Practice Specification
Fence - Woven Wire Fence (Code 382)

SCOPE

This specification establishes the technical details, workmanship, quality and extent of materials required to install the line assemblies in accordance with the Conservation Practice Standard. Specifications for braces and other line assemblies are contained in separate documents.

The NRCS Washington Jobsheet for Woven Wire Fence shall be used to document the site-specific requirements for installing, operating, and maintaining the practice on a specific field or treatment unit. The work shall consist of furnishing materials and installing materials for the specified design at the location(s) shown on the plan map, drawings, or as staked in the field.

Fencing includes brace assemblies, line assemblies, gates, cattle guards, and other components required for meeting site conditions and achieving the objectives of the practice application. Other documents (worksheets, maps, drawings, and narrative statements in the conservation plan) may be used to document site specifications, plan or design the practice. If a fence is being planned that is not provided for in the following specifications, contact the Washington State Range Management Specialist for approval at the beginning of the planning process and prior to construction.

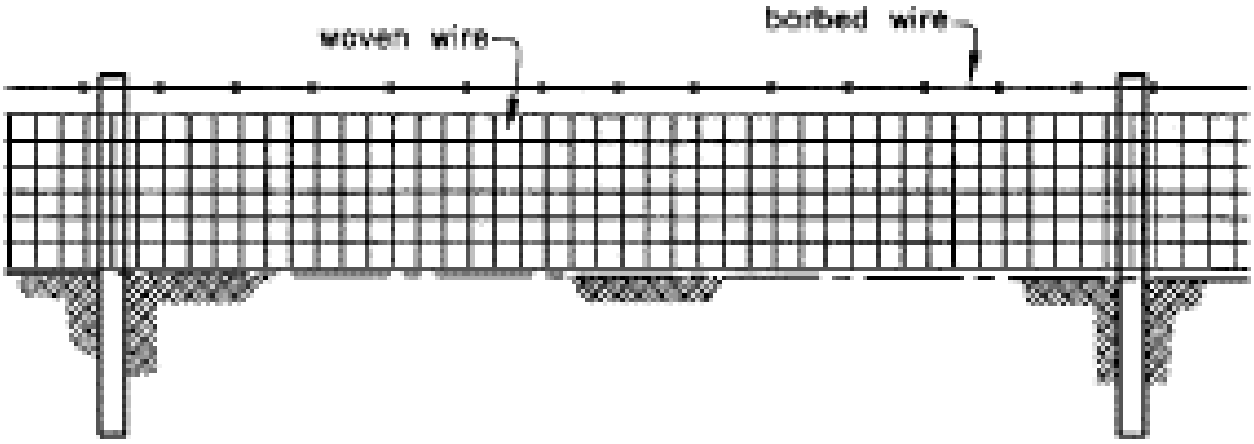
The fence will be installed in accordance with proper safety procedures. The completed job shall be workmanlike and present a good appearance.

If brush or rock clearing, grading or other land work is to be done in conjunction with the fence installation, appropriate grading and erosion control measures shall be undertaken or installed. Specifications for all measures to be installed in conjunction with the fence should be attached to the Jobsheet.

TYPE OF FENCES

Woven-wire

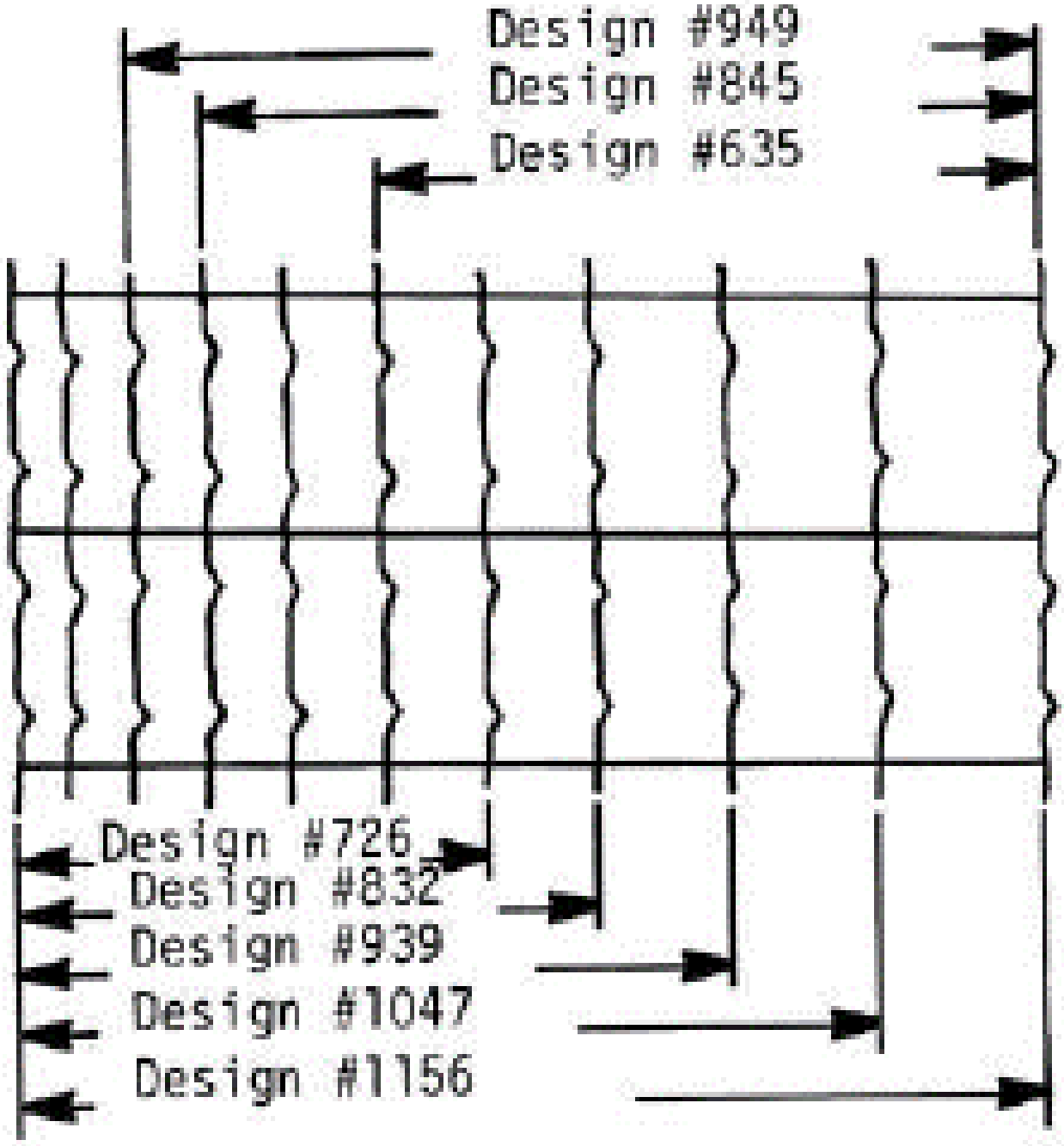
Woven-wire fence is best used in areas where tight control is necessary: sheep, goats, horses, hogs, people, wildlife depredation, or predator control. Woven-wire fences consist of woven-wire stretched between line posts. The spacing of the mesh of the woven-wire differs, depending on the kind of animals the fence is designed to control. Woven-wire fences can be adapted to most terrain, but are not well suited to areas of heavy snow loads or subject to frequent ponding and flooding.



