

Practice Specification Fence (Code 382)

General Specifications

Procedures, technical details, and other information relevant to and for providing additional guidance of the Conservation Practice Standard 382, Fence, are listed below.

Guidance on design, location and installation consideration for wildlife is available in the Oklahoma Biology Technical Note 35.

Deviations

Deviations from the standards and/or listed specifications can only be approved by the State Resource Conservationist (SRC).

Planning Guide

Guidance is available in Oklahoma Range Technical Note 18. Design and Planning Fencing for Conservation

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Table 1: Minimum criteria for selection and installation of fences. Fence design and construction must meet or exceed these criteria.

Intend ed Use	Fence Type	Number of Wires	Minimum Top Wire Height	Max Line Post Spacing W/O Stays ¹	Max Line Post Spacing W/ 2 or more Stays
Cattle	Standard Barbed Wire ⁴	3	38-42	20	30
		4	42-48		
		5	48-52		
	Suspension	4	44-48	N/A	100 ³
	Smooth, high tensile, non- energized; Double strand, non-barbed	5	48-52	20	30
	Smooth, high tensile, Energized	3	38-42	75	150
		4	44-48		
	Woven Wire (Addition of 1- 2 barbed wires may be added to achieve total height)	NA	42-48	20	N/A

Intended Use	Fence Type	Number of Wires	Minimum Top Wire Height	Max Post spacing W/O stays	Max Line Post Spacing w/2 or more stays
Goats / Sheep	Woven Wire (Caution with horned goats)	NA	32-42	20	N/A
	Standard Barbed Wire	7	38-42	15	20
	Smooth, high tensile, non- energized; Double strand, non-barbed	7	38-42	15	20
	Smooth, high tensile, Energized	5	34-38	75	150
Horses	Board	NA	48	N/A	N/A
	Woven, Mesh	NA	42-48	20	N/A
	Standard Barbed Wire	4	48-52	20	30
	Smooth, high tensile, Energized	4	48-52	75	150
	Smooth, high tensile, non- energized ; Double strand, non-barbed	5	52-56	20	30
Large Wildlife	Woven	NA	96	20	N/A
All Livestock	Temporary (portable), Energized ²	1-3	2/3 shoulder height of animal	75-100 ²	N/A

1. Use the maximum line spacing without stays when planning fences for lanes, holding pens or areas around watering or feeding facilities.
2. Temporary / Portable fences are only used for interior crossfencing or for temporary protection of areas (i.e. critical area during vegetation establishment). Should not be used for areas that will receive heavy livestock pressure. May be smooth high tensile steel, aluminum, galvanized, polywire or polytape (See Table 2 for wire requirements) Line post spacing may vary in order to maintain the desired wire height.
3. Stays will be installed at no more than 15 foot intervals between posts. They should swing free of the ground to permit the fence to sway. Stays will be constructed of durable materials designed for this purpose.
4. Planned fences in areas with candidate or listed species shall be constructed with the guidelines for the species of concern

Materials & Construction Specifications

Variations from materials and construction may be approved if sufficient documentation is provided to the State Resource Conservationist that proves the variations will result in an installation that will meet or exceed this standard and specification

WIRE

All wire will be of new galvanized material and in accordance with criteria outlined in Table 2 and applicable American Society of Testing Materials (ASTM) standards.

Table 2 Minimum Criteria and Specifications for Wire

Wire Type	Minimum Wire Size	^{1/} Other Requirements (Protective coatings, Tensile Strength / Breaking Load) etc.
Standard Double Strand Barbed wire Standard Smooth double strand wire	12 1/2 gauge (Barbed will have 14 gauge or heavier two-point barbs spaced 4-6 inches apart.)	Class I galvanized. Meets ASTM-121 70,000 psi / 950 lbs. breaking load
Standard Smooth single strand	9 gauge	Class I galvanized. Meets ASTM-121 70,000 psi / 950 lbs. breaking load
High-Tensile Double Strand Barbed Wire	13 ½ - 15 ½ gauge	Class III galvanized. Meets ASTM-A854. Heat treated High Tensile. 170,000 psi
High Tensile Smooth single strand	12-1/2 gauge	
Standard Woven Wire	Top & Bottom wires: min. 12 ½ gauge Intermediate & Stay Wires: min. 14-1/2 gauge	Class I zinc coating or equivalent. Meets ASTM 116. 32 -48 inches minimum height; Maximum 12 inch spacing between stay wires for larger animals and 6" for smaller animals.
High Tensile Woven Wire	14 1/2 gauge	Class III zinc coating or equivalent. Meets ASTM 116. 32 inches minimum height ; Maximum 12 inch spacing between stay wires for larger animals and 6" for smaller animals.
Mesh Wire; such as Horse-No-Climb	Top & Bottom wires: 10 gauge Intermediate & Stay Wires: 12-1/2 gauge	Class I zinc coating or equivalent. At least 48 inch high, less than or equal to 2 inch x 4-inch mesh spacing.

