

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE SPECIFICATION
FENCE, STANDARD AND HIGH-TENSILE
(Ft.)
CODE 382

PURPOSE OF SPECIFICATION

This Specification provides guidance for the installation of the Fence practice, not including fences designed to deter small mammals. For guidance and specifications on small mammal deterrent fences, refer to the NRCS 382X-Fence practice. Guidance may include information about applying different methods listed in the Conservation Practice Standard, details of site preparation and protection, instructions for use of materials described in the Standard, and other information not directly addressed in the Standard.

Specifications for the installation, operation and maintenance of the practice shall be prepared for each treatment unit in accordance with the requirements in the Conservation Practice Standard and the guidance in this Specification. The site specifications shall be recorded in the Conservation Practice Jobsheet and given to the client.

TYPES OF FENCE

There are many types of fence. For planning and design purposes, they've been broken into two types: High Tensile and Non-High Tensile (standard).

A high tensile fencing system uses smooth 12-1/2 gauge wire with a yield strength of 200,000 pounds per square inch, or a strength of 1,600 pounds for each wire. Conventional fencing wire (non-high tensile) normally has a yield strength of less than 60,000 pounds per square inch. A conventional 12-1/2 gauge wire will yield at tensile force of less than 500 pounds and break at less than 550 pounds.

High tensile wire is flexible enough to bend, wrap, tie in knots, or to be clamped with crimping sleeves. Tension in the wire is maintained by permanent in-line stretchers or tension springs. The use of high tension in the wire reduces sag in the wire. The higher tension in the wire requires the use of strong end- and corner-brace assemblies.

The main disadvantage of high tensile fencing is that cattle may slip through the smooth wire easier if the wire is not electrified. Also, animals tend to rub on non-electrified smooth wire fences.

DESIGN CRITERIA AND GUIDANCE

The following tables, figures and charts are provided to give planners and landowners options when designing a fence to meet specific needs. Use the information provided to design a fence that meets NRCS specifications. Take careful note of the footnotes throughout the tables when designing each fence. Any of the following tables, figures or charts may be copied into a specific Fence jobsheet for greater understanding between the NRCS and client.

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Table 1. Fence-Type, Wire, Line Post Spacing, Wire Height -- Fence construction must meet or exceed these minimum specifications:

Kind of Grazing Animal	Kind of Fence		Galvanized Wire (New Only)		Minimum Number of Wires	Maximum Line Post Spacing With or Without Stays (feet) ^{7/}	Maximum Line Post Spacing With 2 or More Stays (feet)	Minimum Height of Top Wire (inches)	Special Considerations ^{15/}
	Non-Electric ^{10/}	Electric	Gage ^{1/}	Type					
Cattle, Carabao or Horse	Barbed		12.5	Malleable	3	16.5	30	40	
	Barbed		12.5	Malleable	4	20	30	42	
	Barbed		12.5	Malleable	5	20	30	44	
	Smooth		12.5	Double-strand malleable	3	16	30	42	
	Smooth		12.5	Double-strand malleable	4	16	30	44	
	Smooth		12.5	High Tensile ^{3/}	3	20	30	42	
	Smooth		12.5	High Tensile ^{3/}	4	20	30	44	
	Smooth		12.5	High Tensile ^{3/}	5	20	30	46	
	Woven			Malleable ^{2/}		16.5	16.5	39	To prevent "bellying" of the wire, additional posts will be located on high points or grade breaks. This may result in closer post-spacing than shown here.
		Smooth	14	High Tensile ^{3/}	1 ^{5/}	75	150	36	
		Smooth	14	High Tensile ^{3/}	2 ^{5/}	100	150	36	
		Smooth	14	High Tensile ^{3/}	1 ^{5/ 9/}	100	150	32	
		Barbed (suspension)		12.5	Malleable or High Tensile	4	N/A	100 ^{4/}	42
	Smooth (suspension)		12.5	Double-strand malleable	4	N/A	100 ^{4/}	42	
Sheep or Philippine Deer	Barbed		14	Malleable	7 ^{8/}	20	30	36	
	Woven			Malleable ^{2/}		20	30	39	To prevent "bellying" of the wire, additional posts will be located on high points or grade breaks. This may result in closer post-spacing than shown here.
		Smooth	14	High Tensile ^{3/}	2 ^{5/}	75	150	24	
		Smooth	14	High Tensile ^{3/}	5	50	150	36	

Table 1. Fence-Type, Wire, Line Post Spacing, Wire Height – Continued...

Kind of Grazing Animal	Kind of Fence		Galvanized Wire (New Only)		Minimum Number of Wires	Maximum Line Post Spacing With or Without Stays (feet) ^{7/}	Maximum Line Post Spacing With 2 or More Stays (feet)	Minimum Height of Top Wire (inches)	Special Considerations ^{15/}
	Non-Electric ^{10/}	Electric ^{16/}	Gage ^{17/}	Type					
Goat; Feral Goat	Barbed		12.5	Malleable	7 ^{8/}	15	20	37	
	Woven			Malleable ^{2/}	8/	20	30	39	To prevent "bellying" of the wire, additional posts will be located on high points or grade breaks. This may result in closer post-spacing than shown here.
		Smooth	14	High Tensile ^{3/}	2 ^{5/ 12/}	75	150	39	Only for use as offsets with Woven Wire to control feral goats. ^{12/}
		Smooth	14	High Tensile ^{3/}	5	50	150	36	
Pig; Feral Pig	Woven		12.5	Malleable ^{2/}		20	30	39	To prevent "bellying" of the wire, additional posts will be located on high points or grade breaks. This may result in closer post-spacing than shown here.
	Barbed		12.5	Malleable ^{6/}	1	N/A	N/A	42	Optional - to be used only in conjunction with Woven Wire. Barbed or smooth wire above woven wire; Barbed wire between woven wire and ground (no more than 1-inch above ground surface).
		Smooth	14	High Tensile	2 ^{12/}	N/A	N/A	42	Optional - to be used only in conjunction with Woven Wire and located as offsets on the outside of the fence. ^{12/}
Small Mammal Deterrent (cat; dog; mongoose) ^{11/}	Woven		11 ^{13/}	Malleable	11/	10	N/A	≥72	^{13/} Maximum 6" X 6" mesh opening. To prevent "bellying" of the wire, additional posts will be located on high points or grade breaks. This may result in closer post-spacing than shown here.
	Poultry			PVC-fuse Coated	11/	N/A	N/A	≥72	All poultry wire must be PVC-fuse coated. Minimum mesh opening = 1-inch. At least one-foot of poultry wire will be placed outside the fence, along the ground surface, to deter digging. ^{14/}
		Smooth	9	High Tensile	11/	N/A	N/A	N/A	Used to support the floppy top created with the poultry wire. ^{14/}

- 1/ All wire must equal or exceed 950 pounds-force (lbs.) break strength. Barbed wire, woven wire and wire netting fencing shall conform to the requirements of Federal Specification RR-F-221 for the specified types and styles of fencing. Barbed wire and woven wire shall have zinc coating of at least 0.80 ounce per square foot of wire surface (Class III galvanization). All wire will be of new-galvanized material. If lab tests are needed, three wire samples of the lot under consideration will be tested. The average strength of the samples shall be the basis for acceptance. Any single sample of the three tested having less than 900 (lbs.) shall disqualify the lot.
- 2/ At least 32" of woven (or net) wire having at least; 11 gage top and bottom strands, 14.5 gage intermediate and stay wires with stay wires spacing 12" or less. Woven wire fences shall be topped by at least one double strand wire, with first strand 2-4 inches above top of woven wire.
- 3/ Electric fences will consist of at least two-wires. Unless otherwise indicated, one or more wires will be hot, one grounded. Wire will be new, smooth 14 gage or heavier, high-tensile 135,000 to 165,000 psi (recommend 160,000 psi), and minimum of Class III galvanization, which has .80 ounces of zinc per square inch of wire surface.
- 4/ Twisted wire stays must be installed at not more than 15' intervals between line posts.
- 5/ For multi-pasture fast move rotations only. Introducing animals to electric fencing in a designated training facility is recommended. Not to be used for exterior fences.
- 6/ Bottom section of at least 48" woven wire, 11-gage or larger top and bottom strands, 12.5 gage or larger intermediate and stay wires, and stay wires spaced no more than 6 inches. Top section of at least 35" woven wire and made of 11-gage or larger top and bottom strands, 14.5 gage or larger intermediate and stay wires with stay wires spaced no more than 12 inches.
- 7/ Line posts must be set at significant high and low points along fence to maintain proper wire height.
- 8/ When cattle are grazed in addition to sheep and/or goats, the top wire will be barbed or smooth, with approximately a 10-inch spacing between top two wires.
- 9/ A minimum 2 wire (grounded to energizer) system must be used in 25-inch or less rainfall area if the ground rods cannot be located where soil moisture is high year-round (eg, locate ground rods near seeps, ponds, springs, or troughs where an overflow can moisten the soil during hot/dry months).
- 10/ When splicing of non-woven wire is necessary, the "Western Union" splice is recommended. This splice is made by overlapping the ends of each wire and wrapping each wire five times around the other wire (Figure 21). The use of a fence-splicing tool will facilitate this operation and result in a neat job. If sleeve is used, a crimping tool is required. When splicing woven wire, refer to Figure 20.
- 11/ The small mammal deterrent fence uses all of the listed wire types in the construction of the fence. The woven wire is the "base" or "foundation" wire that is affixed to the line and brace/corner posts. The PVC-fuse coated poultry wire is attached to the woven wire and also serves as the "floppy top" and ground wire to prevent digging. The smooth wire is used to create the arched supports for the floppy top. Refer to the NRCS 382X-Fence specification for additional requirements for this type of fence.
- 12/ When fencing out feral goats or feral pigs, the optional use of electric wire offsets is recommended. In this case, 2 or 3 electric wires that are offset to the outside of the woven fence and spaced at these intervals is recommended. GOATS: For 2-wire electric offset, spacing should be 14" and 24" above ground surface. For 3-wire offset, spacing should be 14", 24" and 34" above ground surface. PIGS: For 2 wire electric offset, spacing should be 4" and 6" above ground surface. For 3-wire electric offset, spacing should be 4", 6" and 9" above ground surface. All the electric wires will be hot. Do not alternate hot with grounded wires.
- 13/ The woven wire gage must be between 11 and 14.5 gage, and will be fixed-knot, high-tensile, bezinal coated. Select the preferred wire gage and use that throughout the entire project -- do not vary the gage of the woven foundation wire. Use of graduated wire mesh openings is acceptable, provided that the mesh openings do not exceed 6" x 6", and the smallest mesh openings are installed closest to the ground surface. Commonly available materials will meet the specs of 1775-6-12.5 Bekaert solidlock woven wire.

- 14/ All clips and fasteners will be stainless steel to protect against corrosion. Fasten both wire meshes (woven and poultry) to all line, brace, corner and gate posts with stainless steel wires, clips or hog-rings.
- 15/ Wire Tension for Barbed or Smooth Wire Fences: The wire tension midway between the posts shall be such that the pressure of 10 pounds will allow no more than 4 inches of displacement for the straight line between posts. Wire Tension for Woven Wire: The tension on the top wire of the woven wire course will be such that the pressure of 10 pounds will allow no more than 6 inches of displacement from the straight line between posts.
- 16/ Refer to Table 4 for additional requirements for this type of fence.

