Practice Specification
Fence (Code 382)
Safety/Security Fence Specifications

SCOPE

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

LOCATION

Locate the fence as shown on the project map and as staked in the field.

SITE PREPARATION

Remove all trees, stumps, brush and debris from the fence construction site and dispose of properly so that they will not interfere with construction or proper functioning of the fence. Removed material must not be deposited or buried in a draw.

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

MATERIALS

Chain Link Fence

Chain Link Wire Fabric

Must be a minimum 5 feet high, 9 gauge wire with a minimum tensile strength of 1,290 lbs. Chain link fence fabric must conform to the requirements of ASTM A 392, “Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric,” 2-inch woven mesh, and 9-gauge galvanized steel wire.

Install chain link fabric on the side of the fence post that will receive the highest loading, as identified in the construction plans. The fabric must not be attached to posts until at least 5 days after posts are set in the ground with concrete backfill. The fabric must be stretched taut and securely fastened, using 9 gauge tie clips, to posts at intervals not exceeding 15 inches and to top rails or tension wires at intervals not exceeding 2 feet. Take care to equalize the tension on each side of each post.

Steel Pipes

Posts and fence framework must conform to the requirements of ASTM F 1043 “Strength and Protective Coatings on Steel Industrial Fence Framework.”

Top rail and gate frames: Must be a minimum 1 5/8 inch outside diameter standard (Schedule 40) steel pipe.

Line posts: Must be a minimum 2-inch nominal outside diameter standard (Schedule 40) steel pipe, and of sufficient length to support the height of the fence. Set line posts in concrete a minimum of 30 inches deep. The concrete for each line post must be at least 4 times the diameter of the post and extend at least 6” below the bottom of the post.

Corner, gate, end and pull posts: Must be set at the beginning and end of each continuous length of fence and at abrupt changes in vertical or horizontal alignment. Pipe posts must be a minimum 2 3/8 inch nominal outside diameter standard (Schedule 40) steel pipe, and of sufficient length to support the height of the fence. Set in concrete a minimum of 30 inches deep. The concrete must be at least 4 times the diameter of the post and extend at least 6 inches below the bottom of the post.

Use pull posts in all straight spans of fence longer than 500 feet.

Fittings and Gates: Fence fittings must conform to the requirements of ASTM F 626, “Standard Specification for Fence Fittings.” Fittings must be galvanized steel. Wire ties and clips must be 9 gauge galvanized steel.

Installation: Unless otherwise specified by the manufacturer, line posts must be set at intervals not exceeding 10 feet, as measured from center to center of each post.

For all concrete around posts, extend concrete 2 inches above grade and towel to a crown to shed water.

Line posts may be driven to a minimum of 42 inches into grade and concrete omitted.

Corner, gate, end and pull posts may be driven to a minimum of 48 inches into grade and concrete omitted.

Cap all posts immediately after installation.

Gate frames must be fabricated and hung so that they sag no more than 1 percent of the gate width.

Woven Wire Fence

Fence Wire and Fasteners

All wire must have Class III galvanization.

If barbed wire is used in conjunction with the woven wire, the wire must consist of 2 twisted strands of 12½ gauge (standard, non-high tensile) wire or Hi-Tensile strength wire of 15½ gauge or larger (14 ½). The barbs must 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.

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

For standard woven wire, top and bottom strands must be 10 gauge or heavier, and 12½ gauge wire, or heavier for intermediate strands.

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

Staples must be of 9-gauge Class III galvanized steel or heavier with a minimum length of 1½ inches for softwoods and a minimum length of 1 inch for close-grained hardwoods. Wires must 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 must 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 pipe 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.

CONSTRUCTION

Wire Placement

The top of all wooden posts must 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 must be at least 1-inch higher than the top wire of the fence.

Fence height is be defined as the average height from ground to top of wire at each fence post. Fence height is be a minimum of five feet tall.

Attach wire to wood posts using 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. Leave space 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.

Place wires must be located on the side of the fence post that will receive the highest loading, as identified in the construction plans. Place wire on the outside of a curve or corner in the fence when required for structural stability.

Join wires with approved splices such as “Western-Union Splice,” square knot, or lap splice with three crimping sleeves or equivalent. “Figure eight knots” may be used for joining of Hi-Tensile wires.

Construct the woven wire fence with the base of the woven wire placed 2-4 inches off the ground surface.

Post Placement

In undulating terrain, space posts and stays so that fence height is maintained. Posts in depressions must 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 must be earth or Illinois Department of Transportation Gradation No. CA-6 coarse aggregate. The backfill must be placed in layers no thicker than 4 inches, each layer must be thoroughly tamped, and must completely fill the posthole up to the ground surface.

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

- Standard woven wire (class III galvanized) fences have line posts spaced up to 15 feet apart.
- Hi-Tensile woven wire fences have line posts spaced up to 20 feet apart.

Corners and Braces

Used pipe such as ‘drill stem’ pipe and used railroad ties or utility poles may be used as posts if they are whole, sound, free from decay, have not been previously used as fence material, and so long as minimum diameter and length requirements are met for the type of fence to be constructed. Used red cedar, black locust and Osage orange can be used as long as the posts are whole, sound and free of decay and 1 inch larger in diameter than designated in Table E.