Polywire or “Twine-Type”	Minimum of 8 strands of aluminum or stainless steel filaments	Wires interwoven with polyethylene or polypropylene fiber. Only used for temporary fences and where pressure from livestock is not heavy.
		The polywire (twine-type) is more durable especially when it is being rolled up and moved often and should be used when multiple wires are planned.
Galvanized Steel	14 gage	Use for 1 to 2 wire temporary fences. 150,000 psi / 690 lbs. breaking load
Aluminum		Use for 1 to 2 wire temporary fences. 38,000 psi / 215 lbs. breaking load

^{1/} Wires designated as regular, commercial and utility grade wires are available but do not offer the level of treatment as the Class I and III. Cooperators should be informed of this fact when considering wire. These types are not included in this standard. Most wire

manufacturers include wire specifications on fence tags. If information is not provided or known, lab testing may be needed to determine strength of wire.

WIRE SPACING

Height of the top wire will be as specified in Table 1. Fences for large animals like cattle will have the bottom wire a minimum of 12 inches from ground and no more than 18 inches when planning wildlife friendly fences. All other wires should be equally spaced between the top and bottom wires unless there is a combination of livestock, such as cattle and sheep, in which case the lower wires shall be designed for the smaller animal and overall height will be for the larger animal. For smaller animals like sheep and/or goats, the bottom wire shall be no more than 5-6 inches up from the ground and maximum spacing between lower wires (lower 18-20 inches of fence) will be 8 inches.

INSTALLATION OF WIRE

Fence wire will be stretched to sufficient tension prior to being fastened to posts. Temperature variations must be considered (wire will tighten in cold weather and expand in hot weather).

For suspension fences, wire tension is critical and wires should be stretched to allow no more than 3 inches of sag between posts set at 100 feet and 1.5 inches for posts at 50 feet.

Wherever possible, wire will be attached to fence post on side receiving most pressure, at top wire heights based on intended use (Table 1.)

ATTACHING WIRE TO POSTS

The following criteria will be followed for attaching wires to line posts:

Wood Posts

- Staples will be 9 gauge steel with a minimum length of 1 ½ inches for soft woods and 1 inches for hardwoods.
- Drive staples diagonally to the wood grain at a slight downward angle (upward if pull is up) to avoid splitting the post.
 - Space will be left between post and staple to allow free movement of wire and to avoid damage to zinc coating.

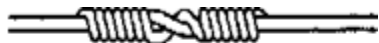
Steel posts(including T-Posts) - Manufactured wire clips or 12-12 ½ gauge galvanized wire can be used. Wire clips or drilled holes can be used for fiberglass posts. When using 12 - 12 ½ gauge wire on steel pipe posts, make sure wire is wrapped tightly to hold wire to specified heights and prevent movement up and down the post.

Insulators (electric fences only)

- Porcelain, ceramic, high quality UV Stabilized polyethylene or equivalent insulators will be used on wood and steel line posts as well as corner and end assemblies.
- Offset Brackets can be attached to standard fences at intervals of 50-60 feet and a height equal to 2/3 the height of the animal controlled.

WIRE SPLICES

The **Western Union** splice is the preferred method for standard wire. The splice shall have a minimum of 8 wraps on each side of center tightly wound and closely spaced. When using on woven wire, make the join at a vertical stay wire.



WESTERN UNION SPLICE

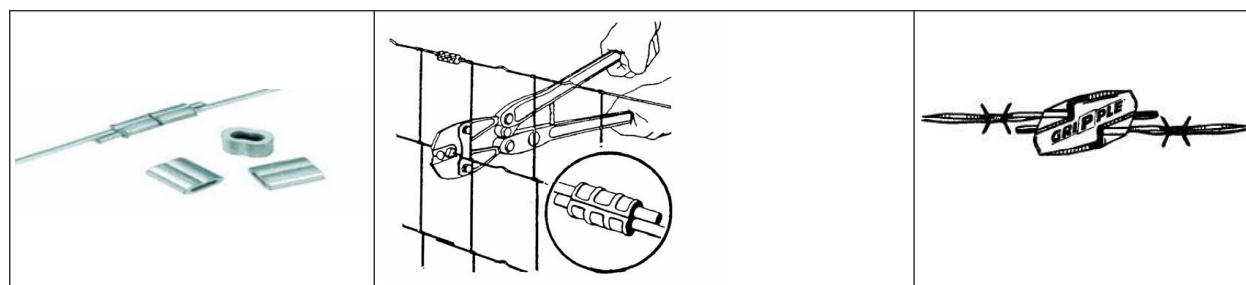
An accepted alternative for standard barbed wire fences is the “**double loop knot**” splice where the wire has a minimum of 8 wraps on each side of the loops. Do not use the on high tensile wire.



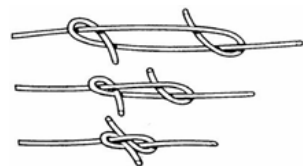
b) Double Loop Knot

Mechanical Splices are the preferred splice method for high tensile wire and are available for most standard wire types. Mechanical splices must be designed for the type of wire installed and have a tensile strength of at least 80% of the wire strength. Various types are available and each functions in a different manner and will be installed according to manufacturer's recommendations. Special tools may be needed for installation of these splices.

Crimping sleeves (left, center photos) are installed by sliding the two wire ends through a minimum of 2 sleeves and crimping with a special tool. The Gripple (right photo) splice is installed by inserting the two wire ends through a set of jaws that grab onto the wire and then a special tool is used to provide tension to the wire through the Gripple.