Table 2. Fence Posts and Fasteners -- Construction must meet or exceed these minimum specifications:

Kind of Post	Post Use and Treatment ^{1/}	Minimum Post Length (feet) ^{6/}	Minimum Post Diameter at Smallest End (inches)	Minimum Buried Depth (feet) ^{2/}	Minimum Staple Gage ^{3/}	Minimum Wire Fastener Gage ^{3/}	Maximum Angle Change Without Use of Brace Posts ^{4/}	Maximum In-Line Brace Spacing (feet) ^{9/}	Special Considerations
Wood	Line Post	6/	3	2	9	16	20°	N/A	
	Brace/Corner Post	7	5	3	9	16	20°	N/A	5/
	In-Line Brace Post	6	4	2	9	16	20°	1320	5/
	Gate Post	7	5	3	9	16	N/A	N/A	5/
Steel	Line Post	6/	7/	Wood=2. Steel T-post=1.5	N/A	16	20°	N/A	7/
	Brace/Corner Post	7	2-7/8	3	N/A	16	20°	N/A	8/
	In-Line Brace Post	6	2-7/8	2	N/A	16	20°	1320	8/
	Gate Post	7	2-7/8	3	N/A	16	N/A	N/A	8/

^{1/} Post Use is specified for Line, Brace or Gate posts. Brace post requirements apply to corner post arrangements also. Post Treatment required: 1) Cut surfaces of Koa, Ohia or Eucalyptus posts will be hand-painted with approved wood preservative to prevent rot. All bark will be removed and all surfaces and cuts will be treated. Kiawe does not need to be treated with preservative. Ohia is not recommended for use in wet soil or climate conditions; 2) Redwood, Cedar or Pine posts will be treated with a creosote coal-tar solution, or pentachlorophenol, or chromated copper arsenate (CCA). In accordance with Federal Specification TT-W-571c or TT-W-571i, there will not be less than six pounds retention of the preservative per cubic foot of wood.

^{2/} Posts may be driven into soil if depth is sufficient to meet buried depth requirements. Posts may also be drilled into rock and then stabilized with concrete. Posts placed in dug-holes will be stabilized with a minimum of 12" x 12" concrete that fills the entire depth of the hole. If posts cannot be driven, drilled or dug into the ground, circular rock cribs can be used to stabilize the posts. Each rock crib will be constructed with woven wire (mesh openings no greater than 6" x 6"), and filled with rocks at least 6-inch diameter in size on the longest surface. The rock crib will equal the height of the line or brace posts, and will be ≥24 inches in diameter when finished.

^{3/} When staples are used, they must be driven diagonally with the wood grain to avoid splitting the post. Space will be left between the staple and the post to permit wire movement. Staple length will be ≥1.5 inches for softwoods and ≥1.25 inches for hardwoods. If tie wires are substituted for staples, the tie wires will be 16-gage or heavier, Class III galvanized, and wrapped around the posts. Factory clips may also be used on wood and steel posts. For fences close to the coast or located in brackish water conditions, and for all Small Mammal Deterrent fences, all fasteners and clips will be stainless steel.

^{4/} When fence angle changes more than 20°, brace posts must be installed.

^{5/} Horizontal or diagonal compression member will be ≥6 feet long and ≥3 inch diameter. It will be located 6-12 inches from the top of the vertical brace posts. The compression member will be secured to the vertical in-ground post(s) with steel pins or dowels (rebar), or notched and spiked to the in-ground post(s). If diagonal, the post end will rest on a large, flat surface (rock, disk blade, concrete surface, etc). A tension wire will extend from the farthest brace post to the bottom of the diagonal post (≤6 inches above the ground surface), and will be tightened to prevent slippage of the diagonal post. Both posts supporting the tension wire will be notched no more than 1-inch deep for the wire to rest within.

^{6/} Line post length will be long enough to allow for at least 1.5-feet of buried depth, plus 3-6 inches above the top wire. For example, if the top wire height is 42 inches, the line post length can be 6-feet (42" wire height + 18" buried depth + 6" post height above top wire = 66").

- 7/ Line post anchor plates will be fully buried. All fence posts will be erect within 2-inches of plumb. All fence posts will deviate no more than 3-inches of centerline. All steel line posts ("T", "U", and "Y" posts) will be at least 1.33 pounds per linear foot. Steel line posts will be rolled from high carbon steel and have a protective coating (galvanized or hot-dip process, or painted in accordance with Commercial Standard 184 (one or more coats of high-grade, weather-resistant steel paint or enamel applied and baked)). Steel line posts will also be studded, embossed or punched to allow attachment of wire. For the PIA-West offices (Guam, CNMI), if forged-steel line posts cannot be obtained in a reasonable time frame for installation, it is acceptable to use minimum 1-inch diameter rebar posts as line posts. No exceptions or variations will be made to corner, brace, or gate posts requirements.

- 8/ Steel posts for corner and gate posts will weigh at least 7.58 pounds per linear foot and will be free from excessive pitting and/or corrosion. Angle iron with the horizontal compression member welded or bolted to the in-ground posts is acceptable (minimum angle iron dimensions for brace member are 2" x 2" x 1/4"). Horizontal or diagonal compression member will be ≥6 feet long and ≥3.0 inch diameter. It will be located 6-12 inches from the top of the vertical brace posts. The compression member will be secured to the vertical in-ground post(s) with steel pins or dowels (rebar), or notched and spiked to the in-ground post(s). If diagonal, the post end will rest on a large, flat surface (rock, disk blade, concrete surface, etc). A tension wire will extend from the farthest brace post to the bottom of the diagonal post (≤6 inches above the ground surface), and will be tightened to prevent slippage of the diagonal post.

- 9/ In-line braces in straight sections (no turns or bends that require a brace assembly) will be spaced no greater than 1320-feet apart on level or gently rolling terrain. In areas with steep or difficult terrain, braces will be spaced no greater than 660-feet apart (or closer if needed).

Table 3. Special Considerations for Suspension Fences

Component	Special Considerations
Suitability of Use	<p>Suspension fences are not suitable for rough or broken country, or where vegetation will interfere with the whipping action of the fence.</p> <p>Suspension fences should not be built on a curve. In-line directional changes will be accomplished by definite angle that are properly braced.</p>
Posts	<p>Posts for suspension fences are subjected to greater tensions than non-suspension fence posts. They should be built with double brace assemblies every 660-feet or closer. Any straight section of suspension fence more than 1320-feet long will have a minimum of 2 equally-spaced line anchor or pull post assemblies. Tie off all wires at stretch panels and start with new wire on the next section.</p> <p>All wood corner posts, brace and in-line pull posts will have an 8-inch diameter top and be imbedded at least 3.5-feet in the ground. The post(s) will extend 3 to 6-inches above the top wire.</p> <p>If wood line posts are used, they will have a minimum top diameter of 4-inches.</p> <p>Steel line posts will be at least 6-feet long, have anchor plates fully buried, and be driven or drilled into the ground at least 2-feet deep.</p>
Wire	<p>Suspension fences will have at least 4 wires spaced appropriately for the kind of animal control desired.</p> <p>The wire will be kept tight so there is no more than 3-inches of sag between posts.</p>
Stays or Droppers	<p>Stays or droppers of Class III galvanized twisted wire, wood, or fiberglass will be used to maintain wire spacing, serve as visual barriers to animals, and distribute pressure evenly to all wires in the span.</p> <p>An effective dropper for feral pig deterrent is a sheet of black-colored high density polyethylene (HDPE) material. Grommets should be installed in the HDPE material where it will be wired to the bottom of the suspension fence span, on the downslope side of the fence. After hanging the HDPE from the bottom wire through the grommets, shape the material to follow the contours of the ground surface, leaving at least 2-feet of extra material length to drape along the ground. Affix a 2x4-inch treated wood board to the HDPE material along the straightest length of the ground. The 2x4 should be as long as possible and affixed in the same direction as the suspension fence (eg, across the drainage). During non-flood events, the HDPE acts as a visual "curtain" barrier to turn animals away. During flood events, the 2x4 and HDPE will float to allow water passage. When floodwaters subside, the HDPE and 2x4 (if still intact) should return to their original positions, although this should be checked after each event.</p> <p>Treated wood stays may be preferred due to their effective visual barrier to animals.</p> <p>Stay spacing between posts should be 15-20 feet.</p> <p>The lower ends of the stays must not touch the ground or otherwise interfere with the swaying motion of the fence.</p>

Table 4. Electric Fences -- Construction must meet or exceed these minimum specifications:

Kind of Post	Post Use and Treatment ^{1/}	Minimum Post Length (feet)	Minimum Post Diameter at Smallest End (inches)	Minimum Buried Depth (feet) ^{2/}	Minimum Staple Gage	Minimum Wire Fastener Gage	Maximum Angle Change Without Use of Brace Posts ^{4/}	Maximum In-Line Brace Spacing (feet)	Energizer and Grounding Requirements ^{5/ 8/}
Wood	Line Post	^{6/}	^{7/}	1.5	9	16	20°	N/A	Energizer minimum peak output = 5,000 volts at 35 to 65 pulses/minute. High power, low impedance. Grounding system required.
	Brace/Corner Post	7	5 ^{3/}	3	9	16	20°	N/A	
	In-Line Brace Post	6	4 ^{3/}	2	9	16	20°	1320	
	Gate Post	7	5 ^{3/}	3	9	16	N/A	N/A	
Steel	Line Post	^{6/}	^{7/}	1.5	N/A	16	20°	N/A	
	Brace/Corner Post	7	2-7/8 ^{3/}	3	N/A	16	20°	N/A	
	In-Line Brace Post	6	2-7/8 ^{3/}	2	N/A	16	20°	1320	
	Gate Post	7	2-7/8 ^{3/}	3	N/A	16	N/A	N/A	

1/ Post Use is specified for Line, Brace or Gate posts. Brace post requirements apply to corner post arrangements also. Post Treatment required: 1) Cut surfaces of Koa, Ohia or Eucalyptus posts will be hand-painted with approved wood preservative to prevent rot. All bark will be removed and all surfaces and cuts will be treated. Kiawe does not need to be treated with wood preservative. Ohia is not recommended for use in wet soil or climate conditions; 2) Redwood, Cedar or Pine posts will be treated with a creosote coal-tar solution, or pentachlorophenol, or chromated copper arsenate (CCA). In accordance with Federal Specification TT-W-571c or TT-W-571i, there will not be less than six pounds retention of the preservative per cubic foot of wood.

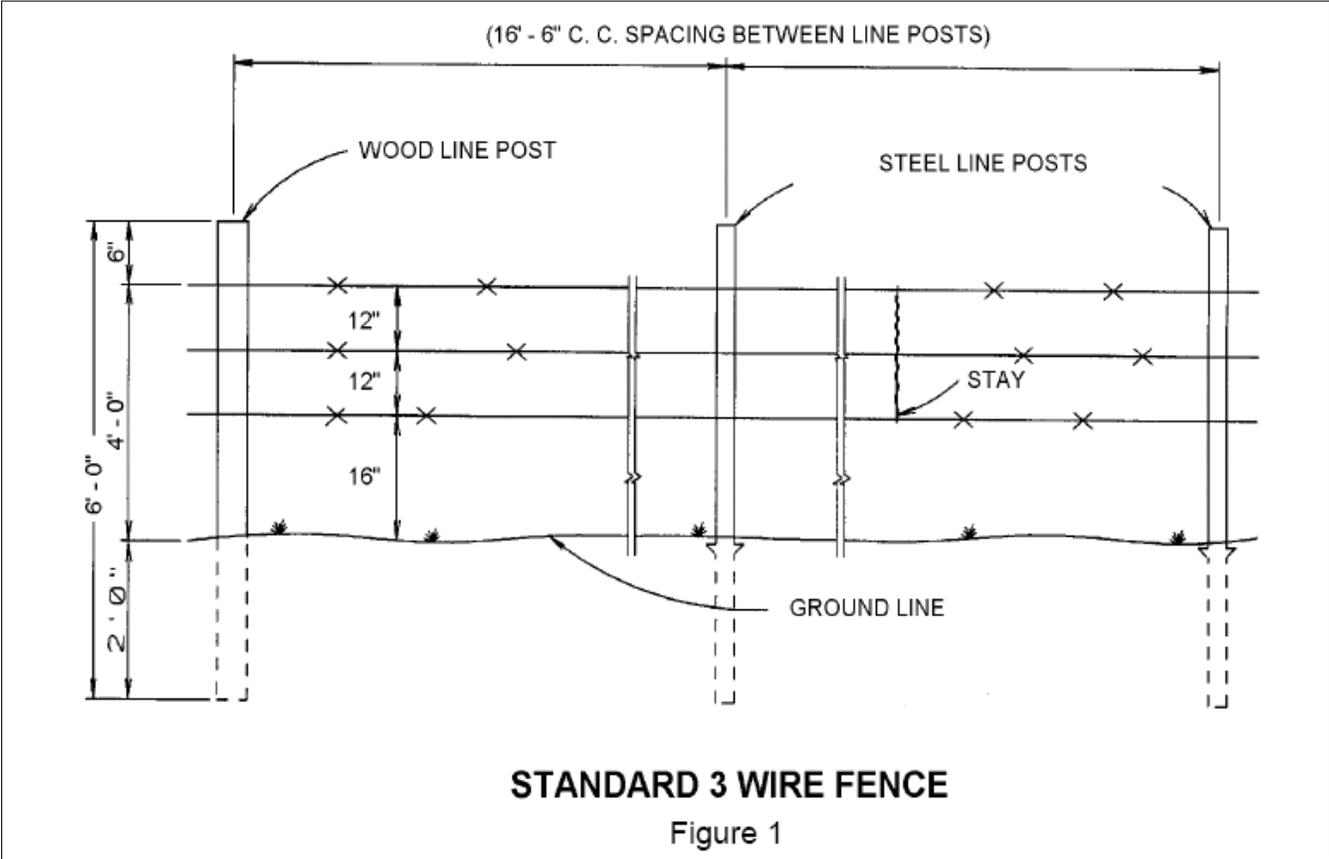
2/ Posts may be driven into soil if depth is sufficient to meet buried depth requirements. Posts may also be drilled into rock and then stabilized with concrete. Posts placed in dug-holes will be stabilized with a minimum of 12" x 12" concrete that fills the entire depth of the hole. If posts cannot be driven, drilled or dug into the ground, circular rock cribs can be used to stabilize the posts. Each rock crib will be constructed with woven wire (mesh openings no greater than 6" x 6"), and filled with rocks at least 6-inch diameter in size on the longest surface. The rock crib will equal the height of the line or brace posts, and will be ≥24 inches in diameter when finished.

