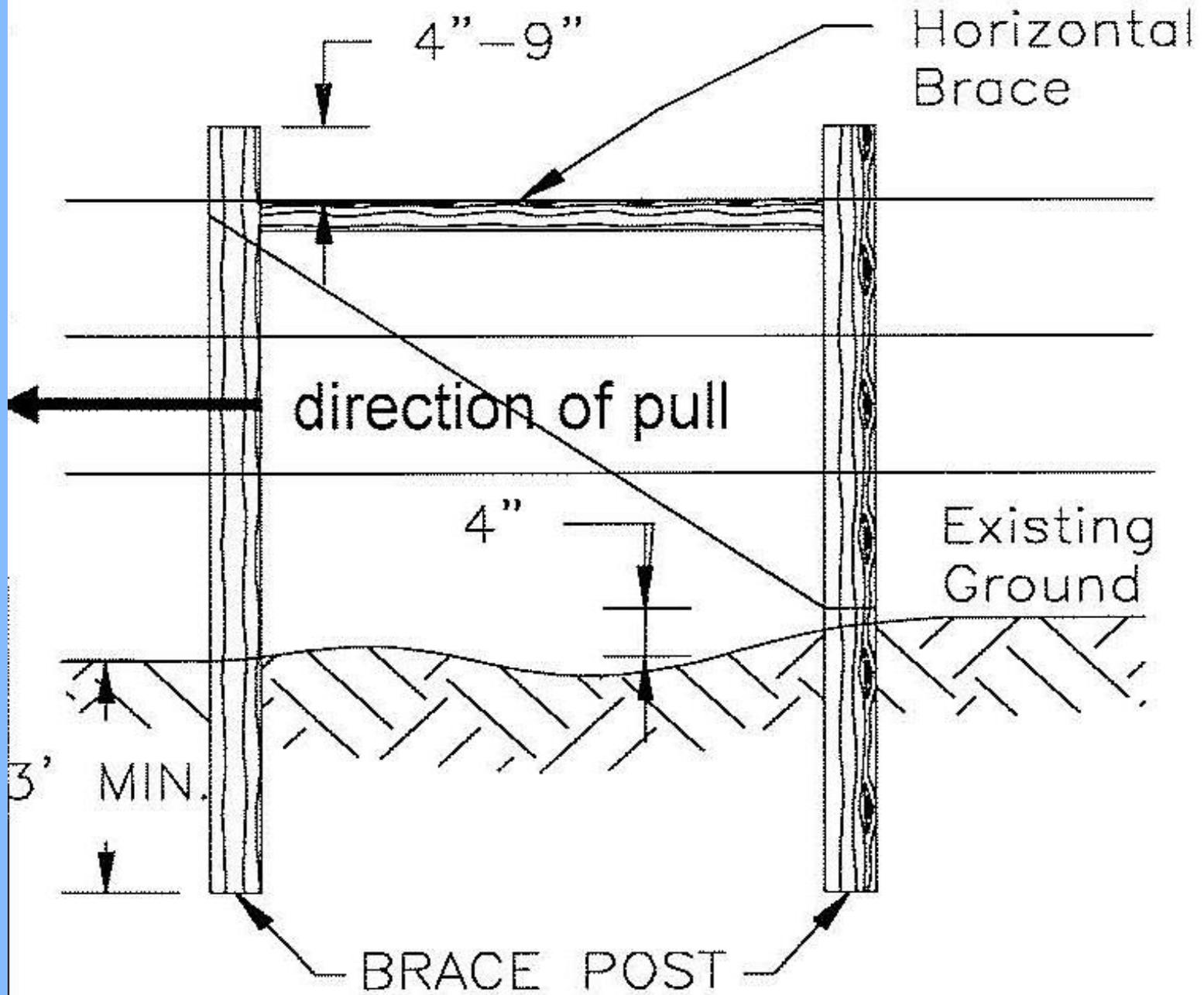
FLOATING BRACE ASSEMBLY

SINGLE POST CORNER OR ANGLE BRACE ASSEMBLY

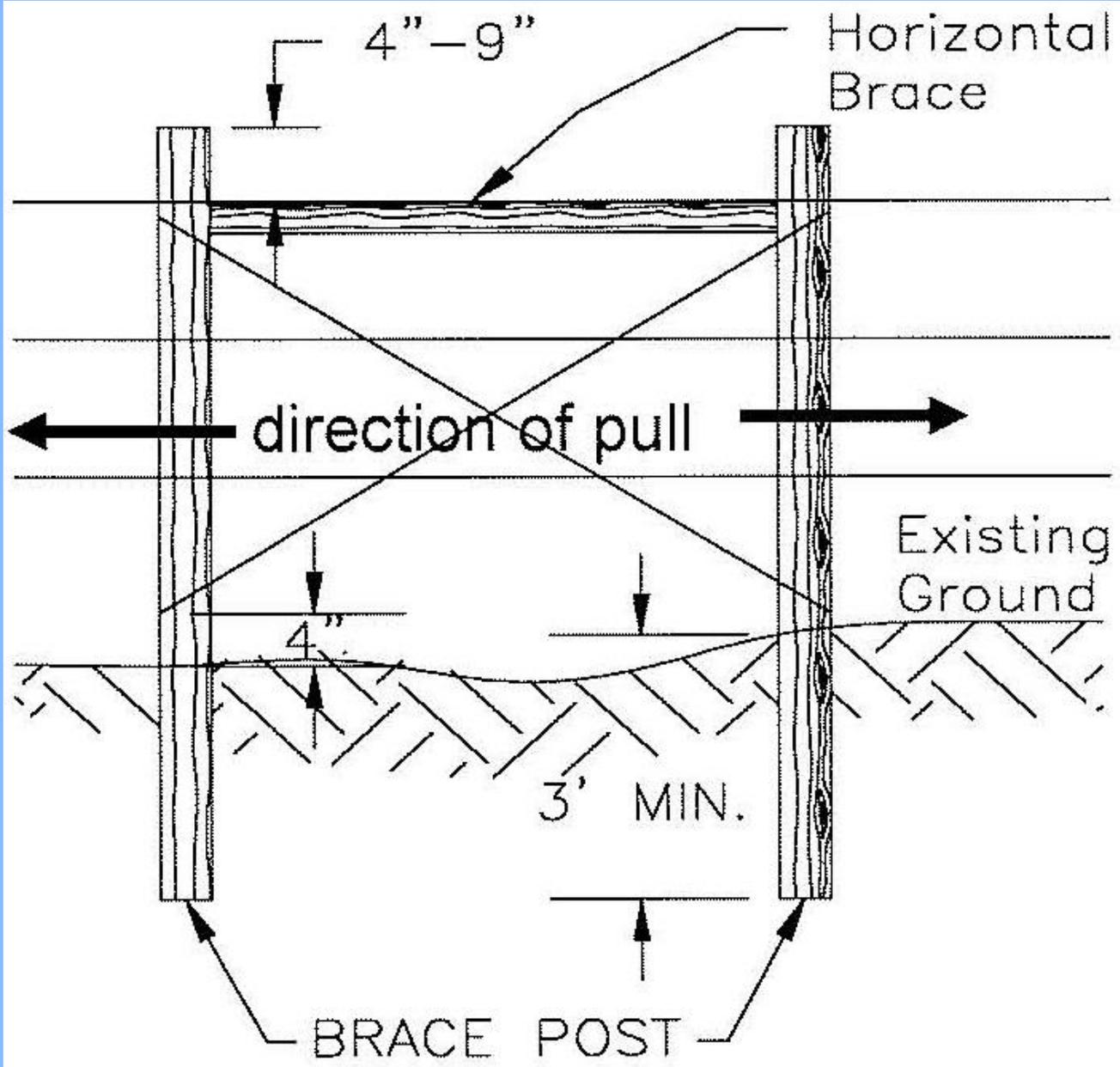








SINGLE H-BRACE ASSEMBLY



PULL POST ASSEMBLY

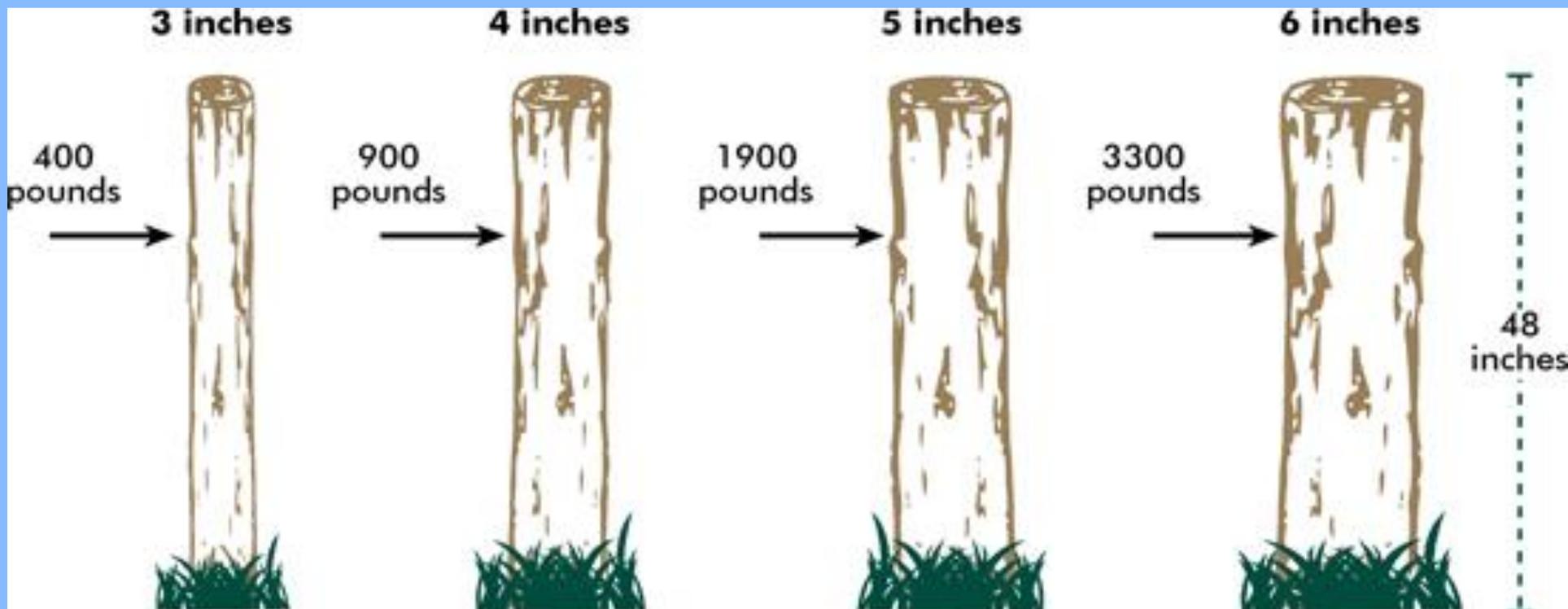
Wooden posts

About the best all-around post to use is the pressure-treated type.

When used with high-tensile fences, there is an additional factor to be considered: strength.

A six-wire fence applies 1,200 to 1,500 pounds of pull to a corner post.

The chart below shows the approximate force necessary to break various diameters of pressure-treated pine.



FIBERGLASS POSTS - EXAMPLES



SUNGUARD II

http://www.kencove.com/fence/Fiberglass+Posts_product.php

The Composite Post:



The Pilot Driver



- The Pilot Driver simply pilots a hole for your Flex Posts. If you have good (decent) soil, you will probably not need one.
- However, when dealing with hard packed soils and or rocky conditions, it will help you in effort and post appearance.
- It seems to aid in moving small rocks out of the path of the post, thus giving you a straighter & more plum post (so long as your pilot hole is straight & plum).

The Power Flex Post:

HOW IS THE WIRE ATTACHED TO THE POST?

