

## FENCE SPECIFICATIONS

### NATURAL RESOURCES CONSERVATION SERVICE

The materials used in construction and installation of fences must be in accordance with and meet or exceed, in size, strength, durability and lifespan, the requirements listed in this specification.

#### FENCE PLACEMENT

For all domestic livestock, install and/or maintain fences in areas that will best facilitate the grazing land resource management, handling, nutritional supplementation, watering, and movement of the type of livestock managed. Locate fences to facilitate management of different adjacent land-uses, and to separate special management areas within land-uses. Special management areas include ecological sites, pasture types, grazing management units, alleys, riparian areas, and critically eroding areas. Where applicable, right-of-way may need to be established for the facilitation of fence installation and maintenance. Consider fencing along the contour to minimize livestock trailing and subsequent erosion.

#### BARBED WIRE AND NET WIRE FENCE – GENERAL MATERIAL AND INSTALLATION CRITERIA

All wire shall have Class III galvanized coating **except** for 12 ½ gauge barb wire. 12 ½ gauge barb wire can be Class I **or** Class III.

1. Staples - Use at least 9 gauge galvanized staples which are at least 1 ½ inches long for softwoods (pine) and 1 inch for hardwoods (Red cedar, oak, mulberry, catalpa, black locust, and bois-d-‘arc). Drive staple(s) diagonally, so wire can slip with the wood grain and at an angle which allows staple to open.
2. Line Posts - Shall have a minimum length of 6 ft. ; be set approximately 15 inches in the ground and spaced not more than 20 ft. apart without stays and 30 ft. apart with 2 or more stays spaced 8 ft. apart.
  - a. Untreated wood (Red cedar, bois-d-‘arc, mulberry, catalpa or black locust) having a minimum top diameter of 3-1/2 inches.
  - b. Pressure treated wood (Pine most commonly available) with a minimum top diameter of 2-½ inches. Wood preservation treatment shall be in accordance with Federal Specifications No. TT-W-571i (.4 retention).
  - c. Metal - Standard T or U section steel post (1.25 lbs/ft) 6 ft. long or equivalent metal rod or pipe.
3. Corner, End/Gate Post and H-Brace Post
  - a. Wood - A minimum of 6 inch top diameter of treated timber or durable wood listed above for upright post and 4 inch for cross post. **Landscape timbers are not allowed.**
  - b. Metal - Minimum 2-3/8 inch metal pipe or equivalent. At least (1) 80 lbs. bag of concrete should be used in each 12 inch post hole to secure brace assembly. Metal cross post must be a minimum of 2 inches in diameter.
  - c. All brace post assemblies shall have a minimum of two (2) posts in line to provide a suitable anchor for the fence. They shall be spaced at a maximum of 1320 ft. or at corners and points of any change in direction or extreme changes in slope. An 8% or greater slope is considered an extreme change in slope. Any change of direction will require a 3 upright post brace assembly (Figure 1).
  - d. Placement of the horizontal cross-member should be in the upper 1/3 of the upright post and no higher than 6 inches from the top of the post.

