



Electric Fence Systems

Requirements for Meeting the NCDE Food Storage Special Order

Dave Gasvoda, Project Leader

Since 1995, persons using any portion of the National Forests in the Northern Continental Divide Grizzly Bear Ecosystem (NCDE) have been required to store food, garbage, and other attractants (such as horse feed) in a bear-resistant manner (Special Order No. F10014S95). The area includes wilderness and nonwilderness portions of the Flathead, Lewis and Clark, Lolo, and Helena National Forests south and west of Glacier National Park (see attached map).

Electric fence systems are an acceptable means of meeting the requirement for storage in a bear-resistant manner. Electric fence systems can be used alone or to supplement other forms of bear-resistant storage, such as using bear-resistant containers, or suspending attractants from a support.

Inspection

It is the user's responsibility to operate the system in the field at the required levels. Forest Service employees will inspect electric fences when they are set up in the field.

Fence System Requirements

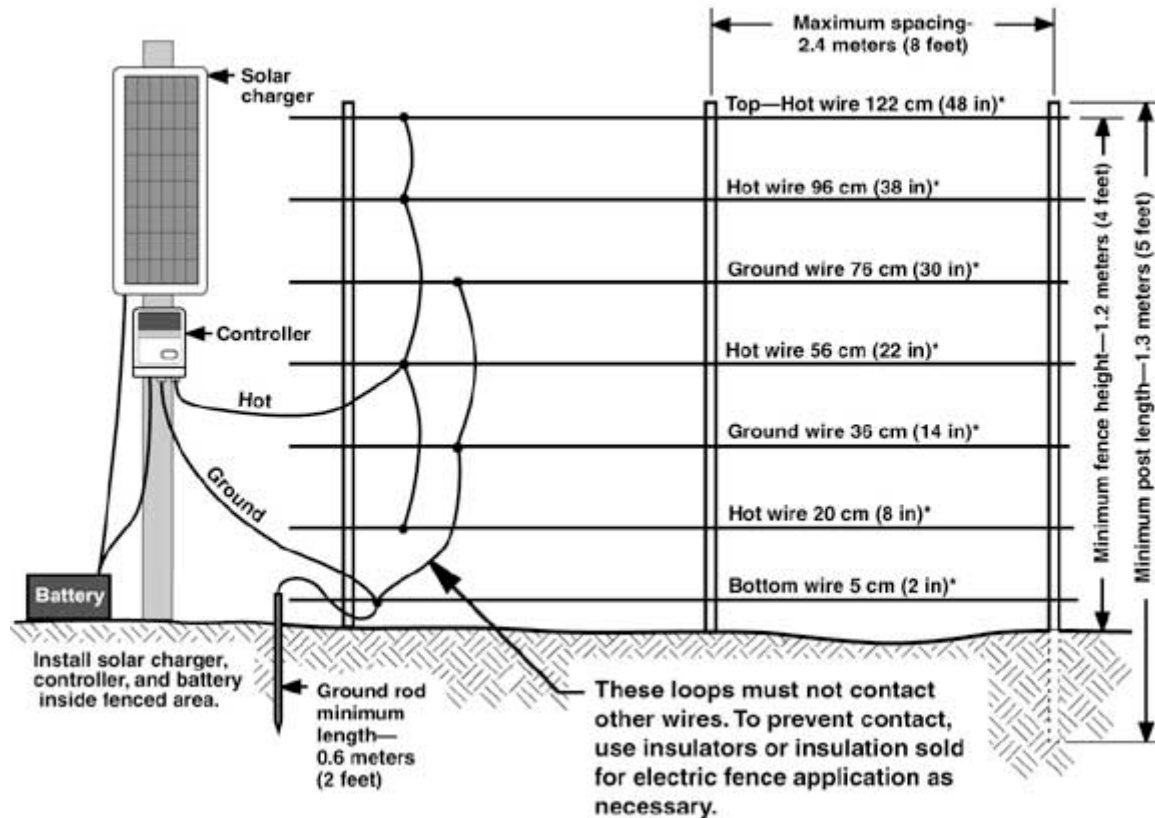
Fence systems must meet the following minimum requirements:

- The minimum height shall be 1.2 meters (4 feet). Posts shall be at least 1.3 meters (5 feet) long and spaced not more than 2.4 meters (8 feet) apart. The fence shall be constructed with seven wires spaced 15 to 25 centimeters (6 to 10 inches) apart as shown in the illustration on page 2. The bottom wire should be no more than 2 inches from the ground and it may touch the ground.
- The conductors (wires) may be either smooth metal fence wire (16 gauge minimum) or Polywire (polyethylene interwoven with at least six strands of stainless steel wire). In order to make the fence more visible, the top wire may be

Polytape (polyethylene ribbon interwoven with at least five strands of stainless steel wire and at least 1.2 centimeters ($\frac{1}{2}$ inch) wide).