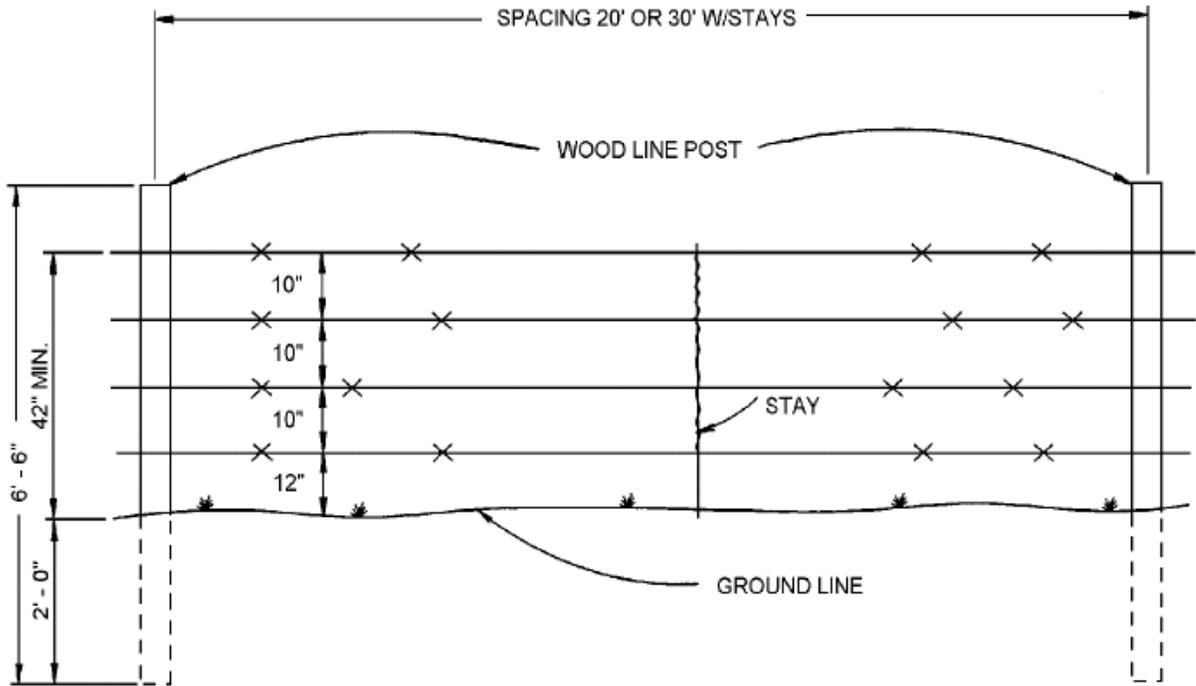
3/ The width of all braces will be at least 6 feet. Any compression members in H-braces will be at least 6 feet long. If using a diagonal brace configuration, the angle of the diagonal brace pole will be no less than 40-degrees and no more than 50-degrees. All diagonal brace poles will be supported at the ground on a flat surface (eg, rock) or will abut to a buried post. Refer to Chart 1 in the 382-Fence specification for allowable modified bracing configurations when building single- or double-strand electric fences.

4/ For single- or double-strand electric fences only, a modified brace configuration is allowed when the angle of change differs. Refer to Chart 1 in the 382-Fence specification for the allowable modified bracing configurations for those type of fences.

5/ The energizer will deliver enough voltage to control the identified animals. At least 1,000 volts for cattle and horses; 3,000 volts for sheep and domestic goats; 5,000 volts for feral pigs and feral goats. The maximum wire length controlled by one energizer will not exceed the manufacturer's specifications. All circuitry will be solid state. Safety fuses will work properly. The energy source can be alternating current (AC), direct current (DC) or photovoltaic (PV). Follow manufacturer's recommendations when connecting the energizer to the energy source. If using DC (batteries), they must be capable of operating for at least 3 weeks without a recharge, they must be connected to a recharge system (PV, wind, etc), must have a load regulator to prevent overloading of the battery during periods of high solar radiation or wind, and must have cutoff facilities to prevent deep discharge of the battery. Wet cell batteries are rechargeable, and deep-cycle marine batteries are preferred to conventional auto or tractor 12V batteries. Dry cell batteries last from 1 to 6 month and are not rechargeable. Dry cells batteries are only allowed for temporary grazing systems.

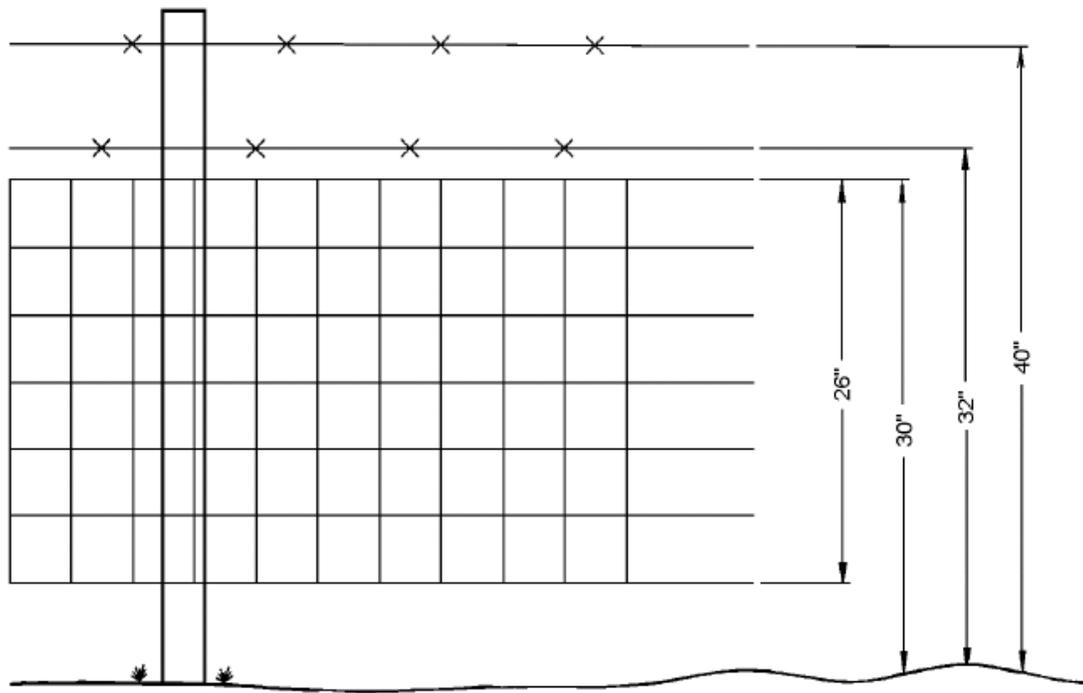
- 6/ Line posts must be long enough to allow for the desired height aboveground, including at least 3-inches above the top wire, plus at least 18-inches of buried depth.
- 7/ Wood line posts will be at least 2-inch diameter at the narrowest point. Tubular steel posts or steel pipe will be at least 1-inch inside diameter. T-posts will weigh at least 1.33 pounds/foot of length, exclusive of the anchor plate. Fiberglass or Insultimber posts will be at least 1/2-inch diameter. Rebar posts will be at least 5/8-inch diameter (size 5 rebar). All line posts, regardless of type, will be set into the ground at least 18 inches.
- 8/ All electric fences will be grounded. For fences with all the wires "hot" (electrified), the energizer ground wire will be connected to a series of ground rods driven into the ground. Follow manufacturer's specifications for grounding. As a rule of thumb, use at least 4 ground rods, spaced 10-feet apart and driven at least 4 feet into the ground. The ground wire will be connected to each ground rod with a secure clamp. Ground rods will be of the same type of metal -- either all steel or all copper, and will be at least 3/4-inch diameter or greater. Do not mix metal type among the ground rods. For optimal grounding success, the ground rods should be located in an area where soil moisture is moderate to high throughout the year. Dry areas are more difficult to maintain a consistent ground. For fences with both "hot" and "cold" wires (electrified wires and ground wires), the "hot" and "cold" wires will alternate. For example, a 3-strand electric fence would have the top and bottom wires hot, and the middle wire cold (ground). Fences of this type do not need a ground rod system. The grounding is accomplished by the presence of the ground ("cold") wires and the circuit is completed through animal contact.





