

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

FENCE (FEET)

CODE 382

MONTANA CONSERVATION PRACTICE SPECIFICATION

BARBED, SMOOTH, OR WOVEN WIRE

SCOPE: This specification provides guidance for the installation of permanent barbed, smooth, or woven wire fences. Fencing includes all components required for achieving the objectives of the practice and meeting site conditions.

TYPE OF FENCES

Post and Wire Fence

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 for cattle. Smooth wire is generally considered safer for horses and llamas.

High-Tensile Wire Fence (non-electrified)

High tensile post-and-wire fences are suitable for areas that receive moderate to heavy pressure by livestock.

Let-down Fence

The let-down fence is typically a four-strand barbed-wire fence that can be laid on the ground during winter after the grazing season or during periods of expected big game movement, but remains under tension at all other times. This fence design is suited for use where seasonal movements of big game must be accommodated, or where wildlife pressure on fences is high. Let-down fences are designed for mountainous areas with heavy snow pack that can loosen or break fence wires and pull over fence posts.

Although let-down fences greatly reduce fence damage from snow or wildlife, several disadvantages of this fence design shall be noted:

- Cannot protect against stray or trespass livestock when fence is down;
- Must be raised and lowered each year; and
- Over-winter contact with the ground corrodes fence wire more quickly.

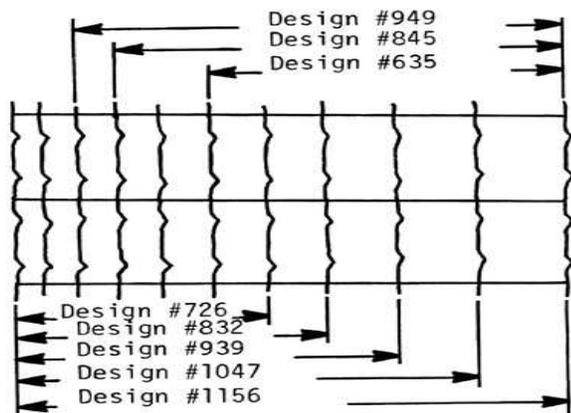
Woven-wire Fence

Woven-wire fence is best used in areas where tight control is necessary: sheep, goats, horses, hogs, people, wildlife depredation, or predator control. The spacing of the mesh of the woven-wire differs, depending on the kind of animals the fence is designed to control.

Woven wire is not safe for large wildlife species, especially in travel corridors. Horses can get hooves caught between wires if the mesh is too large.

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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.":

- the first one or two numbers relate the number of line wires;
- the next two numbers to the right specify the height of the wire in inches;
- the 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 of the vertical stay wires between the top and bottom wires.

MATERIALS AND CONSTRUCTION SPECIFICATIONS: Materials used in the construction of fences will be new, except as outlined in the specifications, and will have a minimum life expectancy of 10 years. All materials must be in accordance with, and equal or exceed, in strength and durability, the requirements listed below.

LINE POSTS: Wooden posts are preferred for use in high snowfall areas because of their extra strength. 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.

TABLE 1. Line Post Requirements for Barbed, Smooth, and Woven Wire Fence

Wood posts do not need to be new materials; however, all posts shall meet the minimum quality 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 of sufficient length to meet setting depth, fence height requirements, plus 2 inches.				
BRACE POST TYPE	MINIMUM DIAMETER/WEIGHT	MINIMUM SETTING DEPTHS	MINIMUM LENGTH	MINIMUM PROTECTIVE COATING, OTHER
Wood-juniper, cedar, black locust	4 inches 3-1/2 inches for woven wire	24 inches	6 feet	None
Wood-pine or similar woods	4 inches 3-1/2 inches for woven wire	24 inches	6 feet	Complete penetration of the sapwood with approved treatment materials
Standard "T" or "U" section steel Rolled from high carbon steel and studded, embossed, or punched for wire attachment with anchor plate	1.33 pounds per foot of length, exclusive of anchor plates	18 inches	5-1/2 feet	Hot dip galvanized, or one or more coats of high-grade, weather-resistant steel paint, or enamel applied and baked.
Live trees	6 inches	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: Chemically-treated wood posts shall not be used in wetlands, areas with high water tables, or other areas where chemical treatment may have the potential to leach into soils and/or move offsite.

