

NATURAL RESOURCES CONSERVATION SERVICE

CONSTRUCTION SPECIFICATION

382B - FENCE – HIGH TENSILE SMOOTH AND COATED WIRE AND BRAIDED
ELECTRIFIED ROPE

1. SCOPE

This work shall consist of furnishing and installing permanent electric and non-electric high tensile smooth wire fences and braided electrified rope including related essential components. The installation of complete high tensile smooth wire and/or braided rope fence systems in strict accordance to a single manufacturer's recommendations may be acceptable, but is subject to the approval of the NRCS State Grazinglands Specialist in advance of any commencement of work including material purchase and delivery. Electric and non-electric fences are constructed similarly with the exception that electric fences have insulators between the wire and all conductive materials. Braided electrified rope may be used to increase the visibility of the fence. One or more wires can be replaced with braided rope.

2. MATERIALS

Unless otherwise shown on the drawings or specified in Section 11 materials for high tensile or braided rope fencing shall conform to the following requirements:

Wire

Wire used for animal control shall be new, smooth or coated, Class III galvanized wire with a minimum of 14 gauge, or new braided electrified rope with a minimum warranty of 20 years. For all materials, the minimum material breaking strength will be 1000 pounds.

For electrified fences, the wire used as a lead-out from the energizer to the charged strands of fence, the grounding system, or used to pass electric pulses underneath gate openings or over stream crossings shall be insulated 12-1/2 gauge wire rated a minimum of 20,000 volts

Note: Wire used for residential and commercial electric applications does have the adequate amount of insulation for use with fence energizers

Insulators

The insulators shall be high density porcelain, ultra-violet light resistant high density molded plastic, or flexible tube type insulators labeled for electric fence applications.

Fasteners

The staples shall be; Class III galvanized, slash cut point, minimum of 9 gauge wire staples. When used for fastening to hardwoods, staples will have a minimum length of 1¼ inches. For softwood posts, staples must have barbs and have a minimum length of 1½ inches.

Where preservative pressure treated wood (0.40 lbs. /cubic foot CCA or equivalent non-CCA treatment) is used, the fasteners shall be either hot-dipped galvanized, stainless steel, or other material recommended by the hardware manufacturer.

For steel, fiberglass and composite posts the fasteners shall be a minimum of 16 gauge galvanized wire. If fence is electrified the fastener will be wrapped around the insulator on both sides of the post.

Posts

All brace, corner, and gate posts - shall be black locust, larch, red or white cedar, preservative pressure treated softwood (0.40 lbs./cubic foot CCA or equivalent non-CCA treatment)*. In mineral soils, post diameter shall be a minimum of 5 inches for hardwood and 7 inches for softwood, square post shall be a minimum of 5-1/2 inches in both directions. The length of the post shall be a minimum of 7-1/2 feet. In organic soils, contact the State Grazinglands Specialist. Wood posts shall be structurally sound, predominantly straight throughout their length, with all limbs trimmed flush with the body of the post.

Line posts - shall be black locust, larch, red or white cedar, preservative pressure treated wood (0.40 lbs./cubic foot CCA or equivalent non-CCA treatment)*, galvanized steel "T" or "U" posts, fiberglass or composite posts, or other material of equivalent longevity and strength. In mineral soils wooden line posts diameter shall be a minimum of 3-1/2 inches, square post shall be a minimum of 3-1/2 in both directions. The minimum length shall be 5-1/2 feet. In organic soils, contact the State Grazinglands Specialist. All steel, fiberglass or composite line posts shall have a minimum length of 5-1/2 feet, fiberglass or composite "T" posts shall have a minimum width of 1.2 inches, and round posts a minimum of 3/4 inch diameter. When steel posts are used, they shall be 1.3 pounds per foot of length.

Landscaping lumber is not acceptable wood.

Brace rails - shall be a minimum 4 inches in diameter for hardwood and 5 inches for other softwood. Square rails with the equivalent cross section may be used. Length of brace rails shall be a minimum of 8 feet long with a maximum of 10 feet long where horizontal and a minimum of 10 feet long where diagonal.

Landscaping lumber is not acceptable wood.

