

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD**

**FENCE  
(Feet)  
CODE 382**

**DEFINITION**

A constructed barrier to animals or people.

**PURPOSE**

The fence practice facilitates the accomplishment of conservation objectives by providing a means to control movement of animals, people, and vehicles.

**CONDITIONS WHERE PRACTICE APPLIES**

The fence practice may be applied on any area where management of animal or people movement is needed. Fences are not needed where natural barriers effectively serve the purpose.

**CRITERIA****General Criteria Applicable To All Purposes**

Height, number, and spacing of fence wires shall be installed to facilitate control and management of the animals or people of concern.

Fencing materials, type, and design of fence installed shall be of a high quality and durability. The type and design of fence installed will meet the management objectives and site challenges. Based on need, fences may be permanent, portable, or temporary.

All materials used to construct a permanent fence shall meet or exceed the minimum requirements in the Materials section of the Specifications. Placement of posts for permanent fences shall meet the requirements for the applicable post material and fence type in the Post Placement section of the Specifications.

The fence design and installation shall follow all federal, state, and local laws and regulations.

All permanent fences are to be constructed with the intent of being left in place for at least 20 years. Therefore, the criteria for all permanent fences require material, design, and construction

that shall have a minimum life expectancy of 20 years with minimal maintenance.

Fences shall be positioned to facilitate management requirements. Ingress/egress features such as gates and cattle guards shall be planned.

Height, size, spacing and type of posts will be used that best provide the needs for the type of fence required and are best suited for the topography of the landscape.

All fence wires shall be attached to the side of the post closest to the livestock. Wire shall be placed on the outside of corner posts and where placing the wires on the outside of a curve in the fence is required for structural stability.

Notching of posts to retain wires or braces is prohibited in any part of a fence.

Fence location is the responsibility of the landowner/user. Legal surveys may be needed for proper fence location.

The landowner shall be responsible for locating all buried utilities in the project area, including drainage tile and other structural measures.

**Permanent Electric Fence**

Barbed wire is not to be electrified or insulated for electrification.

Electronic energizers or power fence controllers shall be installed and grounded according to the manufacturer's recommendations. The energizer shall be protected by an external lightning arrester. For protection of 120- or 240-volt energizers, a voltage surge/spike protector shall also be installed.

**Permanent Non-Electrified Fence**

Barbed wire fence shall not be used for containment of sheep or goats.

Woven wire fences for containment of sheep or goats, or where needed to protect livestock from predators, shall be constructed with the base of the woven wire placed within 2 inches of the ground surface.

### Temporary Fence

For temporary electric fence, the number of wires and spacing shall be designed to accomplish the desired result of the fence, with a fence height at least 2/3 of the shoulder height of the grazing animal. When multiple wire systems are used, spacing of wires should be designed to ensure head electrical contact when animal attempts to place head between wires.

Manufactured products such as temporary poly-wire, poly-tape, or plastic net fence may be used for animals such as sheep, goats, hogs, and crowding areas. Follow manufacturer's directions for construction, use, and operation.

Temporary fences may be attached to permanent fences to further subdivide pastures.

### CONSIDERATIONS

The fence design and location should consider: topography, soil properties, livestock management and safety, livestock trailing, wildlife class and movement, location and adequacy of feeding and watering facilities, development of potential grazing systems, human access and safety, landscape aesthetics, erosion problems, moisture conditions, flooding potential, stream crossings, and durability of materials. When appropriate, natural barriers should be utilized instead of fencing.

Where applicable, cleared rights-of-way may be established to facilitate fence construction and maintenance. Avoid clearing of vegetation during the nesting season for migratory birds.

Fences established across gullies, canyons or streams may require special bracing, designs or approaches.

Fence design and location should consider ease of access for construction, repair and maintenance.

Fence construction requiring the removal of existing unusable fence should provide for the proper disposal of scrap materials to prevent harm to animals, people and equipment.

Consider wildlife movement needs when locating and constructing fences. Strands of

wire spaced too close together at the top of a fence can entangle deer.

When using gates of substantial weight, consider supporting free end of gates, when open or closed, to relieve constant pressure applied to post on hinged end of gate.

Consider soil erosion potential when planning and constructing a fence on steep slopes.

When using electric fences, use training areas to condition livestock to fences. Select a well-fenced area and construct an electric fence across or around the area to allow animals to come in contact with the electric fence. Normally, a minimum of 12 hours of exposure to the electric fence is required. Most animals will be fully trained in 48 hours. When animals approach the fence with caution, they are trained.

When using electric fence with sheep or goats, they must be clean shorn prior to being introduced to the fence.

Check with appropriate utilities prior to erecting electrified wires or ground wires near overhead power lines, telephone wires, or radio antennas. If electrified fences must cross power lines, etc., cross lines at as close to perpendicular as possible and keep top fence wire below 6 feet. Ground rods may be needed at each side of crossing for safety in case of downed power lines.

**Consider all safety recommendations and cautions from suppliers, distributors, manufacturers, installers, dealers, power companies, electricians, and other professionals, when constructing fences.**

### PLANS AND SPECIFICATIONS

Plans and specifications are to be prepared for all fence types, installations and specific sites. Requirements for applying the practice to achieve all intended purposes shall be described. Plans and specifications shall be in keeping with the Illinois Fence standard.

The plan shall include the following:

- Location of fences marked on the Plan Map.
- Total number of acres to be fenced.
- Fence components that include items identified on Job Sheets 382e and 382ne, as applicable.
- Quantities of materials to be used that are not included in job sheets.

- Quality of materials to be used (treatment, protection, etc.)
- Completed standard drawings, as applicable.
- Applicable Job Sheets.
- Construction specifications

**OPERATION AND MAINTENANCE**

Develop an operation and maintenance plan that is consistent with the purposes of the practice, intended life, safety requirements, and the criteria for the fence design.

