

NATURAL RESOURCES CONSERVATION SERVICE CONSERVATION PRACTICE SPECIFICATION

STANDARD POST AND BARBED WIRE FENCE (Feet)

CODE 382(a)

I. SCOPE

The work shall consist of furnishing materials and installing barbed wire, smooth wire, or combinations thereof, at the location(s) shown on the plan map and, if needed, on the drawings or as staked in the field.

Fencing includes brace assemblies, gates, cattle guards, and other components required to meet site conditions and achieve objectives for practice application.

II. CONSIDERATIONS

Fence type and the fence design selected will be adequate to control the animal(s) of concern, and must be suited to the landscapes over which it will be installed and shall be adapted to the physical environment of the site.

Fence type and the fence design selected will be adequate to meet the intended life expectancy of the conservation practice.

Boundary fences shall comply with Nevada state laws and fencing codes or standards for construction. Refer to the Nevada Revised Statutes Part 569.431 (1991) for the definition and requirements of a "Legal Fence".

WILDLIFE CONSIDERATIONS

SAGE GROUSE

Fences are an entanglement risk to large, ground nesting birds. Fences are especially dangerous for sage grouse near leks. When planning fences in known sage grouse habitat, consult with the NRCS State Biologist regarding the fence placement and lek locations.

Besides fence placement, there are a number of modifications that can be made to the fence to make it more visible to birds and other wildlife. To make a fence more visible, consider using the white tipped metal fence posts, securing flagging or reflectors to the top fence wires, or slide sections of PVC pipe over the top wire.

DEER AND ELK

In areas where big game animals are expected to cross the fence line, total height to the top line wire shall not be more than 40-inches and the top two line wires shall be set a minimum of 12-inches apart at the

post location. The bottom wire will be set at a minimum of 16 inches (18" is preferred) above ground and be smooth wire.

Deer normally jump with their hind legs forward and the distance between the two top wires is critical to adult deer. If the top two fence wires are loose or too close together, deer can entangle their hind legs in the fence which is often fatal or they can break the top wire(s) in their struggles, damaging the fence.

Elk drag their hind legs over the top of barriers as they jump them. For fence sections with heavy big game use, or when animal entanglement becomes a problem, consider replacing the top fence wire with wooden poles or rails to increase visibility of fencing. Another alternative is to slide plastic pipe over the top line wire of the fence which will increase fence visibility.

ANTELOPE

In antelope country, the total fence height should be constructed as low as feasible and the bottom wire should be at least 18-inches from the ground. In areas recognized as antelope migration routes, the bottom wire should be smooth wire.

For big game migration routes, consider the use of "let-down" fence sections to aid movement of animals. See practice specifications for Let-Down Fencing and Other Fence Components, Practice Code 382(h).

WILDLIFE FRIENDLY FENCE SPACING:

Wire Description	Spacing Measured from Groundline (inches)			
3- wire	16*	26	38	
4-wire	16*	22	28	40

*IN AREAS OF BIG GAME MIGRATION, THE BOTTOM WIRE WILL BE SMOOTH AND SET AT 18 INCHES ABOVE GROUND.

For additional wildlife friendly fencing information, refer to *Fencing Guidelines for Wildlife* (Wyoming Game and Fish, 2004) or *A Landowner's Guide to Wildlife Friendly Fences* (Paige, 2008).

III. SPECIFICATIONS

Standard, or conventional, post-and-wire fences are suitable as permanent fence in areas that receive moderate to heavy pressure by livestock.

A) MATERIALS

All fencing materials will be new, unless an exception is noted.

All materials used in construction must be in accordance with the National Standard Material Specification NSMS #591 (National Engineering Handbook 2009) as described below:

WIRE

Fencing materials shall conform to the requirements of American Society for Testing and Materials (ASTM) Standard Specification ASTM A121 for barbed wire, ASTM A116 for woven wire, ASTM A390 for poultry fencing or netting, and ASTM A854 for high-tensile wire. Barbed wire and woven wire shall be Class 3 zinc coated as specified in ASTM A641 unless otherwise specified. High-tensile wire shall have type I zinc coating unless otherwise specified. Aluminum wire requires no protective coating.

When the size of steel wire is designated, the diameter shall be defined for U.S. Steel Wire Gage.