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WIRE

TABLE 2. Wire Type Requirements for Barbed, Smooth, and Woven Wire Fence

WIRE TYPE	MINIMUM WIRE SIZE	MINIMUM PROTECTIVE COATING	STRAND-BREAKING STRENGTH	OTHER
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 (Gaucho Wire)	15-1/2 gauge	Class III galvanized per ASTM-121	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	
Standard Woven Wire The label shall indicate the wire meets ASTM A-116 or ASTM A-584 standards.	Top & Bottom Wires: 11 gauge Intermediate & Stay Wires: 14-1/2 gauge	Class I zinc coating or equivalent		At least one strand of barbed or smooth wire will be added at the top, spaced 2-6 inches above the woven wire.
High Tensile Woven Wire	12-1/2 gauge	Class III zinc coating or equivalent		At least one strand of barbed or smooth wire will be added at the top, spaced 2-6 inches above the woven wire.

STAYS

TABLE 3. Stay Requirements

STAY TYPE	MINIMUM DIAMETER/WEIGHT	MINIMUM LENGTH
Wood	2.5 inches diameter	Fence height + 3 inches
Wire	9-1/2 gauge twisted, manufactured for this purpose; Galvanized zinc coated	2 inches + distance between bottom & top wire
Fiberglass	Especially fabricated for this purpose	Fence height + 3 inches

BRACE AND ANCHOR POSTS: Posts must be of sufficient length to meet fence height, setting depth requirements, plus 6 inches.

TABLE 4. Brace Post Requirements for Barbed, Smooth, and Woven Wire Fence

Wood posts need not be new materials; however, all posts shall meet the minimum quality criteria for durability and protective coating and be sound and free from decay, with all limbs trimmed substantially flush with the body.				
BRACE POST TYPE	MINIMUM DIAMETER/ WEIGHT	MINIMUM. SETTING DEPTHS	MINIMUM LENGTH	OTHER
Wood-juniper, cedar, black locust	5 inches	3 feet	7 feet	None
Wood-pine or similar woods	5 inches	3 feet	7 feet	Complete penetration of the sapwood with approved treatment materials
Steel, round	2-3/8 inches outside diameter (OD), 3.65 lb./foot or equivalent	3 feet set in 12-inch diameter concrete	7 feet	Galvanized with 2 oz./square foot zinc coating Schedule 40 pipe will meet these requirements
Steel, angle iron	2.5-inches x 2.5 inches x 0.25 inch	3 feet set in 12-inch diameter concrete	7 feet	Galvanized with 2 oz./square foot zinc coating
Live trees	10 inches	Wire not wrapped or stapled directly to tree. Several wood slats spaced around the tree trunk provide protection if wire is wrapped around the tree. Staple wire to slats.		

Note: Chemically-treated wood posts shall not be used in wetlands, areas with high water tables, or other areas where chemical treatments may have the potential to leach into soils and/or move offsite.

POST DEPTH: 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** or **TABLE 4—Brace Post Requirements**.

Wood posts shall be driven or set in holes and back-filled with compacted earth or poured concrete. 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.

Steel line posts shall be driven solidly into the ground until the plate is covered. If soil conditions prevent firmly setting line posts in the ground, rock-jacks, Figure-4's, or wire cribs may be used.

BRACING AND ALIGNMENT: Bracing is the key determinant to the structural soundness and longevity of wire fences. Braces are required at all corners, gates, direction change angles, and at all definite slope breaks. Fence shall be reasonably straight and shall not deviate more than 12 inches between any corner, gate, or in-line brace assembly.

Maximum distance between brace panels in the fence line shall not exceed 1,320 feet (80 rods) on level terrain, and shall be installed at lesser intervals wherever the horizontal direction of the fence changes more than fifteen degrees, or where vertical angles cause excessive strain on posts and fasteners.

Recommended brace types include the Standard H-brace, and the Diagonal brace.

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Horizontal Braces

Wooden horizontal brace members (compression braces) shall be at least 5 feet in length and notched into the top half of the brace post and anchor post, at a minimum of 36 inches above ground level and below the top 6 inches of the brace and anchor post. Steel dowels can be used, rather than notching, to attach horizontal brace between anchor post and brace post.

TABLE 5. Brace Member Requirements for Barbed, Smooth, and Woven Wire Fence

BRACE MEMBER TYPE	MINIMUM DIAMETER/WEIGHT	MINIMUM LENGTH	OTHER
Wood, horizontal	4 inches	5 feet	Fully treated
Wood, diagonal	4 inches	6 feet	Fully treated
Steel, round, horizontal, pipe or tubular steel	2 inches OD, 2.25 lb./foot or equivalent	5 feet	None
Steel, round, diagonal, pipe or tubular steel (when used with and all metal brace system)	2 inches OD, 2.25 lb./foot or equivalent	6 feet	None
Steel, angle iron, diagonal (when used with and all metal brace system)	2 inches x 2 inches x 0.25-inch	6 feet	None

Bracing Wire

Brace wires (or guy wires) shall be formed from two complete loops of:

- No. 9 gauge smooth wire,
- No. 12-1/2 gauge double-strand smooth wire, or
- No. 12-1/2 gauge high tensile smooth wire.