The operation and maintenance plan shall include the following, as applicable:

Regular inspection of fences should be part of an ongoing maintenance program. Inspection of fences after storms and other disturbance events is necessary to ensure the continued proper function of the fence.

Maintenance and repairs will be performed in a timely manner as needed, including tree/limb removal and water gap replacement.

Clear vegetation from fence lines to reduce voltage loss. Remove fallen limbs. Overhanging trees and limbs should be trimmed or removed as needed to prevent trees or limbs from falling onto the fence.

Voltage of electric fences will be checked periodically to ensure at least 3,000 peak volts at the farthest distance from the charger. If voltage is not sufficient, determine the cause and correct. During dry weather, ground rods may need water applied to soil around them.

Maintain between 200 to 250 lbs. tension on Hi-Tensile fence wires. Check wire tension throughout the year.

Electrified floodgates must be maintained and kept clear of debris. During extended flooding periods, switch floodgate(s) off.

Remove and properly discard all broken fencing material and hardware. All necessary precautions should be taken to ensure the safety of construction and maintenance crews.

**REFERENCES**

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**NATURAL RESOURCES CONSERVATION SERVICE  
CONSTRUCTION SPECIFICATION**

**FENCE**

**(Electric Fence)**

**SCOPE**

The work shall consist of constructing the fence, including any associated gates, water gaps, electrical system and other related items as required by the construction plans or job sheets.

**LOCATION**

The location of the fence shall be as shown on the Fence Job Sheet (JS382e) or identified on a project map, and as staked in the field.

**SITE PREPARATION**

All trees, stumps, brush and debris shall be removed from the fence construction site and disposed of so that they will not interfere with construction or proper functioning of the fence. Removed material shall not be deposited or buried in a draw.

Remove and properly discard all broken fencing material and hardware. All necessary precautions should be taken to ensure the safety of construction and maintenance crews.

**MATERIALS**

**Fence Wire (Energized) and Fasteners**

Wire shall be 12½ gauge, single strand, minimum tensile strength of 140,000 PSI, and 1,078 lbs. minimum breaking strength. All wire shall have, as a minimum, Class III galvanization.

All fasteners for insulators, etc. will be Class III galvanized or stainless steel.

**Wire Insulation**

All underground wire installations must be double-insulated, Class III galvanized, Hi-Tensile strength steel 12½ gauge or larger wire. The insulation must be high-density polyethylene with ultraviolet stabilizer or high-density polypropylene with ultraviolet stabilizer.

Insulators for steel and other conductive material posts must be high-density

polyethylene with ultraviolet stabilizer, high-density polypropylene with ultraviolet stabilizer, or porcelain that withstands a minimum of 12,000 volts or more without arcing.

Insulators for end, corner, and angle braces must be high-density polyethylene with ultraviolet stabilizer, high-density polypropylene with ultra-violet stabilizer, or porcelain that withstands a minimum of 12,000 volts or more without arcing. Do not use insulated galvanized wire or reinforced tubing for attaching fence wires around post of brace assemblies.

Red insulators should not be used due to their attractiveness by hummingbirds.

**Posts and Stays**

Posts and stays shall conform to size and material specifications in Table A, except as noted below.

Use of landscape timbers is prohibited in any part of a fence.

Reinforced concrete or metal posts of equivalent strength to wood posts specified for corner, gate, end or pull assemblies, and brace posts may be substituted if a suitable means of attaching wires and braces to the posts is available.

Six (6) foot, or longer, fiberglass posts may be used in exterior fences; however, if the depth of placement is less than the depth required in Table A, every sixth post must be wood and the wood posts must meet size and depth placement specifications for exterior fences.

Manufactured fiberglass brace assemblies that contain fiberglass posts (minimum of 2 inches outside diameter and 1.5 inches inside diameter) and are attached to screw-in anchors in the ground are acceptable if installed according to manufacturer's recommendations, and if the fiberglass component is guaranteed to last for 20 years without flaking, peeling, rotting, abnormally

discoloring, splintering or deteriorating from sunlight and weather.

Live trees shall be allowed for bracing or line posts only when application of standard wooden posts or steel posts is impractical because of restrictive soil depths due to parent material (rock, shale, etc.) and cannot be set or driven to the minimum depths required by the standard and specification. At no time shall live trees constitute more than 10 percent of the line posts used.

Live trees used for bracing and line posts shall have a diameter breast height (DBH) equal to or greater than those prescribed for normal wooden posts.

The top of all wooden posts shall be 2 to 4 inches above the top wire of the fence to prevent splitting when attaching insulators.

All posts of materials other than wood shall be at least 1-inch higher than the top wire of the fence.

## CONSTRUCTION

### Wire Placement

Fence height shall be defined as the average height from ground to top of wire at each fence post. Fence height of exterior/property line fences shall be at least 54 inches, unless a lower height is allowed by law and is shown on the Fence Job Sheet (JS-382e). In no case shall the height of the exterior/property line fences be lower than 48 inches.

Fence height of interior fences shall be at least 2/3 of the shoulder height of the grazing animals.

Wire shall be attached to line posts by a method that allows the wire to slip. Attach wire to fiberglass posts by loose clips or by running through holes in post. For wood or steel posts, attach wire to posts by insulators. Attach to stays with tight clips to hold stays in place.

Wires shall be placed on the side of the post located closest to the livestock. Wires shall be placed on the outside of corner posts and where placing the wires on the outside of the post(s) in a curve in the fence is required for structural stability.

All sections of fence must be started and ended at all corners, ends, braces, and pull assemblies. For dug corners/ends only one

(1) corner may be pulled around using Hi-Tensile single strand wire. For driven corners/ends less than 500' from end to end, a maximum of four (4) driven corners may be pulled around using Hi-Tensile single strand wire. Wire tighteners/strainers will be placed in the middle of the pull.

