Electric Fencing 101

Electric Fencing Systems Design, Installation & Maintenance

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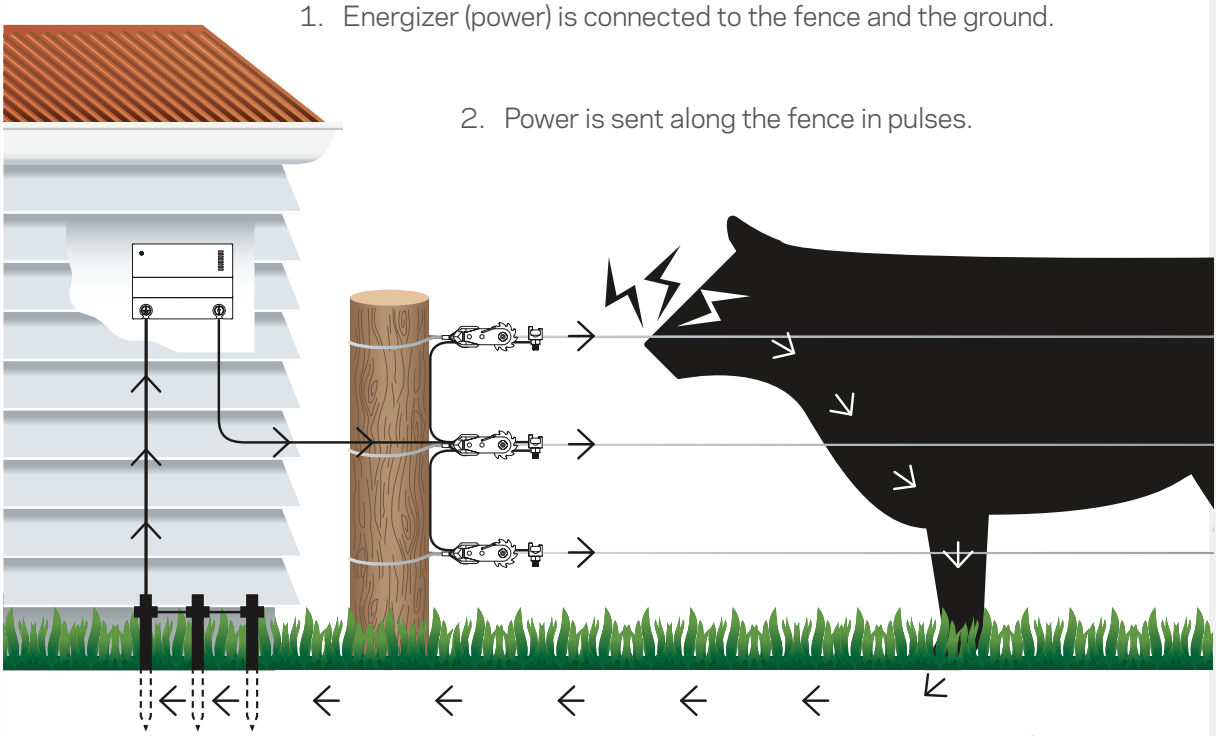
Electric Fencing 101
Contents

Why Use Electric Fencing?

- Keep domestic animals in
- Keep wild animals out
- Separate different groups of animals
- Allow rationing of crops and pastures
- Fence off eroding areas, trees, rivers and roads

A short, safe and memorable shock to create a psychological as well as a physical barrier.

1. Energizer (power) is connected to the fence and the ground.
2. Power is sent along the fence in pulses.



3. Animal receives shock when it touches the fence.

At a basic level electric fencing is **more effective at containing domestic animals livestock/excluding wildlife than traditional fencing** due to the fact that the short, safe and memorable shock creates a psychological as well as a physical barrier.

A pulsed electric current is sent along the fence wire, about one pulse per second, from an energizer which is grounded. When the animal touches the fence it completes the circuit between the fence and the ground receiving a short, sharp - but safe shock. The shock is memorable enough that the animal never forgets.

An electric fence is a psychological barrier, so it doesn't need great physical strength. However, it must be well designed and constructed to absorb some pressure from animals, snow and wind. The energizer must have enough power for the length of fence and for the animals being controlled.

Why Use Electric Fencing?

Pasture Management and Rotational Grazing

Beyond just keeping animals in and out, electric fencing is the best way to achieve optimum pasture yield using rotational grazing methods. This approach works by keeping the grass fresh, short and palatable which ultimately leads to increased meat and milk production as well as reduced supplemental feed costs. It involves grazing paddocks in rotation using a combination of permanent and/or temporary fenced grazing areas.