Brace wires shall extend from a point approximately 6 inches below the top of the brace post to as close to ground level as possible on the anchor post. Never have the wire on the brace post higher than the top of the anchor post or it will pull the anchor post up to that level. The brace wires shall be double-wrapped around each post, stapled and spliced together. A stout stick, 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.

Diagonal Braces

Brace wires shall extend from a point approximately 4 inches above the ground level of the anchor post. The brace wires shall be double-wrapped around anchor post and threaded through a hole in the brace post. 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 member is tightly secured.

LINE POST SPACING: Spacing is the same for all line post materials.

TABLE 6. Line Post & Stay Spacing

FENCE TYPE	LINE POST SPACING MAXIMUM INTERVAL
3-Wire Fence	16-1/2 feet (1 rod)
4-Wire Fence	20-foot without stays 25-foot when one stay is set mid-way between line posts 30-foot when two stays are set at 10 feet intervals between posts
3-Wire or 4-Wire Suspension Fence	80 to 100 feet (not to exceed 100 feet). Stays shall be spaced not to exceed 16-1/2 feet (1 rod) in the line
Woven Wire Fence	20 feet
Heavy Snow Country and Let-Down Fences	16-1/2 feet (1 rod) between wooden posts

FENCE HEIGHT and WIRE SPACING: Fence height is measured from the ground at post locations and between posts.

TABLE 7. Fence Height and Spacing Requirements

INTENDED USE	FENCE HEIGHT AND LINE WIRE SPACING
Domestic livestock control	36 inches minimum 42 inches maximum
Wildlife Movement Areas- In areas where big game animals are expected to cross the fence line	Maximum height of 42 inches. Wire spacing of the top two line wires shall be a minimum of 10 inches apart at the post location. Bottom wire 18 inches from ground for antelope.
Riparian pastures and riparian enclosures	Effective height to the top line wire will not be more than 42 inches. The top wire shall be smooth (not barbed) because riparian areas provide wildlife habitat and water. Bottom wire 18 inches from ground.
Woven Wire, Sheep and/or Cattle	Bottom of woven wire to ground: 1/2-inch minimum to 3-inches maximum. Use maximum if additional barbed wire is used below woven wire. Add one or two strands barbed or smooth wire 2 to 6 inches above top of woven wire. Do not exceed total fence height of 42 inches

Common Wire Spacings

- 3-Wire Cattle: 12", 26", 40"
- 4-Wire Cattle: 12", 22", 32", 42"
- 4-Wire Cattle with Antelope: 18", 26", 34", 42"
- 5-Wire Sheep: 5", 11", 18", 26", 36"
- 5-Wire Cattle and Sheep: 8", 16", 24", 33", 42"; or 5", 11", 18", 28", 42"

SPLICING: When splicing of wire is necessary use conventional wire-loop, "Western Union" splice or compression fittings.

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STAPLES AND FASTENER 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.

TABLE 8. Staples and Fastener Requirements

U-shaped staple, conventional wire: No. 9 gauge galvanized wire or bright hard wire; at least 1 inch long
L-shaped deformed shank staple: No. 9 gauge galvanized wire or bright hard wire; at least 1 inch long
Fence wire shall be fastened to steel posts using steel clips manufactured for the purpose of attaching wires, or 9 gauge smooth wire
Other post types will use fasteners and methods recommended by the manufacturer.

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 live 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.

ROCK-JACKS AND FIGURE-4's: Rock-jacks and Figure-4's are particularly useful in areas where it is difficult to set regular posts, such as swampy or rocky areas. Rock-jacks provide the primary fence support in lieu of brace and end post assemblies. An alternative system of wire supports—in the configuration of the number "4"—is used in lieu of line posts to provide wire support. Figure-4's, steel posts, and fence stays can be used in combination to suit site conditions.

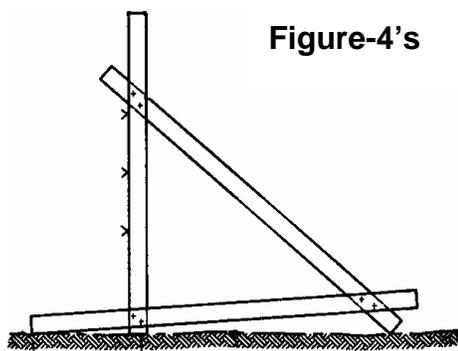
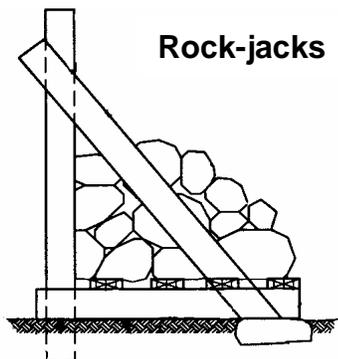