Wood post will be treated with the materials and treatment levels as required in Table F and untreated wood used for post will consist of black locust, red cedar, Osage orange and red wood. These untreated wood posts will be referred to as, “Native wood” posts in this practice standard. Bracing is required at all corner, gate, pull, and end assemblies in a fence. Notching of posts to retain wires or braces is prohibited in any part of a fence and is discouraged on native wood species.

Install end bracing at locations where the fence ends and on both sides of gate openings when gate is located inline.

Double “H” assemblies are required for all 8-foot high fences.

Double “H” assemblies are required where sandy loams and coarser textured soils, or sites with restricted soil depth of less than 48 inches exist, a “dead-man”, or a screw-in anchor applied against the direction of pull. Refer to Web Soil Survey: soil reports, soil physical properties, engineering properties.

For corrosive soils, screw anchors may be used in place of a dead-man, looping brace wires through eye of installed screw anchor. Refer to Web Soil Survey: soil reports, soil qualities and features, soil features.

Space pull assemblies at intervals not to exceed 660 feet. Tie off all wires at pull assemblies.

For 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 IL ENG-810.)

For double “H” assemblies, wire must be tied off at middle post. Loose tie wires from center post to end post. (Refer to standard pull assembly drawing.IL ENG-832.)

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, vertical change bracing, and pull post assembly. The post must be driven a minimum of 5 feet into the ground.

The horizontal brace member must (as a minimum) be the equivalent of a 4-inch diameter post or standard weight (schedule 40) galvanized steel pipe of at least 2⅜-inch outside diameter installed in the upper 1/3 of the posts and below the top wire.

The horizontal brace member length must be between 8 foot and 2.5 times the height of the top fence wire. As a minimum, 3/8-inch diameter, Class I, Class II or Class III galvanized pins will be used to hold horizontal brace in place.

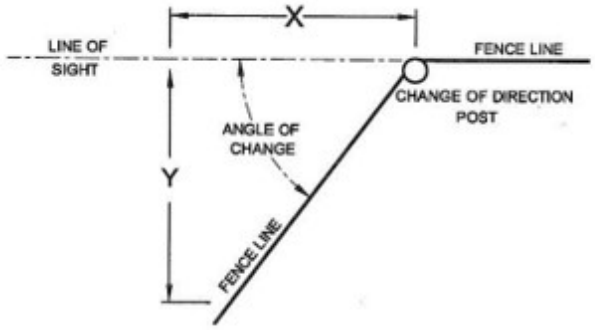
Schedule 40 galvanized steel pipe 2 3/8 –inch (OD) diameter, can be used for end, corner and braces posts, and follow standard drawings.

Steel pipe may be primed and painted as an alternative to galvanizing.

Changes in fence directions greater than 20 degrees, but less than 60 degrees require change of direction bracing as shown in standard drawing IL ENG-823, option 1. Tie off all wires at corner and end posts. Do not pull barbed or woven wire around corner posts.

The diagram below 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 Figure 1, change of direction is slightly over 20 degrees.

Figure 1 Estimating Fence Line Angle of Change



FOR X = 10 FEET	
Y	ANGLE
1 FT. 9 IN.	10°
3 FT. 8 IN.	20°
5 FT. 9 IN.	30°
8 FT. 5 IN.	40°
11 FT. 11 IN.	50°
17 FT. 4 IN.	60°

Changes in fence directions from 60 to 90 degrees require a standard corner brace assembly. Tie off all wires at corner posts.

Do not pull wire around corner posts.

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 inch lean toward the outside of the curve.

Gates

On hinged gates, set hinge pins to hold gate in place so gate cannot be lifted off pins. When using gates of substantial weight, provide support to the free end of gates, when open or closed, to relieve constant pressure applied to post on hinged end of gate.

Gate height must equal the height of the installed fence.

UTILITIES

The landowner and/or contractor is 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 36 inches in the ground.) See note for depth of T posts	Black locust, red cedar or redwood. [1,2]	3	At least one-half of the diameter of the red cedar or redwood post must be heartwood.
	Osage orange. [1,2]	2 1/2	
	Pressure-treated pine or other wood of equal life and strength.	3	Pressure treatment must 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).	*	*** Weight must be at least 1.33 pounds per foot of length with the weight of the anchor plate.** 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, pressure-treated pine or other wood of equal life and strength, with appropriate knee, deadman, angle, or "H" brace. [1,2]	6	At least one-half of the diameter of the red cedar or redwood post must be heartwood. Pressure treatment must be according to Table F. Posts must be set at least 48 inches deep or below the frost line.

[1]At least one-half of the diameter of the red cedar or redwood post must be heartwood. Pressure treatment must be according to Table F.

[2]Used red cedar, black locust and Osage orange can be used as long as the posts are whole, sound and free of decay and 1 inch larger in diameter than designated in Table E.

TABLE F: Allowable pressure treatment for wood posts. Pressure treatment must 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^3
Creosote and creosote solutions	UC4 = 6.0 – 8.0 lbs/ft^3
Chromated Copper Arsenate (CCA)	UC4 = 0.4 lbs/ft^3
Alkaline Copper Quat (ACQ)	0.4 lbs/ft^3
Micronized Copper Quaternary (MCQ)	UC4 = 0.34 lbs/ft3
Micronized Copper Azole (MCA)	UC4 = 0.15 lbs/ft3

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.

Specific Site Requirements

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