KEY BENEFITS

Effective
Maximize results potential of feed and greatly improve the feed quality and yield.

Efficient
Direct harvesting of grass or fodder crops by animal with the manure returned directly to the soil during the process.

Flexible
Use a combination of permanent & portable fencing to maximize grazing area control.

KEY CONSIDERATIONS

Achieving optimum pasture growth is a delicate balance. When considering how best to meter out the pasture feed available look at the following:

1. Number & size of grazing areas - grazing specific areas, so other pasture sections are able to rest and re-grow.
2. How many animals to put on that grazing area - efficiently grazing the allocated area.
3. And for how long – graze to desired residual grass height

The combination of these factors determines the rotation length (how many days before the first area in the rotation is grazed again). The optimum rotation length varies significantly depending on the geographical location and time of year.

The more regular the shift (preferably daily or every few days) the more time the pasture spends growing rather than being grazed, leading to greater grass growth and stock carrying capacity.

Where a permanently fenced paddock is further subdivided using portable electric fences the stock are contained by both a front and a back fence. The back fence protects the recently-grazed area to allow it to recover so it can be grazed again sooner.

Subdivision with high stocking density ensures grass is harvested down evenly to the optimum residual length, and that over time manure is spread more evenly over the whole grazing area.

Why Use Electric Fencing?

Why It Works

Maintaining grass at the high growth tilling stage ensures young, lush, green pasture with high protein and energy levels. Grazed and rested for the right amount of time creates the ideal conditions for grass growth when the plants produce leafy shoots from the base.

There are various grass varieties to suit different environments. Longer term options last 10 years or more and shorter term annuals can give extra yield over a shorter time-frame.

Forage crops (i.e. turnips, kale, sorghum etc.) are low cost to establish and can be used to fill feed deficits during cold and/or dry months where grass growth slows or stops altogether. Direct grazing of such crops using portable electric fencing eliminates harvesting and feeding out, with animal waste being returned directly to the land.

Managed Grazing Examples

If you farm sheep intensively, you may want as many as 100 paddocks. This means the sheep can be moved daily onto a fresh paddock using a three month rotation during slow or zero growth periods. When there are lambs and ewes during spring, two or more flocks can be grazed on a faster rotation.

For beef and dairy producers 30–50 paddocks are usually enough. Cattle are easy to strip graze with only one wire when longer rotations are necessary during slow growth periods.

Getting Started

Every electric fence system is made up of a:

- Power System
- Fencing System

Selection of these depends on property size, fencing usage and animal type.

Power System

1. Do you have a reliable power source?
   - Will determine Energizer type – 110v or battery (including solar options)

2. How much fencing are you looking to power?
   - Distance influences Energizer size – and fence construction

3. What is your location?
   - Grounding is critical to good power transfer, drier areas need different fencing set-ups and more grounding to compensate
   - Solar energizer options are perfect for remote locations with good sunshine

Fence System

1. What do you want to achieve with your fencing?
   - Determines permanent and/or temporary subdivision

2. How long do you want it to last?
   - Some products are designed to last well over 10 years others while others are warranted under 10 years

3. What animals are you trying to keep in/out?
   - Influences the fence setup like the number of wires & spacing
   - Impacts product choice. For example, horses have special requirements

Energizers

All Gallagher Energizers are low-impedance and guarantee a high-energy pulse. Selection is based on power availability, fence length, number of wires, vegetation touching the fence, application (does it need to be regularly moved) and the number of animals (fence pressure).

The only true way to compare different Energizers is based on **STORED JOULES**, it is a constant measure and not affected by variations in fence conditions or grounding.

Stored Joules – How it works
Like horsepower on a vehicle. It is the potential power in the engine to maintain speed no matter what the vehicle is pulling behind, or what the gradient of the road is.

In an Energizer, power from either a 110V outlet or battery source enters the unit and is stored in capacitors. This stored energy is the potential voltage available in the single pulse per second generated when the animal touches the fence. The higher the stored joule rating the greater the Energizer's ability to push past shorts caused by weeds and fence faults, as well as cover future fence expansion.

Gallagher Recommends Always purchase the highest powered Energizer you can afford. More power provides more confidence that the fence will perform despite unexpected shorts like vegetation growth. Also electric fence systems tend to grow, so purchase an Energizer with headroom to power additional future fence.