- e. Wood posts used for horizontal cross-members will be straight and free of splintering. If the brace post and anchor post are notched, the notch will not be more than 1 inch to achieve a secure fit. The horizontal cross-member must be attached using screws, nails, or steel dowel pin (drilled to fit, and at least 2 inches into each post).
  - f. H-Brace Post - Minimum of 8 ft. in length must be set approximately 3 ft. in the ground, spaced 6 ft. apart.
4. Trees or in-service utility poles **shall not be used** as corner posts or line posts in fence
  5. Any metal pipes used must be permanently capped to exclude rainwater and all metal components used must be painted with a durable permanent rust resistant coating or be galvanized; components will be repainted if rusting occurs.
  6. Allow newly installed braces and assemblies to settle and/or pack dirt sufficiently around all post; do not over-tighten wires. Do not allow fill dirt to contact wire.
  7. Wire clips or fasteners must be galvanized and similar to strength of fence wire.
  8. Boundary and exclusion fences shall be constructed so that the wire is on the side of the post facing the animals to be controlled. Wire may be on either side of the post when cross fencing.
  9. Diagonal crosswire in brace shall be looped and tied back to itself. The free end of the diagonal crosswire will pass through this loop and be tied back to itself.
  10. Fence wires will be brought back around the brace post and securely tied back to itself.
  11. All barbed wire fences except woven (net) should have a bottom wire set a minimum of 14" above ground with middle two wires set at 10-14" intervals, and top wire set at not less than 48" above ground.
  12. A woven (net) barbed wire fence should have a minimum 32" woven (net) wire set at ground level with one strand of 12 ½ gauge barbed wire or equivalent set 3" above the woven wire, and another strand of 12 ½ gauge barbed wire or equivalent set 10" above the first barbed wire, or 35" woven (net) wire set at ground level with one 12 ½ gauge barbed wire or equivalent set 10" above the net wire. For sheep and goats alone, 39-48" net wire set at ground level will suffice.
  13. On a barbed suspension fence, twisted wire stays must be installed at not more than 20 foot intervals between line posts. All stays should swing free of the ground to permit the fence to sway when contacted by animals. Suspension fences shall not be constructed on a curve. Directional changes in the line shall be by definite angles and properly braced. Suspension fences should be constructed with approximately a 3 inch sag in the wire between posts to permit maximum sway of the fence.
  14. On fences without stay post, line posts must be set at significant high and low points along fence to maintain proper wire height.
  15. NRCS conservationist must certify variations that meet or exceed this standard.

#### **ELECTRIC FENCING GENERAL MATERIAL AND INSTALLATION CRITERIA**

Livestock that has not been controlled by electric fence in the past or if the history is unknown, a training period is required. Livestock must be introduced to electric fencing in a designated training pasture, pen, trap, or other area. Select a well fenced area and construct a fully charged electric fence across or around the area to allow animals to come in contact with the electric fence. Normally, a minimum of 12 - 24 hours continuous exposure to the functioning electric fence is required. Most animals will be trained in 48 – 72 hours. Livestock to be controlled by electric fencing must never be allowed to come into contact with non-electrified electric fence wire, gates, and other components that are normally electrified.

## Energizers and Components

1. Energizers for permanent electric fences should be high voltage/low impedance short pulse which can produce at least 4000 volts output, with all livestock containment fences charged (on) when under maximum anticipated load.
  - a. Recommended one DIGITAL read out volt meter to be accompanied with energizer.
  - b. For 110 volt or 220 volt energizers, install a voltage spike/surge protector to protect energizer from power surges from the energizer plug.
2. Grounding - A minimum of three (1/2 inch diameter) 6 ft. long galvanized steel rods will be installed near energizer spaced at 10 ft. intervals. Avoid mixing dissimilar materials to prevent electrolysis (so not use copper components). For large energizer systems (14 or more joules), use a minimum of 3 additional feet of ground rods per joule of energizer output capacity.
3. Lightning arrestor or lightning choke will be required (See Figure 2). Install an additional set of four 6 ft. ground rods for arresting the lightning. Locate rods 65 ft. away from ground rods set for the energizer. These rods will also be spaced 10 ft. apart. Energizer manufacturer's requirements for lightning protection must be met or exceeded.

## Wire Requirements

1. Galvanized – 12 ½ gauge high tensile steel wire with Class III galvanized coating. Minimum strength for 3 or more wires should be 170,000 PSI or greater and 130,000 PSI minimum strength for 1 or 2 wires.
2. Wires attached to line post must be allowed to slip and be locked to stay post if applicable.
3. For splicing high tensile strength wire, use only the equivalent of crimping sleeves, figure eight knots or thread through knot. All electrical connections (both ground and positive) must use the equivalent of crimping sleeves or galvanized joint clamps.
4. Underground wire - All underground wire(s) must be insulated, molded, high tensile strength steel 12-1/2 gauge or larger wire. The insulation must be high density polyethylene or polypropylene with ultraviolet (UV) stabilizer and capable of withstanding a minimum of 10,000 volts. Underground wire must be approved by manufacturer for direct burial. Wire must be buried at least 18" below normal ground level. Underground wire should be placed in a ½" or larger PVC pipe when underground wire is installed in a high traffic area.