*Organically certified operations will need to check with certifying organizations on acceptable treatment materials and location of use before selecting treated wood posts.

Battens

Battens shall be a minimum of 3 feet in length shall be attached vertically to all strands of wire and/or rope. They shall be naturally decay resistant hardwood, plastic or composite 1 to 1½ inches in width and 1 inch in thickness, fiberglass or composite notch "T" posts of 5/8 inch minimum width and round posts of 1/2 inch minimum diameter.

Gates

Gates shall be the types, sizes, and quality needed to achieve the level of animal control required. All hardware necessary for the proper functioning of the gate shall be included. Gate and associated hardware shall be installed according to the manufacturer's recommendations.

Energizers (Fence chargers)

For electrified fences, the energizers shall be manufactured fence energizers, which are safety approved by U.S. Bureau of Standards, Underwriters Laboratories (UL), or other international standards with approvals printed on the energizer name plate.

Fence energizers may be powered by 115/230V alternating current, direct current battery. Solar panels may be a component of the fence charger. Where solar panels are relied upon, the actual output of the photo-voltaic panel must be sufficient to adequately recharge battery(s) and power energizer for the average solar radiation received at the site of use.

Energizers shall be capable of producing the minimum electrical output required under normally expected conditions consistent with the kind and class of animal, the type and amount of fencing, and any other considerations significantly affecting animal control.

Grounding Rods (electrodes)

For electrified fences, electrodes shall be ½ inch galvanized steel or copper rod or UL approved ground rod with a minimum length of 6 feet.

Note: Follow the energizer manufacturer’s specification for the number of rods needed and their spacing.

3. SETTING POSTS AND BATTENS

Spacing

Posts and battens shall be spaced according to Table 1 below. Topographic features of the site may dictate closer spacing and will be specified in Section 11.

Table 1 - Maximum Spacing of Fence Posts for High-Tensile Wire and Braided Electrified Rope Fence

Number of Wires	Maximum Line Post Spacing (feet)		Maximum Batten Spacing (feet)
	with Battens	without Battens	
1	-	75	-
2	150	75	75
3	150	50	50
4	150	50	50
5	150	50	50
10	66	33	33

Method of Installation

In mineral soils, the minimum depth of corner, gate, and end assembly posts will be 3½ feet. Line posts shall be 1½ feet deep. In situation where post are not able to have the minimum depth or in organic soils, contact the State Grazinglands Specialist. When posts are driven, the top of the post shall be protected from splitting by applying driving pressure uniformly over the entire post end area. Posts that are damaged during driving shall be removed from the fence and replaced.

Where posts are set in hand-dug or augured holes:

- Postholes shall be at least 6 inches larger than the diameter or side dimensions of the posts.
- Earth backfill around the posts shall be thoroughly tamped in layers not thicker than 4 inches and backfill shall be tamped firm to the ground surface. When concrete is used backfill around the posts shall be rodded into place in layers not thicker than 12 inches and shall completely fill the posthole to the ground surface. Backfill, either earth or concrete, shall be crowned up around the posts to 2 inches above the ground surface.
- No stress shall be applied to posts set in concrete until at least 24 hours after the concrete has set. Posts for gates shall be allowed to set for at least 48 hours.

4. BRACE ASSEMBLIES

In mineral soils a single brace assembly - 'H' brace - may be used with 6 or fewer strands of wire or rope on corners, gates, ends, changes in topography and at watercourse crossings. Single corner posts with a diagonal brace may be used for 2 or less strands of wire or rope provided posts are set by power post driver and installed with a 3-4 inch lean away from the resultant pull of wires. A double brace assembly shall be used in similar instances with fences where more than 6 strands of wire are used. In organic soils contact the State Grazinglands Specialist.

Line brace assemblies shall be installed at intervals of not more than 700 feet on continuous straight reaches. If double braces are used at corners or ends, a line brace assembly shall be installed at intervals of not more than 1300 feet on continuous straight reaches.

Where the fence line changes horizontal direction greater than 10 degrees, vertically greater than 20 degrees, and on both sides of a stream crossing, brace assemblies shall be installed.

Additional instances needing brace assemblies will be specified in Section 11.