- Barbed wire will be at least No. 12½-gauge (.099-inch diameter) steel wire for conventional post-and-wire fence with No. 14-gauge (.080-inch diameter) barbs spaced not more than five inches apart.
- Smooth wire will be at least No. 12½-gauge (.099-inch diameter).
- All barbed-wire and standard smooth wire shall have a minimum strand breaking strength of 950-pounds or 70,000-psi tensile strength.

LINE POSTS

All wooden materials used in this practice that require preservative treatment will conform to National Standard Material Specification NSMS #585.

Wooden posts are preferred for use in high snowfall areas because of their extra strength. Wood posts need not be new material; however, all posts should be of the most durable wood type available, such as juniper, cedar, locust, or eucalyptus. All posts that come in contact with the soil shall be treated with an EPA-registered wood preservative. Wood posts shall be treated from the butt end of the post to distance of at least 30 inches for line posts and 36 inches for all corners, gate and brace posts.

- Wood line posts shall be a minimum of 6½-feet long.
- At least 95 percent of the top of each wooden line post (two inches above the top wire) must be 3-inches, or larger, in diameter.

Specially manufactured 2-inch x 1½-inch hardwood posts that are at least 5½-feet long and have been treated with an EPA-registered wood preservative are also acceptable.

- Standard T- or U-section steel posts weighing not less than 1.33-pounds per foot of length, exclusive of anchor plate, may be used in lieu of wooden line posts where post strength is not important, or in rocky areas where posts must be pounded or drilled to be set.
- Steel line posts shall be at least 5½-feet long.

Steel posts shall conform to the requirements of ASTM A 702.

Steel posts are to be studded, embossed or punched for the attachment of wire and have an anchor plate near the bottom of the post. Steel line posts shall be rolled from high carbon steel and have a protective coating. The coating may be either galvanizing by the hot dip process, or painted using one or more coats of high quality, weather resistant, paint or baked enamel.

Steel line posts will ground a fence as long as the soil is moist. In areas where lightning is a hazard, spacing steel line posts every 150-feet in a line of wood posts offers fair protection.

Fiberglass posts are lighter than steel posts and withstand greater side-to-side stress. Polypropylene plastic posts have adequate strength but special clips are needed to attach wire to the posts. Fiberglass and plastic posts will not rot.

- Fiberglass and plastic posts must be a minimum of 5½-feet long.
- "T"-shaped fiberglass posts need to be at least 1¼-inch in diameter.
- Round plastic posts should be at least 3⅜-inches in diameter.

Live trees, at least 6-inches in diameter, may be used in lieu of line posts. Wire shall not be wrapped around or stapled directly to a live tree without the tree being protected. With loose tree bark stripped away, a wood slat is nailed (50d to 60d spikes) to the fence line side of the tree. Line wire is then stapled to this "nailer" strip, not the tree. Several wood slats will be spaced around the tree trunk if line wires are wrapped around the tree. These precautions not only limit tree injury, but also prevent the tree from growing over the fence wire and will make future fence repair easier.

BRACE POSTS – WOODEN

All wooden materials used in this practice that require preservative treatment will conform to National Standard Material Specification NSMS #585.

- All wooden corner, gate, and in-line vertical brace unit posts shall have a minimum top diameter of 5-inches.
- Wooden corner, gate, and in-line vertical brace unit posts shall have a minimum length of 7-feet.
- Wooden horizontal or diagonal braces shall have a minimum diameter of 4-inches.
- Wooden horizontal braces shall be a minimum of 6-feet in length.
- Wooden diagonal braces shall be a minimum of 6½-feet in length.

Wood brace posts shall be of cedar, redwood, juniper, treated pine or of other wood of equal life and strength. Pine posts shall be treated with an EPA-registered wood preservative. Posts shall be sound, free from decay, with all limbs trimmed substantially flush with the body. All posts shall be substantially straight throughout their full length.

BRACE POSTS - STEEL

Steel brace posts and horizontal braces shall conform to the requirements of ASTM A702 for steel posts and ASTM A53 for bracing pipes. Steel posts and braces shall have a protective coating; either galvanized, or painted using one or more coats of high grade, weather resistant, paint or baked enamel.