## Posts

1. Line Post - Maximum line post spacing with 2 or more stays will be 150 ft. apart. The maximum line post spacing without stays will be 100 ft.
  - a. Fiberglass sucker rods of no less than 3/8 inch diameter can be used on 1 and 2 wire fences. Fiberglass sucker rods must be at least ¾ inch in diameter on fences more than 2 wires.
  - b. Fiberglass T-post must be new and at least 1 inch in cross-section for fences with more than 2 wires. Steel T-post and other conductive material post can be used ONLY if polyethylene or polypropylene with ultraviolet (UV) stabilizer insulator is used.
  - c. PVC post can be used as stays if material is UV treated. PVC stays must be at least ½ inch in diameter.
  - d. Pull post or pull post assemblies for electric permanent fence shall be spaced no more than ½ miles apart on undulating terrain. On flat terrain, spacing may be increased to end of spool (normally 2000 or 4000 ft.).
2. Corner and End/Gate Post
  - a. Minimum post length will be determined by the number of wires used. The length of the post should be 36" (below ground) plus 6" above the height of the top wire (Example: a two wire fence with the top wire set at 30"; the minimum post length will be 72" or 6 ft.).

- b. Braces for electric fences with two wires or less can use a Bed Log Brace (Figure 2). A Bed Log Brace shall consist of a wood (pressured treated or durable wood) post with minimum top diameter of 4" set 3 ft. below ground or steel post with minimum 2 3/8 inch diameter, capped, set 3 ft. below ground. The bed log shall set a minimum of 3' below ground, be 4 ft. long and a minimum of 3" in diameter. Bed logs will have a minimum treatment of (0.40) or be made of a durable wood.
- c. Wood - (Pressure treated or durable wood) Single pole post are for low tension applications only. A single wood post can be used on fences 2 wires or less. Post will have a minimum top diameter of 6 inches and be set firmly in concrete, 3 ft. in the ground. At least (1) 80 lbs. bag of concrete is to be used in each 12 inch post hole to secure brace assembly.
- d. Metal – Single pole post are for low tension applications only. A single steel pipe can be used on fences 2 wires or less. Minimum of 2-3/8 inch steel pipe or equivalent, capped, set 3 ft. in ground in concrete. At least 1 80 lbs. bag of concrete should be used in each 12 inch posthole to secure brace assembly.
- e. For 3 or more wire fences or when heavy duty gates will be installed, a minimum of two (2) posts in line will be installed to provide a suitable anchor for the fence. Post will have a minimum top diameter of 6 inches, 8 ft. in length, and be set firmly 3 ft. in the ground. Cross post will be minimum 4 inch (See Figure 1 for Corner and End/Gate Brace Post).
- f. Allow newly installed braces and assemblies to settle and/or pack dirt sufficiently around all posts, do not over-tighten wires.
- g. Metal pipes must be permanently capped to exclude rainwater and all metal components used must be painted with a durable permanent rust resistant coating or be galvanized; components will be repainted if rusting occurs.

### **Electrical Accessories**

1. Insulators - Any plastic or porcelain insulators used in the installation of permanent electric fences shall be capable of withstanding a minimum of 10,000 volts. Any plastic insulators used will be ultra-violet (UV) treated.
2. Warning signs - Electric fence warning signs are recommend every 300 ft. on exterior fences. Warning signs are also recommended to be posted around barns, troughs, and other facilities as specified by any local, state, and/or federal laws or regulations.
3. Gate handles, switches, and other hardware used to conduct current must be galvanized or use aluminum components.
4. NRCS Conservationist must certify variations that meet or exceed this fencing practice standard.

### **Floating Electric Fence**

Livestock access ramps into ponds shall be fenced to provide controlled and contained access. In lieu of a permanent fence, a floating electric fence can be constructed.