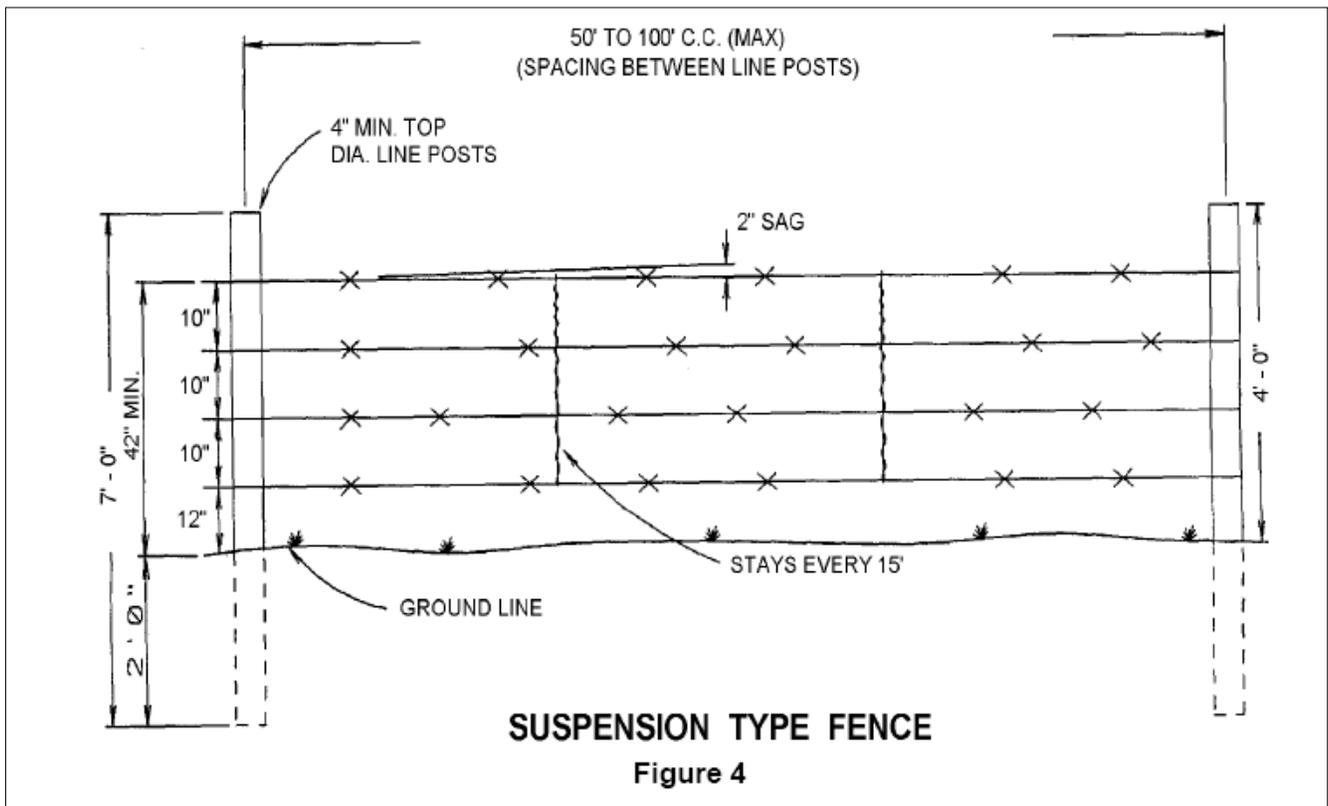
STANDARD 4 WIRE FENCE

Figure 2



WOVEN WIRE WITH 2 STRANDS BARBED WIRE

Figure 3



Steel diagonal-brace ends and corners have been used satisfactorily by setting the end or corner post in concrete and placing the diagonal braces in concrete. However, mixing the concrete and waiting for the concrete to cure add time and effort to the operation.

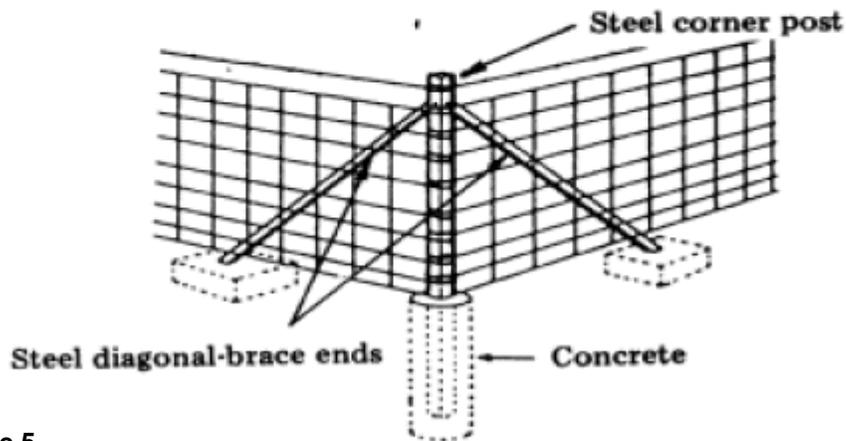
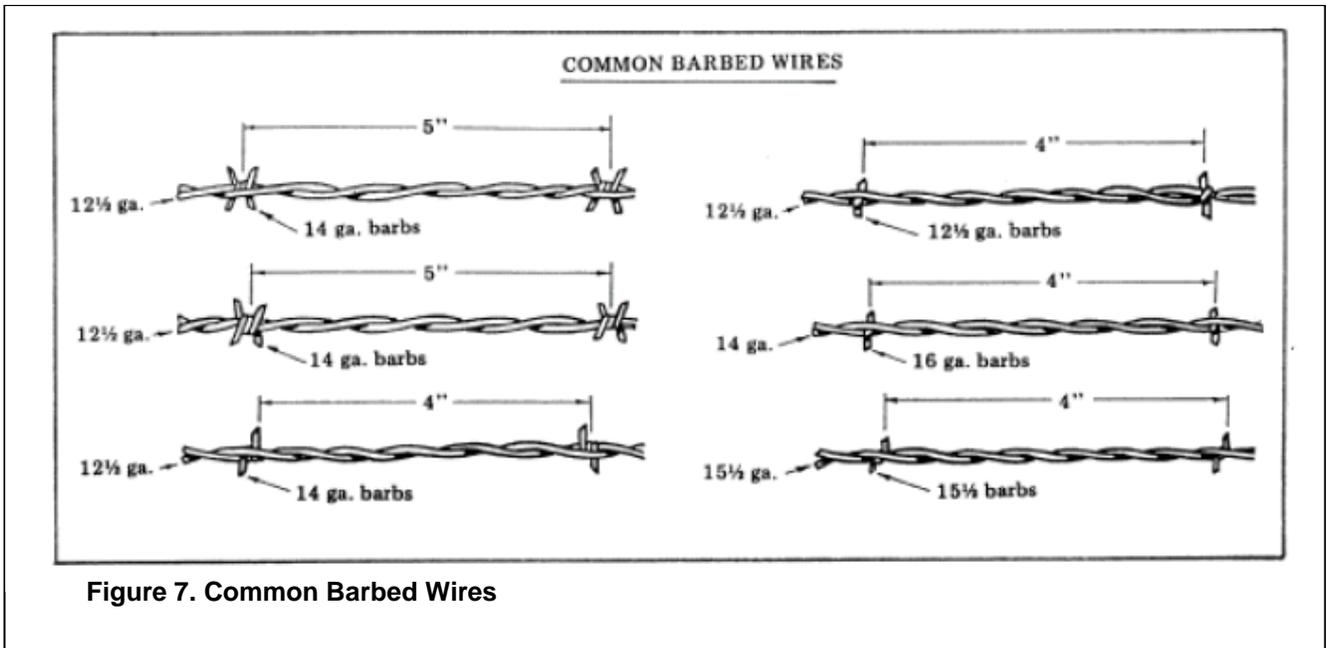
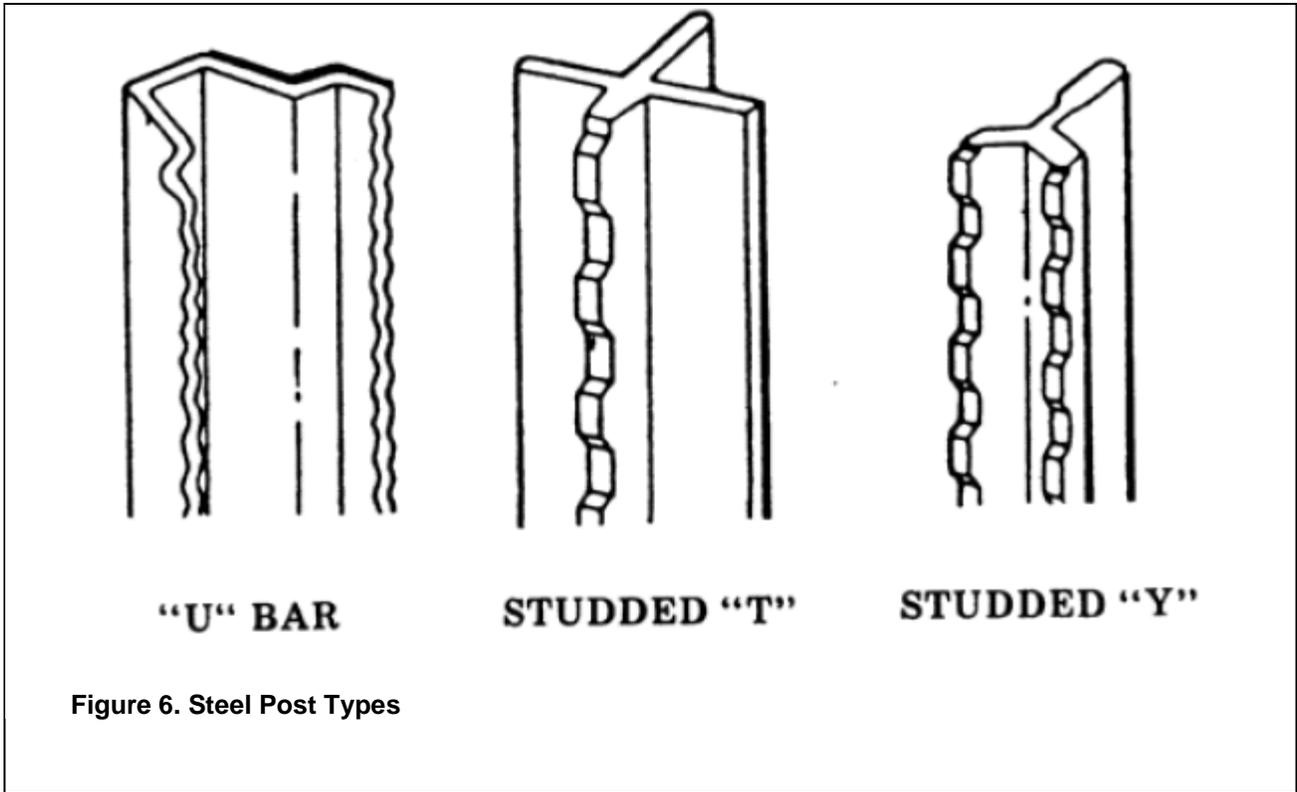


Figure 5.



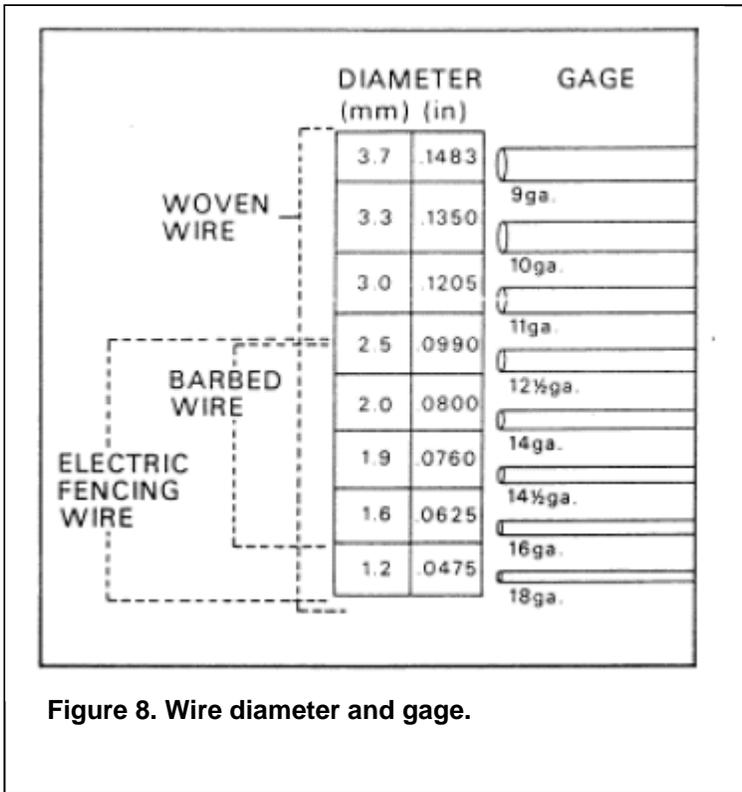


Figure 8. Wire diameter and gage.