- The fence shall be no closer than 1 meter (3 feet) from the items it is protecting.
- A ground wire return fence shall be used. This fence uses alternating hot and ground fence wires. The top two wires are connected to the fence controller's hot terminal. The third wire down connects to the fence controller's ground terminal. The next wire connects to the hot terminal, and so forth. The bottom wire must be a grounded wire and may touch the earth. The ground terminal connects to an earth ground.
- An earth ground shall be constructed using a metal rod 0.6 meters (2 feet) long or longer. The rod should be driven into the earth as deep as practical. Allow a few centimeters (inches) to remain above the ground so the ground lead wire can be attached. The ground rod should be located in a wet spot if one exists.
- Fence conductors (wires) must be under tension, not loose or sagging. Corner supports (posts, trees, etc.) must be sturdy enough to not deflect excessively under the tension. Fiberglass or plastic corner posts may be used, provided that they are adequately braced. All fence wires connected to the hot terminal of the fence controller must be supported using suitable electric fence insulators. Separate insulators are not required on fiberglass or plastic supports.
- The fence controller must be specified by the manufacturer to have a minimum stored energy of 0.7 joules. Its minimum peak output voltage must be specified as being at least 6000 volts.
- The user must have an electric fence tester on site that is capable of displaying voltage measurements from 600 to 5000 volts. Both multiple glow lamp and digital display types are acceptable. The digital display units are likely to be more accurate and easier to read. The inspection testing shall be made using a Forest Service digital meter. It shall be used to determine that the minimum requirements are met.
- Test the fence voltage as far as possible from the fence controller. Connect the meter's ground terminal to one of the fence's ground wires and touch the meter's hot terminal to a hot fence wire. Test each hot wire by touching the meter's hot terminal to the wire. Test each ground wire by connecting the meter's ground terminal to the ground wire being tested while touching the meter's hot terminal to any hot wire.

Each conductor must have a tested minimum of 5000 volts. The voltage must appear at least 40 times a minute.



***Height above ground; distance between wires may vary from 6 to 10 inches.**

Discussion of Requirements

The fence must be high enough that a bear cannot walk or jump over it. The wires must be close enough together so that a bear cannot get its head through without contacting the wires.

The top fence conductor may be high-visibility fence ribbon (Polytape) to decrease the chances of accidental human contact.

A ground wire return fence is effective when the earth is too dry to be a good conductor and make a good electrical connection to the bear's feet. The grounded wires in the fence provide a direct electrical return path to the fence controller's ground terminal. Because the bear must make good contact with two wires to get a shock, the bear may apply considerable force to the fence before the conductors work through the fur and contact its skin. This is why the ground wire return configuration requires strong fence wire and sturdy corner posts. Also, Polywire needs to be pulled tight to prevent sagging that could short hot conductors to ground conductors.

The ground rod provides an electrical circuit using the earth as the return path under wet conditions. A bear will get shocked when it contacts any hot conductor while standing on wet soil.

Grass and weeds should be cut short so most vegetation around the fence perimeter does not contact any hot wires, even in windy conditions. Wet vegetation conducts some of the electric

current to ground and will decrease the shock delivered to a bear. Fences that contact wet vegetation are unlikely to produce the 5000 volts required by the inspection test.

Choosing an Electric Fence Controller

Manufacturers refer to fence controllers as "energizers," "chargers," and "fencers." It is difficult to compare the controllers from different manufacturers because specifications have not been standardized. The controllers being marketed for pet control are not likely to be suitable.

Gallagher Model B50 (which has been superseded by Model B75) and Model B150 have been used successfully for bear fences by the Montana Department of Fish, Wildlife & Parks.

Other models stated by their manufacturers to meet the 6000 volt and 0.7 joule specifications are:

Bear Fence Models that Manufacturers Claim Meet the 6000 volt and 0.7 joule specifications	
Fi-Shock	Model SS-7000
Parmak	Model MAG.-12 SP
Red Snap'r	Model LIB-15
Speed-Rite	Model SB 1000 Model SB 1500 Model SB 5000

Manufacturers whose literature does not specify stored energy in joules must specify in writing the models that meet the minimum stored energy requirement of 0.7 joules.

Very high energy controllers are not recommended because they are expensive, large, and heavy, especially when the battery requirements are considered. They can deliver a nasty or perhaps even fatal shock to humans who might accidentally contact the fence.

Solar-powered fence controllers are recommended for most installations. The battery life for most non-solar powered controllers depends on the capacity of the battery and the power used by the fence controller. Solar panels will usually eliminate the need to charge or replace batteries, allowing smaller, lighter batteries to be used.

A solar-powered unit should be located so it will be in direct sunlight most of the day.

Choosing a Fence Tester

Two types of suitable electric fence testers are available. The least expensive types use five to eight glow lamps that progressively light for increasing voltage. They can not be read in direct sunlight.