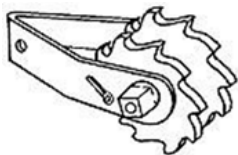


The “**Figure – 8**” splice is an alternative method for high tensile wire and works best on single strand, smooth wire. Install by overlapping wires 2 inches, looping each wire over and back through, and then pulling together. As the fence is stretched the splice will tighten.



IN-LINE STRAINERS

In-line strainers will be used to maintain tension in permanent, high tensile steel, smooth wire fences. They will be placed near center of fence line to achieve equal tension at both ends of the line. They should be installed on each wire between each pull assembly and a distance not to exceed 4,000 feet for straight line stretches and 1200 feet for uneven terrain or non-straight stretches.



POSTS

The criteria for posts apply to all line posts and posts used for brace assemblies. Table 3 contains additional criteria for line posts. Criteria for brace posts assemblies are found in Tables 4 and 5 and associated Figures for braces.

Wood Posts - Must be new (never before used), sound and free from decay. Except for red cedar, mesquite, Osage orange, catalpa, and black locust, all wood posts shall be treated with a preservative which is approved by either Federal Specification TT-W-571 or the American Wood Preservers Association (AWPA).

Steel Pipe - May be new or used, of good quality, free of rust and pitting, and painted or galvanized for rust resistance. Posts will have the top permanently capped to prevent rainfall from entering the post.

Trees as post. Fencing may be fastened to trees in rocky areas where postholes are impossible to dig or in frequently flooded areas where fences are difficult to maintain. Trees should be properly aligned and sturdy so that swaying and other movements will not affect the operation of the fence. A buffer (treated board) shall be installed between the wire and the tree to keep the tree from growing around the wire. In places where a buffer cannot be attached to the tree, the staples driven directly into the tree must completely penetrate the sapwood below the bark.

Table 3 Minimum Criteria and Specifications for Line Posts

Line Post Type ¹	Minimum Diameter/ Weight	Minimum Setting Depths (inches) ¹		
		Rocky Soils	Sandy Soils	All Other
Wood (round posts only)	3 inches	18	30	24
Standard steel "T" or "U" - New, high carbon steel, galvanized, enameled and baked, or painted with weather resistant steel paint. Will have an anchor plate and be studded, embossed or punched for wire attachment.	1.25 pounds per foot of length	Anchor plate must be fully into and below ground surface (Approx. 15-18 inches)		
Steel Pipe	2 inches outside diameter (OD) weighing 3.65 lb/ft or equivalent	18	30	24
The following criteria are applicable only for electric fences (most common use in temporary fences). Posts shall meet or exceed the requirements provided by energizer manufacturer. Fiberglass posts will be a composite of marble fiberglass and polymer resin, treated by thermosetting				

Manufactured "Tread-in" Type posts	Rigid Plastic, PVC, other synthetic posts	<i>For use with temporary electric fences only</i> – Set at 18 inches or depth recommended by manufacturer, whichever is deeper.

¹ Minimum lengths of posts will allow for required setting depths and fence height plus at least 2 inches of post above the top wire

LINE POST ALIGNMENT

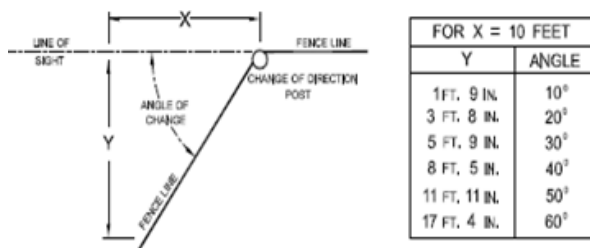
Spacing for line posts will be the same for all types of posts used. Maximum spacing is provided in Table 1. Installation shall ensure that adequate fence height is maintained based on its purpose (see Table 1). Line posts will be set in as straight a line as possible between corners or turns. When fencing along curved lines, use straight sections with appropriate in-line bracing.

BRACING and BRACE ASSEMBLIES

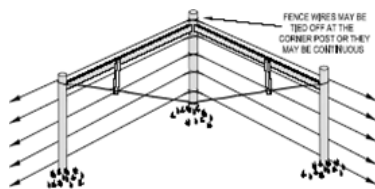
Bracing of anchor (pull) posts is required at all corners, gates, and fence ends and at certain specified distances (determined by length of pull) at sudden changes in elevation (slope) and alignment changes in the fence line.

Brace assemblies are installed to anchor wire strands and are the foundation of a good fence. They are designed to resist the loads that are transferred from tensioned fence wires, contraction of wire due to weather, and shock loads from livestock pressure or fallen trees. Braces fail because of structural failure (improper design, poor materials, and overstressed members), weak soil or soil movement (soils shear in front of posts, sandy soils) or post pullout (poor design or poor soils cant support tension). Therefore, criteria for brace assemblies account for soils, depth of post placement, number of wires (tension), terrain, materials and purpose.