Width will be according to design for livestock water access ramp, as specified in the Animal Trails and Walkways (575) general specifications. Distance into water will be adequate to assure water availability regardless of fluctuating levels.

The floating fence will be constructed of 2-4 inch plastic pipe. All elbows, fittings and ends will be sealed to prevent water from getting into the pipe. The floating frame will be attached to the anchor post using a rope with slack to allow for movement of frame. Guide posts shall be either fiberglass or steel, a minimum of 2 inches in diameter. Steel "T" posts can also be used and will need a plastic pipe sleeve placed over it. Posts shall be set a minimum of 2 feet into ground. Heights shall be equal or greater than height of vertical wire supports.

Vertical wire supports shall be of same size and material as floating frame and will be capped. Height will be 3 feet above waterline. Spacing will be sufficient to maintain fence height without sagging. Wire will be attached to vertical supports with insulators or brackets at a minimum height of 2 feet waterline.

Floating fence will be regularly inspected for needed repairs. Debris may need to be removed and materials replaced. Inspect pipe for leaks or other damage that may interfere with normal operation.

### **HORSES**

When planning or installing fencing for use with horses, avoid the use of barbed wire and steel Tee (T) posts when possible. Substitute 12 ½ gauge smooth wire with minimum Type III galvanization for barbed wire. Consider capping exposed ends of steel T- post if use is desired. Do this in order to minimize potential injury, especially when areas of confinement are small.

### **GOATS AND SHEEP**

When using net wire, especially with horned goats and sheep, use wire that has large enough openings or spacing in between squares to allow animals that stick their heads through the fence when browsing or grazing, the opportunity to free themselves. Vertically oriented wires or stay wires should have a minimum spacing of 12 inches.

When cattle are grazed in addition to sheep and/or goats, use one barbed wire above the top wire or above 39 inch net, with approximately 10 inch spacing between top two wires

### **WILDLIFE CONSIDERATIONS**

Consider wildlife movement needs when locating fences. Where white-tailed deer range, and the height of fence is less than 48 inches, space the top two wires a minimum of 10 inches apart to reduce the hazard of deer getting tangled in the fence. However, if 47 inch or higher, net wire is used, consider not using another wire above the net wire. If another top wire is used consider keeping the spacing between the top strand of net wire and the top wire(s) to about one inch.

On a malleable wire woven fence the bottom section shall be constructed of at least 48" woven wire, 11 gauge or larger top and bottom strands, 12 ½ gauge or larger intermediate and stay wires, and stay wires spaced no more than 6 inches. The top section shall be constructed of at least 35" woven wire and made of 11 gauge or larger top and bottom strands, 14 ½ gauge or larger intermediate and stay wires spaced no more than 12 inches.

On woven fence made with high tensile wire, top and bottom strands may be 12 1/2 gauge or larger and intermediate and stay wires must be made of 14 1/2 gauge or larger.

Fence Construction Check Sheet (Non-Electric)

Landowner: \_\_\_\_\_ Tract No: \_\_\_\_\_ By: \_\_\_\_\_
Field No: \_\_\_\_\_ Fence No: \_\_\_\_\_ Length: \_\_\_\_\_ Date: \_\_\_\_\_
Planned Installed

Table with columns for Item, Unit, Minimum, Planned, and Installed. Rows include sections for Wire (Barbed and Net), Corner/End/Gate/H-Brace Posts, and Line Posts (Wood and Steel).

(1) Certificate required for treated posts and metal pipe must be permanently capped and painted or galvanized.

All gates used must meet or exceed standard for type of fence constructed.

