SPECIFICATIONS

I. Barbed or Woven Wire

Barbed wire fence will be constructed of at least four wires; total height will not be less than indicated in the table below. An exception will be partition fences for planned grazing systems. These fences may consist of three barbed wires.

Woven wire fences shall be constructed at least 32 in. high with at least one strand of barbed wire above the woven wire, except as noted in the table below.

A. Fence Fabric and Wire

1. Barbed wire as a minimum shall be 12 ½ gage with 4-point barbs spaced not more than 6 in. apart.
2. Woven wire, as a minimum, shall meet the gage for top and bottom strands as specified in the table below.

FENCE CONSTRUCTION

Use	Height (in.)	Barbed Wire Strands	Woven Wire Stay Spacing (in.)	Gage[a]
Cattle or mixed livestock	44	3 or 4	6 or 12	11
Hogs	32	b	6 9	
Sheep or Goats	39	4	6 or 12	9
Horses	47	c	6 or 12	11
People	47	c	6 or 12	11
Deer	94	c	6 bottom & 12 top	9

[a]Minimum gauge top and bottom stands of fabric.
[b]One strand below woven wire fabric.
[c]Generally not applicable.

B. Posts

1. Materials – Posts and braces shall be constructed of wood, steel, concrete, or a combination of these. Untreated wood posts shall be of cedar or locust. All other species can be used if pressure treated.

2. Post Sizes

a. Wood Posts –

(1) Untreated wood line posts minimum 4 in. diameter or 4 in. square, on the small end.
(2) Pressure-treated wood line posts minimum 3 in. diameter or 3 in. square, on the small end.
(3) Treated wood corner, brace and gate posts minimum 5 in. diameter or 5 in. square, on the small end.
(4) Untreated wood cross braces minimum 3 ½ in. diameter or 3 ½ in. square, on the small end, with maximum length of 10 ft.

b. Steel posts shall be hot-dipped galvanized, with not less than 2 ounces per square foot of zinc coating or they may be painted steel. Painted steel may be used but shall be clean of loose scale before one or more coats of high-grade, weather-resistant metal paint is applied.

(1) Steel corner and gate posts shall be 2.5 x 2.5 x 0.25 in. angle iron, or 2.5 in. outside diameter pipe or tubular steel.
(2) Steel line post (1.33 lbs. per ft.) shall be studded or punched T, U, or Y shaped with anchor plates or acceptable alternative based on manufacturer's recommendation.
(3) Steel braces shall be 2 x 2 x 0.25 in. angle ireon, or 1.62 in. outside diameter pipe or tubular steel.

c. Maximum Spacing and Minimum Anchorage Depth –

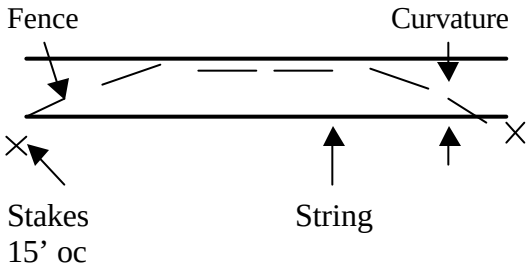
(1) Line posts	16 ½ ft. apart	2 ft. deep
(2) Brace posts	660 ft. apart on the level, closer on steep, irregular land	3 ½ ft. deep
(3) Brace posts on corner	8' from corner	3 ½ ft. deep
(4) Corner	----------	3 ½ ft. deep

C. Bend assemblies – Curve or contour fence shall have maximum post spacing as follows:

Fence Curvature (Inches)	Post Spacing (Feet)
4 or less	14
5-6	12
7-8	10
9-14	8
15-20	7

Curvature shall be measured using at least three stakes, spaced 14 ft. apart along the fence line. A string is stretched between the first and third stakes, and the curvature measurement (in inches) is the perpendicular distance from the string to the second (middle) stake.

FENCE CURVATURE



Post shall lean outward from the curve approximately 2 in. at the top.