Each woven-wire fence type has a fence tag with a design number that accurately describes the configuration of the fencing material. In the “Design No.”’

- first one or two numbers relate the number of line wires;
- next two numbers to the right specify the height of the wire in inches;
- next to last number grouping (either the number 6 or the number 12) identifies the spacing of vertical stay wires; and

- the final one or two numbers give the gauge of intermediate wires.

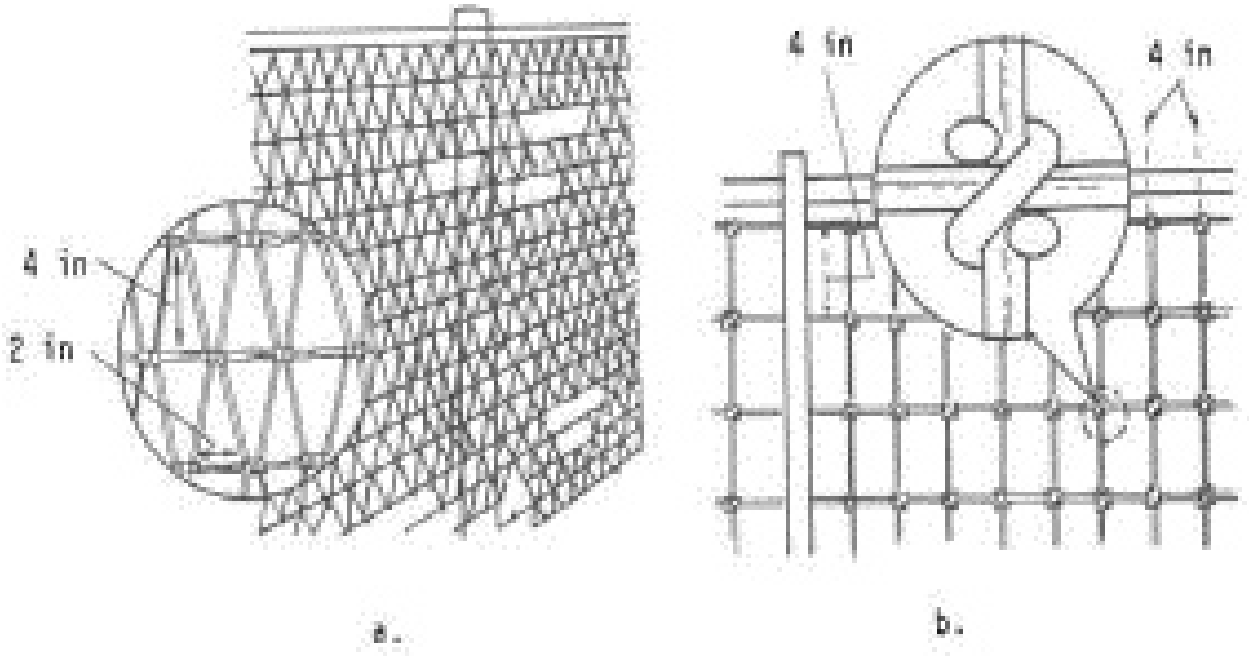


For example, woven wire with “Design No. 726-12-11”, has 7 line wires, is 26 inches high, the vertical stays are spaced 12 inches apart, and the intermediate wires are No. 11 gauge. Intermediate or filler wires include the horizontal line wires and all the vertical stay wires between the top and bottom wires.

Woven wire is not safe for wildlife.

Mesh Fence

Mesh fences, such as horse-no-climb, is used for confinement fencing-corrals, feed lots, and small acreage areas. No-Climb types of configurations are used for camelids and horses to prevent fence damage and potential injury to the animal.



MATERIAL SPECIFICATIONS

All materials used in the construction of fences shall have a minimum life expectancy of ten (10) years. Fences will be constructed that equal or exceed the strength and durability of one built in accordance with the materials specifications in the following tables.

If a fence is to have improved longevity and reduced maintenance use one of more of the following concepts:

1. Larger diameter wooden posts or heavier weight line posts (1.33 lb/ft. instead of 1.25 lb/ft.
2. Deeper setting of longer posts
3. Closer spacing of posts and braces, and/or
4. Using a stronger line post periodically.

Line Posts

Steel line posts can be used in moderate to low snowfall areas, or in rocky areas where posts must be pounded or drilled to be set. One main disadvantage of using steel posts is that they are likely to be bent or forced out of line by livestock or heavy weed pressure. Wooden posts are preferred for use in areas with high snowfall, high livestock pressure (e.g., intensive grazing systems, riparian fences, or areas adjacent to cropland with high expected weed loads). Using wood posts every 50 to 75 feet can help keep steel posts from bending and improve the strength of the fence. A combination of wood and steel lines posts (e.g., 1 in 3 or 1 in 5 posts being wood) can significantly increase the strength of the fence but even as few as (1 in 7 or 1 in 10) can be helpful.

Wood line posts do not need to be new materials (Railroad Ties and Power Poles are adequate); however, all posts shall meet the minimum criteria for durability and protective coating. Wood posts need to be sound and free from decay, with all limbs trimmed substantially flush with the body. Post shall be sufficient length to meet buried depth, fence height requirement plus 3 inches. Lengths listed below are based on a 42-inch top wire height.

Line posts set in muck, peat, or soils on which water stands, shall be wooden - 8 ft long and set a minimum of 4 ft. deep.

Table 1 Line Post Requirements

LINE POST TYPE	MINIMUM DIAMETER	MINIMUM SETTING DEPTHS	MINIMUM LENGTHS	MINIMUM PROTECTIVE COATING, OTHER
Wood-juniper, cedar	3-1/2 inches	24 inches	6 feet	None
Wood other than above	3-1/2 inches	24 inches	6 feet	Complete penetration of the sapwood with approved treatment materials. Pressure-treated, entire length of post. See note below.
Standard “T, “Y” or “U” section steel rolled with high carbon steel and studded, embossed, or punched for wire attachment with anchor plate.	1.25 pounds per foot of length, exclusive of anchor plates	18 inches Top of the spade + 2 knobs – minimum of 18”	5.5 feet	The coating may be either galvanized by the hot dip process or painted in accordance with Commercial Standard 184 with one or more coats of high- grade, weather-resistant steel paint or enamel applied and baked.
Live trees	6 inches at top wire	Wire not wrapped or stapled directly to tree. A wood slat is nailed to the side of the tree and the wires stapled to the slat.		