Splicing of Hi-Tensile wire will be accomplished by using a lap splice with 3 crimping sleeves or equivalent, "figure eight knot," "square knot," "Western-Union splice" or other acceptable tying methods. Tying of Hi-Tensile wire to end post will be accomplished using "thread through method" or an eye splice with 2 crimping sleeves with appropriate insulators as needed. (Reference standard drawing: Methods of Tying Hi-Tensile Strength Wire).

Positive charged wires must be insulated when coming into contact with conductive material (i.e. posts, corners, trees, etc.).

When using live trees as posts, protection will be provided between the tree and wire or insulators by:

1) using strips of treated wood, red cedar, Osage orange, black locust, fiberglass or rigid plastic. Strips should be at least 3½ inches wide and 6 inches in length and placed 3 inches above top and 3 inches below bottom of wire to prevent splitting or cracking; or

2) using a 3/8 inch by 8 inch eye or "J" screw may be fastened directly to the tree to the depth of the threads and then an end or corner insulator assembly attached to the eye or "J" screw.

### Wire Tension

In-line strainers/wire tighteners will be installed on each wire to obtain/maintain the correct tension. In-line strainers/wire tighteners will be installed in the center of wire pull sections when wire pulls are greater than 600 foot in length.

The tension on each wire shall be maintained according to type of grazing animal or season. A tension spring will be used on at least one wire strand as a guide in maintaining proper tension. Tension of wires will be approximately 200 – 250 pounds.

Where electrified exterior/property line fences come into proximity of trees/woods, all wire

strands shall be installed with tension springs. Interior fences with 4 wires or greater that are located in proximity of trees/woods should have springs installed on the top two wire.

Use of tools specifically designed for handling and constructing Hi-Tensile fence is recommended for safety and ease of installation.

### Number and Spacing of Wires

The number of wires shall be as shown on the Fence Job Sheet (JS-382e).

Exterior/property line fences shall be constructed of at least five wires. Interior cross fences shall be constructed of one or more wires, with the interior fence height being at least 2/3 of the shoulder height of the grazing animals.

Table C suggests wire spacings and electrical polarity for different kinds and classes of grazing animals. When multiple wire systems are used, spacing of wires should be designed to ensure head electrical contact when an animal attempts to place head between the wires.

In instances where ground moisture is high, an all-positive charged fence will normally suffice. If experience shows that the soil on site will dry to the point of not causing a shock to the animal, then a combination of positive (+) and negative (-) wires should be used.

One- and two-wire electric fences may be used for interior uses such as streamside fencing and subdividing pastures, but may not be used for property line or roadside fencing.

### Post Placement

In undulating terrain, space posts and stays so fence height is maintained. Posts in dips shall be constructed so that they will not pull out of the soil. Two-inch or smaller posts will be anchored or wooden posts set to sufficient depth to resist pull out.

Set or drive posts to depth as specified on plans or as outlined for the type of post in Table A.

Backfill around posts shall consist of earth or Illinois Department of Transportation Gradation No. CA-6 coarse aggregate. The backfill shall be placed in layers no thicker than 4 inches; each layer shall be thoroughly tamped, and

shall completely fill the post hole up to the ground surface on set posts.

Spacing of line posts and stays for permanent electric fence depends on terrain and number of wires. Maximum spacings are as follows (Refer to Table D):

- One-wire fences have line posts spaced up to 90 feet apart with no stays.
- Two- and three-wire fences have line posts spaced up to 50 feet with no stays or up to 100 feet with stays placed every 50 feet.
- Four-wire fences have line posts spaced up to 30 feet with no stays or up to 90 feet with stays placed every 30 feet.
- Five-wire and above fences have line posts spaced up to 30 feet apart.

### Corners and Braces

Bracing is required at all corner, gate, pull, and end assemblies in a fence. The horizontal brace member shall (as a minimum) be the equivalent of a 4-inch diameter post or standard weight (schedule 40) galvanized steel pipe of at least 2 3/8-inch outside diameter installed in the upper 1/3 of the posts and below the top wire. Steel pipe may be primed and painted as an alternative to galvanizing. The horizontal brace member length shall be between 8 foot and 2.5 times the height of the top fence wire. As a minimum, 3/8-inch diameter, class III galvanized pins will be used to hold horizontal brace in place. A tension member (brace wire) composed of 2 complete loops of Class III galvanized 9 gauge smooth wire or Class III galvanized 12½ gauge Hi-Tensile strength smooth wire may be used. "H" Braces, Double "H" Braces, or Angle Braces shall be used in standard fences. Refer to applicable IL NRCS Fence standard drawings for specifications on corners, angles, or brace assemblies.

End bracing will be installed at locations where the fence ends and on both sides of gate openings when gate is located inline.

Changes in fence directions greater than 20 degrees, but less than 60 degrees require change of direction bracing as shown in standard drawings.

Changes in fence directions from 60 to 90 degrees require a standard corner brace assembly.

Driven series of single posts should be used on a maximum of 10-foot centers when rounding a long, gradual fence curve greater than 20 degrees. Driven single posts must have a minimum diameter of 6 inches and be driven at least 4 ft. into the ground with a 4" lean toward the outside of the curve.

Double "H" assemblies are required for all fences that have greater than 6 strands of Hi-Tensile wire or 8-foot high game fences.

On sandy loams and coarser textured soils, or sites with restricted soil depth of less than 36 inches, a "deadman", a screw-in anchor applied against the direction of pull, or a double "H" assembly is required.

For double post pull assemblies with brace (H assembly), wire must be tied off at pull assembly to the post opposite the direction of pull. (Refer to standard pull assembly drawing.)

Dug brace assemblies that are supporting gates must have an additional brace wire to support the gate, resulting in brace wires making an "X".