D. Fasteners

1. Wood Posts -- Use 1 ¼ in. galvanized 9-gage staples.

2. Steel or Concrete Posts – Use galvanized 9-gage wire ties or coated clamps.

E. Grounding Wire Fence

To provide livestock protection against lightning, all strands of the fence shall be securely fastened with galvanized wire ties to grounding electrodes at intervals of not more than 150 ft. for dry, rocky soil and not more than 300 ft. for moist or damp soils. Fences built with metal posts set in earth provide adequate lightning protection.

Electrodes for grounding fences shall be driven into firm earth to a minimum of 3 ft. They shall be either a standard galvanized steel post or a ¾ in. galvanized steel pipe. The continuity of wire fences should be broken at maximum intervals of 1,000 ft.

Any modifications for grounding must adhere to manufacturer's recommendation.

II. Nonelectric High Tensile Fence

A. Wire

1. Perimeter fences will be constructed of at least 6 wires with the total height of the fence not less than 46 in. Cross fences will also be constructed of at least six wires with a total height of the fence not less than 46 in. for cattle and horses and 36 in. for sheep. Wire will be new, smooth and meet or exceed the following:

   Breaking Strength – 800 lb
   Rust-proofing or Galvanizing – Type III or equivalent
   Minimum Gage 14

2. Spacing and Height – The following wire spacing and heights will be used as guidelines:

Fence Description	Wire Spacing Starting at Bottom (in).	Total Ht. (in.)
10 Strand Livestock Fence	4-4-4-4-5-5-5-5-5-5	46
10 Strand Livestock Feedlot	10-4-4-4-5-5-5-5-5-5	52
8 Strand Cattle Fence	4-5-5-5-6-6-7-8	36
6 Strand Cattle Fence (not for calves)	14-5-6-6-7-8	46
6 Strand Sheep Fence	4-5-5-6-8-8	36

Adjustments in number of wires and spacing may be made according to manufacturer's recommendation.

3. Tension: 150-250 lbs. each wire. Apply tension with an in-line stretcher. Install a tension spring on at least one wire to gage tension. Use an in-line wire tightener on each strand.

4. Fastening –

   a. At corner and gate braces wrap and twist wire or use crimping sleeves or wire anchor through posts for maximum strength.

   b. Staple wires to posts with 1 ¾ in. galvanized 9 gage staples with slash cut points. Do not drive staples tight in posts. Angle staples to prevent splitting post. Drive into post at downward angle on knolls and at an upward angle in depressions.

   c. Angle notched posts do not need fasteners.

   d. Wire clips will be used to fasten wire to straight notched and fiberglass posts.

B. Posts – All posts shall be either pressure treated wood, or cedar or locust.

1. Corner, brace or gate posts.

   a. Minimum size 6 in. diameter or 6 in. square, on small end.

   b. Set posts 4 ft. deep.

   c. See Attachment 2 for typical gate or corner assemblies.

   d. See Attachment 3 to determine when brace assemblies are needed.

2. Line Posts

   a. Minimum 4 in. diameter or 4 in. square, on small end.

   b. Set posts 2 ½ ft. deep.

   c. Spacing – 16 ½ ft. without battens or 60 ft. if battens are used between posts, at 15 ft. spacing.

C. Brace Assemblies

A double brace assembly will be used for gate and corner posts where 8 or more strands of wire are used.

The following are minimum guidelines:

1. Double Brace Posts – 5 in. diameter x 7 ½ ft. long, set 3 ½ to 4 ft. deep.

2. Horizontal Brace Rail – 4 in. diameter x 8 ft. long placed 3 to 4 ft. above ground.

3. Brace Post Pins – 3/8 in. x 9 in. and ¾ in. x 4 in. galvanized steel rods.

4. Brace Wires – 12 ½ gage high-tensile wire, double wrapped with 1 ½ in. x 2 in. x 2 ft. twist stick.

Follow manufacturer's recommendations if modifications to the above are required.

D. Bend Assemblies – See Section I C and Attachment 2.

E. Installation

Normal fencing construction techniques shall be followed, and the fence shall be constructed in a workmanlike manner.