- All metal corner, gate and in-line vertical brace unit posts shall be pipe or angle iron (**not Tee-posts**) at least 6½-feet in length.
- Steel pipe installed as posts shall have a minimum outside diameter (OD) of 2.375 inches or an equivalent weight of 3.65-pounds per lineal foot, or larger.
- Angle iron installed as posts shall have sectional dimensions of at least 2½ x 2½ x ¼-inch.
- Horizontal or diagonal cross braces will be new and at least 1.660-inches (OD) in diameter or angle iron a minimum of 2 x 2 x ¼-inch in dimension.
- Steel horizontal braces will be a minimum of 6-feet in length.
- Steel diagonal cross braces will be a minimum of 6½-feet in length.

OTHER: Specialty hardware is commercially available that allows the use of standard steel fence posts in design of fence end, in-line and corner brace structures.

Alternative types of materials and designs may be used for fence construction if: (1) they meet or exceed NRCS fence specifications; and, (2) they are approved in advance by the State Resource Conservationist.

Locally accepted fencing materials and fence configurations not addressed in Nevada NRCS fence

specifications may be incorporated into the Field Office Technical Guide with prior approval of the State Resource Conservationist.

BRACING WIRE

Brace wires (tension members or guy wires) shall be formed from two complete loops of No. 9-gauge smooth wire or two complete loops of No. 12½-gauge double strand smooth wire.

Tension wires shall have a tensile strength not less than 58,000 pounds per square inch and shall have a minimum of Class 3 zinc coating as specified in ASTM A 641.

STAYS

Stays and stay fasteners shall conform to the requirements of the appropriate ASTM for the fencing material specified, unless otherwise specified.

Wooden stays may be constructed of any sound, straight, piece of durable wood at least 1½-inches in diameter.

Wooden stays should be long enough to extend at least 4-inches above the top wire strand.

In areas of deep snow, wooden stays are preferable and should be at least 2½-inches thick by 3 inches wide.

Wire stays shall have a minimum of Class 3 zinc coating as specified in ASTM A641 and shall be at least No. 9½-gauge twisted wire especially manufactured for this purpose.

Length of wire stays shall be at least 2-inches more than the distance between the top and bottom line wires. The lower part of wire stays shall not touch the ground.

Wire stays are best suited for areas of only light snow pack, as heavy snow loads bend the wire stays and damage the fence.

Fiberglass stays, especially fabricated for this purpose, may be used.

STAPLES AND CLIPS

Staples shall be No. 9-gauge galvanized wire at least 1½-inches long for soft woods and a minimum length of 1-inch for tight-grained, hardwood posts.

Staples shall be at least 1¾-inches long when high-tensile wire is used.

Fence line wire shall be fastened to steel posts using steel clips manufactured for this purpose or with two turns of No. 16-gauge, galvanized, wire.

B) CONSTRUCTION SPECIFICATIONS**ALIGNMENT**

Wire fences shall be reasonably straight and may not deviate more than 12-inches from a straight line between any corner and brace assemblies. Reasonable deviations in alignment shall be permitted where rocky ground or steep slopes make it necessary.

FENCE HEIGHT

The intended use of the fence determines fence height and line wire spacing. The minimum height (measured from the ground at post locations) of conventional post-and-barbed wire fences shall not be less than 36-inches.

LINE POST

Line posts must be set at significant high and low points along fence line to maintain proper wire height.

- Wooden line posts shall be set solidly in the ground a minimum depth of 24-inches.

Wooden line posts can be driven.

Where post holes are dug for installing fence posts, the holes shall be at least 6-inches larger than the diameter or side dimension of the posts.

Post holes shall be back-filled with tamped soil unless otherwise specified.

- Steel line posts shall be driven solidly into the ground a minimum depth of 18-inches. For very loose, sandy, soils set posts 24-inches deep.

Under moderate snow pack conditions, steel posts can be prevented from settling into the ground by attaching a wood stay to each steel post.

If soil conditions prevent firmly setting line posts in the ground, rock-jacks or wire cribs may be used. See practice specifications for Rock-Jack and Figure-4 Fence, Practice Code 382(f).