Pull assemblies shall be spaced at intervals not to exceed 1,320 feet (80 rods). Tie off all wires at pull assemblies and start new wires for the next section.

Single driven 7-inch minimal diameter post may be substituted for end panel, corner, and vertical change bracing, and pull post assemblies. The posts shall be driven a minimum of 5 feet into the ground.

Three wire Hi-Tensile fence corner, gate, end, and brace post assemblies may use a single 6 in. X 8 ft. post driven 48 inches into the ground with properly tightened wires.

Corner, gate, end, and brace post assemblies for 1- and 2-wire fences may use the options listed in Table A.

### **Electrical Grounding System**

All electric fences must be grounded. The two type of systems are listed below.

Earth-Return System – An energizer grounding system is used that relies on livestock's contact with the earth for a ground and the resulting shock.

Wire-Return System – An energizer ground is used and at least one non-energized fence

wire is connected to the non-energized side of the energizer, ensuring that a circuit is completed when an animal comes in contact with an energized wire and a grounded wire.

Non-electrified fence wires need to be attached to a ground rod at intervals between 1,300 to 1,500 feet, or according to manufacturer's recommendations.

Install at least one ground rod at all breaks in the fence such as gates, gaps, and flood control sections. Keep ground rods at least 25 feet from water lines, well casings, or other grounding systems. Do not use the grounding system for other existing applications. Do not connect the energizer into any existing ground system.

For best results, ground rods (galvanized pipe or rod ½ inch or larger in diameter) should be buried where soil remains moist. Drive sufficient 6- to 8-foot rods into the ground at least 10 feet apart and 6 to 8 feet deep to provide the required amount of grounding. Connect a continuous ground wire (12½ gauge, Class III galvanization) from the energizer to each pipe or rod with a galvanized steel or bronze clamp.

Copper clad ground rods with copper wire may be used if the energizer terminals are stainless steel. If energizer terminals are not stainless steel, do not use copper due to corrosion at the connections and subsequent loss of electrical continuity. Use a copper clamp only with copper wire and copper clad ground rod.

### **Energizer**

Electronic energizers or power fence controllers shall be installed according to manufacturer's recommendations and will meet the following minimum specifications:

- High voltage, low impedance that produces at least 5,000-volt peak output and a short pulse that is less than 300 mAmps in intensity, finished within 0.0003 of a second and a rate of 35 - 65 pulses per minute.
- High impact, weather resistant case.
- Solid state circuitry. Snap in service modules provides for fast field repair.
- Safety pace fuse, to prevent over-pulsing.
- 110-volt or 220-volt mains.
- 12-volt battery powered system capable of charging fence adequately for three weeks before replacing or re-charging battery.

- On fences electrified by battery-powered energizers requiring more energy than can be supplied by a dry-cell battery, a properly sized solar battery charger or solar array will be required.

All energizers must be properly grounded. Normally, three ground rods at the energizer are a minimum. Follow energizer manufacturer's recommendations for minimum grounding requirements. More ground rods may be needed for system to function properly.

All energizers require an external lightning arrestor. Attach lightning arrestor to the fence wires. Install an induction loop type lightning choke in the fence line immediately between the energizer and lightning arrestor/fence. Install more ground rods for the lighting arrestor than for the energizer/charger. Lightning arrestor ground rods must be placed at least 50 feet from the energizer ground rods. (Refer to IL NRCS fence standard drawings for lightning protection and grounding.)

#### **Surge/Spike Protection**

For protection of 120- or 240-volt energizers, a voltage surge/spike protector shall be installed between the energizer and power supply. Also, ground rod(s) should be installed at electric company's transformer pole (primary ground) and ground rod(s) installed at the electrical circuit breaker box (secondary ground), if they do not exist. **Check with local power supply company to ensure applicability and installation.**

#### **Power Supply Cable**

To cross gates and areas where electrical shocks to humans and livestock should be prevented (e.g. working facilities), use 12½ gauge double insulated Class III galvanized wire (insulation rated at 20,000 volts minimum). For underground burial, use 12½ gauge double insulated Class III galvanized wire designed for burial (insulation rated at 20,000 volts minimum). Place buried wire inside plastic pipe to decrease incidence of grounding. When overhead transmission is used, height should be sufficient so as not to impede livestock movement. Wire for overhead transmission does not require insulation.

Buried wire from energizer to fence connection must be insulated and placed in plastic pipe to

decrease incidence of grounding. Insulation must be rated at 20,000 volts minimum.

#### **Do not use household insulated copper wire due to low voltage ratings.**

Wire connections will be made with crimping sleeves, wire crimping taps, split bolt, tap line, or flexible spring connector.

#### **Gates and Water Gaps**

On hinged gates, set hinge pins to hold gate in place so gate cannot be lifted off pins.

Electrified gates may be constructed of a single straight wire with a spring loaded insulated handle, or an expandable, coiled, Hi-Tensile, 12½ gauge wire attached to an insulated handle. The number of wires shall be determined by the fence objective and be at least equal to the number of wire strands in the fence. The gate shall be constructed to be non-electrified when open. Over head or underground transmission lines will carry electricity past the gate to the remainder of the fence.

Fencing across areas of concentrated flow should include water gaps or flood gates. For areas with very little water and only occasional flooding, a breakaway fence or water gap will be sufficient. Areas with regular flooding will require floating gates or panels, or water gates. Refer to applicable IL NRCS Fence standard drawings for water gaps and flood gates.

For depressions less than 16 feet wide, install fence across the depression with no braces.

For depressions over 16 feet wide, construct a fence that will breakaway only in the depression and leave the rest of the fence undamaged. Construct brace assemblies on each side of the depression. Construct a fence in the depression with single end posts 6 inches from the brace assemblies, which allows the depression fence to breakaway without damaging the main fence. Attach breakaway fence section to the main fence with light gauge wire. Refer to applicable IL NRCS Fence standard drawings for more details about fencing across depressions.