- The wire is attached to the post in most cases with a cotter pin through a drilled hole.
 - The cotter pins we recommend are 13 gauge, 5 1/2" long, with a class III Coating.
 - They are long enough to come back around the wire and be snipped and bent over.
 - Please Note: The fence wire should have full movement thru the cotter pin, so we caution you – if the cotter pin is brought back over the fence wire - do not cinch it up tight, like you do with clips on a t-post and barbed wire.





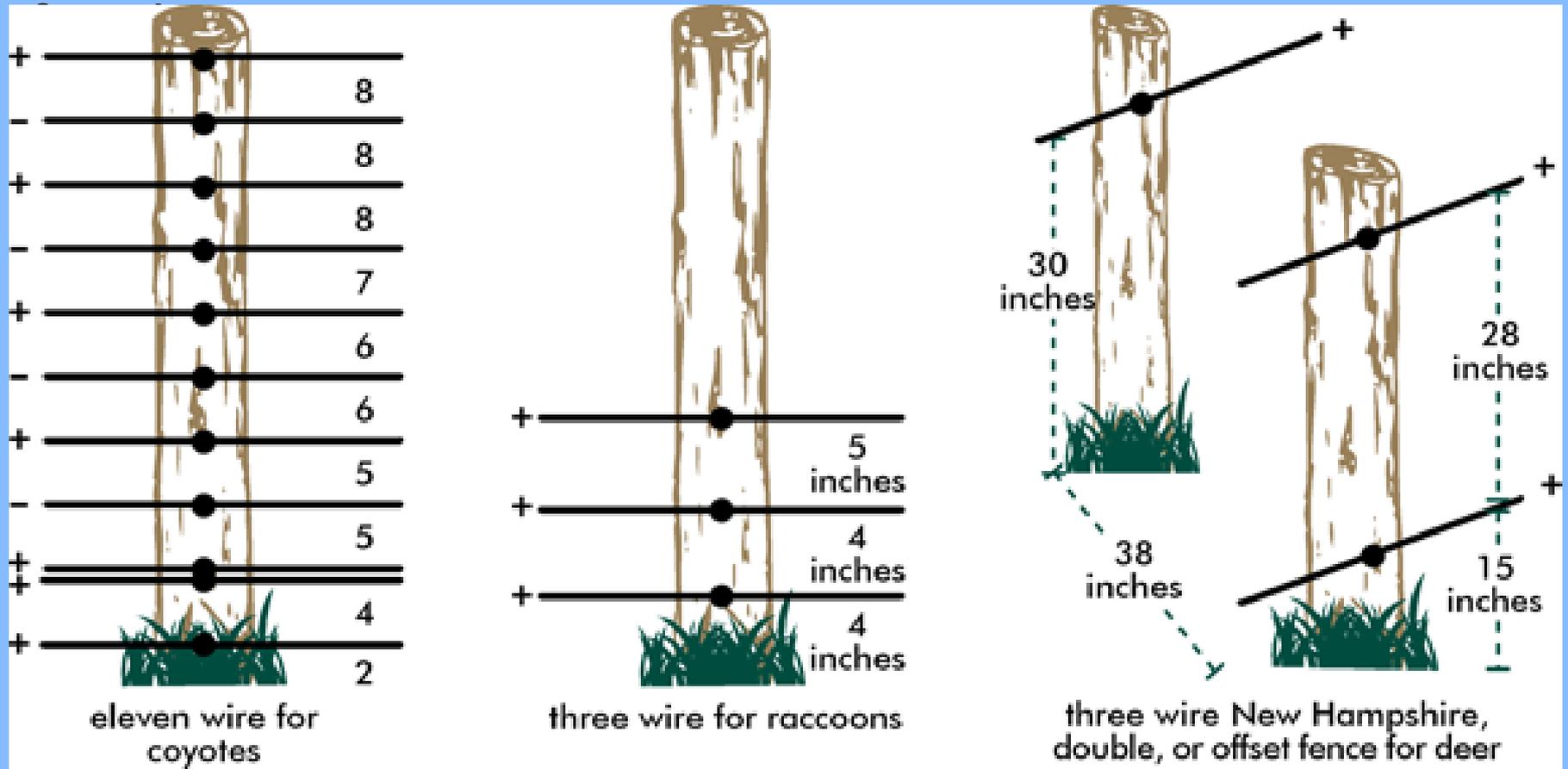
Bendable?