End braces are required where fence ends and on both sides of gate openings. End braces will have an anchor (pull) post where wires are stretched and tied off and one or more brace posts installed in-line with direction of pull, in only one direction. When a change of direction occurs, forces placed on line-posts that are not inline cause leaning, pulling out or complete failure. Therefore, bracing is required. For angles of change (see diagram) less than 20 degrees, a single steel or wood brace post may be used at the point of direction change for extra support. In sandy soils or where angles exceed 20 degrees the inside or corner brace shall be considered in lieu of the single brace. The diagram illustrates the angle of change concept and provides a table that can be used to determine / plan angles of change. Example: measure along fence line (X) 10 feet from post where direction changes, then measure out to fence line (Y). If distance to Y is 4 ft., then according to Table, change of direction is slightly over 20°

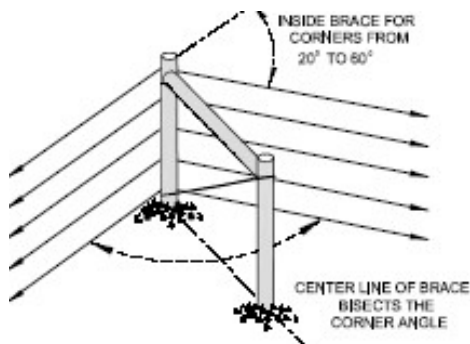


Corner Braces are required at all points where the fence alignment has an angle of change of 20 degrees or more and the pull is from two directions. Corner braces are comprised of the anchor (pull) post where wires are stretched and tied off and one or more brace posts (depending on length of pull) installed in-line with direction of both pulls. Normal brace assemblies are best used when the angle of change is 60-90 degrees. Wires are tied off and stretched at the anchor post.

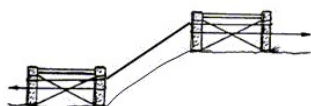


Normal corner assembly - Used when **angle of change is 60-90** degrees

Inside Braces – Best for when **angle of change is 20-60 degrees**. Wires do not have to be cut and tied off, but can wrap around outside post as long as it can be secured (held in place). Brace is installed as “H-Brace” or if using steel pipe, the brace can be an angle brace. Refer to materials and installation requirements for 2 post brace assemblies.

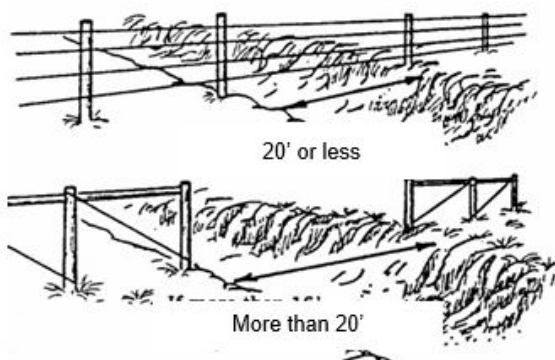


In – Line Pull Post assemblies are located in straight sections of the fence line with pulls in both directions where distance between anchor (pull) posts of corners or ends exceeds the distances outlined in Table 4. They allow for a point in which the wire can be tied off and stretched. They are also used where there are sudden changes in elevations, such as at the bottom and top of steep slopes, or on both sides of watercourses or depressions.

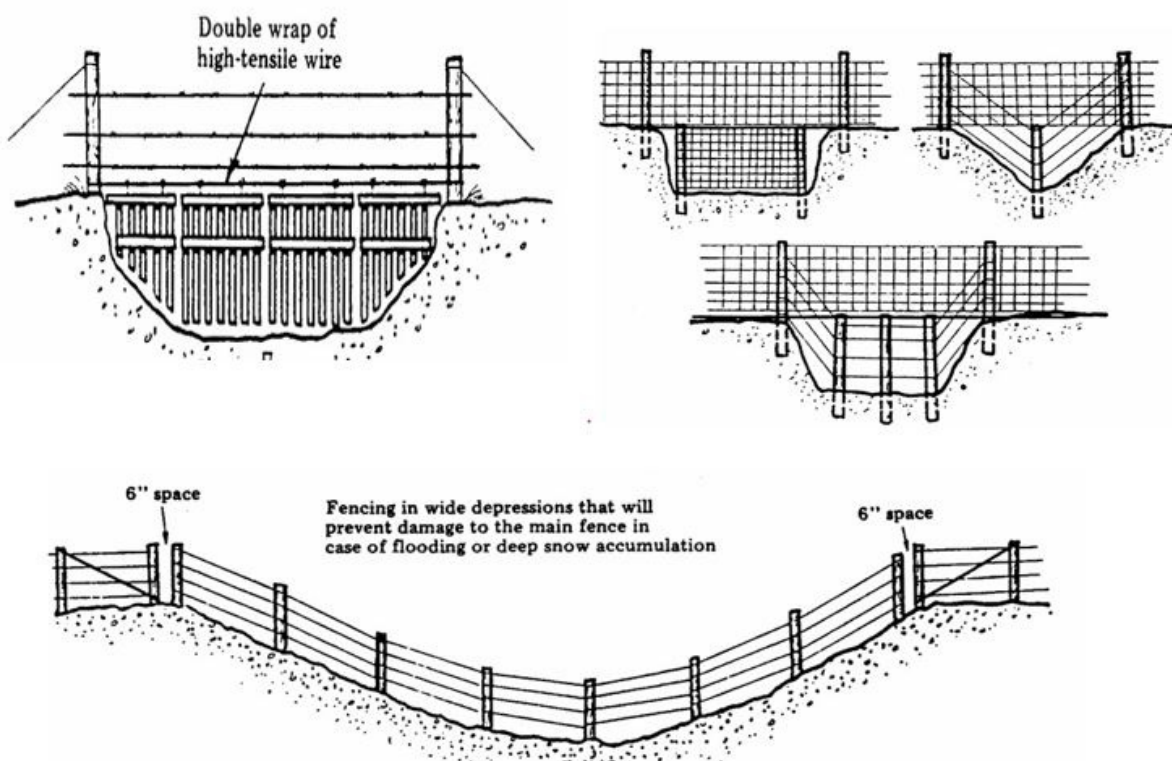


Braces on the top and bottom of steep slopes.