TABLE 9. Rock-jacks Used as Line Posts:

ROCK JACK COMPONENTS	DIMENSIONS	LENGTH
Anchor Post	4 inches x 4 inches dimensional lumber or 6 inches diameter post	5-1/2 feet
Diagonal Braces (legs)	2 inches x 6 inches dimensional lumber, or 3 inches x 6 inches round posts or 3 inches x 6 inches split poles	5 feet, 8 inches
Base Supports		4 feet
Flooring	2 inches x 6 inches dimensional lumber	4 feet, 3.5 feet, 3 feet, & 2.5 feet

Note: Chemically-treated wood posts shall not be used in wetlands, areas with high water tables, or other areas where chemical treatments may have the potential to leach into soils and/or move offsite.

TABLE 10. Rock-jacks Used at Fence Corners, Gates, Pull post locations, or Other Locations Where Extra Support is Needed:

ROCK JACK COMPONENTS	DIMENSIONS	LENGTH
Anchor Post	6 inches x 6 inches dimensional lumber or 6 inches diameter post	5-1/2 feet, may be longer depending on gate design
Diagonal Braces (legs)	2 inches x 6 inches dimensional lumber, or 3 inches x 6 inches round posts or 3 inches x 6 inches split poles	8 feet
Base Supports		5 feet, 8 inches
Flooring	2 inches x 6 inches dimensional lumber	5.5 feet, 5 feet, 4.5 feet, ,4 feet, 3.5 feet, 3 feet & 2.5 feet

Note: Chemically-treated wood posts shall not be used in wetlands, areas with high water tables, or other areas where chemical treatments may have the potential to leach into soils and/or move offsite.

The anchor post is set in the ground to a one-foot depth. If soil conditions prevent setting anchor post, rock cribs can be used. The anchor post must have sufficient length that at least 4-1/2 feet of post rises above the ground level when set.

The floor of the rock-jack shall be constructed of 2-inch x 6-inch boards. Do not nail the platform down. Once the rock-jack frame is constructed and the floorboards are in place, rocks are placed on the rock-jack floor. Large rock weights will be placed at each joint with lesser weight rock distributed evenly over the rock platform. Weight of rock on the platform is 300 to 500 pounds. Line wires are stapled to the anchor post of the line rock-jack. Rock-jacks used for gate, corner, or pull post locations will have the wire wrapped around the anchor post.

Figure-4 fence supports are constructed from either dimension lumber, round, or split poles. Figure-4 supports are composed of 3 frame members: vertical post, diagonal brace, and ground leg.

The upright post shall be at least four feet in length. The diagonal brace and ground leg of the support frame shall each be 5-1/2 feet long. A recommended construction design employs 2-inch x 6-inch boards for each member of the figure-4 support. The bottom end of the vertical post rests on the ground surface.

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ROCK-JACK, FIGURE-4, AND LINE POST SPACING

Rock-jacks are placed at all abrupt breaks in topography and definite changes in alignment to the fence line.

SNOW CONDITIONS AND TYPE OF INTERMEDIATE SUPPORTS	IN-LINE ROCK-JACKS (LINE-JACKS) SPACING
Level (rocky or swampy) sites with light snowfall	100 feet intervals and figure-4's set every 25 feet with a stay (wood, wire, fiberglass) placed midway between each figure-4
Moderately steep topography and/or areas of moderate snowfall	75 feet intervals with stays (wood or fiberglass) spaced at 12-1/2 feet intervals between rock-jacks.
Steep, rocky slopes, or sites with heavy snow loads	50 feet intervals and Figure-4's are set 25 feet from each rock-jack with a wooden stay placed midway between a figure-4
On sites where steel posts can be driven	160 feet intervals and steel posts are set at 20 feet intervals between rock-jacks. A stay is placed mid-way (10 feet) between steel posts

FENCES TO CONTROL WILDLIFE: Where wildlife exclusion is needed to protect valuable crops, hay, or plantings, fences provide the most effective long-term protection. High tensile woven wire fences are very effective for controlling deer and elk on large acreages, but are generally much more expensive than power fences.

Woven and Smooth Wire Fence for Deer and Elk

Deer:

- Minimum of 7-foot height.
- Woven wire 6.5 feet high with one to two strands of smooth or barbed wire on top.
- Line posts: 12-foot length, 40 feet apart, 4.5 feet buried depth.

Elk:

- Minimum of 9 feet height.
- Woven wire 8 feet high, with 2 strands smooth wire on top.
- Line posts: 16-foot length, 40 feet apart, 4 to 6 feet buried depth.