If the depression has regular flooding, use a swinging or floating panel. The panel must be free to swing when water comes through. Construct horizontal cross braces on the down-stream side of the vertical panel(s) in

order to provide for a smooth edge for debris to slide by on the upstream side. Using only wire panels will result in debris catching on the panel and clogging the panel, resulting in failure. Refer to applicable IL NRCS Fence standard drawings for more details about flood gates or picket fences across a stream.

An electrified floodgate may be used in lieu of a non-electrified gate if desired. The electrified flood gate is constructed by stretching an electrified wire across the drainage above high water flow level. Attach droppers of 12½ gauge Hi-Tensile fence wire or drop chains to the electrified wire at a horizontal spacing of 6-inches, stopping above average normal water level. Use crimping sleeves or spacers to ensure drops stay in position. Connect gate to

electric fence with double-insulated cable through a cut-off switch and floodgate controller. Secure drops with crimp sleeves to hold in place. Refer to applicable IL NRCS Fence standard drawings for more details about electric flood gate.

#### **UTILITIES**

The landowner and/or contractor shall be responsible for locating all buried utilities in the project area, including drainage tile and other structural measures.

Prior to all digging and soil disturbance landowner and/or contractor will call Julie.

**TABLE A:** Acceptable post materials and installation depths for electrified fence.

Function	Material Type	Min. Dia. in Inches	Notes
Line Posts and Stays  (Posts must be set or driven at least 24 inches in the ground, except 18 inches for 1 and 2 wire fence posts in soil which is not sandy loam or coarse textured.)	Australian ironwood (eucalyptus)	2	
	Fiberglass reinforced solid round rod	2/3	With UV inhibitors
	70% polypropylene/30% wood	1 1/8	With UV inhibitors, color pigments
	Fiberglass reinforced plastic T-post	1" cross-section minimum	With UV inhibitors
	Black locust, red cedar or redwood <sup>1</sup>	3	At least one half of the diameter of the red cedar or redwood post shall be heartwood.
	Osage orange	2½	
	Pressure-treated pine or other wood of equal life and strength. <sup>1</sup>	3	Pressure treatment shall be according to Table B.
	Standard "T", "Y", or "U" shaped steel posts (hot dip galvanized, painted with high grade weather resistant steel paint, or enameled and baked).	*	<b>* Weight must be at least 1.33 pounds per foot of length less the weight of the anchor plate.</b> Posts must be new. Posts must be set solidly in the ground so that the top of the anchor plate is below the ground surface.
Posts for 3 to 6 wire corners, gates, end or pull assemblies, and brace post assemblies	Wood posts, including black locust, red cedar, redwood, osage-orange, or pressure-treated pine or other wood of equal life and strength. <sup>1</sup>	5 (3 wires) 6 (4 – 6 wires)	Posts for "H" assemblies must be driven or set at least 36 inches deep or below the frost line.
		6 (3 wires)	Single post driven 4 foot into the ground.
		7 (4 - 6 wires)	Single post driven 5 foot into the ground.
Posts for 4+ wire fence corner, gate, end, and brace post assemblies	Manufactured fiberglass brace assemblies that contain fiberglass posts (minimum of 2 inches outside diameter and 1.5 inches inside diameter) and attached to screw in anchors with appropriate angle bracing.	2	Must be installed per manufacturer's recommendations, fiberglass component guaranteed to last for 20 years without flaking, peeling, rotting, abnormally discoloring, splintering, or deteriorating from sunlight and weather.
Posts for 3 wire fence corner, gate, end, and brace post assemblies	Manufactured fiberglass brace assemblies that contain fiberglass posts (minimum of 2 inches outside diameter and 1.5 inches inside diameter or 2 inch diameter) and attached to screw in anchors with appropriate angle bracing.	2	Must be installed per manufacturer's recommendations, fiberglass component guaranteed to last for 20 years without flaking, peeling, rotting, abnormally discoloring, splintering, or deteriorating from sunlight and weather.
Posts for 1 and 2 wire corners, gates, end or pull assemblies, and brace post assemblies	Standard "T", "Y", or "U" shaped steel posts (hot dip galvanized, painted with high-grade weather resistant steel paint, or enameled and baked) with appropriate knee, deadman, angle, or "H" brace.	*	<b>* Weight must be at least 1.33 pounds per foot of length less the weight of the anchor plate.</b> Posts must be new. Posts must be set solidly in the ground so that the top of the anchor plate is below the ground surface.
	Wood posts, including black locust, red cedar, redwood, osage orange, or pressure-treated pine or other wood of equal life and strength, with appropriate knee, deadman, angle, or "H" brace. <sup>1</sup>	3½	Posts must be set at least 36 inches in the ground.
	Wood posts, including black locust, red cedar, redwood, osage orange, or pressure treated pine or other wood of equal life and strength, without any bracing. <sup>1</sup>	5	Posts must be set to a depth at least equal to the height of the post above the ground.
		4	Driven to a depth of 48 inches
	Steel pipe without any bracing.	2¾	Posts must be set to a depth at least equal to the height of the post above the ground.
Manufactured fiberglass brace assemblies that contain fiberglass posts (minimum of 2 inches outside diameter and 1.5 inches inside diameter or 7/8 inch diameter) and attached to screw-in anchors with appropriate angle bracing.	2	Must be installed per manufacturer's recommendations, fiberglass component guaranteed to last for 20 years without flaking, peeling, rotting, abnormally discoloring, splintering, or deteriorating from sunlight and weather.	

<sup>1</sup>At least one half of the diameter of the red cedar or redwood post shall be heartwood. Pressure treatment shall be according to Table B

**TABLE B:** Allowable pressure treatment for wood posts. Pressure treatment shall conform to American Wood Preservers Association (AWPA) Standard U1, Use Category 4 (UC4) or higher.