Crossings at watercourses and drainages (streams, draws, etc) may require special considerations to prevent washout or lifting of posts out of the ground. Materials will be of same kind, grade and size of materials, as adjacent fences. For crossings **less than 20 feet wide**, wires may continue across the depression (not tied off / anchored) with normal line posts on each side. For crossings **greater than 20 feet wide**, use the same guidance shown in Table 4 for End Braces on each side of the crossing. This will require the main fence line wires to be tied off and anchored on each side of the crossing and then wires are added in between the end braces, to complete the fence line across (elevated) or through the crossing (wide, shallow). Line posts in low areas that are subject to lifting out may require anchoring by use of concrete or weights.



To prevent animals from crossing under the fence, **water gaps** will be installed. For areas with very little water and only occasional flooding, a breakaway fence added below the main fence wires should be adequate. These are designed so that in the event they are damaged or wash out, the main fence is not damaged and these can be easily replaced. In areas subject to regular flooding, **flood gates** should be attached below bottom wire and will be designed to allow water and debris to pass and still control livestock. Some type of hinged or breakaway floodgate works best. These are typically made of treated wood or livestock panels.



Brace assemblies contained in these specifications are those that have been proven for longevity, strength and quality. The primary types of braces used and selection criteria are found in Table 4 and Figures as shown in Table 4. Specifications for materials and installation are found in Table 5.

Table 4. Brace Selection and criteria based on type of fence planned

Fence Types	Brace Assembly Types and Figure Reference	# Wires	Maximum Length of Pull (feet)
Standard wire fences (non-electric, electric and suspension)	Single Brace – Ends and Corners (Figure 1-3) These will be the most common brace assemblies used for most situations	5 or more	660' (clay or loam soils) 330' (sands, rocky or prolonged wet soils)
	Single Brace – Ends and Corners (Figure 1-3) These will be the most common brace assemblies used for most situations	3 - 4	1320' (clay or loam soils) 660' (sands, rocky or prolonged wet soils)
	Double Brace – Ends and Corners (Figures 4,5) Used when fence loads or soil conditions require increased brace strength	5 or more	1320' (clay or loam soils) 660' (sands, rocky or prolonged wet soils)
	Double Brace – Ends and Corners (Figures 4,5) Used when fence loads or soil conditions require increased brace strength	3-4	1320' or length of roll of wire
	In-Line Pull Assemblies (2-3 post wood, 3 post steel, welded) (Figure 7)	N/A	1320' or length of roll of wire
Woven Wire	Single Brace – Ends, Corners (excluding slip brace)	N/A	660'
	In-Line Brace Assemblies (2-3 post wood, 3 post steel, welded)	N/A	660' or length of roll of wire

Temporary Electric Fencing (Low tension applications)	Anchor / Pull Posts (Figure 6)	2 or less	1320' (clay or loam soils) 660' (sands, rocky or prolonged wet soils)
Temporary Electric Fencing (High tension applications)	Anchor / Pull Posts with Brace (Figure 6)	2-3	1320' (clay or loam soils) 660' (sands, rocky or prolonged wet soils)
Where rocky or shallow soil conditions do not allow for setting posts, rock baskets may be used for corners, ends and in-line pull assemblies. Rock baskets will be a minimum of 4 feet diameter, made from 4' tall, 12 ½ gauge woven wire or livestock panels with 4" x 6" openings. Wires may be wrapped around basket or 3" wood posts installed around perimeter to tie to.			<660'

Gates

Gates will be designed to accommodate cooperator objectives. Wire gates shall be made of the same materials of the same kind, grade and size specified for the field fence

Table 5. Brace Materials / Installation Specifications – For all Brace and Pull assemblies

Anchor and Brace Posts (used in Brace Assemblies Figures 1-5)	Wood: 6" top diameter, round posts only Steel Pipe: 2 ½" nominal (2 7/8 OD), Schedule 40 (5.8 lb/ft) Depth: All posts will be set at a depth of 42" (3 ½ feet). Steel posts when not driven will be centered in a hole that is a minimum of 12 inches in diameter and filled with concrete. The hole will be completely filled and crowned (mounded) at post base to prevent water from ponding around post at ground level. Minimum posts lengths will allow for required buried depth and fence height plus at least 2 inches of post above top wire. Attaching wire to Anchor / Pull Posts: For standard wire fences, wires will be attached to anchor (pull) posts by two complete wraps around post, stapled (wood posts) or wired (steel posts) and ends tightly twisted around stretched wire at least six times. For woven or mesh wire, determine amount of wire needed to fully wrap around post twice then remove enough vertical stays to provide the length needed. The wire ends are then attached as described above.
Wood Brace members	Size: 4" diameter, round posts only Length: Minimum 8 feet Height: Minimum 3 feet above ground and no closer than 8 inches from top of post Installation: The brace post and anchor posts should be notched to achieve a secure fit and the compression brace attached using 3/8 rebar or steel dowel pin (drilled to fit, and at least 2 inches into each post).