LINE POST SPACING is the same for all line post materials (metal, wood, etc.): Line post intervals shall be as follows:

- 3-wire fence
 - 16½-foot (1 rod) maximum line post interval.
- 4-wire fence
 - 20-foot maximum line post interval without stays.
 - 25-foot maximum line post interval when one stay is set mid-way between line posts.
 - 30-foot maximum line post spacing when two stays are set at 10-foot intervals between posts.

In heavy snow country, wooden posts should be spaced at no more than 16½-foot (1 rod) intervals to assure strength.

In very sandy soils, line posts may need to be spaced as close as 10-feet apart.

LINE WIRE

Fence line wires shall be stretched and attached to posts as follows:

- The fencing wire shall be placed on the side of the post expected to receive the greatest pressure.
- Where fencing is installed to protect a specific area, wire shall be placed opposite the area being protected.
- For installation along curved sections, fencing wire shall be placed on the outside of posts forming the curve.
- The fencing wire shall be fastened to wooden line posts by means of steel staples. Each strand of barbed wire shall be attached to each post.
- The fencing wire shall be fastened to standard T- or U- steel line posts by means of steel wire clips manufactured for this purpose; or with two turns of No. 16-gauge galvanized wire.
- The fencing wire shall be fastened to concrete line posts with two turns of No. 14-gauge galvanized steel or iron wire or in accordance with recommendations provided by the post's manufacturer.
- The top line wire shall be set so that fence posts extend a minimum of 2-inches above the wire.
- All line wires shall be dead-ended on the anchor post (pull post) of gate, corner, and in-line brace assemblies. Wire ends are double wrapped around the anchor posts (pull posts), stapled, and twisted back on the stretched line wire with at least six tightly wound wraps (Exhibit 1).

WIRE SPACING

Wire spacing should be varied according to need.

Examples of fence height and wire spacing (from the ground upward) for conventional barbed-wire fence to control:

MATURE CATTLE and CALVES - NO SHEEP
BOUNDARY FENCE
4-wire fence: 12" - 24" - 36" - 48"
DRIFT/DIVISION FENCE
3-wire fence: 16" - 32" - 48"
DRIFT FENCE
3-wire fence: 16" - 28" - 40"
MATURE CATTLE and CALVES
4-wire fence: 16" smooth wire - 22" - 28" - 40"
MATURE CATTLE, CALVES, and SHEEP
5-wire fence: 6" - 12" - 18" - 28" - 42"
6-wire fence: 6" - 12" - 18" - 26" - 36" - 47"
SHEEP and GOATS
5-wire fence: 5" - 11" - 18" - 26" - 36"

LINE WIRE TENSION

Line wires shall be stretched tight. Fence wires should be tensioned working from the top wire down.

Temperature variations must be considered when setting the tension on line wires (wire will tighten in cold weather and expand in hot weather).

STAPLES

Steel staples shall be driven diagonally with the grain of wood. Staples shall be driven into the post at an angle in the same direction as the line wire is pulling *i.e.*, if the line wire pull is up, staple legs will angle upwards when driven into the post. Staples shall be driven just deep enough to snug the line wire without bending it. The line wire should be loose in the staple (Exhibit 3).

WIRE SPLICING

Wire shall be spliced by means of a Western Union splice or by suitable splice sleeves applied with a tool designed for that purpose. The Western Union splice shall have no less than six (6) wraps of each end about the other. All wraps shall be tightly wound and closely spaced (Exhibit 3).

Splices made with splice sleeves shall have a tensile strength no less than 80 percent of the strength of the wire being spliced.

STAYS

When required, stays shall be evenly spaced between line posts to ensure that the proper interval between line wire strands is maintained.

CORNER, BRACE AND GATE POSTS

Braces are required at all corners, gates, and at all definite slope breaks and changes in alignment to the line fence (Exhibits 1 and 2).

- In straight sections on moderate terrain, in-line brace units are required at intervals not to exceed 1,320 feet (80 rods).
- Corner brace assemblies shall be installed at all points where the fence alignment changes 20-degrees or more. Brace units are required at the beginning and end of each curved fence section.
- Brace units are required at any point where the vertical angle described by two adjacent reaches of wire is upward and exceeds 10-degrees.