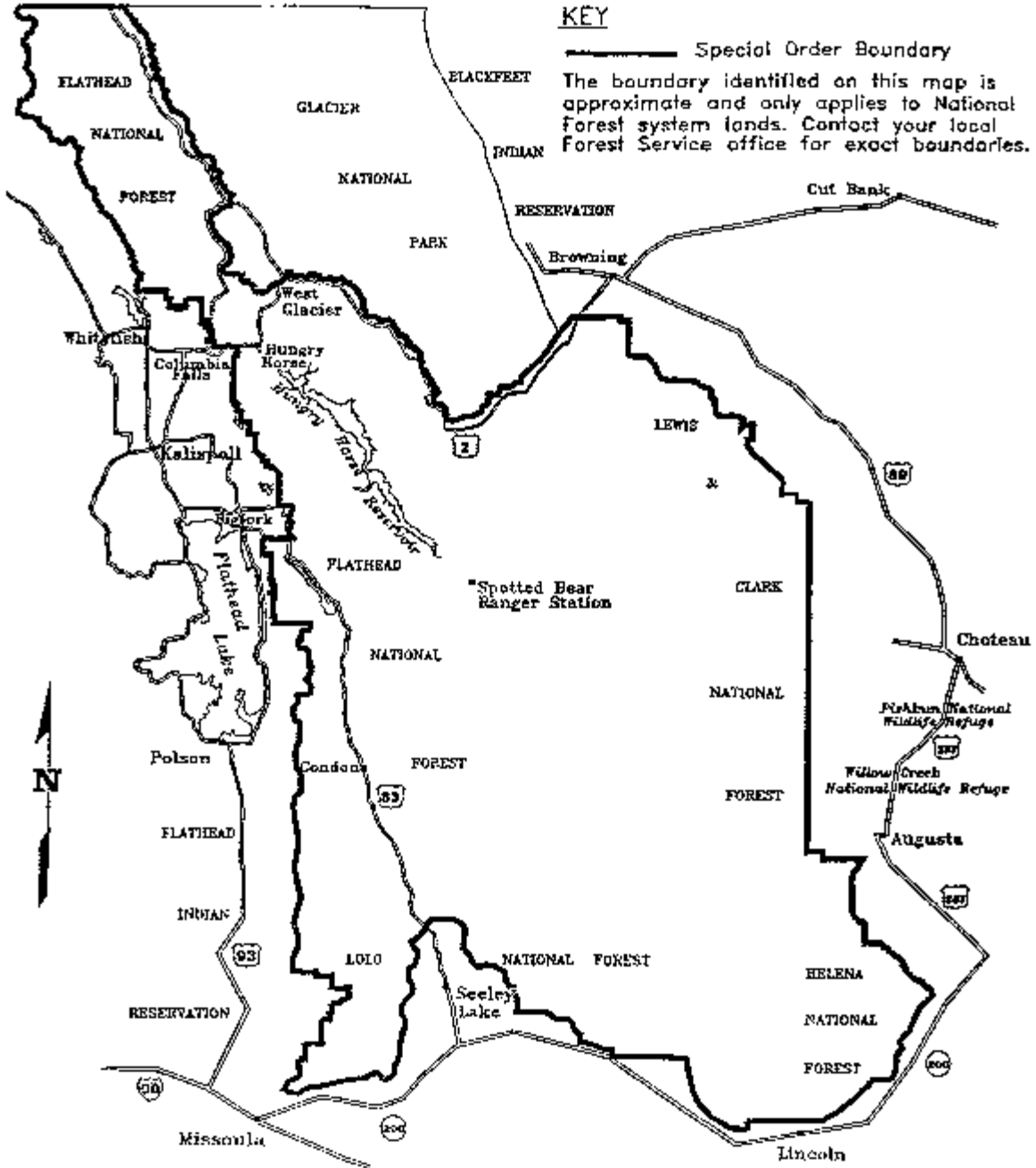
Digital volt meters are more expensive, but are considerably more accurate and are easy to read. Some digital meters are considerably better than others. Units that are polarity sensitive are not recommended. These require that the meter leads be reversed to obtain an accurate reading with some fence controllers. Therefore, the ground lead must be connected to the hot fence wire. This is awkward and greatly increases the chances of the operator being shocked.

The Gallagher Model G503 Digital Volt Meter is recommended for use by Forest Service personnel when they inspect the bear fences.

Summary of Fence Specifications

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Minimum fence height	4 feet
Minimum post length	5 feet
Maximum spacing between posts	8 feet
Conductors must be: <ul style="list-style-type: none">○ Smooth metal fence wire (16 gauge minimum) or Polywire (at least six strands of stainless steel wire)○ For visibility, the top conductor may be Polytape (at least five strands of stainless steel wire, at least ½-inch wide)	
Minimum distance between fence and items inside	3 feet
Ground wire return fence must be used (alternating hot and ground wires)	
Minimum length ground rod (earth ground mandatory)	2 feet
Minimum stored energy of the fence controller	0.7 joules
Minimum tested peak output voltage on every conductor	5000 volts
Minimum shocks per minute	40
Minimum number of wires	7
Distance between wires	6 to 10 inches

Special Order - Food Storage
Northern Continental Divide Grizzly Bear Ecosystem
Northern Region - Flathead, Lewis & Clark, Lolo and Helena National Forests



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Additional single copies of this document may be ordered from:

USDA Forest Service
Missoula Technology and Development Center
5785 Highway 10 West
Missoula, MT 59808
Phone: (406) 329-3900
Fax: (406) 329-3719
E-mail: wo_mtdc_pubs@fs.fed.us