Steel Brace Members	Size: 2" nominal (2 3/8 OD), Schedule 40 (3.65 lb/ft) Length: Minimum 8 feet; Length of diagonal brace members will depend on distance between anchor (pull) post and brace post (stub). Height: Minimum 3 feet above ground but can be at top of post since it will be welded in place. Installation: Steel brace members in conjunction with wood anchor and brace posts will be installed into a 3/4 - 1 inch notch in brace posts. All steel assemblies will be welded and painted for rust protection.
Tension / Brace (guy) Wires	(WHERE APPLICABLE, WOOD ASSEMBLIES) Wire will be twisted or strained to provide necessary rigidity with a twist rod that should be 18 inches- 24 inches long and will remain in place approximately midway along brace wire. Brace wire will be double wrapped and stapled to brace post at height 4-6 inches above brace member and anchor (pull) post at a point no more than 4 inches above the ground level.
Single Anchor / Pull posts (Figure 6)	Wood or steel pipe: 4" diameter when driven Steel Pipe (not driven): 2 1/2" nominal, Schedule 40 if set in concrete at 24" depth Bracing (applicable): Knee braces, deadmen, angle bracing (see diagram) or special manufactured braces (follow installation instructions provided by manufacturer). There are several commercially manufactured systems that incorporate "T" post and steel pipe into bracing assemblies. These should meet or exceed the strength, durability and effectiveness of those provided here and installed according to manufacturer guidelines.