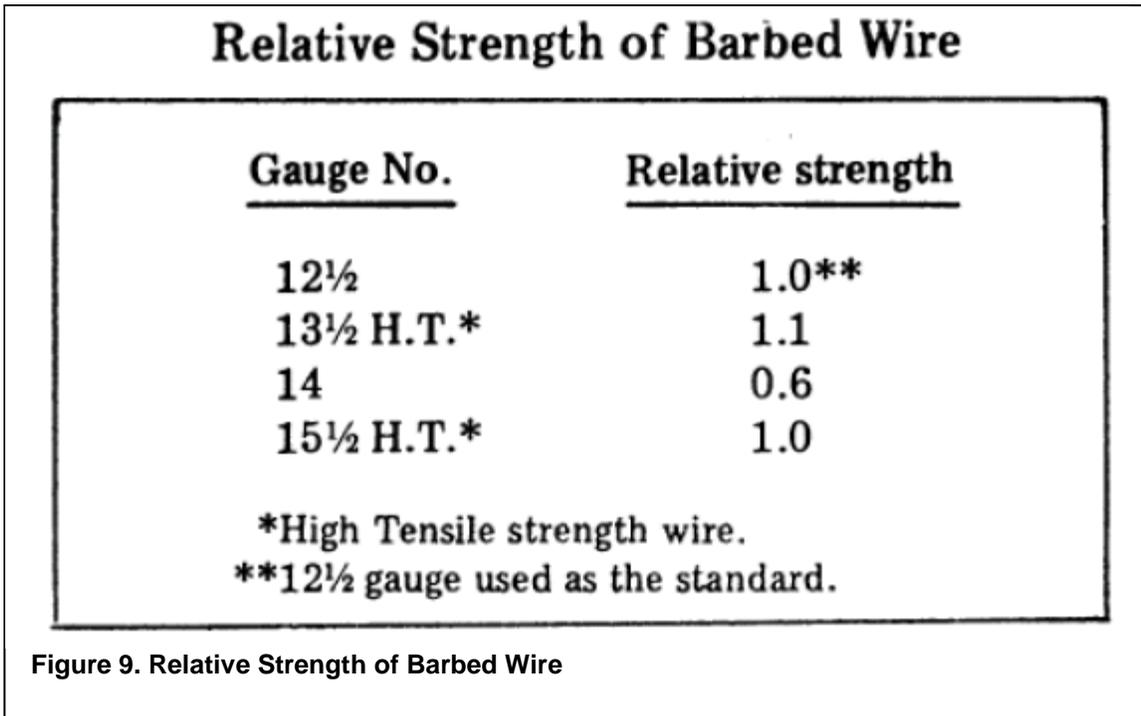


Figure 9. Relative Strength of Barbed Wire

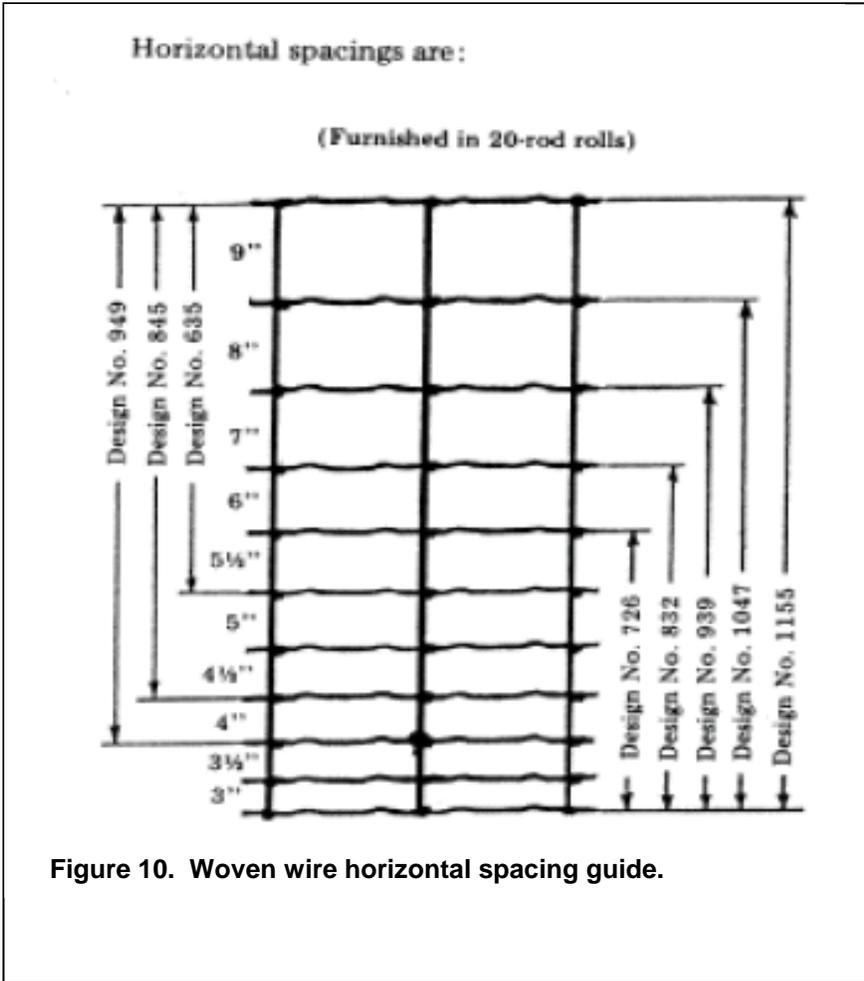
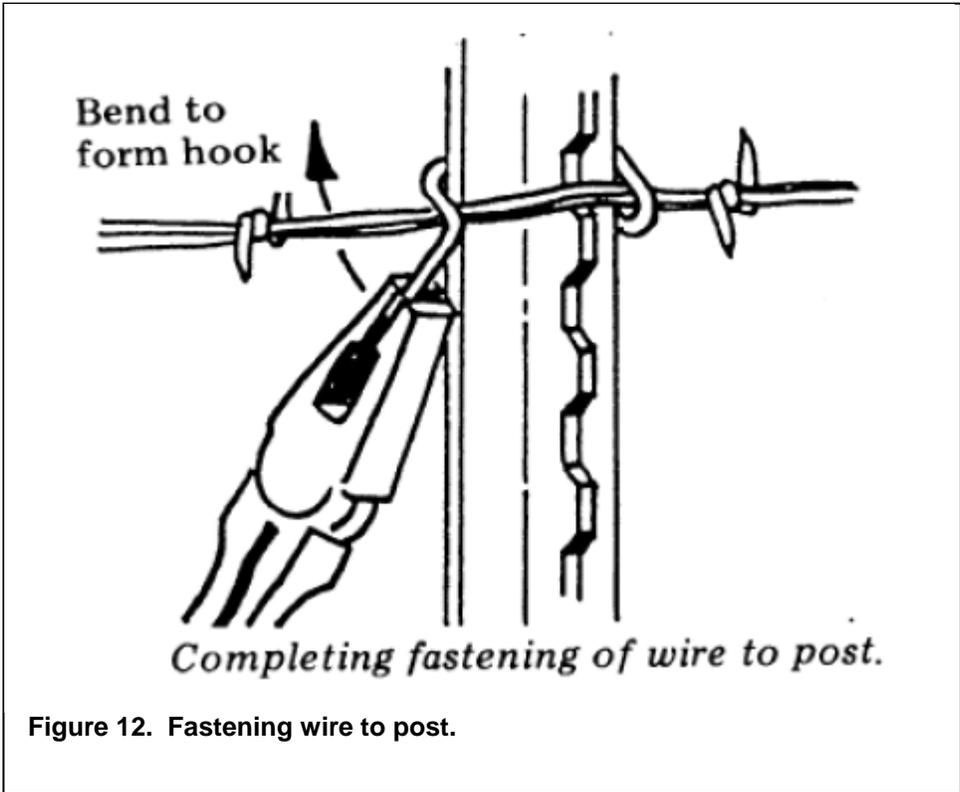
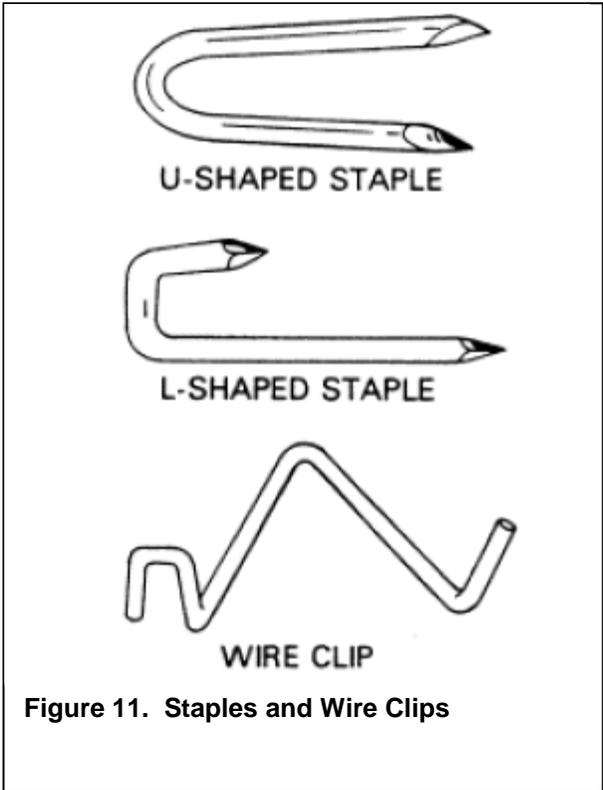


Figure 10. Woven wire horizontal spacing guide.