TERMS

Voltage - an indication of electrical pressure

Current (amps) - an indication of electrical flow

Stored Joules - the amount of energy stored in the energizer

Output Joules - the energy discharged on the fence

Pulse Shape - the measure of the wave of energy traveling down the fence line

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Gallagher's range of Energizers continues a proud tradition of the world's best engineered products

1) Indicator lights on all Energizers tell you at a glance that the Energizer is operating

2) All energizers are fitted with lightning protection and are fully modular for rapid servicing and replacement

3) Gallagher's reputation for worldwide service and satisfaction has endured for over 80 years

4) All Energizers purchased after January 1, 2018 carry a three year warranty.

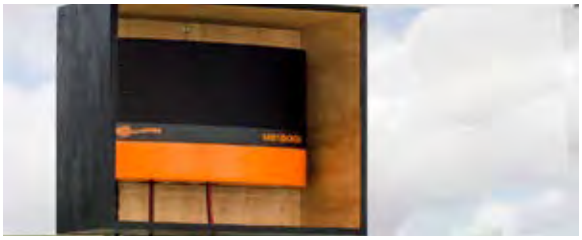
Powering Your Fence

Energizer Selection

Types of Energizers

110V, Plug-in Energizers are the best choice if you have access to a power outlet. The Energizers are reliable in every situation with exception of a power outage and will provide you with the most power for the least about of money. You will need to install them inside a structure where they are protected from moisture.

Battery Energizers are typically portable and great for remote areas far from power outlets especially in cases where they are periodically moved. These are powered by a 12v rechargeable battery, "D" cell batteries or a 9 volt disposable dry cell battery.



Solar Energizers are portable and an excellent choice for temporary fence applications. They are a logical choice for remote areas where there is no 110V outlets. While they have the highest upfront cost per joule, the power to operate them is free as long as they have adequate sunlight.

The solar panel charges the battery by converting light directly into electricity. The battery stores this electricity to operate the energizer. This enables the energizer to operate at night or during periods of low sunlight.

Multi Powered Energizers combined with various adaptors will allow you to power your Energizer using any one of the methods listed above: 110V Outlet, Battery or Solar. This is a great choice if you move your fence to locations where 110v power will exist and other locations where it is not available.

Gallagher Recommends – *comparing on stored joules only, since these distance/acreage ratings are always manufacturers estimates because two properties of the same acreage/fence distance may have dramatically different conditions e.g.: number of wires, vegetation growth, stocking intensity.*

Powering Your Fence

Energizer Selection

		STORED JOULES	'UP TO' DISTANCE CLEAN FENCE (MILES/ACRES)	RECOMMENDED DISTANCE TYPICAL FENCE (MILES/ACRES)	I SERIES OPTION	110v MULTI-POWER	LIVESTOCK CONTROLLED
110 VOLT	M10000i	100.0	1,000 / 6,000	125 / 3,000	▪		
	M5800i	58.0	430 / 2,700	87 / 2,200	▪		
	MB2800i	28.0	250 / 1,500	50 / 1,000	▪	▪	
	MB1800i	18.0	200 / 1,200	42 / 420	▪	▪	
	M1500	15.0	160 / 900	40 / 360			
	M1100	11.0	110 / 650	36 / 280			
	MB1000	10.0	100 / 600	34 / 250		▪	
	M800	8.0	90 / 520	30 / 200			
	M560	5.6	75 / 400	23 / 130			
	M360	3.6	55 /250	19 / 95			
	M160	1.6	30 / 100	11 / 60			
	M120	1.2	15 / 60	6 / 30			
	M60	0.6	10 / 40	3 / 20			
	M30	0.3	5 / 20	2 / 10			
	M10	0.1	2 / 10	0.5 / 3			
BATTERY	B60	0.6	15 / 60	5 / 40			
	B11	0.11	4 / 20	0.6 / 6			
	B10	0.1	4 / 20	0.6 / 6			
SOLAR / BATTERY	B700	7.0	80 / 450	25 / 200			
	B280	2.8	50 / 200	22 / 110		▪	
	B180	1.8	30 / 100	15 / 90		▪	
	B80	0.8	20 / 70	7 / 60		▪	
ALL IN ONE SOLAR	S400	4.0	60 / 280	20 / 120			
	S200	2.0	45 / 160	14 / 90			
	S100	1.0	30 / 100	8 / 60			
	S40	0.4	25 / 80	5 / 30			
	S22	0.22	12 / 40	2 / 15			
	S20	0.20	12 / 40	2 / 14			
	S16	0.16	10 / 30	1 / 10			
	S10	0.1	3 / 15	0.5 / 5			

i Series Fence Energizer Systems

The **i Series Energizers** have extremely reliable power that adapts output up or down depending on your fence conditions. Each one also comes with a separate controller that can be mounted outdoors for easy fence performance checks.