NOTE: Chromated Copper Arsenate (CCA)-treated wood posts should not be used where treated wood may come into contact with water sources (wetlands, streams, high water tables, etc.). Other chemically-treated and pressure-treated wood posts may be used in these areas. (EPA 2002)

Figure 1 Standard Metal Posts

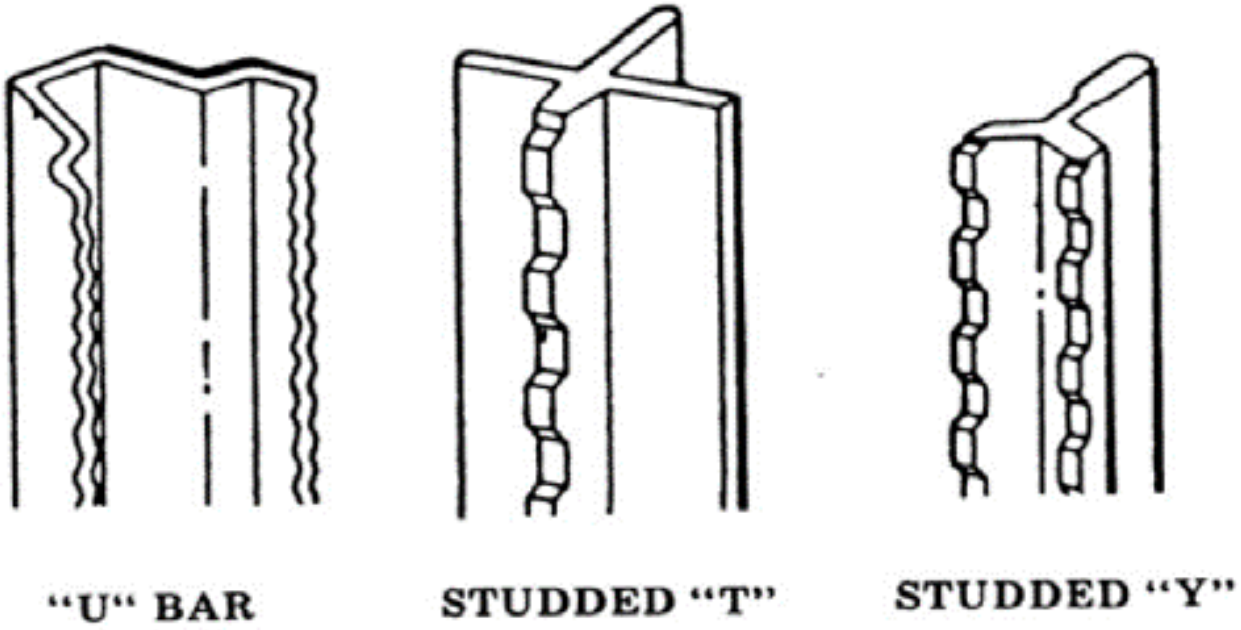
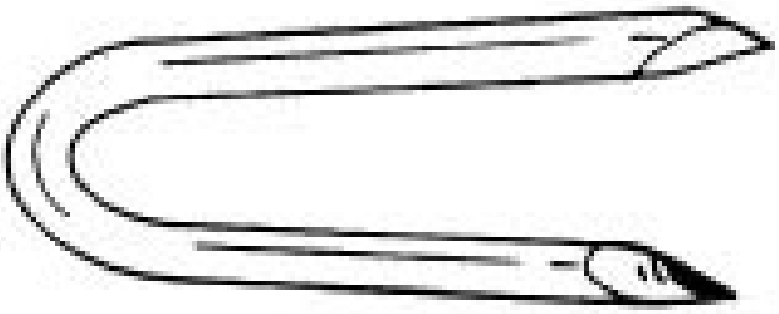


Table 2 Wire Type and Size

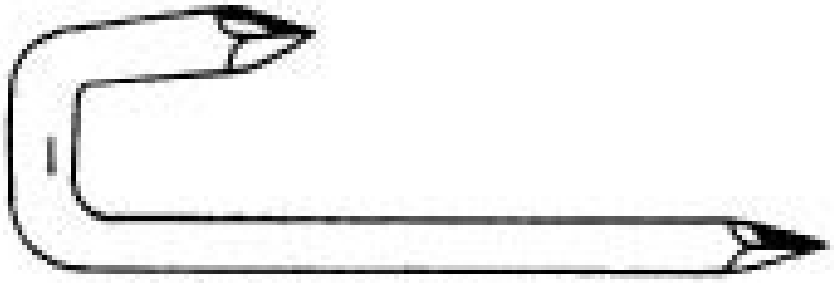
Wire Type	Minimum Wire Size	Minimum Protective Coating	Strand-breaking strength	Other
Standard Woven Wire	Top & Bottom wires: 10 gauge. Intermediate & Stay Wires: 12-1/2 gauge	Class I zinc coating or greater	32 inches minimum to 42- inch maximum height with 6 inch spacing between stay wires.	The label shall indicate the wire meets ASTM A-116 or ASTM A-584 standards.
High Tensile Woven Wire	14 1/2 gauge	Class III zinc coating or equivalent	32 inches minimum to 42- inch maximum height with 6 inch spacing between stay wires.	
Mesh Wire; such as Horse-No-Climb	Top & Bottom wires: 10 gauge. Intermediate & Stay Wires: 12-1/2 gauge	Class I zinc coating or greater.	At least 48 inch high, less than or equal to 2 inch x 4-inch mesh spacing.	