Figure 1. Single "H" Brace

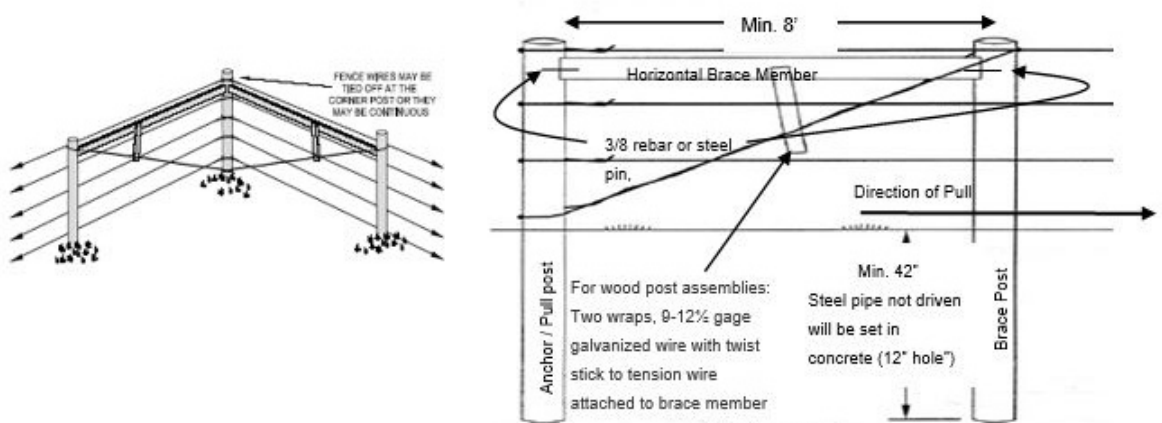


Figure 2 Single Post Steel Welded Angle Brace

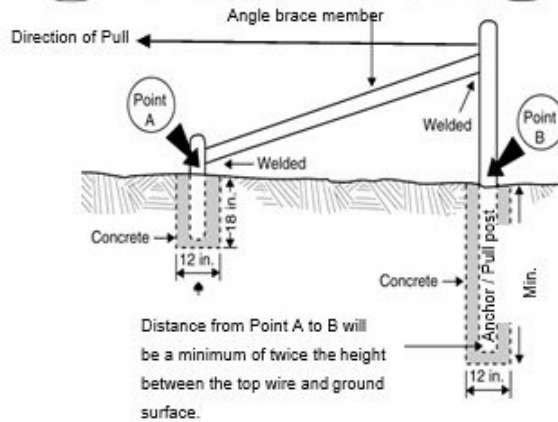


Figure 3 Slip Brace Not for Woven Wire

Single Post Corner Or Angle Brace Assembly

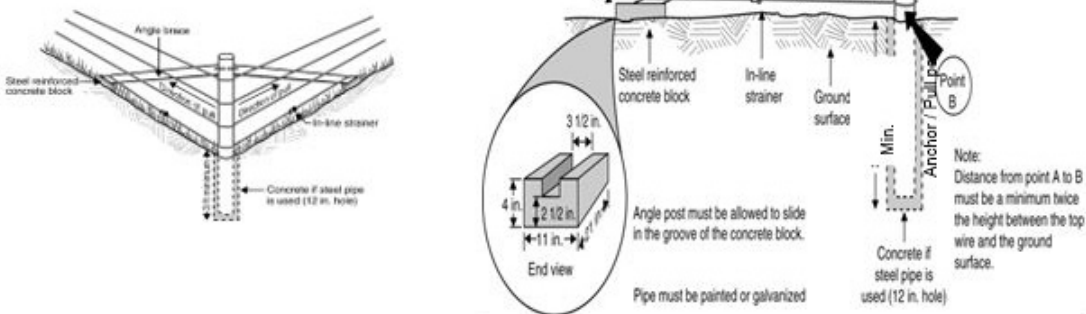


Figure 4 Double "H" Brace

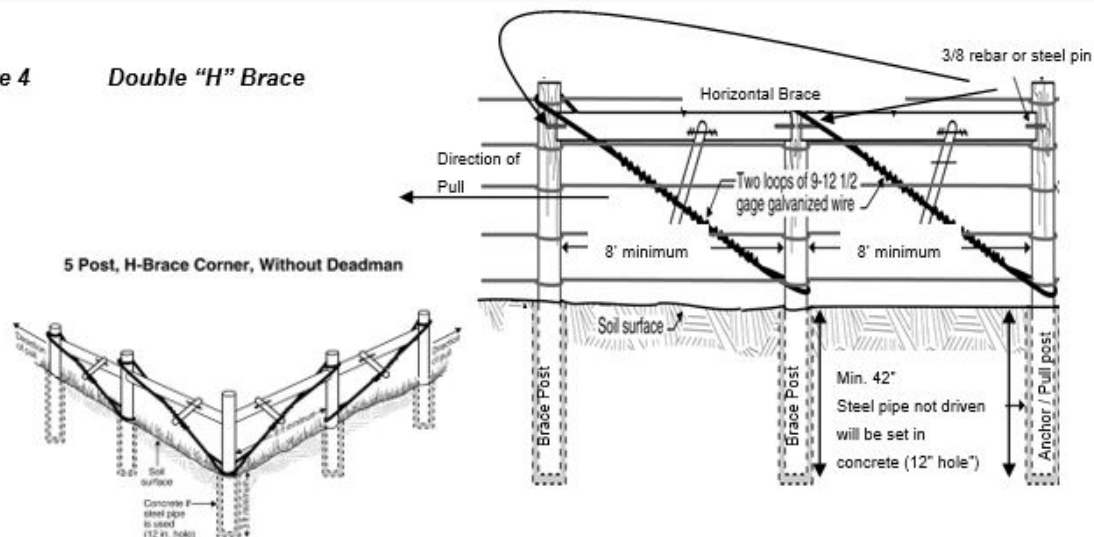


Figure 5 Double Post Steel Welded Angle Brace

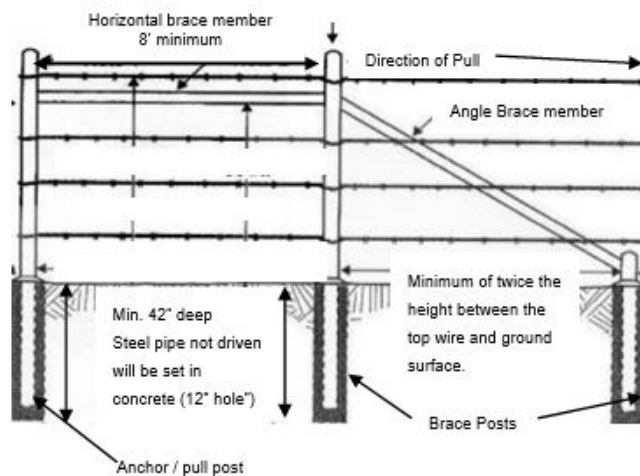


Figure 6 Single Anchor / pull post

Anchor added for high tension, 2-3 wires
(Refer to Table 4)

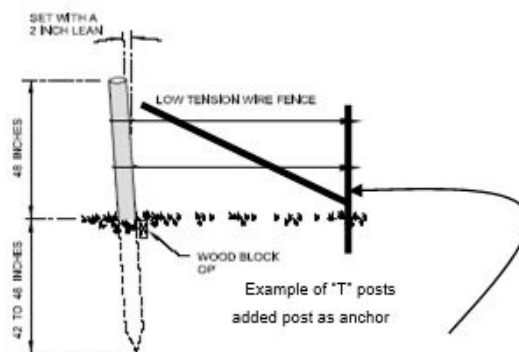
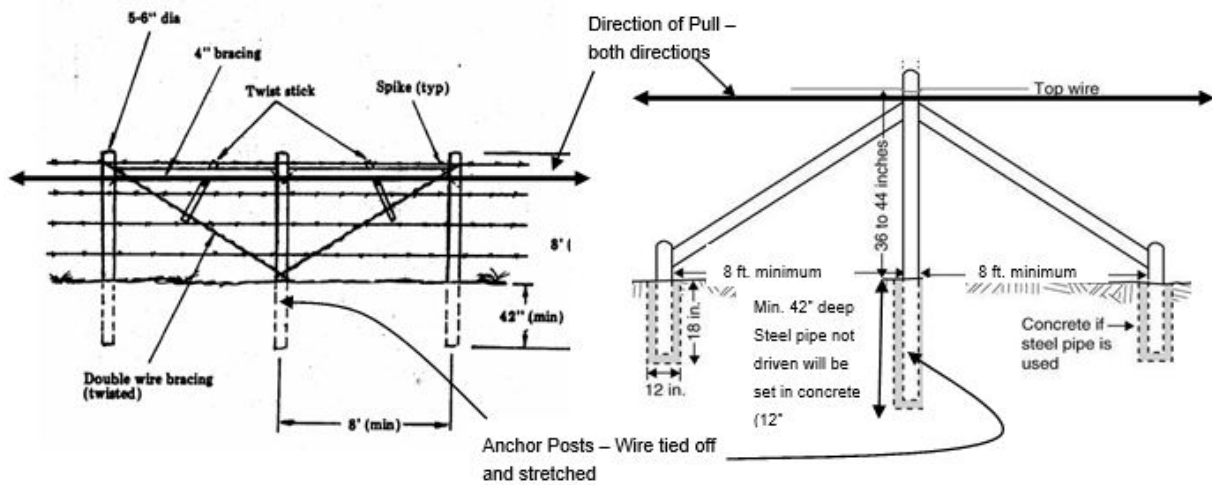