ENERGIZER

Reliable and adaptive performance even in extreme conditions

ENERGIZER CONTROLLER

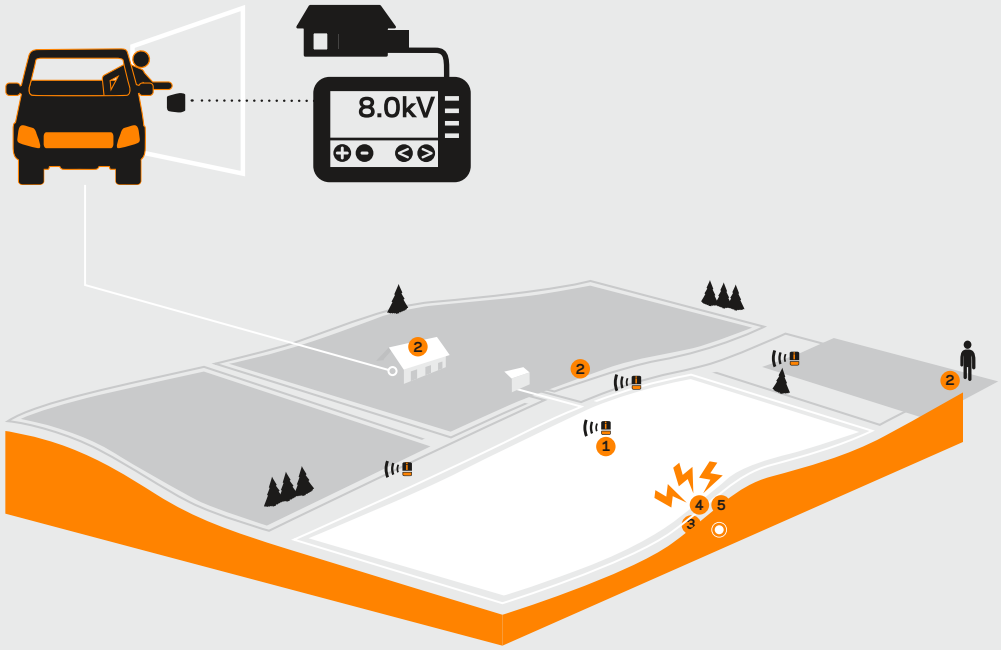
Easily monitor and control fence performance

FENCE MONITOR

Create fence zones and monitor fence performance around your property

ENERGIZER REMOTE & FAULT FINDER

Quickly locate and repair faults



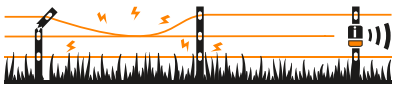
ALARM SYSTEM

Secure your assets

On i Series models you can also add monitors around the fence line that feed information back to the Controller and tell you if all is well or if there is a fault in their area.

The Remote & Fault Finder helps pinpoint any faults quickly, saving hours hunting for and fixing the issue.

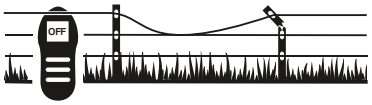
How the System Works:



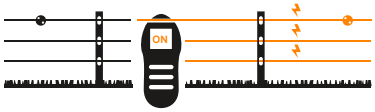
1. Fence Monitor(s) recognize any significant drop in fence zone or Energizer performance and raise alarms.

2. Alerts are sent to the Energizer Controller and/or optional Alarm System.

3. The Controller and Remote indicate which zone is in fault. The Remote is used to find the fault within the zone.



4. Power to the fence at the fault location is turned off using the Remote, allowing a safe and convenient repair.



5. Once the fault is repaired, power is restored to the fence and tested using the Remote.

Grounding Systems

The ground must be as conductive as possible for the fence to give the animal an effective shock. A simple guide is one ground rod for every five joules of stored energy with a minimum of three ground rods.

Follow the recommendation in the chart to get the maximum benefit. When in doubt, add more ground rods. The number of ground rods will vary depending on the power of the energizer and the soil type. High powered energizers need more ground rods than low powered energizers. Dry, sandy, rocky or frozen soil will require more ground rods than wet soils.

Energizer Size	Required Ground Rods
Up to 15 Joules	3 Rods minimum
Up to 25 Joules	5 Rods minimum
Up to 35 Joules	7 Rods minimum

Handy Hint

The rule for ground rods when installing permanent fencing

10′ Between ground rods
3 Ground rods minimum
6′ Minimum length of rods
1 Wire connecting all rods to Energizer ground terminal

As a rule of thumb, use at least 3 ground rods or the Energizer Stored Joules rating divided by 5.