The deeper a post is set, the stronger it will be. If soil conditions prevent the proper setting of anchor posts and brace posts in the ground, rock-jacks or wire cribs may be used. See practice specifications for Rock-Jack and Figure-4 Fence, Practice Code 382(f).

- All wooden corner, gate, and in-line brace unit posts shall be set a minimum of 3-feet in the ground.
- Anchor posts (pull-posts) shall be set with a 1- to 2-inch lean away from the direction of fence pull.

Post holes for installing fence posts shall be at least 6-inches larger than the diameter or side dimension of the posts.

Post holes are to be back-filled with soil unless otherwise specified. Earth backfill around posts shall be thoroughly tamped in layers not thicker than 4-inches and shall completely fill the post hole up to the ground surface. Backfill shall be crowned-up around posts at the ground surface.

- Metal corner, gate, and in-line brace assembly posts shall be set in concrete a minimum of three feet in the ground.

Concrete backfill around posts shall be rodded into place in layers not thicker than 12-inches and shall completely fill the post hole to the surface of the ground. Backfill, either soil or concrete, shall be crowned-up around posts at the ground surface. No stress shall be applied to posts set in concrete for a period of not less than 24-hours following the development of a firm set of the concrete.

Wooden, horizontal, brace members (compression braces) shall be notched into the top half of the brace post, and post being braced, approximately 36-inches above ground level. Steel dowels or brace pins can be used, rather than notching, to attach horizontal brace between anchor post and brace post.

Metal, horizontal cross brace members (compression braces) shall be welded or notched into the top half of the brace post and post being braced at a point approximately 36-inches above ground level.

The elevated end of diagonal brace members, either metal or wood, shall be welded into a metal brace post, or notched into a wood brace post (as appropriate), at a point approximately 36-inches above ground level.

BRACING WIRE

Brace wiring (tension member) shall consist of two wire strands that extend from a point approximately 6-inches below the top of the brace post to about 4-inches above the ground level of the post being braced (anchor post or pull post). The brace wires should be double wrapped around each post, stapled, and spliced together. A stout stick, pipe, or metal rod, about 18 to 24-inches long, is placed mid-way along the brace wires, and all four wires are twisted together so the brace wires tightly secure the compression brace and provide needed rigidity. If a diagonal brace is used, the tightening stick is positioned below the diagonal to avoid hitting this brace member as the stick is turned (Exhibit 1).

CROSSING DRAWS OR STREAMS

When crossing landscape depressions (draws or swales), and fencing follows the ground surface, line posts subject to upward pull shall be anchored.

If the fence wire is installed with the top wire straight and parallel to the ground surface on either side of the depression, extra length posts shall be used to allow specified depth of post placement. Fence wire strands located over a depression should be anchored to a weight or deadman with No. 9-gauge, galvanized, smooth wire to maintain required spacing interval.

Consider use of a deadman or anchor when the bottom line wire at the low spot in crossing rises more than 20-inches above the ground. Additional line wires will be added for short distances between vertical anchor lines as necessary. See Exhibit 4.

When crossing wide (greater than 16½-feet), or deep, stream channels or gullies, the fence should be dead-ended on each side of the crossing by use of line braces. The section across a streambed may be removable, a breakaway type, or swinging picket type fence. Also see practice specifications for Let-Down Fencing, Water Gaps, Cattle Guards, and Other Fence Components, Practice Code 382(h).

GATES AND OTHER FENCE COMPONENTS

Materials used in construction of wire gates shall conform to the kinds, grades, and sizes specified for a new fence, and shall include the necessary fittings and

stays. Panel gate fittings shall not be of a lesser quality than the gate manufacturer's standard. Also see practice specifications for Let-Down Fencing, Water Gaps, Cattle Guards, and Other Fence Components, Practice Code 382(h).

IV. INSTALLATION

Installation of the fence shall conform to the specifications and exhibits or other drawings, as provided.

All posts shall be placed to the required depth and shall be firmly embedded so that there is less than 1-inch of horizontal movement at the top of post when a horizontal force of 80-pounds is applied.

The completed job shall be workmanlike and present a good appearance. The installer and other persons will conduct all work in accordance with proper safety procedures.

V. BASIS OF ACCEPTANCE

After the fence has been installed, a site inspection will be made to determine if fence construction, and the materials used, meets practice specification requirements as specified on the conservation practice documentation worksheet.