Treatment Type	Pressure Treatment Level
Pentachlorophenol (PCP)	UC4 = 0.4 lbs/ft <sup>3</sup>
Creosote and creosote solutions	UC4 = 6.0 – 8.0 lbs/ft <sup>3</sup>
Chromated Copper Arsenate (CCA)	UC4 = 0.4 lbs/ft <sup>3</sup>
Alkaline Copper Quat (ACQ)	0.4 lbs/ft <sup>3</sup>

UC4 = A – Ground contact or fresh water.  
 B – Ground contact, fresh water or important construction components.  
 C – Ground contact, fresh water or critical structural components.

**TABLE C:** Suggested number of wires, animals, fence height, wire spacings and wire charge.

Wires	Animal	Fence Height in Inches*	Spacing from Ground in Inches
1	Cattle Hogs	26 to 32 12	26 to 32+ 12+
2	Cattle Cattle, Sheep, Goats Sheep Hogs	24 to 36 20 to 30 18 to 20 18	18 to 24+/-, 24 to 36+ 8 to 10+, 20 to 30+ 8 to 10+, 18 to 20- 6+, 18+
3	Cattle w/calves, Division Fences Sheep, Goats Cattle, Horses Hogs	34 to 44 32 46 18	11 to 18-/+ , 23 to 30-, 34 to 44+ 10+, 20+/-, 32+ 20+, 34+/-, 46+ 6+, 12+, 18+
4	Cattle, Sheep Cattle Sheep, Goat	30 to 35 40 30 to 38	5 to 7-, 12 to 15+, 18 to 24-, 30 to 35+ 8+/-, 18+, 28+/-, 40+ 6 to 16+/-, 12 to 22+, 18 to 30+/-, 30 to 38+
5	Cattle Horses Sheep, Goats	50* 54 48*	10+, 20+/-, 30+, 40+/-, 50+ 12+, 22-, 32+, 42-, 52 to 54+ 6 to 7+, 11 to 13-, 18 to 21+, 26 to 30-, 35 to 40+
6	Sheep, Goats	48*	5 (neutral), 10 to 11+, 15 to 17-, 21 to 24+, 28 to 32-, 36 to 46+
7	Sheep, Goats (predator)	54"	6+, 12-, 18+, 26-, 34+, 44-, 54+

+ = positive charged wire, - = ground wire, and +/- = positive or ground wire

\* exterior/property line fences = 54 inches, unless a lower height is allowed by law and as shown on the Fence Job Sheet (JS-382e).

**TABLE D:** Spacing of fence posts and stays relative to the number of line wires

Electric Fences, Erected in Straight Lines Over Level Terrain			
Number of line wires	Maximum Spacing of Primary Line Posts		Maximum Stay Spacing
	Without Stays	With Stays	
1	90'	-	-
2	50'	100'	50'
3	50'	100'	50'
4	30'	90'	30'
5	30'	-	-
6	30'	-	-

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSTRUCTION SPECIFICATION**

**FENCE**

**(Barbed Wire, Woven Wire or Suspension Fence)**

**SCOPE**

The work shall consist of constructing the fence, including any associated gates, water gaps and other related items as required by the construction plans or job sheets.

**LOCATION**

The location of the fence shall be as shown on the Fence Job Sheet (JS382e) or identified on a project map, and as staked in the field.

**SITE PREPARATION**

All trees, stumps, brush and debris shall be removed from the fence construction site and disposed of so that they will not interfere with construction or proper functioning of the fence. Removed material shall not be deposited or buried in a draw.

Remove and properly discard all broken fencing material and hardware. All necessary precautions should be taken to ensure the safety of construction and maintenance crews.

**MATERIALS**

**Fence Wire and Fasteners**

All wire shall have Class III galvanization.

For barbed wire, each line wire will consist of 2 twisted strands of 12½ gauge wire or Hi-Tensile strength wire of 15½ gauge. The barbs shall be either 2-point barbs on approximately 4-inch centers, or 4-point barbs on approximately 5-inch centers. 4-point barbs provide more deterrent to grazing animals.

For woven wire, top and bottom strands of standard or Hi-Tensile woven wire shall be 12½ gauge or heavier, and 14½ gauge wire, or heavier, for intermediate strands.

For smooth wire to be installed in conjunction with woven wire, the wire shall be 12½ gauge, single strand, minimum tensile strength of 140,000 PSI, and 1,078 lbs. minimum breaking strength. All wire shall have, as a minimum, Class III galvanization.

Staples shall be of 9-gauge Class III galvanized steel or heavier with a minimum length of 1 1/2 inches for softwoods and a minimum length of 1 inch for close-grained hardwoods. Wires shall be attached to steel posts by use of manufacturer's clips or by two turns of 14-gauge Class III galvanized wire.

**Posts and Stays**

Posts and stays shall conform to the size and material specifications in Table E, except as noted below.

Use of landscape timbers is prohibited in any part of a fence.

Reinforced concrete or metal posts of equivalent strength to the wood posts specified for corner, gate, end or pull assemblies, and brace posts may be substituted if a suitable means of attaching wires and braces to the posts is available.

Live trees shall be allowed for bracing or line posts only when application of standard wooden posts or steel posts is impractical because of restrictive soil depths due to parent material (rock, shale, etc.) and cannot be set or driven to the minimum depths required by the standard and specification. At no time shall live trees constitute more than 10 percent of line posts used.

Live trees used for bracing and line posts shall have a diameter breast height (DBH) equal to or greater than those prescribed for normal wooden posts.

The top of all wooden posts shall be 2 to 4 inches above the top wire of the fence to prevent splitting when attaching insulators.

All posts of materials other than wood shall be at least 1-inch higher than the top wire of the fence.