Vicinity Map/Diagram: \_\_\_\_\_ Remarks: \_\_\_\_\_

This practice meets or exceeds USDA/NRCS specifications:

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Fence Construction Check Sheet (Electric)

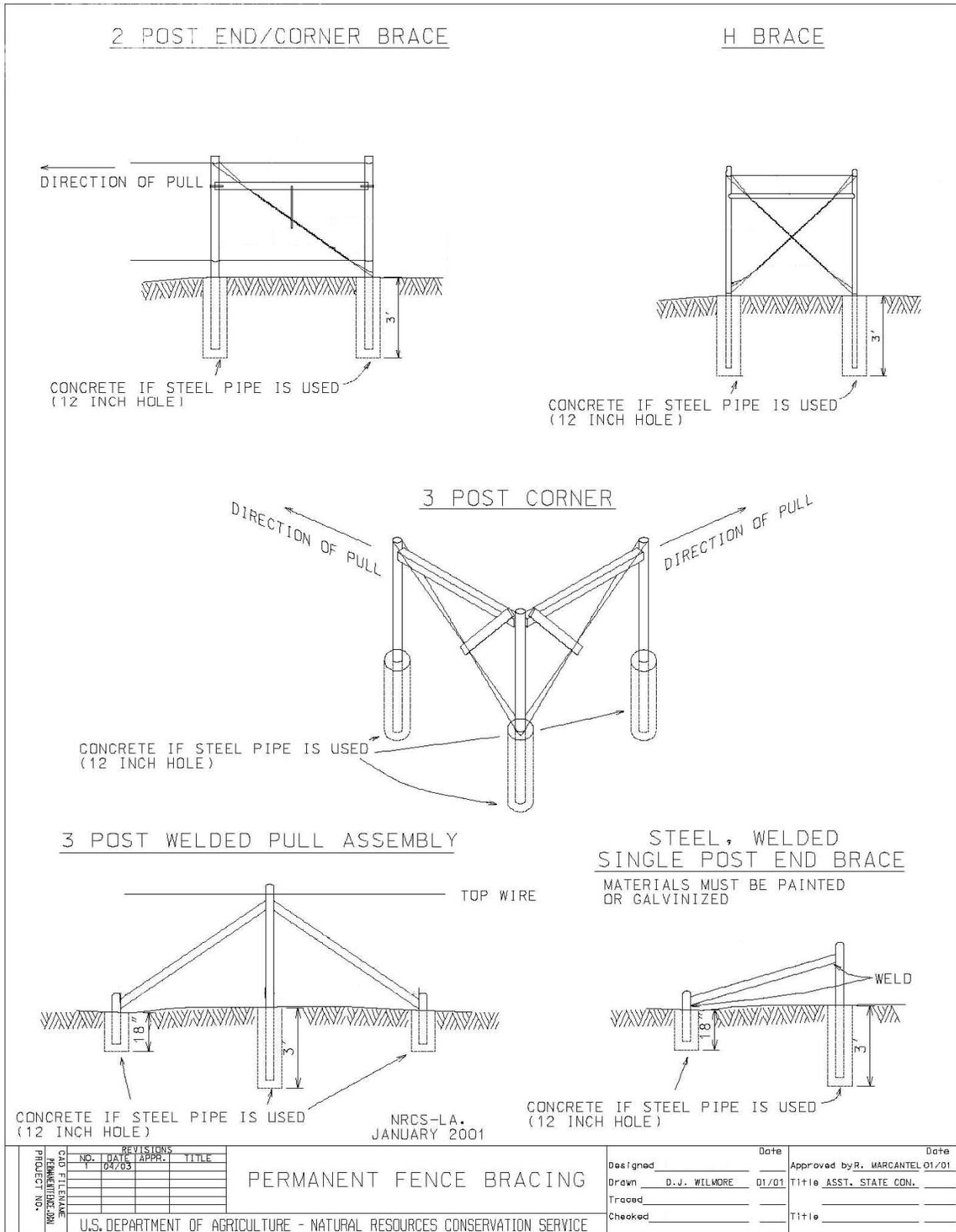
Landowner: \_\_\_\_\_ Planned \_\_\_\_\_ Installed \_\_\_\_\_
Field No: \_\_\_\_\_ Tract No: \_\_\_\_\_ By: \_\_\_\_\_
Fence No. \_\_\_\_\_ Length: \_\_\_\_\_ Date: \_\_\_\_\_

Table with columns: Unit, Minimum, Total Footage, Gauge, Number, Inches, Material, Feet, Pounds. Rows include sections I. Wire, II. Brace Assemblies, III. Line Posts, IV. Accessories, and V. Power Unit.