VI. MAINTENANCE

This practice will require the performance of periodic maintenance.

Fence maintenance items to be alert to and corrected include:

- tension of wire
- bent or broken stays
- broken wires
- post alignment
- wire corrosion
- post stability
- pulled staples or clips
- sagging gates
- bent steel posts
- wildlife concerns

REFERENCES

The following references provide excellent guidance for fence construction, selection of fencing materials, and the installation of fence components.

Henderson, G.E. 1966. Planning Farm Fences. American Association for Agricultural Engineering and Vocational Agriculture, Athens, GA. 54pp.

Paige, C. 2008. A Landowner's Guide to Wildlife Friendly Fences. Landowner/Wildlife Resource Program, Montana Fish, Wildlife, and Parks. Helena, MT. 44 pp.

Sanderson, H.R. T.M. Quigley, E.E. Swan, L.R. Spink, 1990. Specifications for Structural Range Improvements. Gen. Tech. Rep. PNW-GTR-250. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 126p.

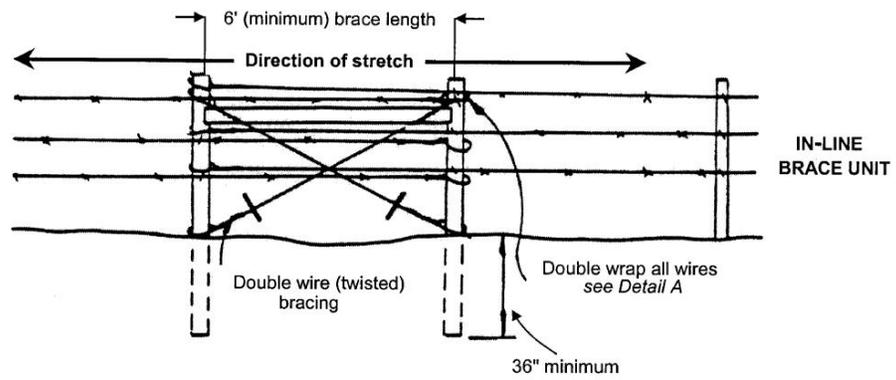
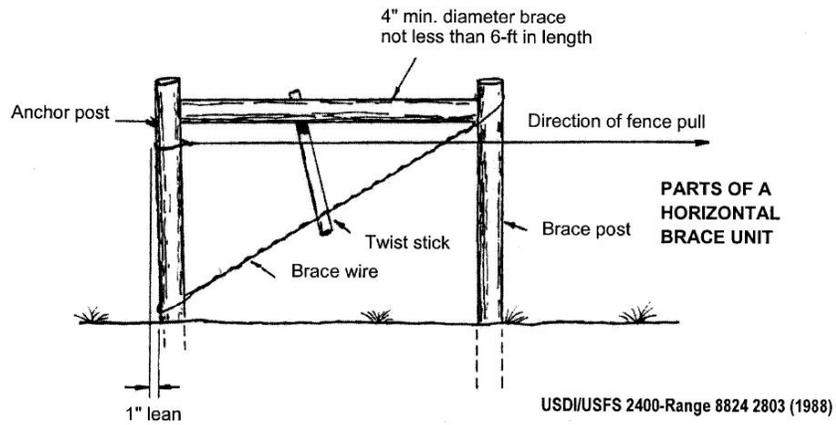
USDA Natural Resources Conservation Service. 2009. National Engineering Handbook Part 642.

USDI Bureau of Land Management and USDA Forest Service. 1988. Fencing. 2400-Range 8824 2803.

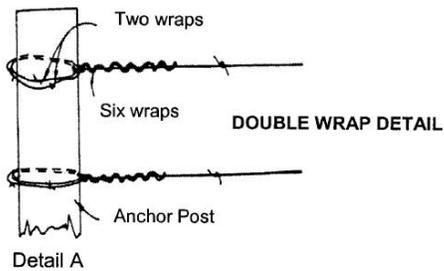
Valentine, J.F. 1989. Range Developments and Improvements. Third Edition. Academic Press, San Diego, CA.

Wyoming Game and Fish Department. 2004. Fencing Guidelines for Wildlife. Habitat Extension Bulletin No. 53.