F. Grounding – See Section I E (page 392-5)

G. Modifications: The above criteria are provided as guidelines. Modifications to the above should be based on manufacturer's recommendations.

III. Electric High Tensile and Conventional Fence

A. Wire

1. Property or boundary fences should generally be constructed using the barbed or woven wire guidelines in Section I or non-electric high tensile guidelines in Section II. The purpose is to provide enough fence to act as a physical barrier in case the energizer does not function properly (see Item No. 6 on page 329-10 for exception).

2. Field fences and cross fences will be constructed using the guidelines provided in this section. Wire will be (Type III) new, smooth zinc or aluminum coated for long life. The wire will be high tensile with a minimum gage of 16. Actual wire size and voltage should be based on manufacturer's recommendations.

The following guidelines are provided with respect to wire spacing and height:

Fence Description	Wire Spacing from Earth (in inches) (Left to Right) All Hot Wire	Hot-Ground Wire (+ Hot Wire) (- Ground Wire)
1 Wire	30	30 +
2 Wire, Top Wire 36”	17-36	17-36 - +
3 Wire, Top Wire 38”	12-22-38	12-22-38 + - +
4 Wire, Top Wire 40”	12-20-30-40	8-18-28-40 - + - +
5 Wire, Top Wire 36”	6-12-18-26-36	6-12-18-26-36 + - + - +

Class of Livestock	No. of Wires
Milk cows (only)	1
Cows/calves Horses/foals	2
Sheep	2
Hard to Hold Cattle	3

3. Interior (subdivision) fences will be constructed using either polywire and movable posts or steel wire. One, two or three wires may be used depending on the needs of the grazing system. At least one wire must be electrified. Polywire and movable posts are not considered to be a part of the permanent fencing system.

4. Sufficient tension is needed to assure proper suspension and maintain stability.

5. Gates should be appropriate for the specific designed fencing system, based on the manufacturer’s recommendations.

6. Where streams are involved, systems will be specifically developed on a farm by farm basis. A consideration of streambank fencing is boundary, perimeter of work fences which will be subject to flooding. Generally, single strand high tensile electric may be appropriate to minimize the physical barrier exposed to flooding, depending on the type of livestock.

B. Posts – All posts shall be either pressure treated wood, or cedar or locust—or other suitable materials based on manufacturer's recommendation.

1. Corner, brace or gate posts

   a. Pressure treated – minimum 5 in. diameter or 5 in. square, on small end.

   b. Minimum diameter for bracing up to 10 ft. long is 3 ½ in.

   c. See Attachment 2 for typical gate and corner assemblies.

   d. See Attachment 3 to determine when brace assemblies are needed.

2. Line posts shall conform to the following:

   a. Notched wood self-insulating, minimum 5 ½ ft. x 2 in. x 1 ½ in.

   b. Fiberglass – minimum 5/8 in. diameter on notched "T"

   c. Other types based on manufacturer's recommendations.

3. Post spacing – posts shall be of sufficient number to maintain fence stability.

C. Battens

1. 40 in. to 48 in. x 1 ½ in. x 1 in. self-insulating notched wooden.

2. Fiberglass – minimum 3/8 in. diameter or notched "T".

3. The use of other posts should be based on manufacturer's specifications.

4. Maximum spacing between battens and line posts will be such that wire spacing will be maintained.

5. Hold downs may be needed in depressions.

D. Brace Assembly

A single brace assembly may be used for gates and corners. Use the following as guideline minimums:

1. Brace posts – 5 in. x 8 ft., set 4 ft. deep.

2. Horizontal brace rail – 3 ½ in. x 7 ½ ft. to 10 ft.

3. Brace pins – 3/8 in. x 9 in. and 3/8 in. x 4 in. galvanized steel rods.

4. Other anchoring devices such as the Penn State prestressed knee brace shall be based on manufacturer's recommendation.