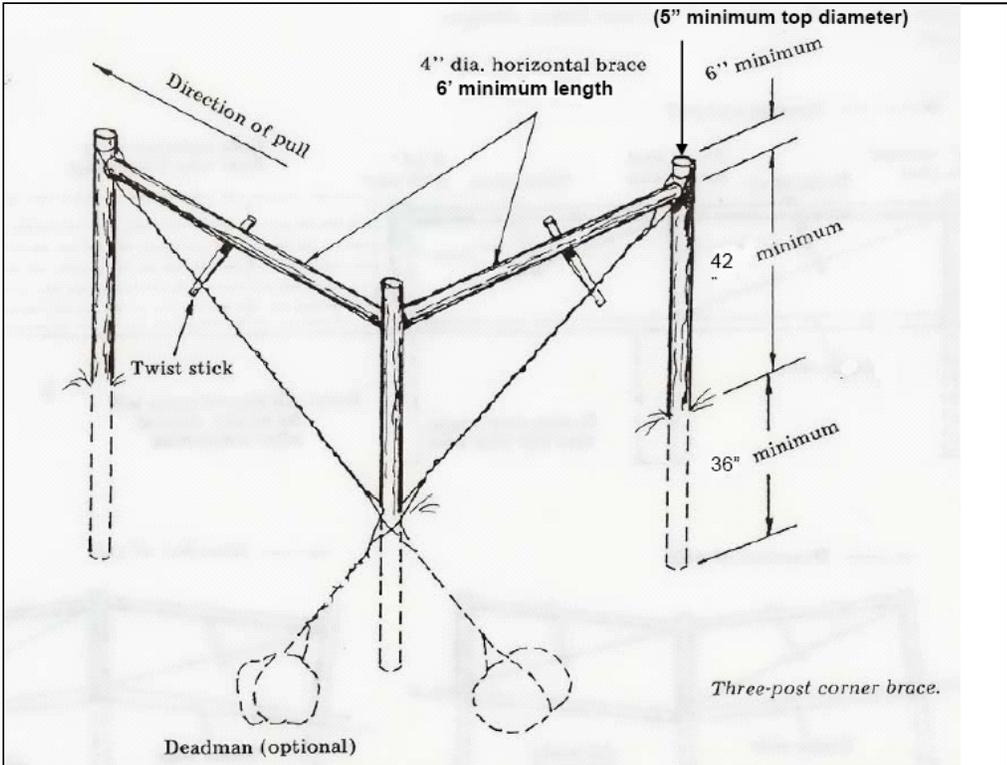


Figure 14. Three-Post Corner Brace

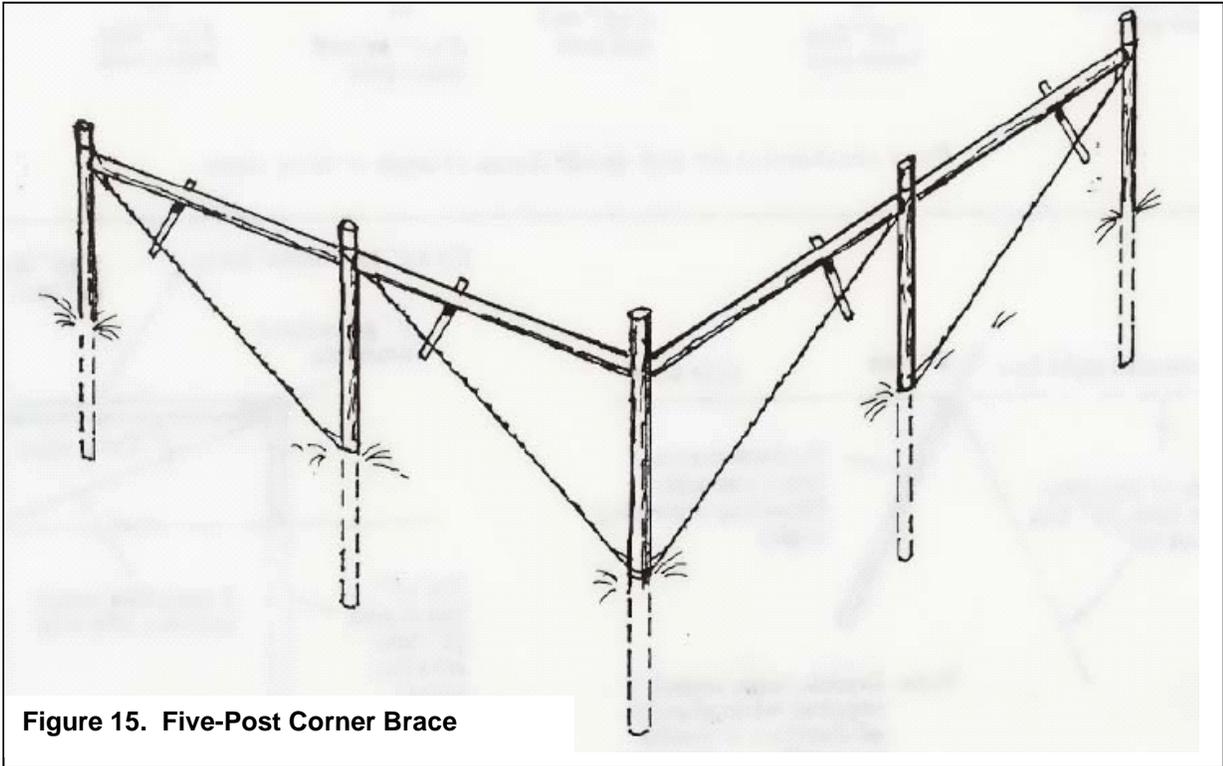
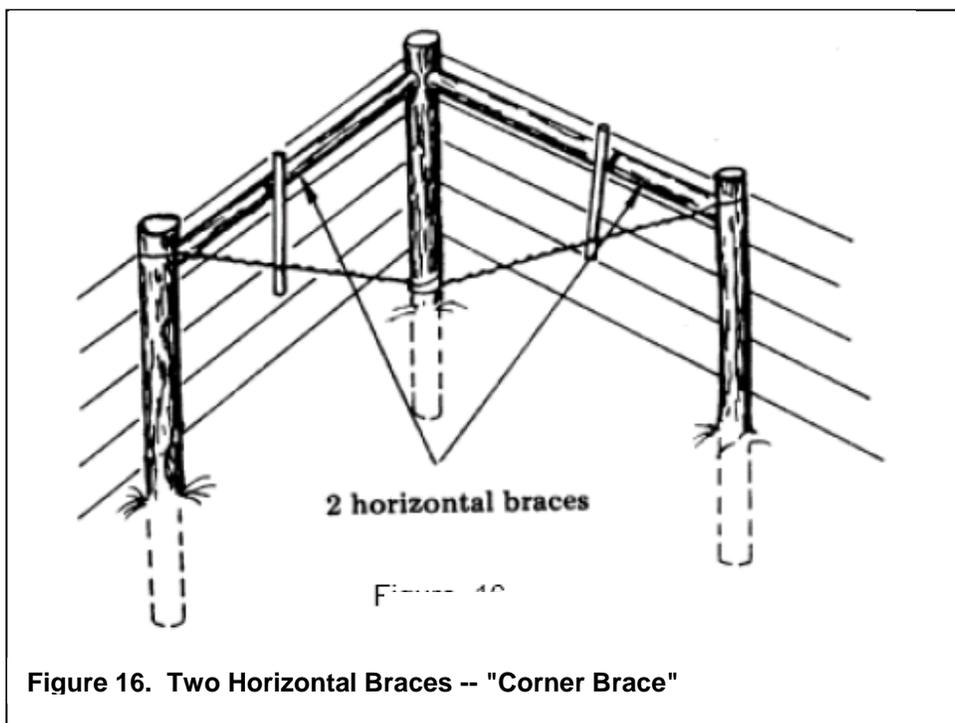


Figure 15. Five-Post Corner Brace



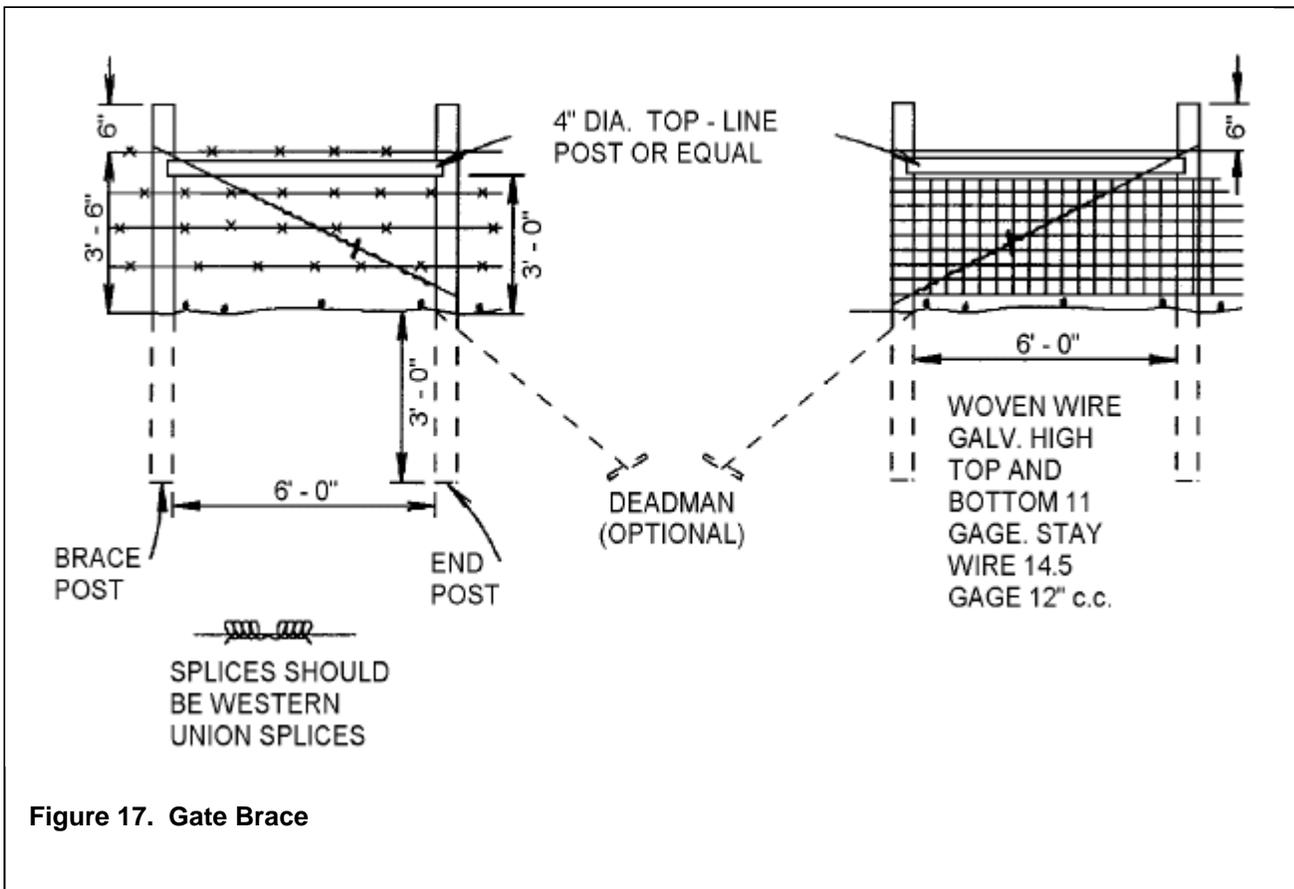
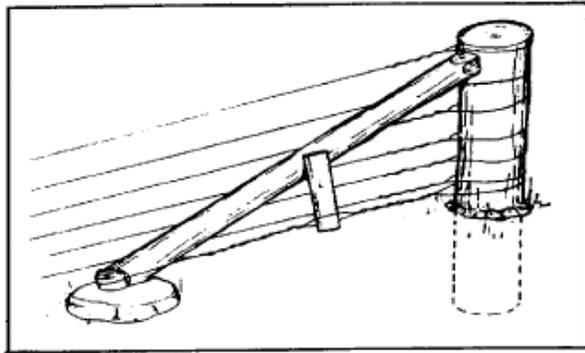


Figure 17. Gate Brace

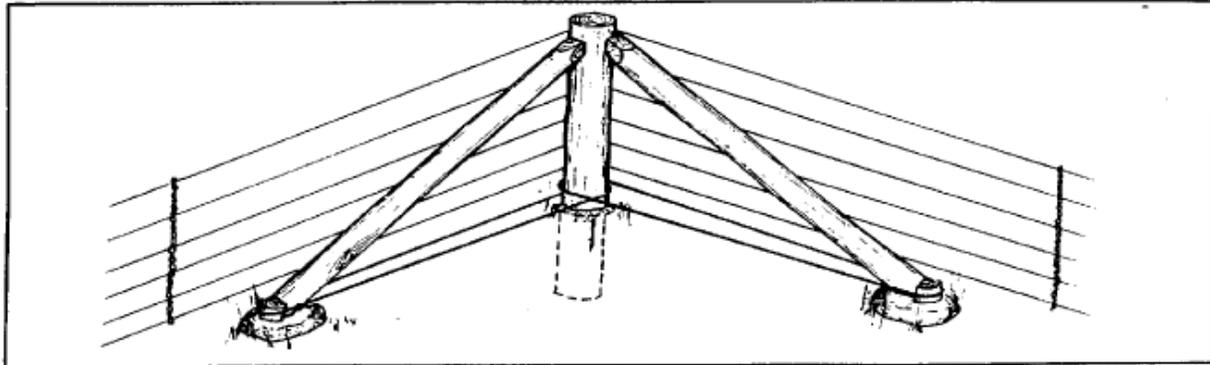


Diagonal gate or fence end strainer.

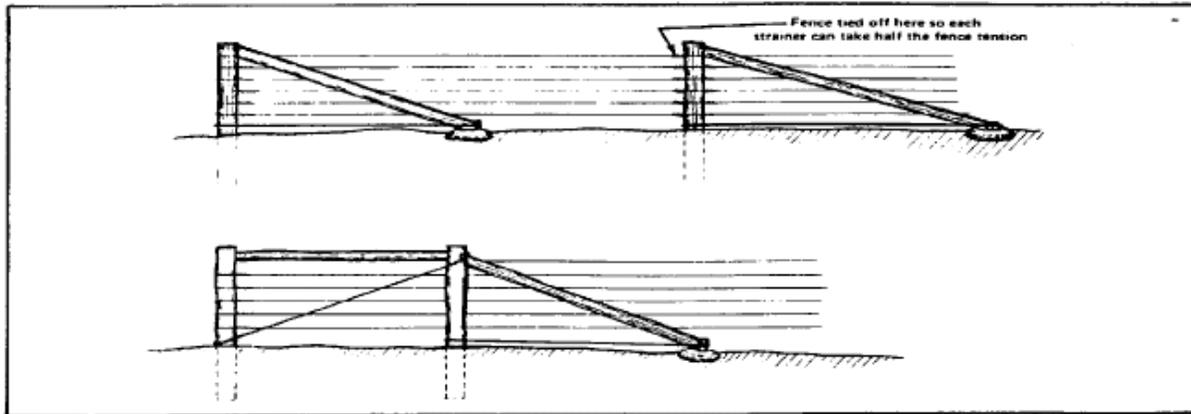
Practical lengths for compression members of diagonal (or horizontal) fence strainers

Pipe size (in)	Wood diameter (in)	Practical length (ft)	Allowable length (ft)
2		8	10
2½		9½	12
3		12	14½
3½		13½	17
4		15	19
	3	7½	
	4	10	
	5	12½	
	6	15	
	7	17½	
	8	20	

½ Diameter at center and straight length assumed.