**CONSTRUCTION**

**Wire Placement**

Fence height shall be defined as the average height from ground to top of wire at each fence post. Fence height of exterior/property line fences shall be at least 54 inches unless a

lower height is allowed by law and as shown on the construction plans/job sheet. In no case shall the height of the exterior/property line fence be lower than 48 inches.

Fence height of interior fences shall be at least 42 inches.

Wire shall be attached to wood posts by staples. Drive staples in diagonally to the wood's grain and at a slight downward angle, (upward if pull is up) to avoid splitting post and loosening of staples. Space should be left between the staple and the post to permit free movement of wire. For suspension fences, special manufactured fasteners specific to the purpose may also be used.

Wires shall be placed on the side of the post located closest to the livestock. Wire shall be placed on the outside of a curve in the fence when required for structural stability.

Joining of wires will be by way of approved splices such as "Western-Union Splice," square knot, or lap splice with 3 crimping sleeves or equivalent. "Figure eight knots" may be used for joining of Hi-Tensile wires.

When using live trees as posts, protection will be provided between the tree and wire by:

- 1) using strips of treated wood, red cedar, Osage orange, black locust, fiberglass or rigid plastic. Strips should be at least 3½ inches wide and 6 inches in length and placed 3 inches above top and 3 inches below bottom of wire to prevent splitting or cracking; or
- 2) using a 3/8 inch by 8 inch eye or "J" screw may be fastened directly to the tree to the depth of the threads and then an end or corner insulator assembly attached to the eye or "J" screw.

In-line strainers/wire tighteners will be installed on each smooth Hi-Tensile wire placed above woven wire to obtain/maintain the correct tension. In-line strainers/wire tighteners will be installed in the center of wire pull sections.

The tension on each wire shall be maintained according to type of grazing animal or season. A tension spring will be used on at least one wire strand as a guide in maintaining proper tension. Tension of wires will be approximately 200 – 250 pounds.

Placement of a single strand of barbed wire at ground level on the opposite side of the post from woven wire will assist in protecting livestock from predators.

### **Number and Spacing of Wires**

The number of wires and spacing shall be as shown on the job sheet.

Barbed wire fences shall be either four (4) or five (5) wires for exterior/property line fences. A minimum of three wires shall be used for interior fencing. Wires shall be spaced approximately equal distances apart. The bottom wire shall be 12 to 18 inches above the ground level. Wires shall be spaced no more than 12 inches apart.

Woven wire exterior/property line fences with woven wire height equal to or less than 32 inches shall have at least 2 barbed or smooth wires above the woven wire, spaced evenly (10 to 12 inches) between the top of the woven wire and the top fence wire. All other woven wire fences shall have at least 1 barbed or smooth wire above the woven wire spaced at 8 to 12 inches above the top woven wire.

Suspension fences shall have a minimum of four barbed wires spaced approximately an equal distance apart, and wire stays shall swing free of the ground. To allow for appropriate sway of the fence, tension on line wires shall permit a maximum 3-inch sag in 100-foot span of fence in warm weather.

### **Post Placement.**

In undulating terrain, space posts and stays so that fence height is maintained. Posts in depressions shall be constructed so that they will not pull out of the soil. Two-inch diameter or smaller posts will be anchored or wooden posts set to sufficient depth to resist pull out.

Set or drive posts to the depth as specified on plans or as outlined for the type of post in Table E.

Backfill around posts shall be earth or Illinois Department of Transportation Gradation No. CA-6 coarse aggregate. The backfill shall be placed in layers no thicker than 4 inches, each layer shall be thoroughly tamped, and shall completely fill the post hole up to the ground surface.

Spacing of line posts and stays for permanent non-electric fence is dependent on type of fence. Maximum spacing shall be as follows:

- Standard barbed wire fences have line posts spaced up to 20 feet with no stays or up to 30 feet with stays every 15 feet.
- Standard woven wire fences have line posts spaced up to 15 feet apart.
- Hi-Tensile woven wire fences have line posts spaced up to 20 feet apart.
- Suspension barbed wire fences have line posts spaced up to 100 feet with stays placed every 15 feet.

### **Corners and Braces**

Bracing is required at all corner, gate, pull, and end assemblies in a fence. The horizontal brace member shall (as a minimum) be the equivalent of a 4-inch diameter post or standard weight (schedule 40) galvanized steel pipe of at least 2 $\frac{3}{8}$ -inch outside diameter installed in the upper 1/3 of the posts and below the top wire. Steel pipe may be primed and painted as an alternative to galvanizing. The horizontal brace member length shall be between 8 foot and 2.5 times the height of the top fence wire. At a minimum 3/8-inch diameter, Class III galvanized pins will be used to hold horizontal brace in place. A tension member (brace wire) composed of 2 complete loops of Class III galvanized 9 gauge smooth wire or Class III galvanized 12 $\frac{1}{2}$ -gauge Hi-Tensile strength smooth wire may be used. "H" Braces, Double "H" Braces, or Angle Braces shall be used in standard fences. Refer to applicable IL NRCS Fence standard drawings for specifications on corners, angles, or brace assemblies.

End bracing will be installed at locations where the fence ends and on both sides of gate openings when gate is located inline.

Changes in fence directions greater than 20 degrees, but less than 60 degrees require change of direction bracing as shown in standard drawings.

Changes in fence directions from 60 to 90 degrees require a standard corner brace assembly.

Driven series of single posts should be used on a maximum of 10-foot centers when rounding a long, gradual fence curve greater than 20 degrees. Driven single posts must have a minimum diameter of 6 inches and be  
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July, 2010

driven at least 4 ft. into the ground with a 4 in. lean toward the outside of the curve.

Double "H" assemblies are required for all 8-foot high game fences.