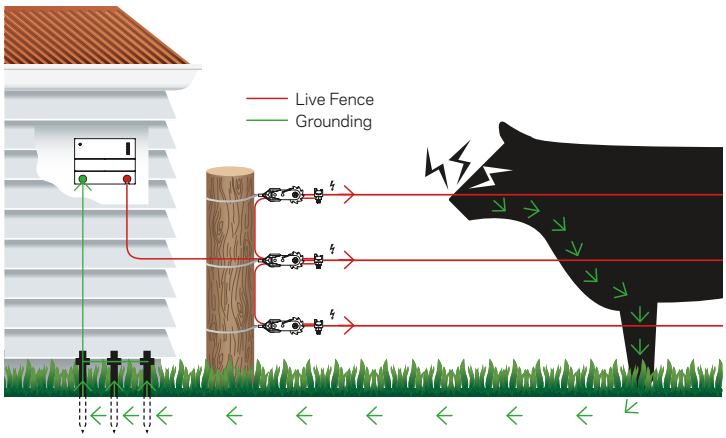
Why does the Energizer need a ground system?

The ground is half the circuit of your fencing system. Electrons travel from the energizer, along the fence wires and back through the ground to the Energizer to complete the circuit. Like a radio antenna collects sound waves, the ground system collects the electrons. The ground must be as conductive as possible for the fence to give the animal an effective shock.

Main causes of a poor ground system are:

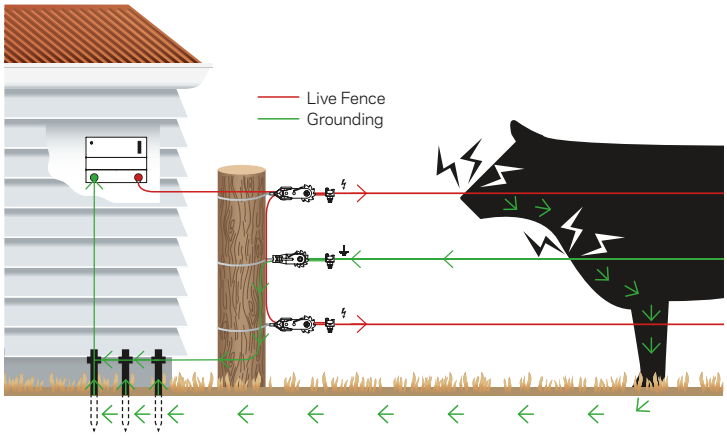
- Rusty or corroded ground rods
- Broken ground wire connecting the rods
- Not enough ground rods
- Ground rods too close together or too short
- Poor connections at the rod or in the connecting wire

Additionally you will need to setup your electric fence according to how 'green' the area is all year round.



All Live Wire System
– best suited for wetter regions

For use in greener regions with good ground conductivity. All fence wires connect to the red terminal on the Energizer and a shock is delivered to an animal when it's touching the ground and the fence at the same time.



Ground Return Wire System
– best suited for drier regions

For use where the ground struggles to conduct enough power (for year-round dry, frozen or snow conditions). The live & ground wires on the fence
create the shock when the animal touches them both at the same time.

Don't	Do
Allow bare wires to touch an iron clad building - use double insulated cable	Keep energizer ground system 33-40' away from other electrical ground connections
Do not use rebar for ground rods	Keep energizer ground system 33-40' away from any metal pipes carrying water
Do not use copper lead-out wire or copper ground rods.	Use galvanized ground rods. Rusty or corroded ground rods will not be effective
Place near fertilizer, animal urine and manure (corrosion)	Locate rods where soil tends to stay moist, north sides of buildings, low spots
Place your ground rods where they are likely to be hit by equipment	Use high conductive cable for connecting the Energizer to the fence's ground system
	When constructing positive/negative fences, re-ground negative wires every 1,200'

Using a Fault Finder

The current flow on the fence will vary depending on the size of your Energizer, amount of vegetation and the size of
your fence system. With time you will learn the normal current flow on your fence.

Fence tools and testers are another
useful accessory to have on hand when building, maintaining or checking an electric fence. Gallagher has two fence testers, both available from your local Gallagher Dealer. The Fault Finder is a all-in one device, current meter and fault finder. The Volt Meter measures volts only.

To obtain the best results from your Fault Finder, Gallagher recommends that you check the current while the fence is
opererating without any faults. Then, when you suspect there is a fault on the fence line, you can compare the current flow with the "normal" current flow.

This will indicate whether a fault exists and, if so, how much the fault is affecting the performance of the fence.

1. The Arrow on the LCD will indicate which direction the current is flowing.

2. Following the direction of the current, take readings approx. every 330' or at junction points along your fence line.

Note: At a junction point, follow the wire with the highest current flow.

3. A fault is indicated by a drop in current flow between two checkpoints. The fault will be somewhere between the two checkpoints.

4. To narrow down location of the fault, work back along the fence checking the current flow at shorter intervals.

5. Correct the fault.

6. After correcting the fault you should see the current reading drop and the voltage group. If not, check for
further faults.

See page 50 for more troubleshooting help using a Fault Finder.

HANDY HINT:

Multi-wire fences connected in parallel will have similar current flowing in each wire. To get the total fence current flow, add together the current flow in each wire.

Fence Volt/Current Meter and Fault Finder
G50905

Fence Volt Meter
G503014

Testing on All Live Wire Ground System

This should be done once a short section of fence has been built. You should test your system at least once a year at the height of any dry period to ensure the grounding capacity is sufficient for the joule rating of the energizer.

Short the fence out at least 330' away from the ground system by using several ground rods between the wires and the ground. Reduce the fence voltage at this point to 2000V (2kV) or less.

Using a Volt Meter, measure the voltage between the wire connecting through the ground rods to the Energizer ground terminal and an independent ground rod. This rod should be a galvanized metal rod, minimum 8" long. Place the rod 3' away from the ground rods or as far away as your Volt Meter cable will reach.

There should be no reading on the Volt Meter; however, up to 200V (0.2kV) is acceptable. If the voltage is higher than this, switch off the Energizer, drive in more ground rods at the recommended spacings and connect them to the existing ground system until the voltage is down to the acceptable level.

Testing a Ground Return Wire System

Install a 6' ground rod as close a possible to the end of the fence. Install a 500 ohm load tester between a hot wire and ground wire. Choose the location for the ground rod in a damp area if possible. If you cannot find a damp area, the ground test may be unreliable.

Using a Volt Meter, measure the voltage between the hot wire and the ground wire across the load tester you just installed.

Next measure the voltage between the hot wire and the independent ground rod, leaving the load tester in place.

If the second voltage reading exceeds the first by more than 1000V (1kV) check the ground return wire for loose connections.

Finally, connect the independent ground rod to the ground return wire as a permanent connection.

Extra ground rods can be added at various places around the fencing system and connected to the ground return wire to improve ground performance.

If the first voltage reading is less than 3kV, your fence system is at risk of poor animal control.

Assuming that your ground wire return checked out satisfactorily, check that the fence hot wire has good connections. If connections are good, it is possible that your energizer is too small for your fence system. Assess your total length of fence or property size against the energizer selection chart on page 11.

Powering Your Fence

Lightning Protection & Leadouts

Lightning Diverters
Lightning will likely damage your Energizer if it strikes your electric fence. Gallagher Energizers have internal lightning diverters that give partial protection against small strikes.

Since lightning always finds the easiest way to ground, installing a Lightning Diverter will give added protection by providing a path for any lightning that strikes the fence to be diverted to the ground.

Otherwise disconnect the Energizer from the fence and power supply during lightning storms.

> Using the diverter does not guarantee complete protection. In bad lightning areas, grounding the top fence wire helps significantly by encouraging the lightning get to ground without passing through the Energizer.

Leadout
Leadout describes the cable and wire that carries the power from the Energizer to the middle of your fence system. It can be either run overhead or underground. Insulated leadout cable should be used to prevent the leadout from shorting out on obstructions or the ground and should be used in buildings, under gateways and where soil could corrode exposed galvanized wire.

Undergate cables should not be used for long leadouts or for long distances underground, because 16 gauge galvanized wire will cause resistance to the flow of current reducing the available voltage in the fence.

This is not so important on small properties, but where medium sized distances of fencing are to be erected (<10 miles), use 12.5 gauge leadout cable. On large properties powering large energizers larger than 20 joules, high conductive cable should be used.

Never use household electrical cable; it is made for a maximum of 440 volts and for inside work only.

Never use copper wire undergate cable because electrolysis problems occur where it is joined to galvanized fencing wire.

Keep resistance to a minimum and ensure maximum power transfer around your property by choosing the cable with the lowest ohm's rating.

CAUTION

NEVER use household electrical cable. It is made for low voltage use only.

NEVER use copper wire/cable because electrolysis (electrical corrosion) occurs where it joins galvanized wire.

Fence Construction

Selection of the right fencing systems depends on property size, fencing usage and animal type. Use this electric fence guide to help you configure your fence based on your usage and the animal(s) you will be fencing.

1 Permanent Electric Fencing

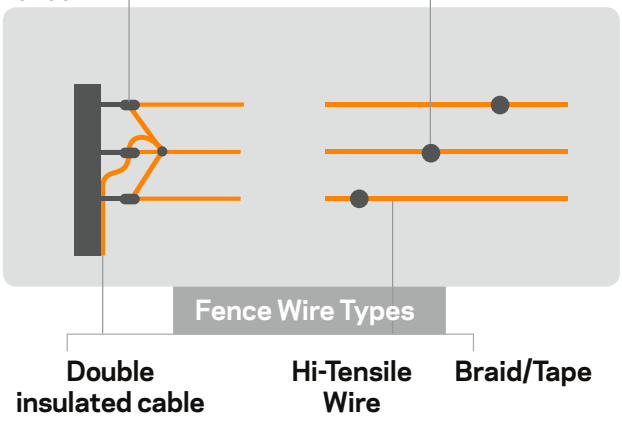
Permanent electric fences for highly effective animal control that lasts a lifetime.

2 Offset Fencing

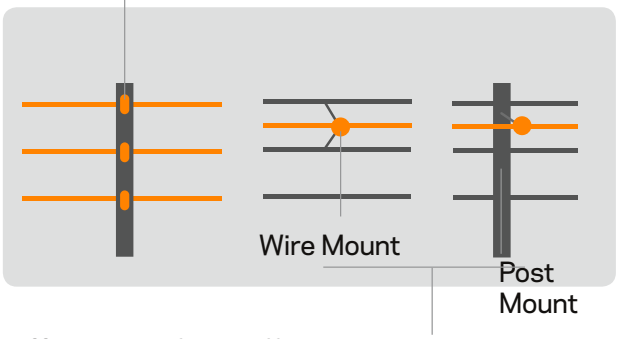
Extend the life of an existing conventional non-electric fence by retrofitting an electric wire.

End strain assembly provides an insulated attachment between the wire and the strainer posts at each end of the fence.

In line straining allows the fence to be tensioned and re-tensioned as required.



Insulators attach the fence wire to the posts, keeping the wires at the correct spacing and height.



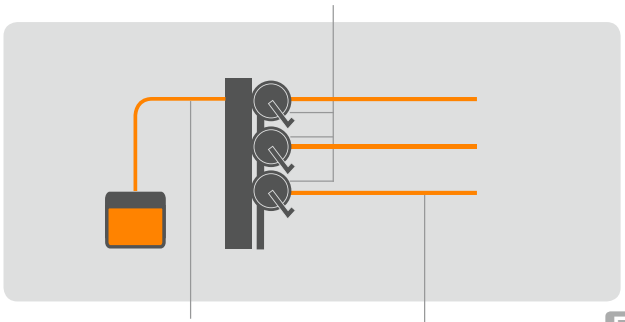
Offsets specific to Offset Fencing, hold the electric wire off the existing non-electric fence wire or posts on a conventional fence line.

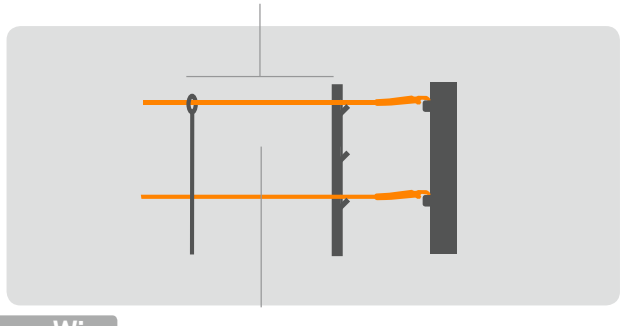
3 Temporary/Portable Fencing

Easy to transport, assemble and take down for short-term animal control or rotational grazing.

Reels hold the tape, braid or wire for the portable fence. You can use just one reel for single line fences or up to three reels, attached to a reel stand, for multi-wire fences.

Posts are lightweight yet sturdy. Pigtail and Ring Top posts are most popular for cattle fences and multi-wire treadins are used for all livestock fences.





Power Connectors are leads that connect a portable fence to an existing permanent electric fence.

Fence Wire

Tapes, Wires and Braids are used on portable fences rather than the high tensile galvanized wire used on permanent fences. Gallagher conductors are ideal for portable electric fences as they are light, visible, easy to wind and durable.