Figure 7 In-Line pull Post Assemblies



ADDITIONAL SPECIFICATIONS FOR ELECTRIC FENCES

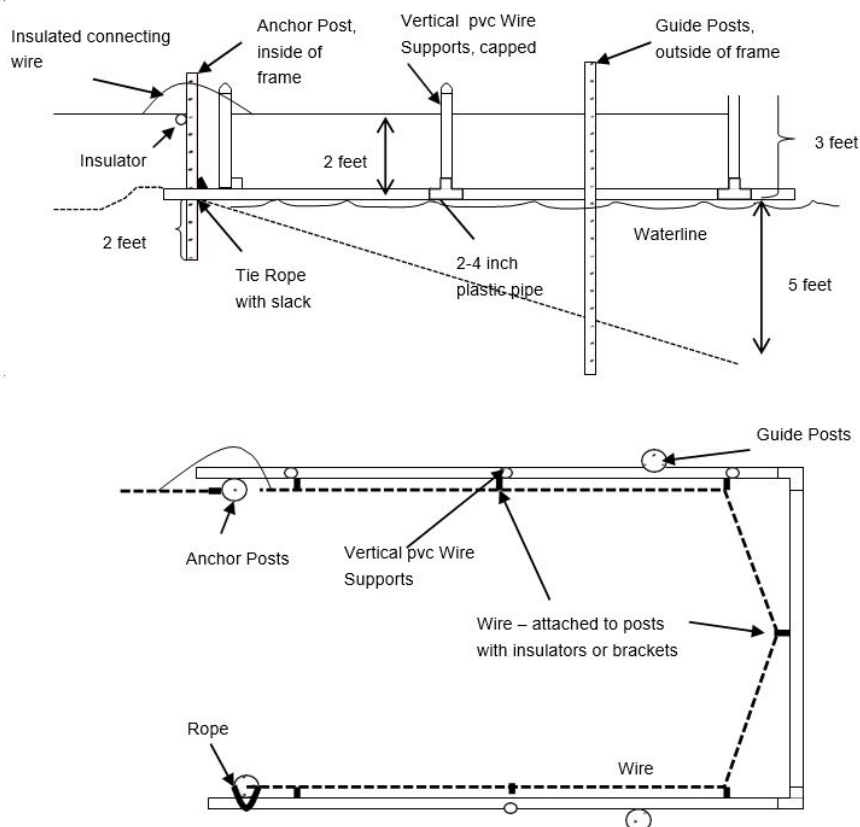
Energizers (power fence controllers) will be installed according to manufacturer's recommendations and should meet or exceed the following minimum criteria:

- May be solar, 110 or 220 volt, or 12 volt battery units.
- High power, low impedance with a 5,000 volt peak output and a pulse that is less than 300 milliamps (mAmps) in intensity, finished within 0.0003 of a second, and at a rate of 35-65 pulses per minute.
- Solid state circuitry and high impact weather resistant case.
- Safety pace fuse to prevent overpulsing
- Joule rating high enough to provide a minimum shock at the farthest point as follows:
 - Sheep and hair goats – 2000 volts
 - Horses, hogs and meat goats – 1200 volts
 - Cattle – 1600 volts
- Rule of Thumb for Joules – 1 output joule will power 3 miles of fence under normal loads. Heavy, dense vegetation will increase the load, therefore requiring more joules.
- Chargers will be grounded and protected from lightning according to energizer manufacturer recommendations.
- *When two or more wires are used, the top wire should always be hot. With two wires, the bottom can be hot or grounded, with three or more, wires will alternate hot / ground with top and bottom being hot.*

Gates for energized fences shall be installed according to manufacturer's recommendations.

ADDITIONAL SPECIFICATIONS FOR FLOATING ELECTRIC FENCE

In lieu of a permanent fence, a floating electric fence can be constructed. All wire, insulators and installation will be according to materials and construction specifications for all other fences.



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. This should be at a minimum depth of 5 feet.

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.

3. Specific Site Requirements