At least one strand of barbed or other wire will be added at the top spaced 2-6 inches above the woven wire

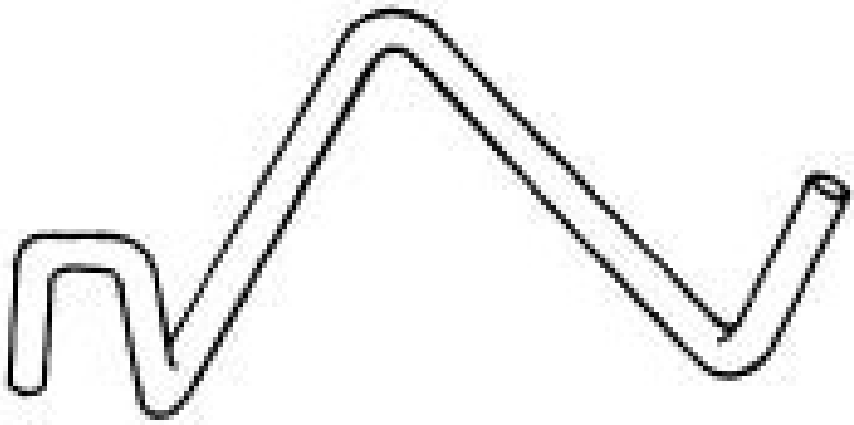
STAPLES AND FASTENER MATERIAL REQUIREMENTS



U-SHAPED STAPLE



L-SHAPED STAPLE



WIRE CLIP

U-shaped staple, conventional wire: No. 9 gauge galvanized wire or bright hard wire; at least 1 and 3/4-inchlong.
L-shaped deformed shank staple: No. 9 gauge galvanized wire or bright hard wire; at least 1 and 1/2-inch long.
Fence wire shall be fastened to steel posts using steel clips manufactured for the purpose of attaching wires, or 9 gauge smooth wires.

Other post types will use fasteners and methods recommended by the manufacturer.

INSTALLATION SPECIFICATIONS

LINE POST SPACING AND SETTING

All posts shall be placed to the required depth and shall be firmly embedded. Posts shall be set to the minimum depths listed in **TABLE 1−Line Post Requirements.**

Wood posts shall be driven or set in holes and backfilled with compacted earth or poured concrete. Where postholes are dug, the holes shall be at least six (6) inches larger than the diameter of side dimensions of the posts. Earth backfill around posts shall be thoroughly tamped in layers not thicker than 4 inches and shall completely fill the posthole to the ground surface. Concrete backfill around posts shall be rodded into place in layers not thicker than 12 inches and shall completely fill the posthole to ground surface. Backfill, either earth or concrete shall be crowned up around posts at the ground surface.

Concrete shall be class 3000 in accordance with Washington NRCS Construction Specification CS-42, Concrete for Minor Structures. Concrete shall be allowed to set for ten days before tension is applied to the line assemblies through tightening of wire.

Steel line posts shall be driven solidly into the ground until the plate is covered plus 2 knobs, minimum of 18 inches. If soil conditions prevent firmly settling line posts in the ground, Figure-4 (WA-Standard Drawing lsk-260) or wire cribs (WA-Standard Drawing lsk-253) may be used.

Post spacing in areas shallow to rock may vary based on availability of post sites. Probe with a rock probe to determine desirable post sites. Steel pipe and steel post are recommended to use in cracks between rocks. Concrete in the post where possible. Rock bits are available in some areas for drilling rock. Use stays to maintain wire spacing. A post set in a 5 gallon bucket of concrete may be used as a line post. Bury bucket as deep as possible.

Where rock occur within the required embedment depth for posts, a hole of a diameter slightly larger than the largest dimension of the post shall be drilled in the rock and the post grouted in. The depth of post embedment shown on the Jobsheet will not be required and the post may be shortened as necessary, provided the line post is embedded within the rock for a minimum depth of 12 inches or the required embedment depth of the post is attained. Grouting will be required on the portion of the post in solid rock.

Where solid rock is encountered without an overburden of soil, line posts shall be set into the solid rock a minimum depth of 12 inches. The posts shall be cut before installation to lengths which give the required height of post above ground.

After the post is set and plumbed, the hole shall be filled with grout consisting of one part Portland cement and three parts clean, well graded sand. The grout shall be thoroughly worked into the hole so as to leave no voids. The grout shall be crowned to carry water from the post.

FENCE HEIGHT and WIRE SPACING

Fence height is measured from the ground at post locations

Wire Type	Minimum Wire Size	Minimum Protective Coating	Strand-breaking strength	Other
Standard Woven Wire	Top & Bottom wires: 10 gauge Intermediate & Stay Wires: 12-1/2 gauge	Class I zinc coating or equivalent	meets ASTM A-116 or ASTM A- 584 standards.	At least one strand of barbed or other wire will be added at the top spaced 2-6 inches above the woven wire.
High Tensile Woven Wire	14 1/2 gauge	Class III zinc coating or equivalent		
Mesh Wire; such as Horse-No-Climb	Top & Bottom wires: 10 gauge Intermediate & Stay Wires: 12-1/2 gauge At least 48 inch high, less than or equal to 2 inch x 4- inch mesh spacing.	Class I zinc coating or equivalent	.	

Provisions must be made for identified crossings for wildlife movement; both over and under the fence. These areas will not exceed 1/4-mile apart and there must be a minimum of one per fence. The fence in these designated crossing locations will not exceed 42 inches at the top wire and must include a minimum of one alternative to allow for wildlife movement (*see Range Technical Note 102 - Riparian And Other Tight Fence - Wildlife Considerations).

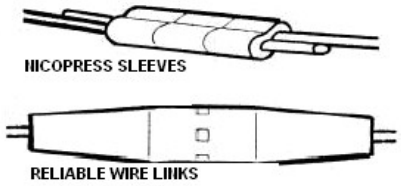
SPLICING INSTALLATION REQUIREMENTS

Non-High Tensile Wire

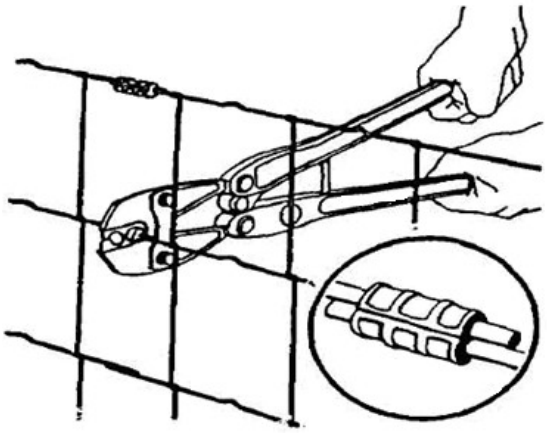
When splicing of wire is necessary use “Western Union” splice or compression fittings.

High Tensile Wire

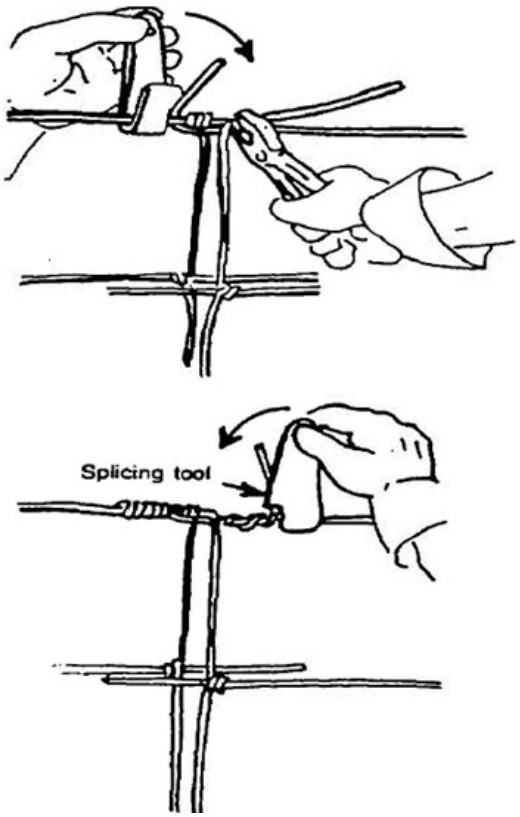
When splicing of wire is necessary, use compression fittings.