V. Power Unit
A. The energizer selected must be high voltage/low impedance, short pulse which can produce at least 4000 volts Output with all livestock containment fences charged (on) when under maximum anticipated load.
(1) Certificate required for treated posts and metal pipe must be permanently capped and painted or galvanized.
Vicinity \_\_\_\_\_
Map/Diagram \_\_\_\_\_

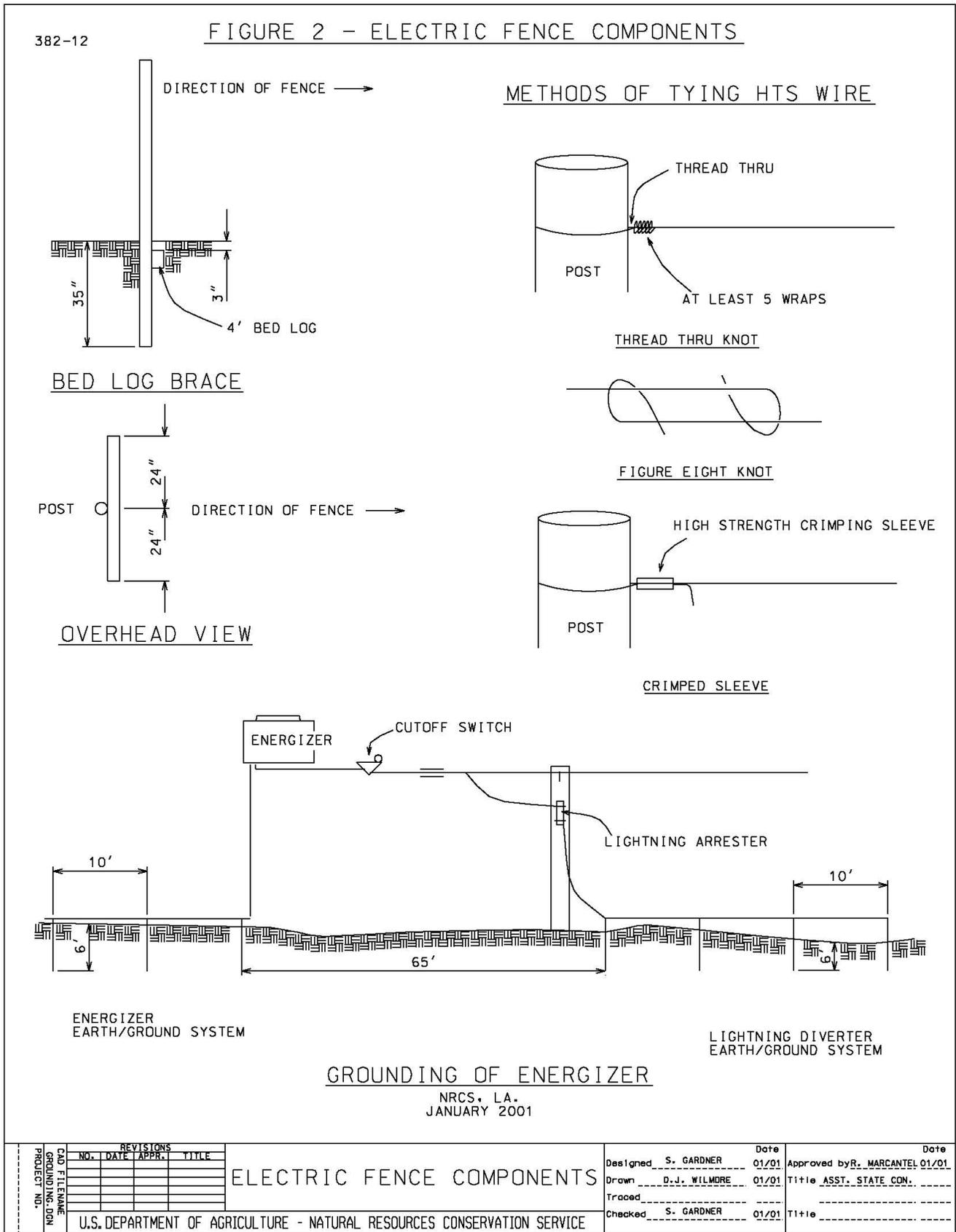
This practice meets or exceeds USDA/NRCS specifications:
Signature: \_\_\_\_\_ Date: \_\_\_\_\_