Two diagonal strainer corner braces.



Use of two diagonal strainers for holding in soft soil. Also, one horizontal and one diagonal strainer could also be used as shown. Each of the diagonal strainers takes half of the tension in the fence; therefore, the fence must be tied off at each diagonal strainer.

Figure 18. Diagonal Bracing and Strainers

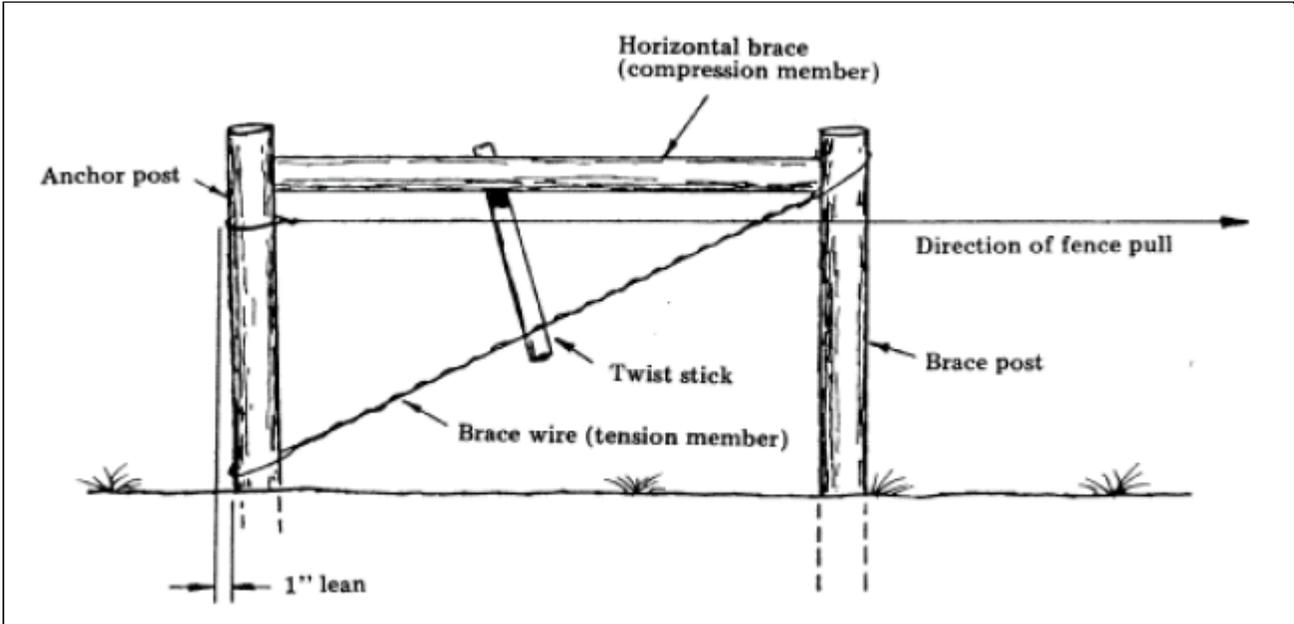


Figure 19. Parts of Horizontal Brace

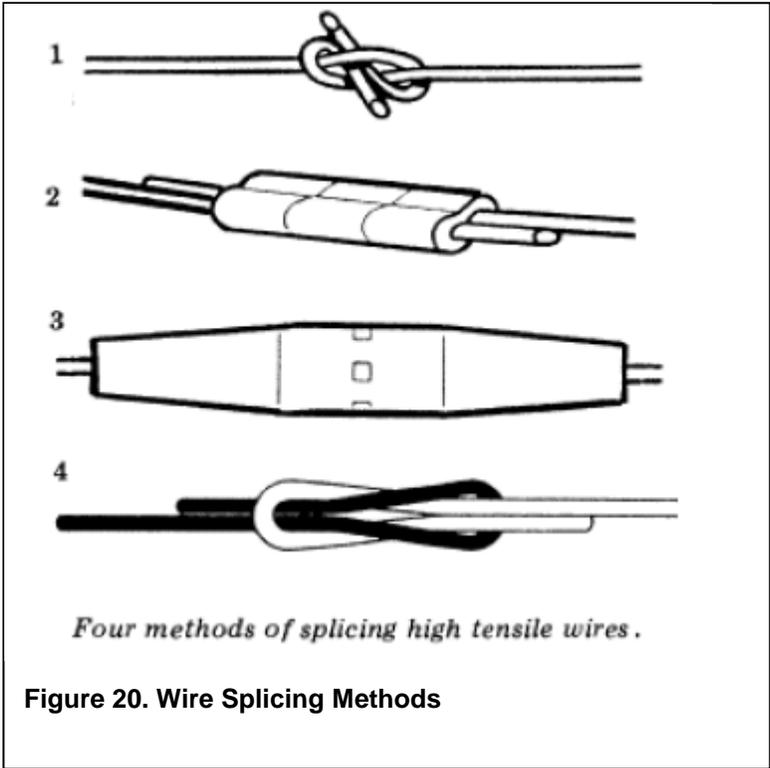
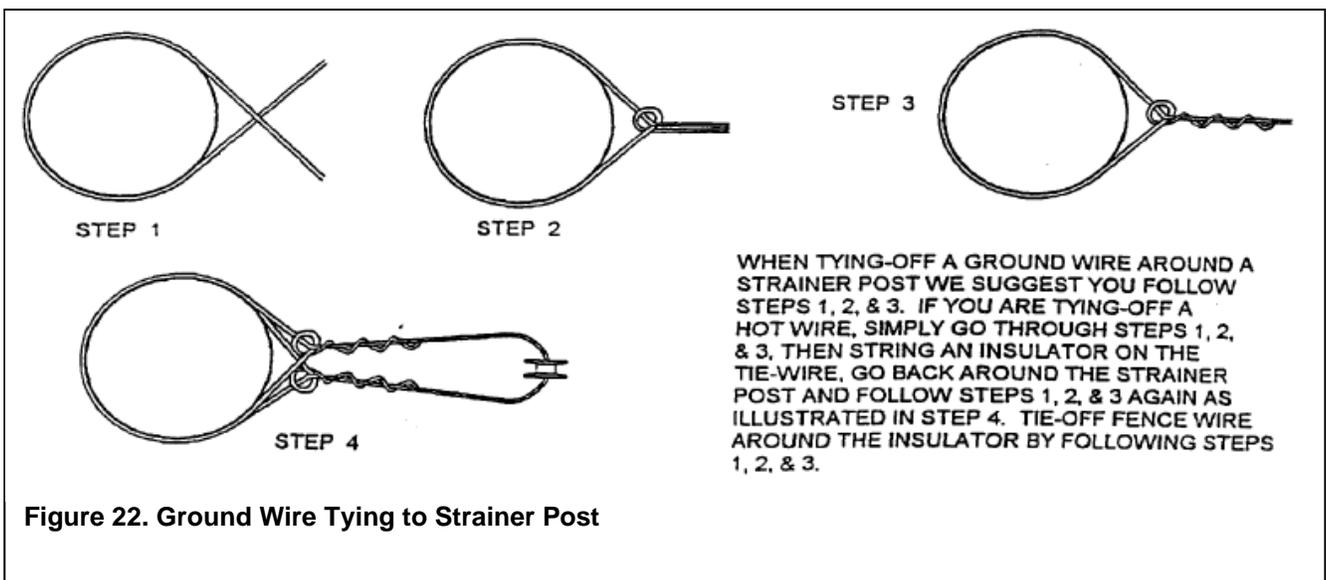
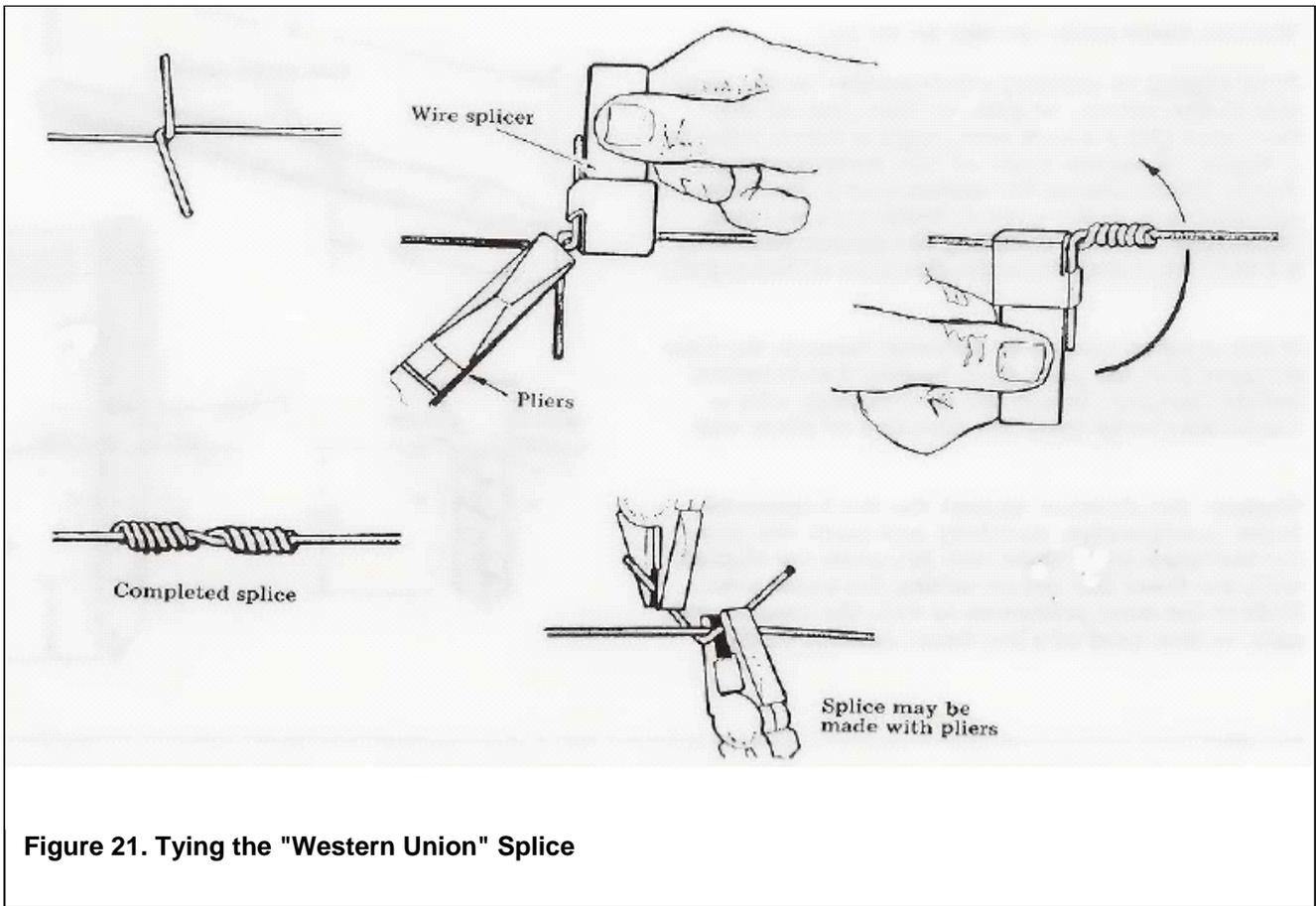
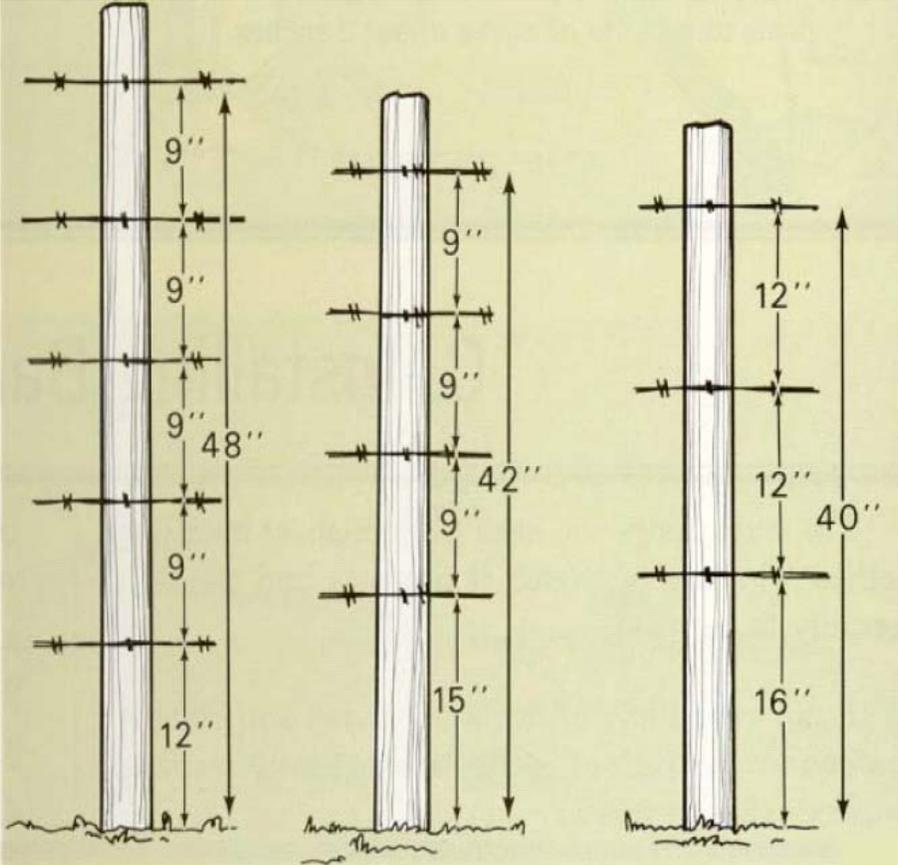