E. Bend Assemblies – Same as for nonelectric fences (See Section I C).

F. Fastening and Insulators

1. Use preformed corner insulator hangers, crimping sleeves or approved knots for corner and end posts. Use wire clips or equivalent on self-insulating line posts and battens.

2. Selected posts of dry hardwood and pressure treated creosoted hardwood may be used without additional insulators.

3. Insulators must be used if posts are pressure treated softwood, salt treated hardwood, cedar of locust.

4. Insulators will be high density, molded black plastic ultra violet light resistant (polypropylene, polyethylene) Type S, Type Double U and H tube, nail types. Insulators must be strong enough to support long spans of wire and must allow the wire to slide freely.

G. Energizers

Low impedance, high voltage electronic energizers or power fence controllers must be adequate to maintain output for controlling the type of livestock, based on manufacturer's recommendations. They must be UL approved or equivalent.

1. Installation shall have safety features recommended by the manufacturer.

2. Warning signs will be placed on electric fences as recommended by the manufacturer.

H. Grounding – See Section I E (page 392-5)

IV. Deer Fence

For construction of deer fence, use the following publications:

1. Pennsylvania Wildlife Nuisance and Damage Control No. 12 – Deer

2. High-Tensile Electric Deer Fence

These publications describe the Penn State five-wire system.

V. Chain-Link Fence

A. Materials

Chain-link fence fabric, fence posts, top rails, braces, gates and accessories shall conform to the requirements of this specification. Materials shall be as follows except as otherwise specified.

Fabric:	2-inch mesh, 9-gauge, minimum weight of zinc coating 1.8 ounces per square foot. (Double dipped galvanized).
Posts:	See Pipe Criteria Table, page PA-382-13
Top Rail:	See Pipe Criteria Table, page PA-382-13
Braces:	Same as Top Rails
Gates:	Frame – See Pipe Criteria Table, page PA-382-13 Interior Braces – Same as top rail
Height:	4’ minimum or as shown on the drawings

B. Installing Fence Posts

Unless otherwise specified, line posts shall be placed at intervals not exceeding 8 feet measured from center to center of adjacent post.

Posts will be set in concrete a minimum of 12 inches.

All posts shall be capped immediately after installation.

Other details as shown on the drawing.

C. Installing Wire Fabric

Fencing fabric shall not be stretched until at least 3 days after the posts are set in concrete walls or 5 days after the posts are set in concrete backfill.

The fabric shall be stretched taut and securely fastened, by means of 9 gage tie clips, to the posts at intervals not exceeding 15 inches and to the top rails or tension wires at intervals not exceeding 2 feet. Care shall be taken to equalize the tension on each side of each post.

D. Installing Gates

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

VI. References

A. USDA Farmers Bulletin 2173

B. ASAE Engineering Practice: ASAE EP 250.2

C. High Tensile Wire Fencing – NRAES-11, Northeast Regional Agric. Engr. Service – Cooperative Extension

D. Federal Specification RR-F-191

E. ASTM A-120, F-654, F-669, F-761, and F-900

PIPE CRITERIA
for
CHAIN LINK FENCE

	Top Rail & Gate Frame	Line Post	End & Gate Post
Outside Diameter (Inches)			
Trade Size	1 5/8	2	2 1/2
Nominal Pipe Size	1 1/4	1 1/2	2
Actual Size	1.660	1.900	2.375
Standard Pipe (Schedule 40)			
Wall Thickness (Inches)	0.112	0.145	0.154
Weight (lb/ft)	1.82	2.72	3.65
Zinc Coating (oz/ft^2)	1.8	1.8	1.8
High Strength Pipe (Min. 50,000 psi Yield Strength)			
Wall Thickness (Inches)	0.065	0.090	0.130
Weight (lb/ft)	1.107	1.74	3.12
Zinc Coating (oz/ft^2)	0.9	0.9	0.9

NOTE: Outside diameter requirements are the same regardless of pipe material. Pipe material must be either Standard Pipe (Schedule 40) or High Strength (Minimum 50,000) psi Yield Strength) meeting the wall thickness, weight, and zinc coating requirements shown in the table for that type of pipe.