FIGURE 1



..FENCES\PERMANENT\FENCE.dgn 4/4/2003 10:35:42 AM

FIGURE 2



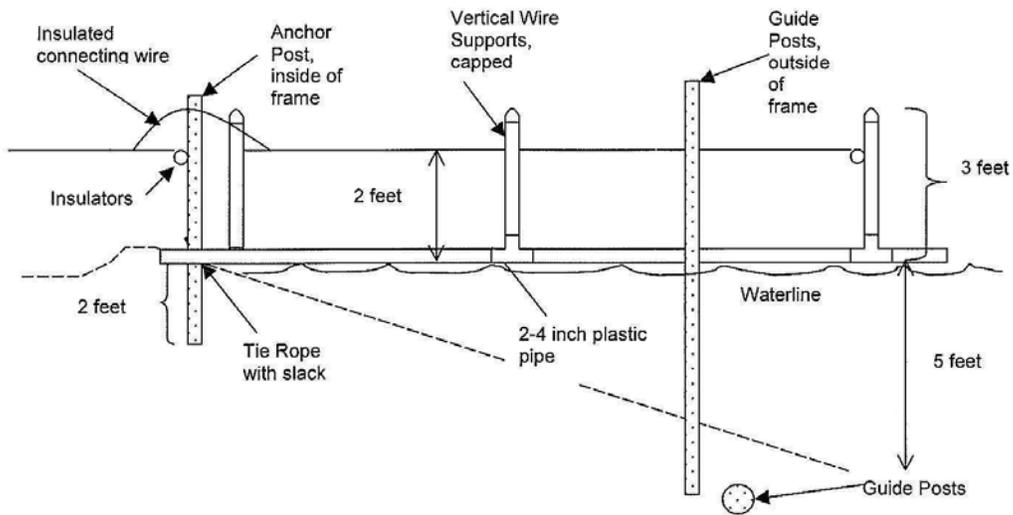
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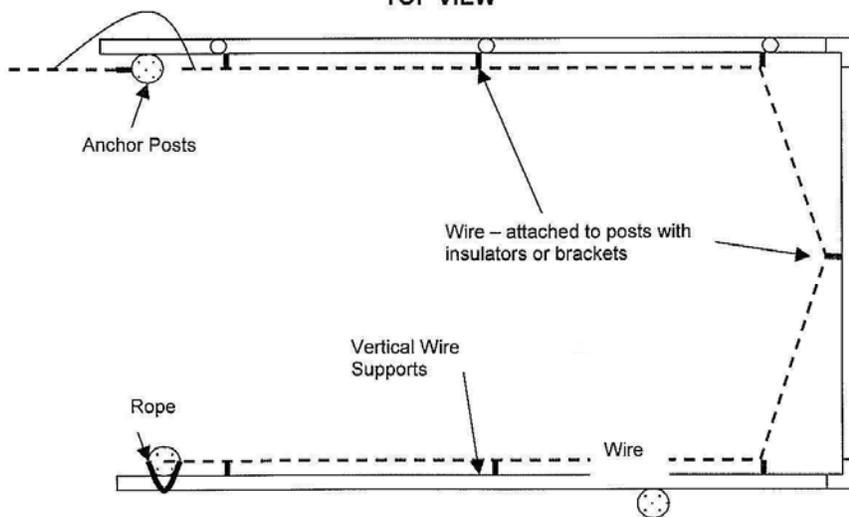
Figure 4