On sandy loams and coarser textured soils, or sites with restricted soil depth of less than 36 inches, "deadman", a screw-in anchor applied against the direction of pull, or a double "H" assembly is required.

For double post pull assemblies with brace (H assembly), wire must be tied off at pull assembly to the post opposite the direction of pull. (Refer to standard pull assembly drawing.)

Pull assemblies shall be spaced at intervals not to exceed 1,320 feet (80 rods) for barbed wire fences and 660 feet (40 rods) for woven wire fences. Tie off all wires at pull assemblies and start new wires for the next section.

Dug brace assemblies that are supporting gates must have an additional brace wire to support the gate, resulting in brace wires making an "X".

A single 7-inch minimum diameter driven post may be substituted for end panel, corner, and vertical change bracing, and pull post assembly for 6 strand barbed wire or less. The post shall be driven a minimum of 5 feet into the ground.

### **Gates and Water Gaps**

On hinged gates, set hinge pins to hold gate in place so gate cannot be lifted off pins.

Fencing across areas of concentrated flow should include water gaps or flood gates. For areas with very little water and only occasional flooding, a breakaway fence or water gap will be sufficient. Areas with regular flooding will require floating gates or panels, or water gates. Refer to applicable IL NRCS Fence standard drawings for more detail on water gaps and flood gates.

For depressions less than 16 feet wide, install fence across the depression with no braces.

For depressions over 16 feet wide, construct a fence that will breakaway only in the depression and leave the rest of the fence undamaged. Construct brace assemblies on each side of the depression. Construct a fence in the depression with single end posts 6 inches from the brace assemblies, which

allows the depression fence to breakaway without damaging the main fence. Attach the breakaway fence section to the main fence with light gauge wire. Refer to applicable IL NRCS Fence standard drawing for more detail on fencing across a depression.

If the depression has regular flooding, use a swinging or floating panel. The panel must be free to swing when water comes through. Construct horizontal cross braces on the down-stream side of the vertical panel(s) in order to provide for a smooth edge for debris to slide by on the upstream side. Using only wire panels will result in debris catching on the

panel and clogging the panel, resulting in failure. Refer to standard drawings for flood gates or picket fence across stream.

**UTILITIES**

The landowner and/or contractor shall be responsible for locating all buried utilities in the project area, including drainage tile and other structural measures

Prior to all digging and soil disturbance landowner and/or contractor will call Julie.

**TABLE E:** Acceptable post materials and installation depths for non-electrified fence.

Function	Material Type	Minimum Diameter in Inches	Notes
Line Posts and Stays  (All Posts must be set or driven at least 24 inches in the ground.)	Black locust, red cedar or redwood.	3	At least one half of the diameter of the red cedar or redwood post shall be heartwood.
	Osage orange.	2½	
	Pressure-treated pine or other wood of equal life and strength.	3	Pressure treatment shall be according to Table F.
	Standard "T," "Y," or "U" shaped steel posts (hot dip galvanized, painted with high grade weather resistant steel paint, or enameled and baked).	*	<b>* Weight must be at least 1.33 pounds per foot of length less the weight of the anchor plate.</b> Posts must be new. Posts must be set solidly in the ground so that the top of the anchor plate is below the ground surface.
Wood posts for corners, gates, end or pull assemblies, and brace post assemblies.	Wood posts, including black locust, red cedar, redwood, osage-orange, or pressure-treated pine or other wood of equal life and strength, with appropriate knee, deadman, angle, or "H" brace.	6	At least one half of the diameter of the red cedar or redwood post shall be heartwood. Pressure treatment shall be according to Table F. Posts must be set at least 36 inches deep or below the frost line.

**TABLE F:** Allowable pressure treatment for wood posts. Pressure treatment shall conform to American Wood Preservers Association (AWPA) Standard U1, Use Category 4 (UC4) or higher.

Treatment Type	Pressure Treatment Level
Pentachlorophenol (PCP)	UC4 = 0.4 lbs/ft <sup>3</sup>
Creosote and creosote solutions	UC4 = 6.0 – 8.0 lbs/ft <sup>3</sup>
Chromated Copper Arsenate (CCA)	UC4 = 0.4 lbs/ft <sup>3</sup>
Alkaline Copper Quat (ACQ)	0.4 lbs/ft <sup>3</sup>

- UC4 = A – Ground contact or fresh water.
- B – Ground contact, fresh water or important construction components.
- C – Ground contact, fresh water or critical structural components.

**NATURAL RESOURCES CONSERVATION SERVICE  
OPERATION AND MAINTENANCE**

**FENCE**

The Fence facilitates the installation of a grazing system that has been developed for the livestock operation. Proper Operation and Maintenance will keep the fence practice functioning as intended:

- Inspect fences after storms and other disturbance events. Perform maintenance and repairs in a timely manner as needed.
- Remove and properly discard all broken fencing material and hardware. All necessary precautions should be taken to ensure the safety of construction and maintenance crews.
- Repair or replace post assemblies whenever they show signs of weakness.
- Refasten loose wires to posts and splice broken wires as necessary.
- Keep the fence properly stretched.
- Check water gaps and/or flood gates after heavy rains to remove any blockage and restore proper function.
- Remove fallen limbs from the vicinity of the fence, and repair or replace fence components promptly as needed.
- Clear brush and vegetation from fence lines to reduce voltage loss. Trim or remove overhanging trees and limbs as needed to prevent falling onto the fence.
- Check voltage of electric fences periodically to ensure at least 3000 peak volts at the farthest distance from the charger. If voltage is not sufficient, determine the cause and correct. During dry weather, ground rods may need water applied to adjacent soil.
- Maintain between 200 to 250 lbs. tension on Hi-Tensile fence wires. Check wire tension throughout the year.
- Electrified floodgates must be maintained and kept clear of debris. During extended flooding periods, switch floodgate(s) off.

ADDITIONAL DETAILS:

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