Figure 20. Wire Splicing Methods





5-Wire Spacing

4-Wire Spacing

3-Wire Spacing

Figure 23. Typical Barbed or Smooth Wire Spacing for Cattle.

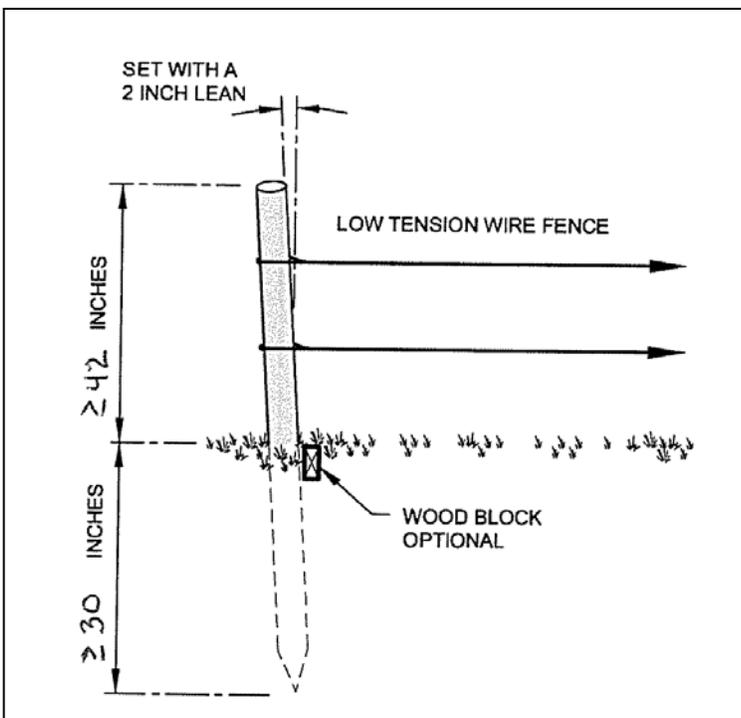
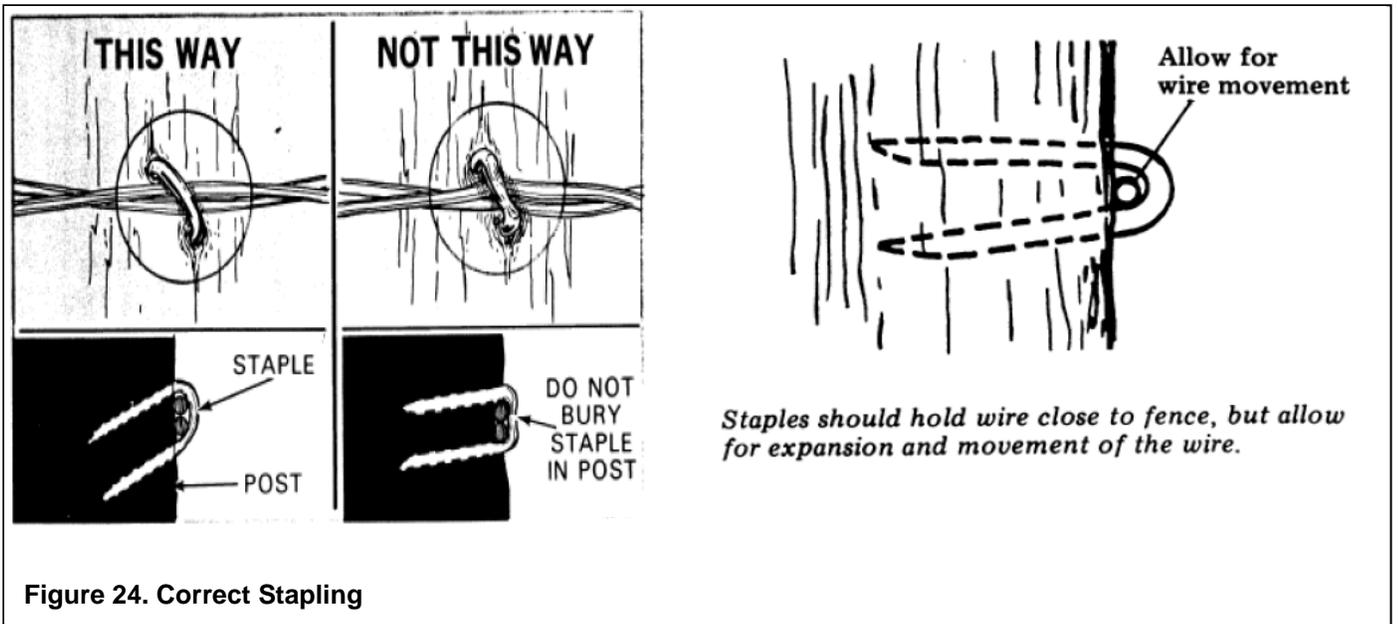


Figure 25. Single Post Brace for Electric Fences Only

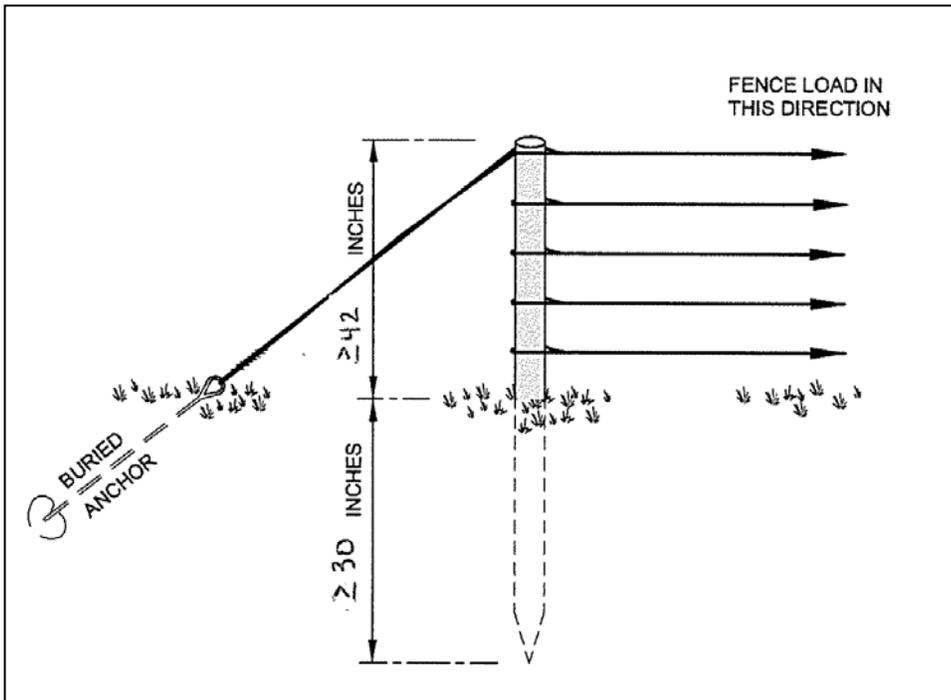


Figure 26. Single Post with Anchor Deadman Brace for Electric Fences Only

Chart 1. Modified Diagonal Bracing Requirements for Single- or Double-Strand Electric Fences

Amount of Turn or Bend in Fence (degrees)	Vertical Post Minimum Diameter (in)	Vertical Post Minimum Length (ft)	Vertical Post Minimum Buried Depth (ft)	12-gauge Guy Wire Required*	Diagonal T-Post Deadman Required	Minimum Length of T-post Deadman (ft)	Minimum T-post Deadman (diagonal) Buried Depth (ft)
<20	4	6	2.5	no	no	N/A	N/A
21-45	4	6	2.5	maybe**	maybe**	4	3
46-68	4	6	2.5	yes	yes	5	4
>68	Use traditional H-Brace or Diagonal Brace as shown in 382-Fence specification.						

* If Guy Wire is needed, it will not interfere with the position of the electric wire.

** Use of a deadman and guy wire is not required when this fence angle bend is encountered. If the producer and planner do use them, also follow the minimum length and depth requirements for the deadman as shown. If neither are used, NRCS advises the producer to closely monitor the vertical posts for any weakness or leaning over time, and correct with installation of the deadman and guy wire as part of normal maintenance.

Chart 2. Wall Thickness of Steel Pipe.

Name	Schedule	O.D.	Actual I.D.	Wall Thickness	Lbs. / FT
1 ½ inch	40	1.900	1.610	0.145	2.72
2 inch	10	2.375	2.157	0.109	
	40	2.375	2.067	0.154	3.65
	80	2.375	1.939	0.218	5.02
2 ½ inch	10	2.875	2.635	0.120	
	40	2.875	2.469	0.203	5.82
	80	2.875	2.323	0.276	7.66
3 inch	10	3.500	3.260	0.120	
	40	3.500	3.068	0.216	7.58
	80	3.500	2.900	0.300	10.25

Chart 3. Rebar Sizes and Dimensions.

The size designations up through size 8 are the number of eighths of an inch in the diameter of a plain round bar having the same weight per foot as the deformed bar. So, for example, a number 5 bar would have the same mass per foot as a plain bar 5/8 inch in diameter. The metric size is the same dimension expressed to the nearest millimeter.

Bar designation number	Nominal diameter in inches (not including the deformations)	Metric designation number	Weight in pounds per foot
3	0.375	10	0.376
4	0.500	13	0.668
5	0.625	16	1.043
6	0.750	19	1.502
7	0.875	22	2.044
8	1.000	25	2.670
9	1.128	29	3.400
10	1.270	32	4.303
11	1.410	36	5.313
14	1.693	43	7.650
18	2.257	57	13.60