COMPRESSION FITTINGS



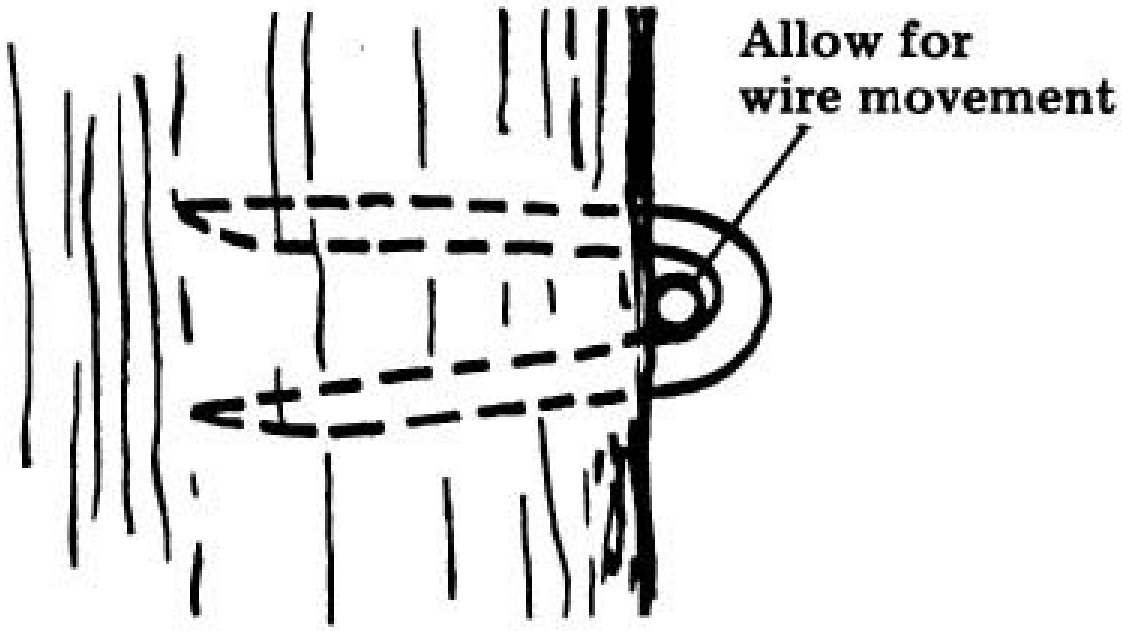
WESTERN UNION SPLICE



STAPLES AND FASTENER INSTALLATION REQUIREMENTS

Staples shall be driven into the post at a 45-degree angle. Staples shall be driven just deep enough to snug the line wire without bending it.

* Reference Standard Drawing LSK-0001 Staples and Wire Attachment



Staples should hold wire close to fence, but allow for expansion and movement of the wire.

FENCE WIRE TENSION

Woven Wire

Temperature variations must be considered when setting the tension on line wires (wire will tighten in cold weather and expand in hot weather). All line wires shall be dead-ended on gate, corner, or the anchor posts (pull posts) of in-line brace units.

TENSION CURVE BEFORE STRETCHING

TENSION CURVE AFTER STRETCHING

To attach woven-wire to posts at wire end points, first determine the approximate length of wire that is needed to wrap the wire around the post two times. Remove enough vertical stay wires to provide the needed amount of line wire. Cut the vertical stay wires between the horizontal line wires. If the woven-wire has hinge joints, loosen the hinge joints and slip them off the end of line wires. Wire ends are then double wrapped around the anchor posts or (pull posts), stapled, and twisted back on the stretched line wire with at least six tight wraps. A spring action is built into most woven-wire by using tension curves configured as a “U”-shaped crimp in the line wire.

Stretch woven-wire so that about one-third of the wire tension curve is removed.

Mesh Wire

Per Manufacturer's recommendations

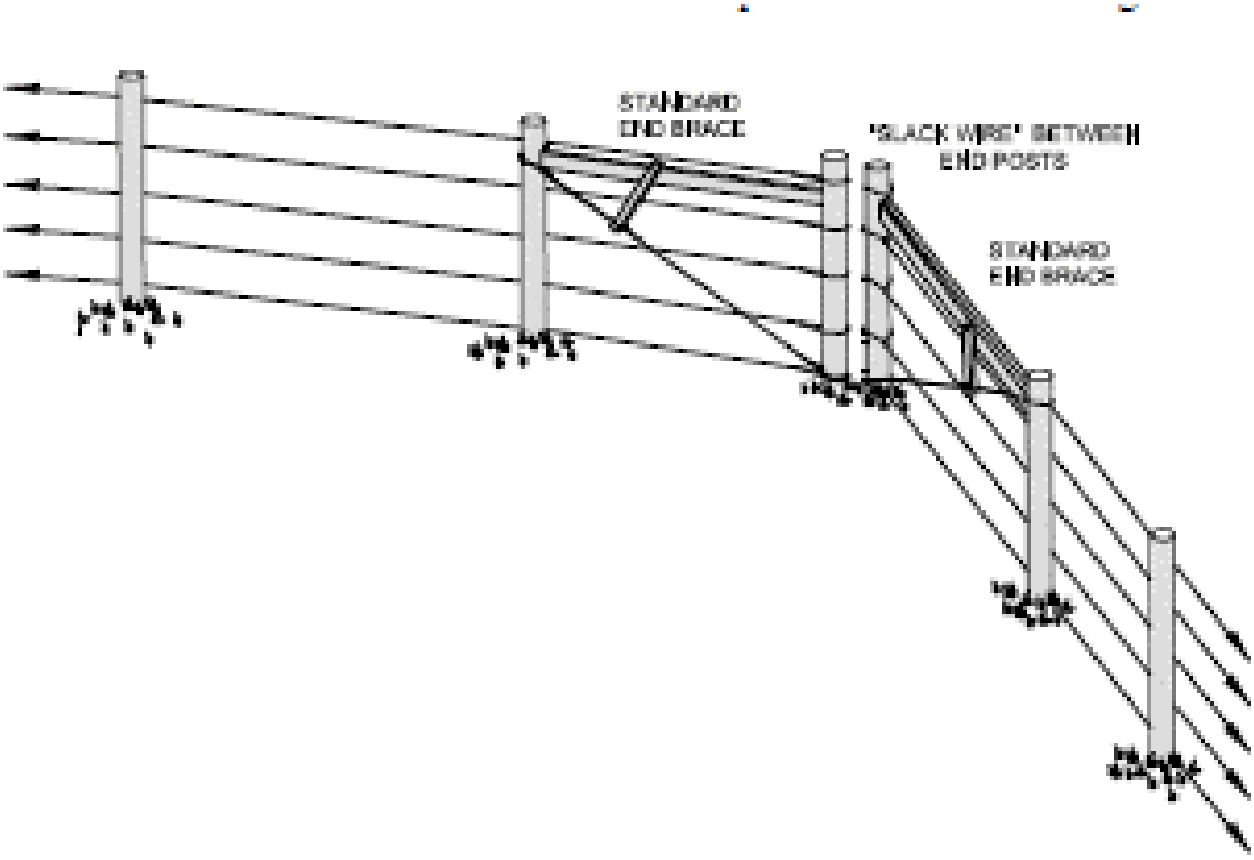
CORNER, BRACE AND GATE POSTS
BRACING AND ALIGNMENT

Bracing is the key determinant to the structural soundness and longevity of wire fences. In straight sections on moderate terrain, in-line brace units are required at intervals not to exceed 330 feet but spacing shall be such as to use standard rolls of wire mesh with a minimum of cutting and waste.

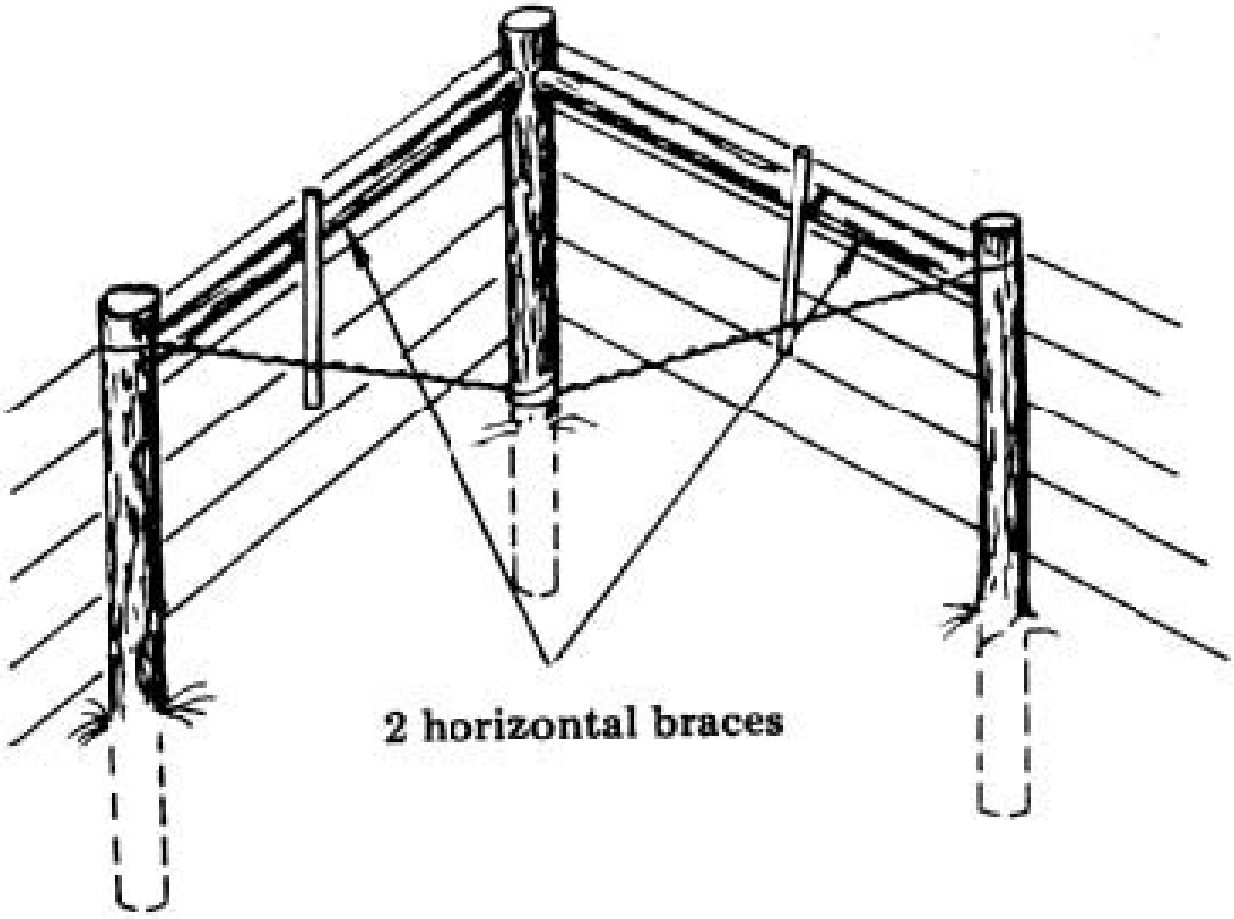
Brace posts shall not be set in muck, peat, or soils on which water stands.

Braces are required at all end corners, gates and definite angles of change (horizontal and vertical) greater than 5 degrees if bearing on a metal line posts, greater than 20 degrees if bearing on a sound wood post a minimum of 4 inches in diameter and embedded a minimum of 3 feet.

- Between 20 and 60 degrees angle of change use a 4 post brace (which is a double H that does not share a common post like the 3 post Standard H-brace) or a double diagonal floating or steel diagonal brace

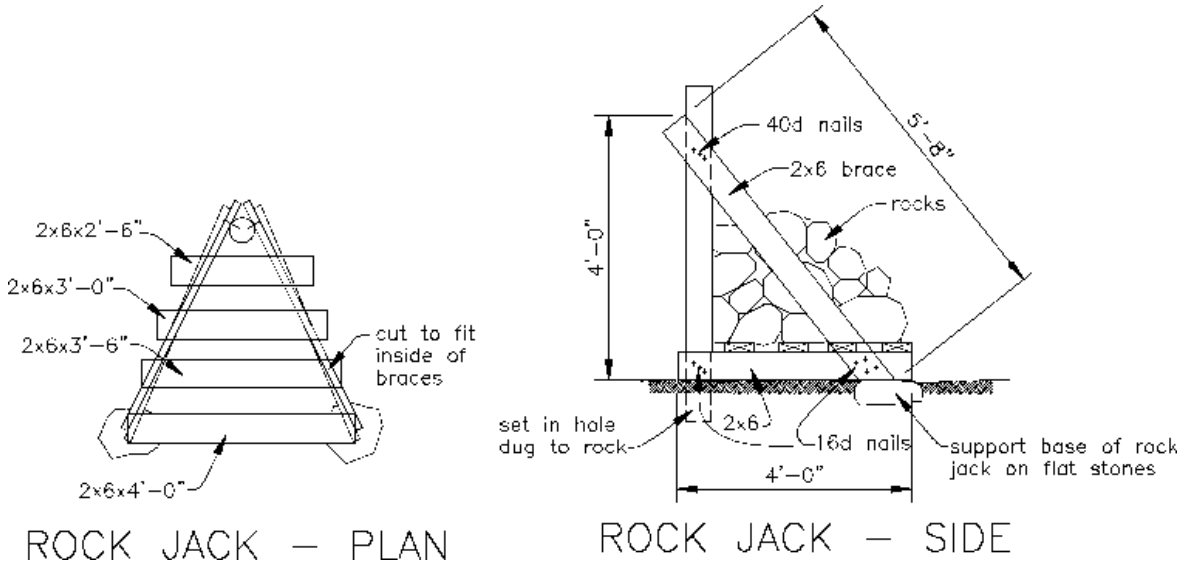


- Greater than 60 degrees angle of change a 3 post brace – horizontal (Standard H-brace) or a diagonal brace may be used

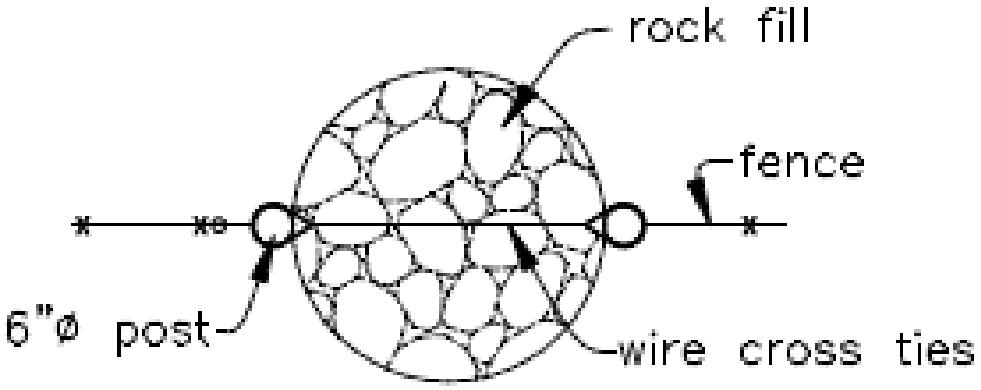


At any angle of change the following alternatives may also be used:

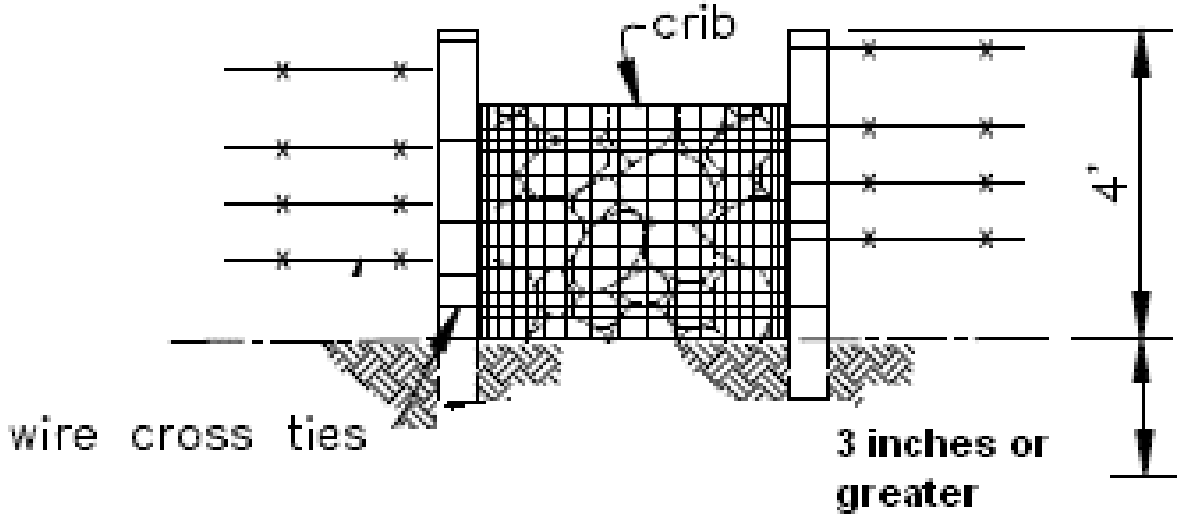
- Standard H-Brace
- Diagonal Steel Brace
- Diagonal Floating Brace
- Rock Cribs –see NRCS-WA Standard Drawing Isk-0253



- Rock jack – see NRCS-WA Standard Drawing Isk-0260

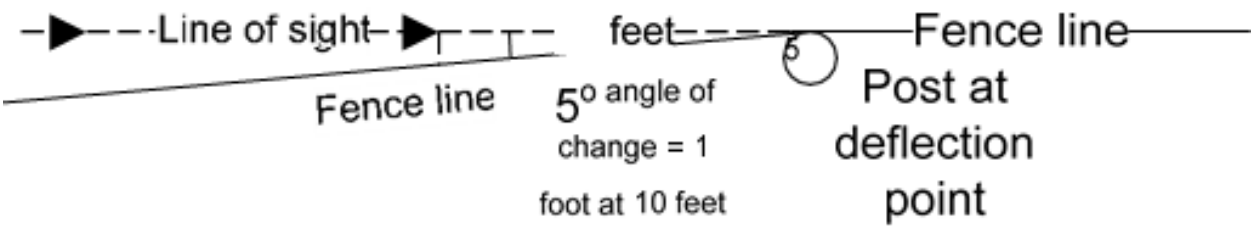


PLAN

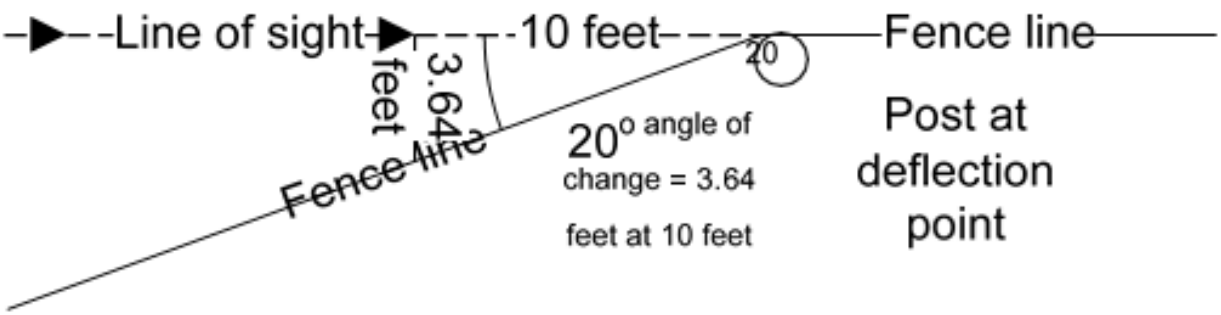


36" wide wire netting, 13' long, formed to make 4'ø crib.

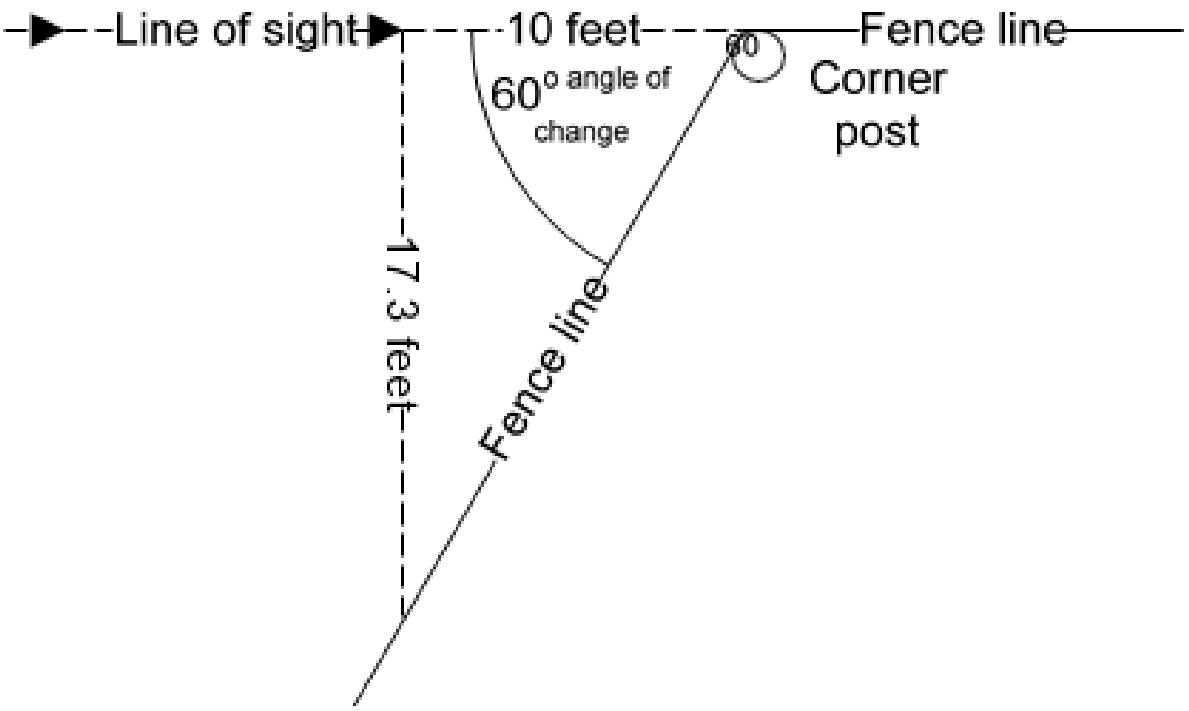
How to estimate a 5° angle

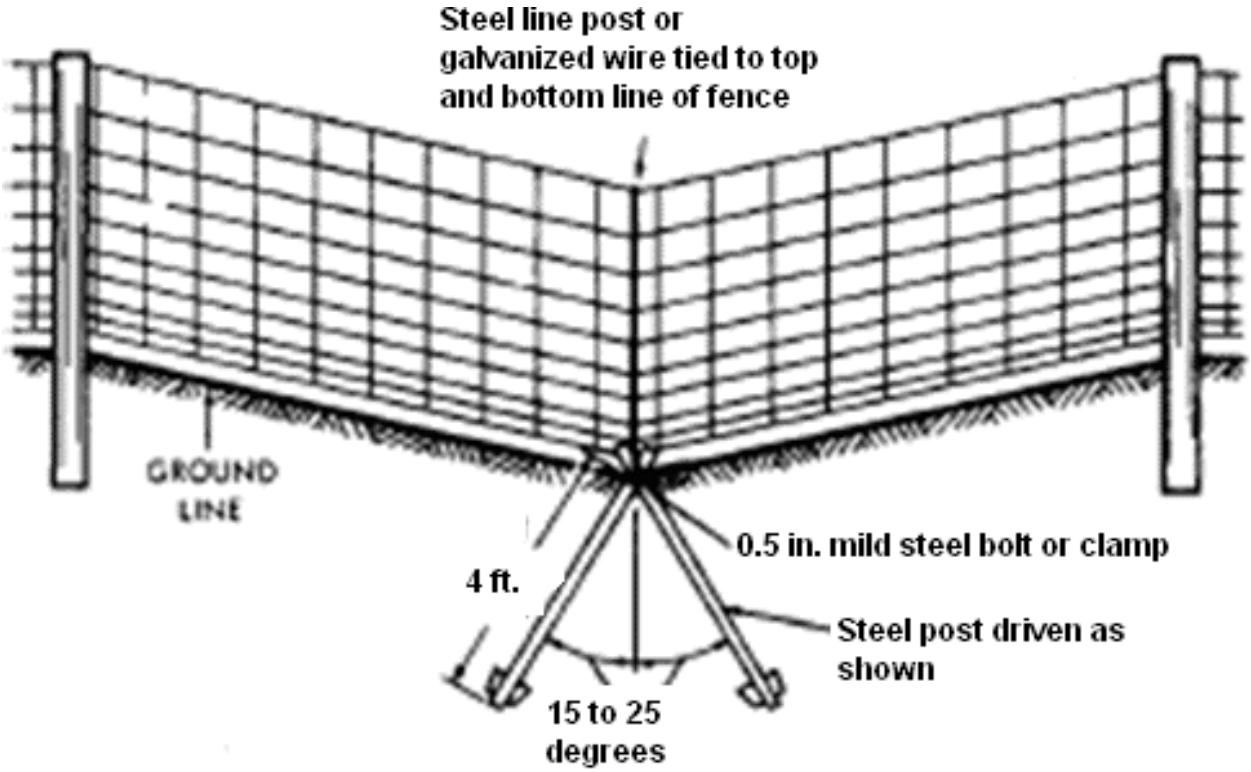


How to estimate a 20° angle



How to estimate a 60° angle





Assembly at change in vertical alignment

Specific Site Requirements