Specialty fences

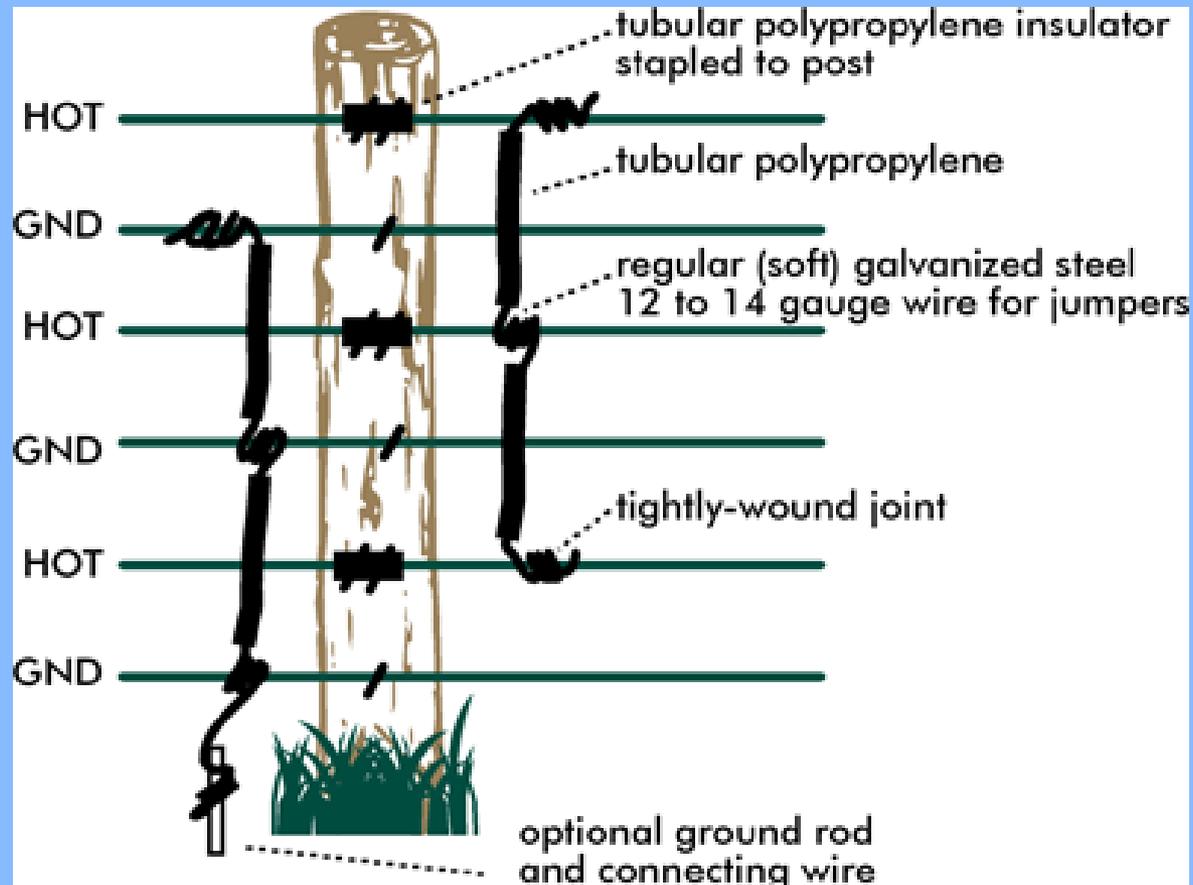
Below are three examples of special fences; an 11-wire fence for coyotes, a three-wire fence for raccoons, and a three-wire offset fence (sometimes called a New Hampshire or double electric fence)



Jumpers

If your fence consists of more than a single wire, you must even out the current flow by separately jumping together all the hot wires and all the grounded wires. This must be done every 1/4 to 1/2 mile.

