



Guidance on High-Tensile Fencing (Electrified and Non-electrified)

Compiled by:

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MINIMUM REQUIREMENTS:

There should be a perimeter fence around the outside of the entire grazing area sufficient to keep the desired species of animals in the pasture, a minimum of 2 high tensile for **electrified** or 4 high tensile for **non-electrified** fencing.

To divide the larger area into paddocks, fences may be constructed with electrified high tensile, soft wire or portable poly wire and tied into the electrified perimeter fence.

High tensile **electric** wire fences should have a minimum of one strand of high tensile smooth wire (interior fence only). The minimum number of wires is dependent on the use of the fence/species of animals.

High tensile **non-electric** wire fences should have a minimum of four strands of high tensile smooth wire interior, but are dependent on the use of fence/species of animals.



MATERIALS:

Wire:

The wire should be new, smooth, and meet or exceed the following:

- Gauge – 12.5
- Tensile Strength – 140,000 psi (minimum)
- Breaking Strength – 900 Lbs. (minimum)



Fasteners:

- (1) Staples should be of 9-gauge galvanized steel or heavier with a minimum length of 1.75 inches for softwoods and a minimum length of 1 inch for close-grained hardwoods.
- (2) Manufacturer's clips or 14-gauge class 3 galvanized wire may be used to fasten wires to steel, plastic/composite or fiberglass posts.

Posts:

All wooden posts and brace members (except red or white cedar, tamarack, and Osage orange or black locust) should be treated and all bark removed from cedar, Osage orange and black locust. The treated wood should supply sufficient strength and last the life of the fence.

- (1) All corner, end and gate assembly posts should be wooden with a minimum top diameter of 5 inches. Assembly post should be of 8 feet long for H-brace or floating brace.
- (2) Plastic/composite line post should be at least 1 inch in diameter and be durable for the life of the fence. All plastic/composite post should be UV protected.
- (3) Steel line post should have the Standard T section with an anchor plate. The post should be studded to aid in wire attachment.
- (4) Fiberglass post should be 7/8 inch in diameter, or fiberglass T post at least 1 inch cross-section and be durable for the life of the fence.
- (5) Other Materials may be used for line post if they are equal or greater strength and quality of the above. If in question consult with the technician.

INSTALLATION:

Post spacing for line post should be a minimum of 50 feet for interior electric fence (a lane fence can be up to 70 foot spacing) and 30 feet for perimeter fence, except when stays are placed every 33 feet (then the post spacing can be up to 100 feet). On sites where the land slope is less than 5 percent, a 50-foot spacing can be used for perimeter fence post. For high tensile non-electric fence, the maximum post spacing should be 12 feet or less to retain animals.

Corner, End and Gate Assemblies:

Brace assemblies are recommended at all corners, gates, pull and assemblies. One of the following assemblies is recommended for corners, ends and gates.

- (1) A floating diagonal brace.
- (2) An H-brace for electric fences with four wires or more and for all non-electric fences.
- (3) A substantial corner post 5-inch diameter or more should be set or driven to a minimum of three feet below ground.
- (4) For a 1-wire interior electric fence, a brace is not required at corners, gates, pull and end assemblies.

Line Post:

Wood, fiberglass, steel and plastic/composite posts should be set or driven a minimum of 24 inches below the ground line for a single or multiple wire fence. If posts are not driven, the backfill around the post should be well compacted. In areas where soil depth restricts the post embedment, additional anchors or dead men applied against the direction of pull should be used.



H brace (Source: Anders Gurda)



Floating diagonal brace (Source: Kent Solberg | Seven Pines Farm and Fence)

Fasteners:

The top wire is recommended to be at least 2 inches below the top of the wooden post and 1 inch below the top of all other posts. Tension should be applied with an in-line stretcher or other tightener on each strand of wire to achieve no visible sag. (Note - don't over tighten.)

Staples are recommended to be driven diagonally to the wood grain and at a slight downward angle (upward if pull is up) to avoid splitting the post and loosening the staples. Space should be left between the inside crown of staple and post to permit free movement of high tensile wire. Barbed staples are recommended to be used for wood posts.

Offset Brackets:

Offset brackets made of galvanized high tensile spring wire, with insulator of high density polyethylene with ultraviolet stabilizer or porcelain, can be attached to standard barbed wire fence to provide a transmission line and/or a protect a standard fence. Place the offset bracket no further than 60 feet apart and attach to the wire of the standard fence next to the post. Place offset brackets at chest height of the animal to be controlled. Ensure that no wire of any existing fence comes in contact with the electric fence wire, as an electrical short will occur. Lightning protection is recommended for all electrified fencers. Follow the fence energizer manufacturer's recommendations.

Energizers:

Power Source. Electronic energizers or power fence controllers should be installed according to the manufacturer's recommendations and meet the following minimum specification.

- High power, low impedance system with solid state circuitry capable of at least 5,000 volt peak output and a short pulse with a high impact weather resistant case.
- 110 volt. 220 volt conventional powered fence energizer.
- 12-volt battery powered capable of operating three weeks without recharging. If the length of fence requires an energizer of more than 4 joules, a solar charger will be needed on the battery system.
- Minimum voltage output by livestock.
- Cattle 3000v
- Sheep and goats 4000v
- Hogs and horses 2000v
- Utilize a safety fuse to prevent over pulsing.

**Size:**

Under normal operations conditions, the energizer should be capable, at a minimum, of producing 1 joule of energy for each mile of wire used. If a portion of the fence will be exposed to dense vegetation, additional energy may be required.

Grounding:

All electric fences should be grounded to the manufacturer's recommendation, and a minimum of three feet of ground rod for each joule of energy output should be installed to properly ground the fence. Ground rods should be placed where soil remains moist for best results. (Under an eave spout for example) Drive a sufficient number of 6 to 8 foot long rods into the soil 10 feet apart to provide the required length of ground rod exposure to the soil. Connect a continuous ground wire from the energizer to each rod. The energizer terminals, ground wire, and ground rods should be made of the same material (steel to steel, copper to copper) to prevent accelerated corrosion which could cause a loss of electric continuity. (Note: additional ground rods may be recommended by the manufacturer.)

The ground wires of the fence may be connected to the same grounding system as the energizer or a separate system, where a combined grounding system is used. The design should meet or exceed the minimum design specified for both the energizer and lightning protector. At least 65 feet should separate the fence grounding system from any other grounding system.

A voltage spike protector is recommended for use with 120 volt energizers.

All underground wire installations should be double insulated; high tensile strength steel, 12.5-gauge or larger wire. The insulation should be high density polyethylene or polypropylene with ultra-violet stabilizer.

Insulators for steel and other conductive material and insulators for end, corner and angle braces should be capable of withstanding at least 10,000 volts of current leakage and should be made of high-density polyethylene with ultra-violet stabilizer or porcelain. Red insulators should not be used as they might attract hummingbirds.

Electrified gates may be constructed of a single straight wire, galvanized cable, polytape or electric rope with a spring loaded handle. The number of wires should be determined by the fence objective. The gate should be constructed so that it is non-electrified when open. Overhead or underground lines are recommended to carry electricity past the gate to the remainder of the fence.

Electrified floodgates may be used in lieu of a non-electrified gate if desired. The electrified floodgate is constructed by stretching an electrified wire across the drainage above high water flow level. Attach droppers of 12.5 gauge high tensile fence wire, galvanized cable, or galvanized chains to the electrified wire at a spacing of 6 inches above the average normal water level. Connect gate to fence with double insulated cable through a cutoff switch and floodgate controller. If flooding is expected for an extended period of time switch the floodgate off.



Guidance on Livestock Watering Systems for Managed Grazing

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Watering systems in managed grazing are installed to provide water sources to cattle in paddocks. The intent is to have water nearby where cattle are grazing. This supports these goals:

- Enhanced consumption of water for each animal as they need it.
- Eliminate the need for livestock to travel long distances for water at central points thus resulting in erosion of highly traveled pathways and around stock tanks.
- Mitigate deposit of excessive animal nutrients to pathways and central watering points.
- Keep nutrients from grazing animals in the locations where they consumed the nutrients in the form of pasture forage and therefore decreasing the need for the addition of synthetic fertilizers.

The water system is comprised of a pressurized source, pipelines to convey water to paddocks and the watering facility in the paddock.

PIPELINE GUIDANCE:

Pipeline systems typically consist of on-surface flexible poly pipe and appropriate fittings designed and operated during times when freezing is not a problem.

Pipe should be sized (pipe internal diameter) for the application. Size depends on multiple factors including distance from water source to furthest watering point, pressure of source to pipeline, number and size of animals and topography. In general, most systems should use at least 1" pipe.

Pressure rating of pipe and fittings should be at least 130% of expected maximum operating pressure. Pressure calculation can be done by a technical service provider or by the producer. It must take into account:

- Pressure of water source itself.
- Pressure – either positive or negative – from change in grade from the water source to the drinking facility. – each 2.3' of change in elevation changes pressure 1 psi.
- Friction loss at maximum flow rate to drinking facility – always reduces pressure and is relatively small compared to the two first considerations.

Plastic pipe for above ground installation should be UV protected.

Allowance for expansion & contraction. Plastic pipe will expand in hot weather and contract in cold weather. It should, therefore, be laid with enough slack to accommodate this effect.



PIPELINE GUIDANCE (continued):

Poly pipe should be protected from damage by equipment and animal traffic. For equipment the best methods are by burying 6 inches -1 foot deep or running pipe through a steel pipe of larger diameter where traffic is present. For movement or damage by animals the best practice is to run pipeline under a stationary fence.

If the topography provides a way to use a gravity flow system with a non-pressurized holding tank and appropriate fittings to supply the pipeline may be included. Sizing of the holding tank should accommodate at least a 24 hour supply of water or provide for automatic refilling with a float or timed device. While total water consumption will vary depending on ambient temperature and the amount of water in the pasture forage, generally speaking you can expect to have consumption of no more than 2 gallons per day per 100 pounds of animal. This is with high ambient temperature and low moisture pasture forage.

If the water source is mechanically pressurized either by a farmstead water system or dedicated and pressurized system, then a pressure relief valve should be installed and set no greater than the maximum allowable pressure of the pipe.

If the water source is the farmstead water system, then a backflow prevention device or air-gap between farmstead system and pasture pipeline system should be installed. This prohibits backflow into the farmstead system and contamination of the domestic system.

Because these piping systems are used only in non-freezing situations, there should be a way to remove water to prevent damage during winter. Usual methods involve opening water point valves and using gravity in sloping systems or air pressure in situations where gravity flow is impossible.

WATERING FACILITY GUIDANCE:

The watering facility refers to the points of water delivery to the livestock. In managed grazing systems, this includes valves and outlets, tanks, flow management devices and practices to protect areas surrounding any stationary tank locations in occupied paddocks. The best practice for good nutrient distribution and mitigation of erosion around drinking point is to provide fittings and attachments to tanks that allow for moving the tank location frequently as you rotate cattle into the paddocks. This is usually accomplished by easily movable, portable tanks and various lengths of hose or line between system outlets and tanks.

Valves from the water line to the tank system can be “quick-connect” or equivalent plumbing fixtures to allow frequent attachment and detachment in the case of movable tanks.



Subsurface water line and risers with quick couplers every 400–800' (Source: Allen Williams | Understanding Ag)



Tanks should be sized for the expected animal use. With in-paddock tanks (no more than 400-500 ft from tank to furthest point in paddock) animals drink randomly thus reducing the need for large inventory of water to accommodate surges in use by multiples of animals. A rule of thumb that seems to work under these specifications is that there should be one gallon of tank capacity for each adult cow or equivalent. Nevertheless, tanks should be fitted with flow valves of high capacity, e.g., allowing for full flow when valve is opened by a float device.

If animal numbers are large - and tank sizes therefore large - moving of tanks and watering location may be impractical. This results in a static watering location and degrading of the area around these points without mitigation. Mud holes and erosion will result. "Hardening" of these areas can be accomplished in various ways. There are two common methods to mitigate these conditions. One is the application of geo-tech type ground fabric covered by gravel and screenings. The other is an all-aggregate approach with base of "breaker-run" (large size) aggregate covered with gravel and screenings.



Grazing Contract Development for Grazing Cover Crops

Some crop farmers place so much value on the benefits derived from a complex cover crop that they purchase cattle of their own to graze cover crops between cash crops. Other farmers, realizing the value from cover crop grazing but not wanting to own livestock, take the responsibility of purchasing and planting the cover crop seed, then allow a neighboring grazer to graze the cover crop forage.

In many of these circumstances, the grazier is responsible for putting in temporary fencing, temporary water, and managing the livestock. The grazier then removes all fencing, water, and livestock before the farmer begins planting preparations. In some cases, no money exchanges hands as both parties derive a perceived benefit. The grazier gets the use of the acreage for the season, and the farmer gets increased soil fertility and biological activity.

In other cases, there are lease agreements based on factors that include monetary exchange. Leases may be based on:

- number of head or animal units per day or month
- acres grazed
- cost of gain
- share of profits

Both parties should consider:

- cover crop management responsibilities
- herbicide residue and resource concerns
- livestock management responsibilities
- land use management responsibilities (including in which conditions livestock must be removed)
- risk management and assessment (including crop insurance requirements)

A note on liability

Landowners should consider adding liability or indemnification clauses that describe liability in case the landowner is sued due to the lessee's actions or conduct. The landowner may also require the lessee to have liability insurance, and may want to examine the policy to make sure they are covered as an "additional insured" in the event of a claim.

Lease Development Resources

Farm Progress Magazine – Wallace's Farmer

Do You Use Grazing Contracts for Cattle? (webpage): <https://www.farmprogress.com/livestock/do-you-use-grazing-contracts-cattle>

Iowa Beef Center

Basics of Contract Grazing (PDF): <http://www.iowabeefcenter.org/information/ContractGrazing1Basics.pdf>

Pasture rental and lease (PDF): <http://www.iowabeefcenter.org/information/ContractGrazing3Leases.pdf>

Rates charged for contract grazing arrangements (PDF):

<https://www.iowabeefcenter.org/information/ContractGrazing4Rates.pdf>



Practical Farmers of Iowa

Contract grazing of cover crops (PDF):

https://practicalfarmers.org/wp-content/uploads/2018/11/PFI2018_Factsheet_ContractGrazing_forWEB.pdf

Successful Farming Magazine

Contract grazing considerations (webpage): https://www.agriculture.com/livestock/cattle/grazing/contract-grazing-considerations_279-ar35009

University of Iowa Extension

Pasture and grazing arrangements for beef cattle (PDF): <https://store.extension.iastate.edu/product/15110>

University of Nebraska

Rental agreements for cover crop grazing (webpage): <https://agecon.unl.edu/cornhusker-economics/2015/rental-agreements-cover-crop-grazing>



Seed Selection for Grazing Cover Crops

The basic rule of thumb is to follow the rule of three and the principle of diversity. The rule of three is to include at least three species of each of the three primary plant functional groups—grasses, legumes, and forbs (broadleaves)—in every mix. The principle of diversity is to create mixes containing a minimum of six to eight plant species. Some mixes can include 18 or more plant species. Diverse cover crop mixes can reduce risk of weather conditions, disease, and may be able to be grazed over a longer period. This may be more difficult to accomplish with cover crops in conventional grain rotations, so remember that some diversity is better than a single-species mix. Cereal rye, oats, and rapeseed can be a forgiving mix between cash crops. Importantly, you should be sure that any legume species in your mix have time to establish in your growing zone.

One caution: be careful with the total amount of brassicas and broadleaves in the mix. Brassicas and broadleaves should be limited to no more than a total of about two to three pounds per acre in the mix. Broadleaves can germinate quickly and grow vigorously. They can easily shade out other species in the mix in the early stages of growth.

Timing also matters. Studies show that cover crops planted just two weeks earlier can yield double the biomass. Depending on when you plant, you may need to consider fast-growing varieties like cereal rye for quick biomass generation.

Planting highly diverse mixes in your cover crop fields can play a role in attracting large numbers of pollinators, including many different species of wild bees and butterflies. These diverse mixes supply important pollinator species with vital food and shelter. In addition to attracting pollinators, diverse mixes also attract hundreds of beneficial insect species. These beneficial insects prey on many of the pest species that we often find in our row crops and can greatly reduce pest pressure and impact, thus reducing the need for chemical insecticides.

There are several good resources to help with cover crop mix design, including:

Green Cover Seed

SmartMix Calculator (online cover crop & forage planning tool): <https://smartmix.greencoverseed.com/>

Which Cover Crops Are Best for Grazing?: <https://greencover.com/which-cover-crops-are-best-for-grazing/>

Midwest Cover Crops Council

Cover Crop Decision Tool (online cover crop planning tool): <http://mccc.msu.edu/selector-tool/>

Sustainable Agriculture & Education

Cover Cropping for Pollinators and Beneficial Insects (webpage): <https://www.sare.org/Learning-Center/Bulletins/Cover-Cropping-for-Pollinators-and-Beneficial-Insects>

Grassfed Exchange

Cover Crops for Grazing (webinar): <https://www.youtube.com/watch?v=tuwwfL2o9d4>

Pasture Project

Fix Your Mix: Using Management Goals to Create Diverse Cover Crop Seed Mixes (webinar): <https://www.youtube.com/watch?v=UFedXItKdQY>