5. ATTACHING WIRE TO POSTS

The wire shall be attached and tensioned to posts as follows:

- a. Wire shall be placed on the side of the post of which the fence is designed to contain livestock or opposite the area being excluded from animals. In either case the wire or rope shall be on the outside of corners and curves in the fence unless swing corners are used. Swing corners are insulators that are tied to the corner post on the inside of the corner, typically used with braided rope.
- b. The wire shall be fastened to the post with staples or other appropriate fasteners. Insulators shall be used for all electrified wires or rope at every contact point with posts, brace rails, and tensioning wires, except where posts and/or rails are of a non-conductive material.
- c. Wires shall be terminated or spliced by using manufactured devices labeled for those specific high-tensile applications or twisting the wires together.

- d. Staples shall be driven diagonally to the grain of the wood and shall be driven so the wire is free to slide behind the staples. Staples shall be driven into posts at an upward angle in depressions and at a downward angle on knolls and on level ground.
- e. Where wire is used as the fastener, the wire shall be wrapped around the opposite side of the posts from the fence wire and twisted around the fence wire a minimum of one full turn on both sides of the post. Where insulator tubes are used the fastener wire shall be twisted around the tube.
- f. Each wire shall have one permanent in-line wire strainer to maintain correct tension; every 4,000 feet for straight line fence stretches, every 2,500 feet for fences with one corner, and every 1,200 feet in uneven terrain with several dips and rises or non-linear reaches. Tension indicator springs are optional, but may be most beneficial in reaches under 700 feet. In-line strainers shall be placed at the center of the spans of fence being tightened.

Where there is a gate(s) between the energizer and other portions of the fence, electrical pulses shall be carried across the opening by burrowing an insulated wire inserted through a protective sleeve of 1/2 inch diameter plastic pipe.

6. FENCING AT DEPRESSIONS

Where fencing is installed through a depression, the line posts and/or battens subject to upward pull shall be anchored by means of extra embedment or by special anchors labeled for such applications, or as detailed on the site specific drawings.

Where the fence is installed with the top wire straight across a depression, extra length posts shall be used to allow normal post embedment. Unless otherwise specified, extra space between the bottom of the fence and ground shall be closed with extra strands of wire properly anchored.

7. FENCING ACROSS WATERCOURSES

Where the fence crosses small watercourses, end the main fence at the top of the streambank on each side with an appropriate end assembly. From separate posts driven next to end posts, construct a separate section of fence across the watercourse that shall be manually or automatically de-energized during high flow or flooding conditions. The only tie between the main fence and the section spanning the watercourse shall be a single electrical connection. In addition, an insulated overhead or underground cable shall be erected to maintain electrical continuity with the fence on the other side of the watercourse. For fence systems where a breakaway fence is required, an energy limiter (floodgate controller) shall be installed.

Where the fence crosses large watercourses or areas prone to frequent flooding capable of carrying debris which could significantly damage the fence, special provisions, such as a breakaway fence or laying the wire on the ground will be made as shown on the site specific drawings or specified in Section 11.

8. ELECTRICAL CONNECTIONS

All junctions of conductors normally intended to pass electric pulses shall have reliable, mechanically solid, and low resistance electrical connections.

9. GROUNDING

Energizers shall be properly grounded and protected from lightning strikes coming through the fence. Where the energizer is powered from an alternating current power source, it shall also be protected on the power side according to the manufacturer's installation instructions.

Grounding electrodes shall be installed according to manufacturer's recommendations. Additionally, grounding of the energizer shall be at least 50 feet from all other grounding systems, well casings, and other underground metal pipelines.

Under no circumstances shall more than one energizer charge the wires of the same fence.

The electrodes shall be free of any corrosion.

10. WARNING SIGNS

Signs warning of the potential for electric shock shall be no farther apart than every 200 linear feet along reaches of fence adjacent to public transportation corridors, property boundaries, internal right-of-ways/easements, gates, and any other sites the public is likely to first encounter the fence. Check with State and Local governments for additional requirements.

11. PROJECT WORK ITEMS TO BE PERFORMED IN CONFORMANCE WITH THIS SPECIFICATION AND ADDITIONAL CONSTRUCTION DETAILS ARE: