

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE SPECIFICATION**

FENCE

(feet)

CODE 382

STANDARD POST AND WIRE

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 Standard Post and 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 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.

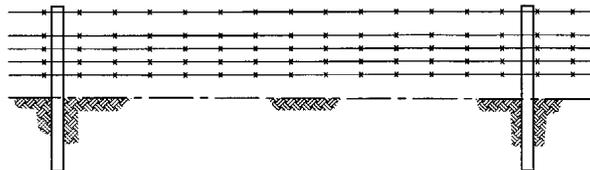
If brush or rock clearing, grading or other land work is to be done in conjunction with the fence installation, appropriate grading and erosion control measures shall be undertaken or installed. Specifications for all measures to be installed in conjunction with the fence should be attached to the Jobsheet.

TYPES OF FENCES

Standard Post and Wire Fence

Standard, or conventional, post-and-wire fences are suitable as permanent fence in areas that receive moderate to heavy pressure by livestock. Barbed wire is the most common fence built. Barbed wire can endanger horses and llamas. Llamas have large, protruding eyes than can be injured by sharp points. A startled horse can run into a fence and be injured by sharp points. Smooth wire is generally considered safer for horses and llamas.

Figure 1 Standard Post and Wire



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:

- a. Larger diameter wooden posts or heavier weight line posts (1.33 lb/ft. instead of 1.25 lb/ft.)
- b. Deeper setting of longer posts
- c. Closer spacing of posts and braces, and/or
- d. 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, should be wood 8 ft long and set a minimum of 4 ft. deep. 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)

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
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.		

Figure 2 Standard Metal Posts

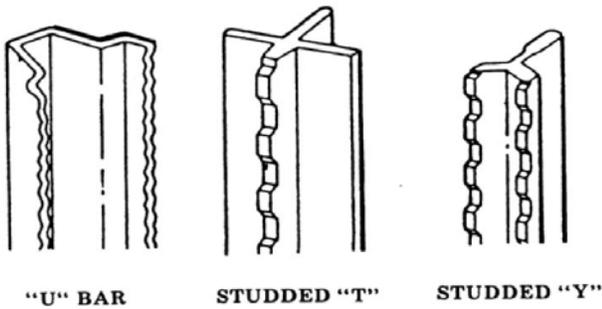


Table 2 Wire Type and Size

WIRE TYPE	MINIMUM WIRE SIZE	MINIMUM PROTECTIVE COATING	STRAND-BREAKING STRENGTHS
Standard Double Strand Barbed Wire	12-1/2 gauge with 14 gauge or heavier two-point barbs spaced not more than 5 inches apart.	Class I galvanized per ASTM-121	950 pounds or 70,000 psi
High-Tensile Double Strand Barbed Wire	15-1/2 gauge	Class III galvanized per ASTM-854	1,400 pounds or 135,000 psi
Standard Smooth Double Strand Wire	12-1/2 gauge	Class I galvanized per ASTM-121	950 pounds or 70,000 psi
Standard Smooth Single Strand	9 gauge	Class I galvanized per ASTM-121	950 pounds or 70,000 psi
High-Tensile Single Strand Smooth	12-1/2 gauge	Class III galvanized per ASTM-854	1,400 pounds or 135,000 psi

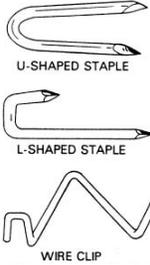
Table 3 STAY TYPE AND SIZE MATERIAL REQUIREMENTS

STAY TYPE	MINIMUM DIAMETER/WEIGHT	MINIMUM LENGTH
Wood - Preferred high pressure areas	2.5 inches diameter	Fence wire height + 2 inches
Wire	9-1/2 gauge twisted, manufactured for this purpose; galvanized-zinc coated	4 inches + distance between bottom and top-wire
Fiberglass	Especially fabricated for this purpose	Fence wire height + 2 inches

STAPLES AND FASTENER MATERIAL REQUIREMENTS

Table 4 Attachment Requirements

U-shaped staple, conventional wire: No. 9 gauge galvanized wire or bright hard wire; at least 1 and 3/4-inch long.
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 POSTS AND WIRES

LINE POST SPACING AND SETTING

Spacing is the same for all line post materials.

Table 4 Line Post and Stay Spacing

FENCE TYPE	LINE POST SPACING (MAXIMUM INTERVAL)
3-Wire Fence	16-1/2 feet (1 rod) with one stay mid-way between posts
4-Wire Fence or more	20-foot without stays 25-foot with one stay set mid-way between line posts 30-foot with two stays set at equal intervals between posts
Heavy Pressure areas	16-1/2 feet (1 rod) between wooden posts or a mix of wood and steel posts – wood/fiberglass stays at approximately 4-foot intervals.

All posts shall be placed to the required depth and shall be firmly embedded. Posts shall be set to the minimum depths listed in **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 Isk-260) or wire cribs (WA-Standard Drawing Isk-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

Table 2 Fence Height and Line Spacing Requirements

INTENDED USE	FENCE HEIGHT
Domestic livestock control with big game consideration.	Maximum height of 42 inches (+ or - 2 inches) for the top wire. Wire spacing of the top two line wires shall be a minimum of 10 inches apart at the post location. Bottom wire should be approximately 14 inches from the ground.
Domestic livestock control with big game consideration where the top wire exceeds 44 inches, but is not greater than 48 inches.	If wire height exceeds 44 inches, the distance between the top wire and the second wire will be at least 12". 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 Common Alternatives below and/or Range Technical Note 102 - Riparian And Other Tight Fence - Wildlife Considerations).

***Common Alternatives.** (1. Smooth wire on top and/or bottom, top wire tied down between two posts, bottom wire tied up between two posts, 2. PVC on top wire for entire length between two posts; raise bottom wire in that stretch, lower top wire in that stretch, 3. Wood rail at top wire between two posts maximum 38 inches high (38-inch elk jump), 4. Extra stays so top and second wire will not cross, etc.). Minimum length for chosen wildlife crossing is that distance between two posts or 1 rod (16.5 feet), whichever is greater.

COMMON WIRE SPACING

1. 3-Wire Cattle: 16", 29", 42"
2. 3-Wire Cattle: 14", 28", 42"
3. 4-Wire Cattle: 14", 22", 32", 42"
4. 5-Wire Sheep: 5", 11", 18", 26", 36"
5. 5-Wire Cattle and Sheep: 8", 16", 24", 32", 42"; or 5", 11", 18", 28", 42"
6. 7-Wire Cattle and Sheep: 3", 7", 11", 16", 26", 36", 44" (need a common alternative for wildlife)

Tension on the wire shall be such that ten (10) pounds of pressure applied midway between posts shall cause no more than six inches (6") of displacement from the straight line between posts.

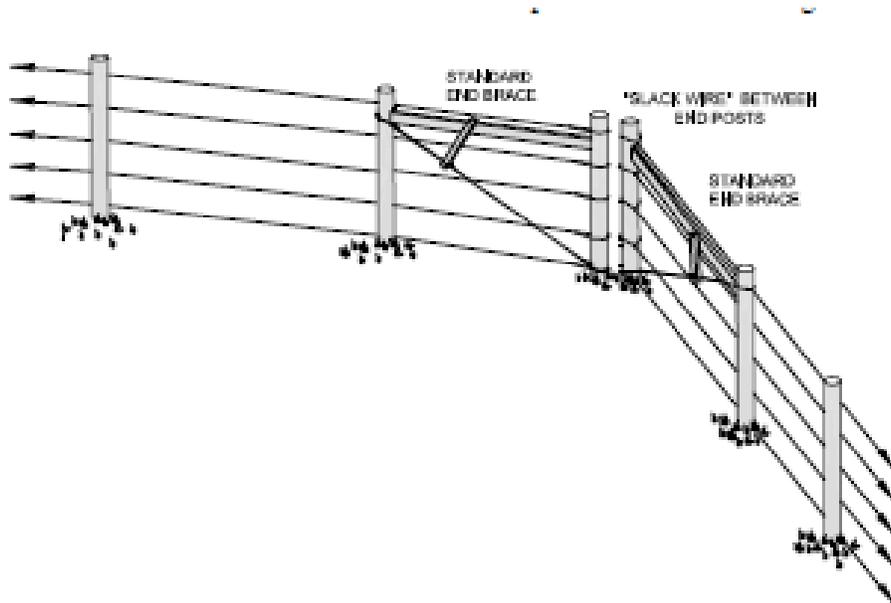
BRACING AND ALIGNMENT

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

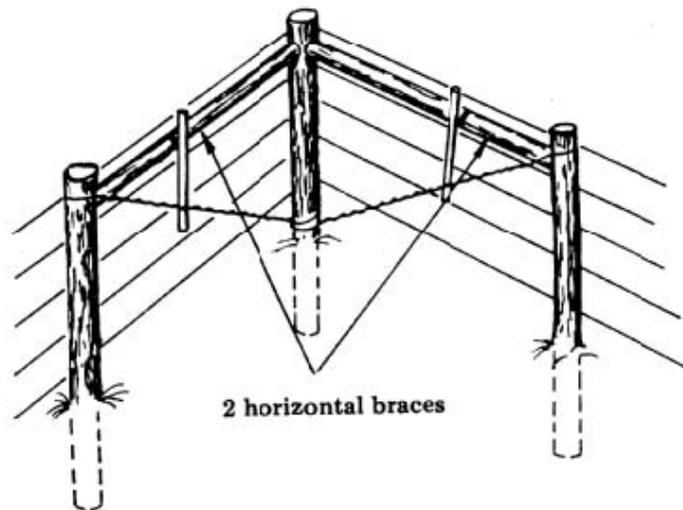
There is no maximum distance between brace spacing as long as means are available to stretch wires. A single 6-inch diameter brace post, buried 3 feet, spaced no greater than 1/4-mile apart is sufficient to stretch the wire. It is recommended not to exceed 1/2-mile between gates (braces) for ease of management.

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

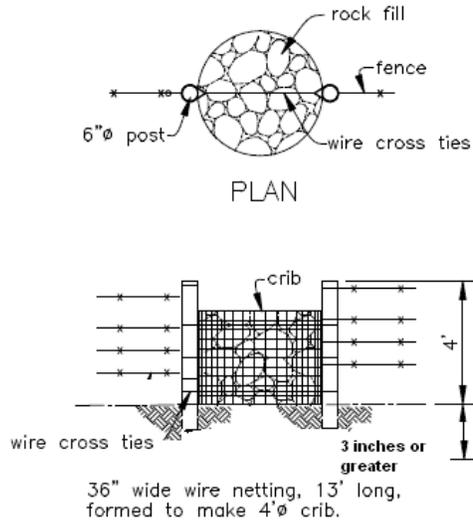


- Greater than 60 degrees angle of change a 3 post brace – horizontal (Standard H-brace) or a diagonal brace may be used

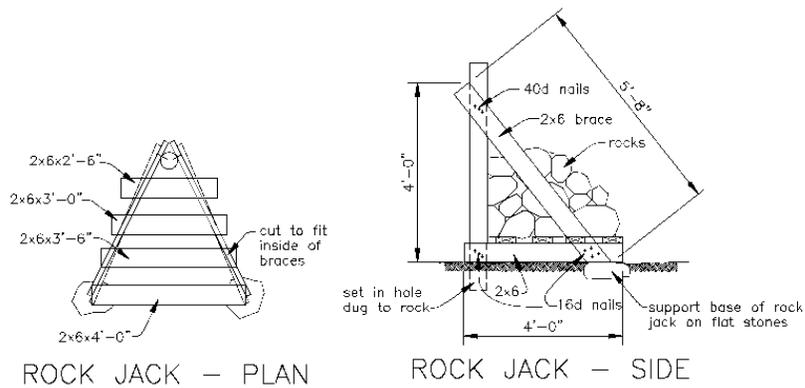


At any angle of change the following alternatives may also be used:

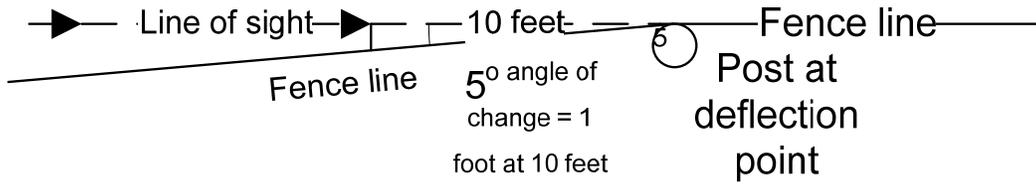
- Rock Cribs –see NRCS-WA Standard Drawing Isk-0253



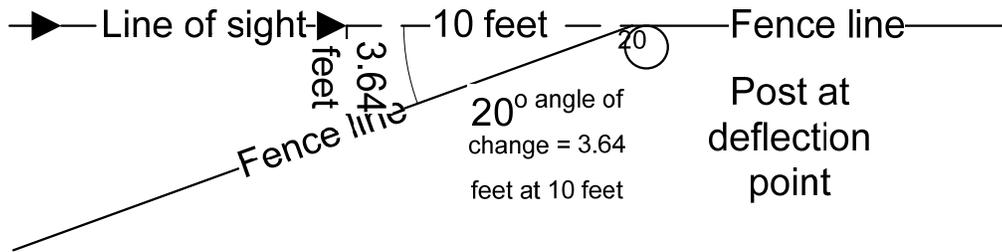
- Rock jack – see NRCS-WA Standard Drawing Isk-0260



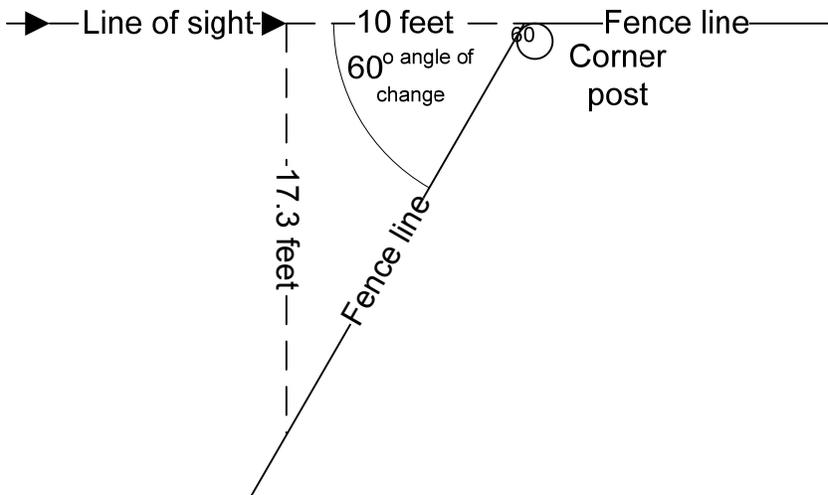
How to estimate a 5° angle



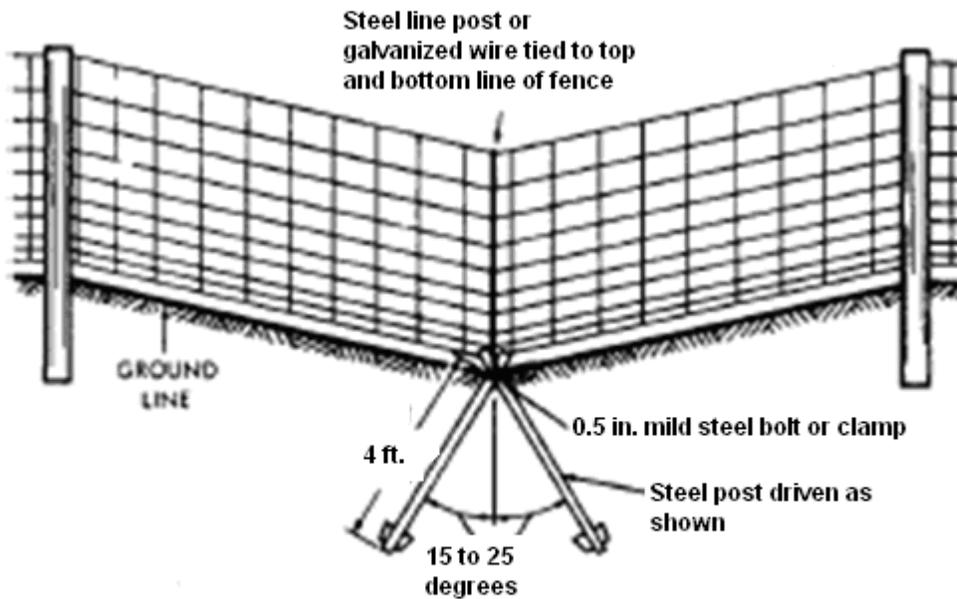
How to estimate a 20° angle



How to estimate a 60° angle



Assembly at change in vertical alignment (dip anchor) shall anchor fencing with two steel fence posts, or equivalent, of at least 4-ft length, as shown below, where change in vertical-alignment exceeds 1 foot per 8 feet (1:8 slope) between line posts.

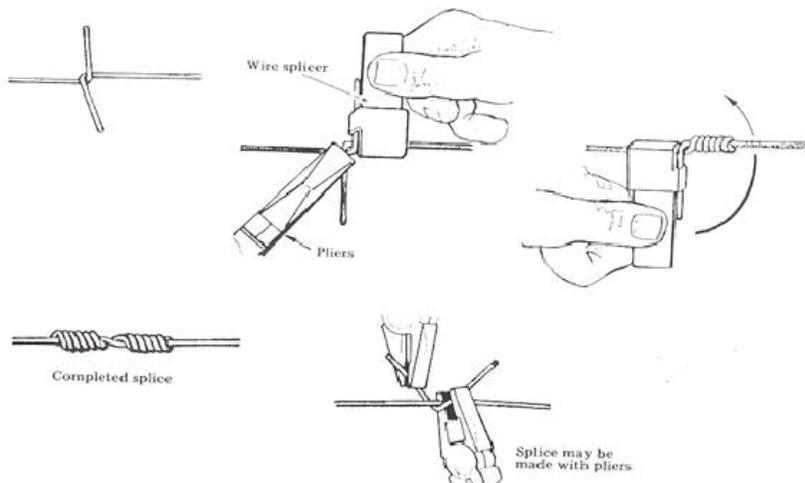


Assembly at change in vertical alignment

SPLICING INSTALLATION REQUIREMENTS

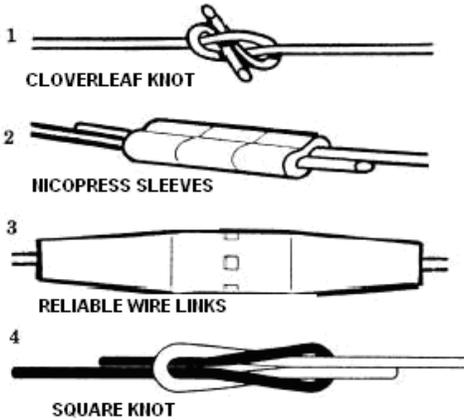
Non-High Tensile Wire

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



High Tensile Wire

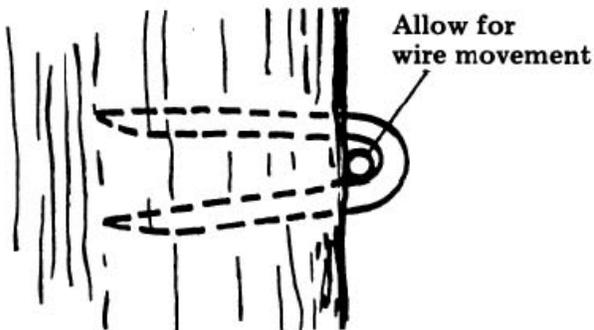
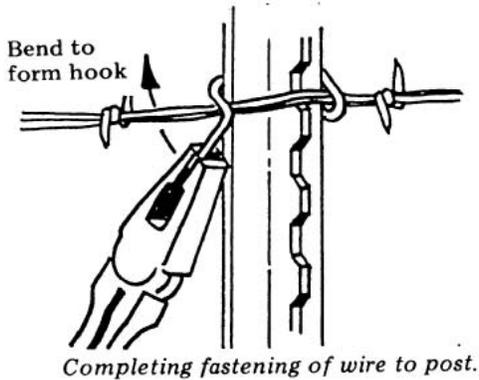
When splicing of wire is necessary, use cloverleaf knot, square knot or compression fittings.



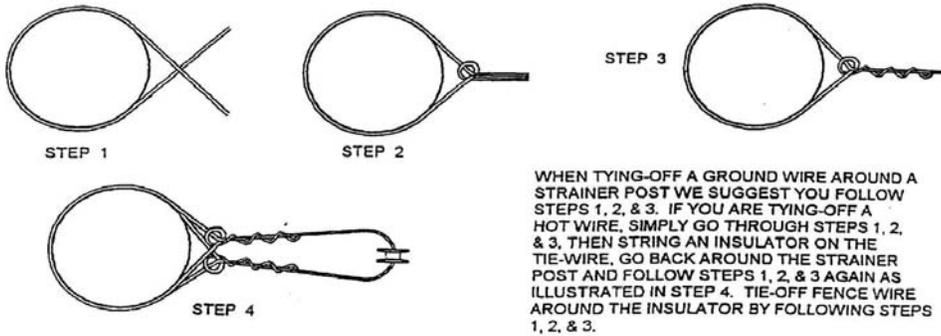
STAPLES AND FASTENER INSTALLATION REQUIREMENTS

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

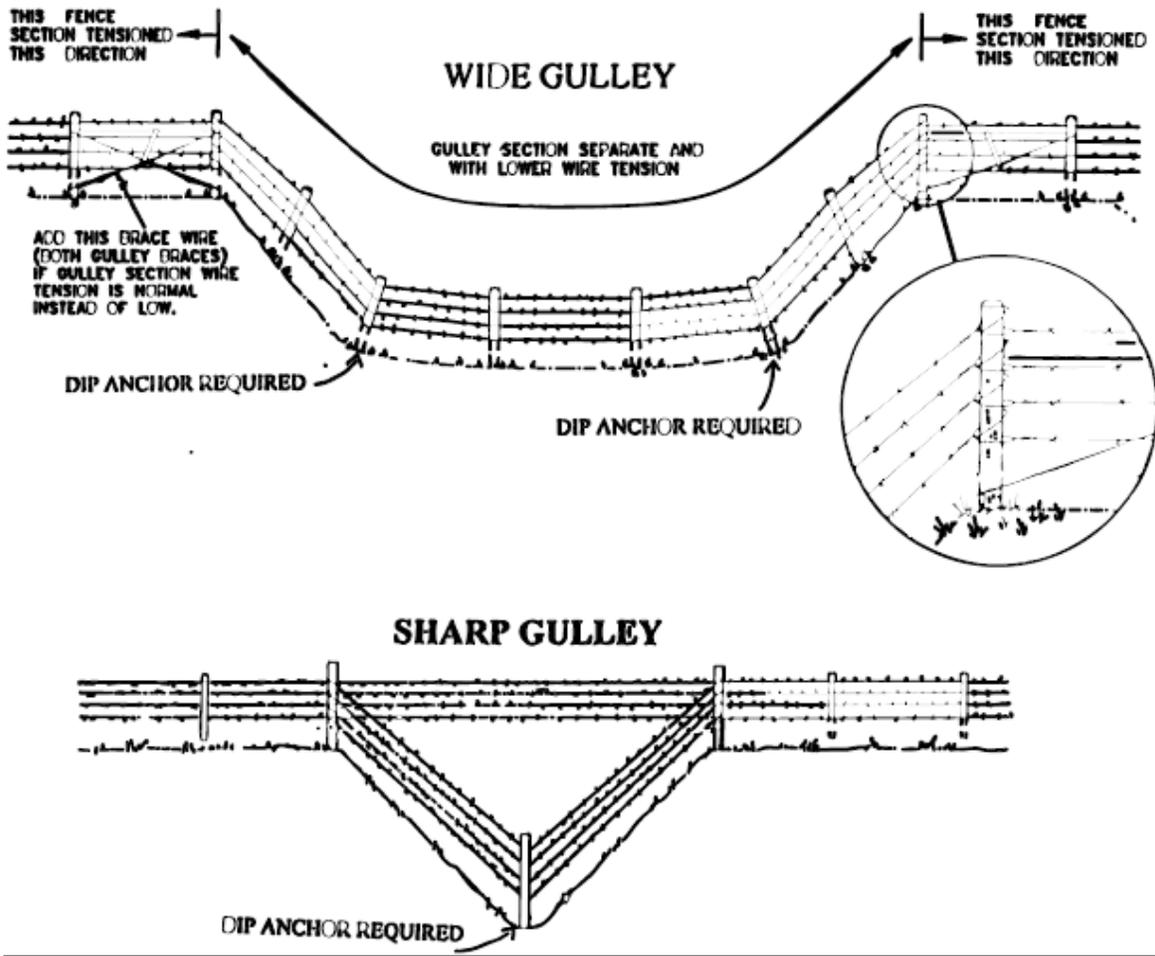


Staples should hold wire close to fence, but allow for expansion and movement of the wire.



CROSSING DRAWS OR STREAMS

When the fence crosses landscape depressions, draws, or swales, and the bottom line wire is more than 20 inches above the ground at the low spot, the use of a deadman may be necessary to maintain fence height. When crossing the streams or very deep draws, the fence may be dead-ended on each side of the crossing by use of line braces. The section across the stream may be removable, a breakaway type, or swinging picket-type fence.



BASIS FOR ACCEPTANCE

After the fence has been installed, a site inspection will be made to determine if the materials and the design and installation adhered to the site-specific specifications documented in the practice Jobsheet.