For jumper wires use regular (soft) galvanized number 12 or 14 steel fence wire and make sure that all joints are tightly wound. For rigidity always jumper at a post. The picture below shows a 6-wire fence with 3 hot wires and 3 grounds.





NRCS eFOTG

Standards, Specifications
& Statements of Work

NRCS Conservation Practice Standard Development

**National Practice
Standard**

**State Practice
Standard**

Why are Standards & Specifications Important?

- 1) Proven technology
- 2) NRCS employee's liability
- 3) Legal constraints for permits
- 4) USDA Program requirements

FENCE

(Feet)

Code 382

Natural Resources Conservation Service
Conservation Practice Standard

I. Definition

A constructed barrier to animals or people.

II. Purposes

This practice may be applied as part of a conservation management system to support one or more of the following purposes:

- exclude livestock or wildlife from areas should be protected;
- confine livestock on an area;
- control domestic livestock while permitting wildlife movement;
- subdivide grazing land to permit use of grazing systems; or
- regulate access to areas by people, vehicles, and/or to prevent trespassing for safety purposes.

NRCS # of wires more stringent.

cookbook requires 20 years

III. Conditions Where Practice Applies

This practice may be applied on any area where livestock and/or wildlife control is needed, or where human access is to be regulated. Fences are not needed where natural barriers will serve the purpose.

IV. Federal, Tribal, State and Local Laws

Users of this standard shall be aware of potentially applicable federal, tribal, state and local laws, rules, regulations or permit requirements governing fences. This standard does not contain the text of the federal, tribal, state or local laws.

V. Criteria

A. General Criteria

1. Fencing shall consist of the acceptable type as defined by Table 1, Criteria, as necessary to meet the movement of animals and the intended management objective.

Minimizes interference from EMF

2. Fencing shall consist of acceptable designs, materials, and methods as described in the Wisconsin Engineering Spreadsheet, Fence Design and Drawings; and Wisconsin NRCS FOTG, Section IV, Construction Specification 10, Fence.
3. Fences may be permanent, portable, or temporary and shall be positioned to facilitate the management requirements.
4. Boundary line fences (fence property line) shall comply with state laws and standards for construction (Ch. 90, Wis. Stats.).
5. Fencing materials shall be of a high quality and durability, and the construction performed to meet the practice design.
6. All permanent fences are to be constructed with the intent of being maintained for at least 10 years. Therefore, the criteria for all permanent fences require material, design, and construction that shall have a minimum life expectancy of 10 years with minimum maintenance.
7. Height, number, and spacing of wires will be installed to facilitate control and management of the animals and/or people, as shown in Table 1. Height, size, spacing, and type of posts used shall meet the needs of the planned fence type and the topography of the site.
8. Barbed wire shall not be electrified or insulated for electrification.
9. Manufacturer's guidelines shall be adhered to during installation and shall meet the minimum construction specifications for each type of fence to ensure proper component assembly.
10. If electric fences must pass under overhead high voltage power lines, cross the power lines as close to perpendicular as possible.



Spreadsheet

- Estimated quantities of fence materials needed.
- Appropriate detailed design drawings for corner assemblies, gates, and specialized components like stream crossings.
- Location of existing fences to be used or removed.
- Details of fencing right-of-way site preparation needs and construction site erosion control.
- Disposal of old and/or scrap fencing materials.

VIII. Operation and Maintenance

- A. Routine inspection of fences should be part of an ongoing management program. Inspection after storm events is needed to ensure the function of the intended use of the fence.
- B. Perform maintenance and repairs as needed to facilitate the intended operation of the installed fence. Remove fallen limbs and maintain proper tension on the fence wires. Overhanging trees and limbs should be trimmed or removed as needed.
- C. Regularly check electric fences to determine the voltage on the fence. If voltage is not sufficient, determine the cause and correct. During dry weather, ground rods may need water applied to soil around them. Clear brush from the fence line to reduce voltage loss. Vegetation should be controlled to maintain proper voltage and prevent stray voltage.
- D. Electrified floodgates must be maintained and kept clear of debris. During extended flooding periods, switch off the electric power to floodgates.
- E. Safety during construction and maintenance is a primary concern. Eye and hand protection should be worn while performing fence maintenance.