EXHIBIT I

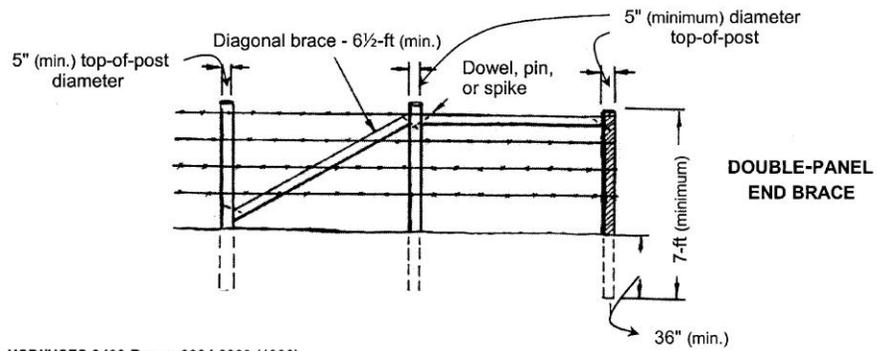
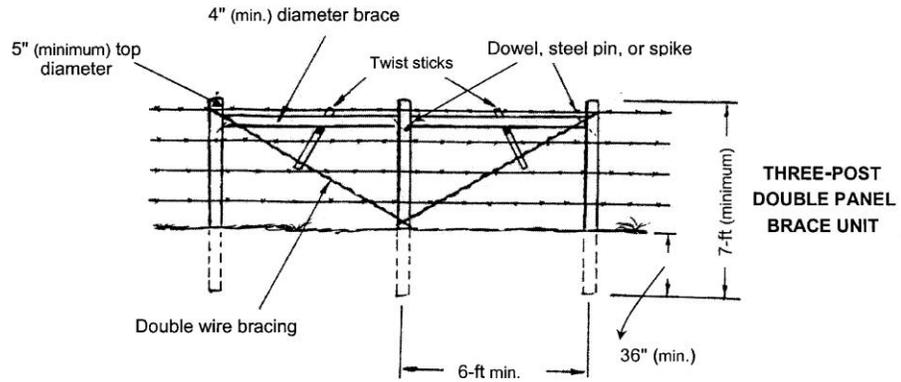


after Sanderson et al, 1990



STANDARD POST AND BARBED WIRE FENCE

EXHIBIT 2



USDI/USFS 2400-Range 8824 2803 (1988)