Floating Fence Diagrams

SIDE VIEW



TOP VIEW



**Table 1. Barbed wire and electric fence requirements for cattle or horses.**

Type (Non electric)	Gauge	Type	Post Spacing			Height of Top Wire	Wire Spacing
			Min. # of Wires	2 or more Stays	Without Stays		
Barbed	12 ½, 13 ½, 15 ½	Malleable or High Tensile	4	30'	20'	48"	Bottom wire set a minimum of 14" above ground with middle two wires set at 10 to 14" intervals, and top wire set at not less than 48" above ground.
Barbed Woven (net)		Malleable or High Tensile		30'	20'	44"	At a minimum 32" woven (net) wire set at ground level with one strand of 12 ½ gauge barbed wire or equivalent set 3" above the woven wire, and another strand of 12 ½ gauge barbed wire set 10" above the first barbed wire.
Barbed (suspension)	12 ½, 13 ½, 15 ½	Malleable or High Tensile	4	100'		48"	Bottom wire set a minimum of 14" above ground with middle two wires set at 10 to 14" intervals, and top wire set at not less than 48" above ground.
Electric Smooth	12 ½	High Tensile	1	150'	100'	24-40"	One "hot" wire set 24" - 40" above ground level. Spacing also includes offset wire on existing fences.
Electric Smooth	12 ½	High Tensile	2	150'	100'	30-42"	Second wire set below at 14" - 24" above ground level.
Electric Smooth	12 ½	High Tensile	3	150'	100'	34-48"	Middle wire set at 24" - 36" above ground, and bottom wire set at 12" - 24" above ground.
Electric Smooth (Interior or Boundary Fence)	12 ½	High Tensile	4	150'	100'	42-60"	Second wire from top set at 34" - 48" above ground, third wire from top set at 20" - 34" above ground, and bottom wire set at 10" - 20" above ground.
Electric Smooth (Exterior)	12 ½	High Tensile	5	150'	100'	50-60"	4 <sup>th</sup> wire set 40" - 50" above ground level, 3 <sup>rd</sup> wire set 30" - 40" above ground level, 2 <sup>nd</sup> wire set 20" - 30" above ground level, and bottom wire set 10" - 20" above ground level.

**Table 2. Barbed wire and electric fence requirements for sheep, goats and deer.**

Type	Gauge	Type	Post Spacing			Height of Top Wire	Wire Spacing
			Min. # of Wires	2 or more Stays	Without Stays		
<b>Sheep</b>							
Barbed	12 ½	Malleable	7	30'	20'	34-36"	Remaining 6 wires set no more than 5" apart and the bottom wire set no higher than 5" above ground level.
Barbed	12 ½ 13 ½	High Tensile	7	30'	20'	34-36"	Remaining 6 wires set no more than 5" apart and the bottom wire set no higher than 5" above ground level.
Woven (net)		Malleable or High Tensile		30'	20'	39"	39" net wire set at ground level.
Smooth	12 ½	High Tensile	4	150'	75'	36"	Lower wires (grounded or hot) spaced at 24", and 14" above ground, with bottom wire (hot) no higher than 6" above ground level.
Smooth	12 ½	High Tensile	5	150'	75'	36"	Lower wires (hot or alternating ground/hot) spaced at 26", 18", and 12" above ground level, with the bottom wire (hot) no higher than 6" above ground level.
<b>Goats</b>							
Barbed	12 ½	Malleable	7	20'	15'	34-36"	Remaining 6 wires set no more than 5" apart and the bottom wire set no higher than 5" above ground level.
Barbed	13 ½, 15 ½	High Tensile	7	20'	15'	34-36"	Remaining 6 wires set no more than 5" apart and the bottom wire set no higher than 5" above ground level.
Woven (net)		Malleable		30'	20'	39"	39" net wire set at ground level.
Smooth	12 ½	High Tensile	4	150'	75'	36"	Lower wires (grounded or hot) spaced at 24", and 14" above ground, with bottom wire (hot) no higher than 6" above ground level.
Smooth	12 ½	High Tensile	5	150'	50'	36"	Lower wires (hot or alternating ground/hot) spaced at 26", 18", and 12" above ground level, with the bottom wire (hot) no higher than 6" above ground level.
<b>Deer</b>							
Woven (net)		Malleable		20'	20'	8'	See Figure 3