IX. References

USDA, NRCS Wisconsin Field Office Technical Guide (FOTG), Section IV, Practice Standards and Specifications.

Wisconsin Statutes, Chapter 90, Fences:
<http://www.legis.state.wi.us/statutes/Stat0090.pdf>.

High-Tensile Wire Fencing, Northeast Regional Agricultural Engineering Service, Ithaca, NY.

Fences, USDI-Bureau of Land Management, USDA, Forest Service. Publication No. 2400, Range 8824 2803. July 1988.

Cadwallader, T. Understanding Electric Fence in "Grazing References Materials Manual," University of Wisconsin, Center for Integrated Agriculture Systems. January 1997.

Missouri Electric Fencing for Serious Graziers, USDA-Natural Resources Conservation Service, Missouri.

USDA, NRCS Wisconsin Engineering Spreadsheet, Fence Design and Drawings:
http://www.wi.nrcs.usda.gov/technical/eng_spreads.htm

Perimeter Fence - last thing keeping the cattle on LO's property

Interior Fence- another fence will keep cattle on LO's property.

10. Fences

PART I: STANDARD BARBED WIRE FENCE (SBWF)

PART II: HIGH TENSILE PERMANENT ELECTRIC WIRE FENCE (HTPEWF)

PART II: HIGH TENSILE NON-ELECTRIC WIRE FENCE (HTNEWF)

PART III: WOVEN WIRE FENCE (WWF)

PART IV: CHAIN LINK FENCE (CLF)

PART V: BOARD FENCE (BF)



PART II: HIGH TENSILE PERMANENT ELECTRIC WIRE FENCE (HTPEWF) AND HIGH TENSILE NON-ELECTRIC WIRE FENCE (HTNEWF)

1. SCOPE

The work shall consist of furnishing all materials required and installation of the fence at the locations shown on the plans. Part II of this specification applies to high tensile permanent electric wire fence (HTPEWF) and high tensile non-electric wire fence (HTNEWF). Refer to Wisconsin NRCS Field Office Technical Guide, Section IV, Standard 382, Fence, Table 1 for minimum fence height, number of wires, and wire spacing.

High tensile non-electric wire fence (HTNEWF) shall have a minimum of four strands of high tensile smooth wire (interior fence only). The minimum number of wires is dependent on the use of the fence.

High tensile electric wire fence shall have a minimum of one strand of high tensile smooth wire (interior fence only). The minimum number of wires is dependent on the use of the fence.

Barbed wire shall not be used on electric fences because of the safety hazard created by the high capacity energizers needed to charge the heavy gauge wire.

2. MATERIALS

A. Wire.

The wire will be new, smooth, and meet or exceed the following:

- Gauge – 12.5
- Tensile Strength – 140,000 psi (minimum) reduced from previous standard
- Galvanizing – Class 3
- Breaking Strength – 900 lbs. (minimum)
- ASTM A 854, Metallic-Coated Steel Smooth High-Tensile Fence and Trellis Wire
- ASTM A 854, Metallic-Coated Steel Smooth High-Tensile Wire Core with UV-Resistant, White, Electrically Conductive Polymer Coating. horses

B. Fasteners.

- (1) Staples shall be of 9-gauge galvanized steel or heavier with a minimum length of 1.75 inches for softwoods and a minimum length of 1 inch for close-grained hardwoods.
- (2) Manufacturer's clips or 14-gauge Class 3 galvanized wire meeting the appropriate ASTM for the fencing material specified may be used to fasten wires to steel, plastic/composite, or fiberglass posts.

C. Posts.

(1) Wood.

All wooden posts and brace members (except red or white cedar, tamarack, osage orange, or black locust) shall be treated by a method listed in the table below to ensure that complete penetration of the sapwood is obtained. All bark shall be removed from the cedar, osage

Summary - Get The
Connection...

**Use Good
Quality
Products.**



"Until the fence is fixed, we're going to rely on self-discipline."