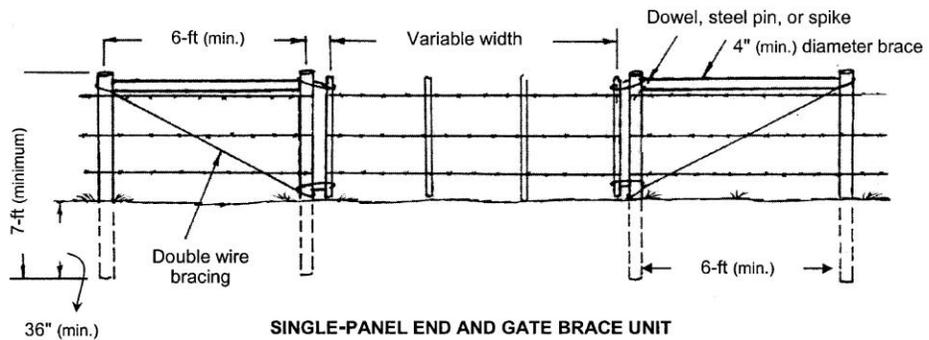
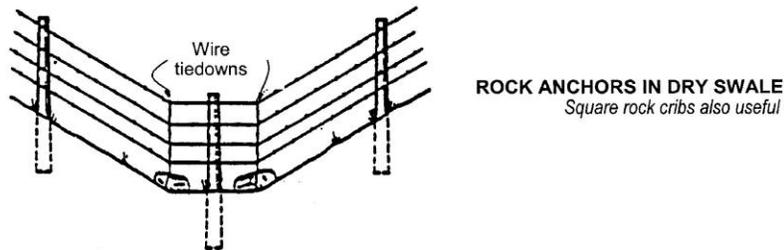
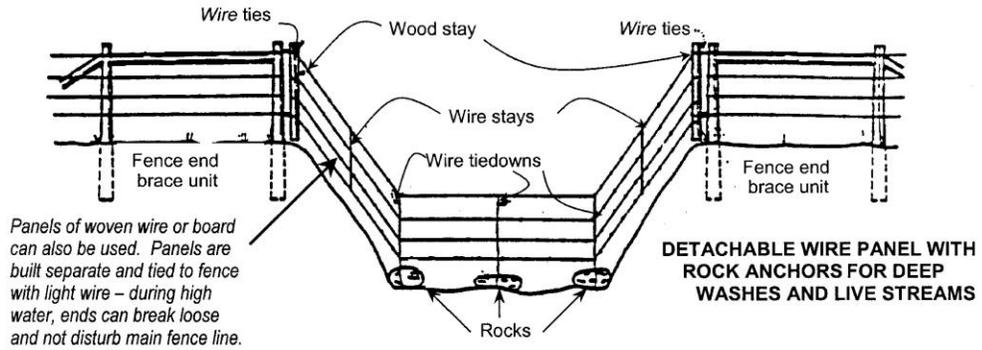
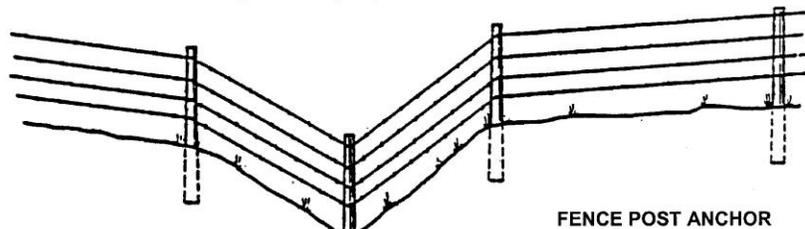


EXHIBIT 4



USDI/USFS 2400-Range 8824 2803 (1988)



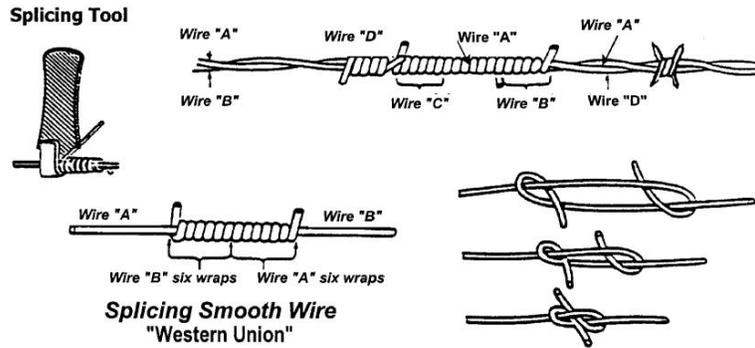
Treated 2" x 4" pieces, 12" to 14" long with pointed ends, are diagonally bolted to post bottom and wedged tightly into sides of posthole then covered with well-tamped gravel and soil.

1/2" carriage bolt

CONFIGURATIONS FOR CROSSING STREAMS AND DRAWS

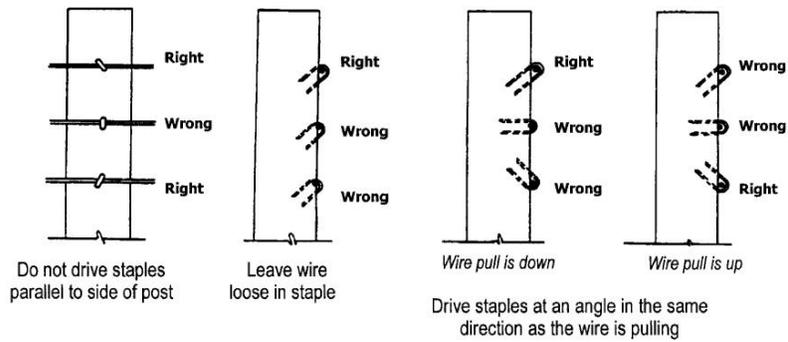
EXHIBIT 3

Splicing Barbed Wire



In-Line Splicing by Tying a "Figure-8" Knot

Stapling Wire to Wooden Posts



after Sanderson et al (1990)