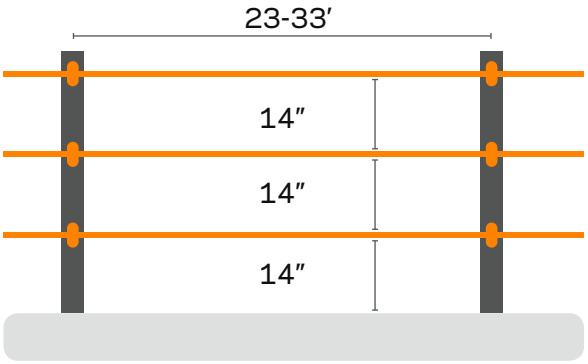
1. Permanent Fencing

High tensile wire systems create long life, permanent electric fences. They are easy to install and provide highly effective animal control that lasts.

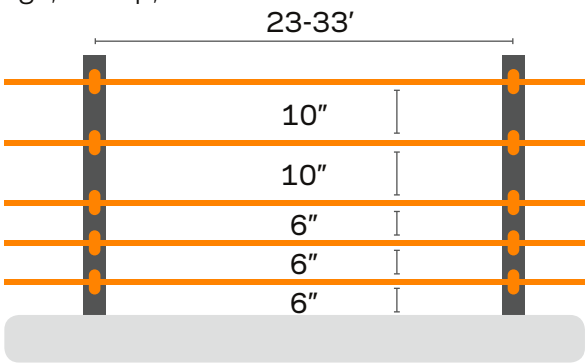
Permanent fences use highly conductive, corrosion resistant fence wire together with wood, t-posts, fiberglass and Gallagher insulated line posts, couple with components to keep fences looking good and working effectively for a life time.

Fence Set Ups

Cattle



Pigs, Sheep, Goats



High quality, long lasting electric fences cost less than other traditional fencing options.

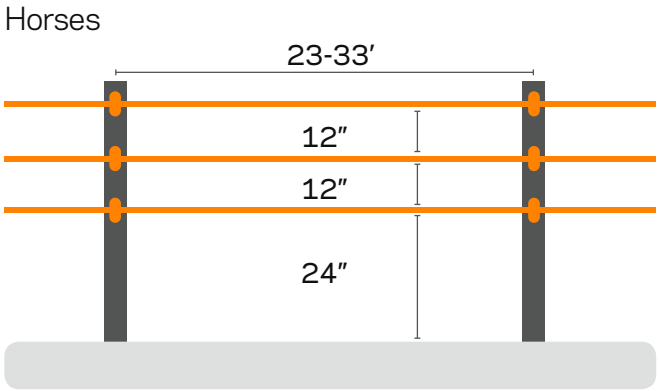
Gallagher's Insulated Line Post makes fence construction easy giving a low maintenance and attractive fence.

Animals quickly learn to respect electric fences and keep away – so the fence looks good for longer, and your investment is protected.

Horses are lively and at times unpredictable, so keeping them safely contained is paramount.

A Gallagher equine fence is a safe, reliable and highly visible solution designed to ensure your horses' welfare.

Three options are commonly used for long term equine electric fencing – a permanent fence using the new Equine Fence Wire, semi-permanent Tape or Braid fences.



Equine Fence Wire is the safest, most effective electric fence for your horse. This long life, high tension fence uses specially designed wire coating to reduce risk of injury.

Turbo Braid can be used as a low tension semi-permanent fence alternative to Equine Fence Wire. Braid is designed not to tangle or overstretch and is easy to install.

A semi-permanent Tape fence is highly visible, simple to construct and will last years, making this type of fence an economical and popular choice for horse owners.

Choosing Permanent Fence Posts

While the heart of your electric fence is your energizer, fence posts are the backbone of your fence system.

A permanent fence post needs to stand straight and solid for many years. Permanent fence line posts typically have about one third of their length underground, so add half again as much to the height of your fence to determine the post length. End and corner posts typically have as much in the ground as above.

There are three basic types of permanent fence posts: wood, steel, fiberglass.

Wood Posts
Round wood posts provide the basis for a strong permanent power fence. Gallagher offers a range of insulators for attaching electric fence wires to wood posts, including special equine fencing products for Equine Fence Wire, braid and tape. Insulators can be attached to the post using staples, screws or flat head nails.

Posts can be installed by digging a hole and then manually backfilling and tamping the post tight, or by driving the post into the ground using a tractor or trailer mounted post driving machine.

Post spacing depends on the number of wires, wire type and terrain and can vary between 15-30'. Post spacing can be extended if fiberglass or wooden droppers are installed between the posts.

Steel Posts
A steel t-post offers a simple line post alternative to a wood post. Steel posts have the advantage of being able to be installed using a sledge hammer or manual post driver, reducing the need for expensive post hole diggers or tractor mounted drivers. They can also be driven into hard ground more easily. Gallagher provides t-post insulators that can snap-on to a steel post and hold a fence wire.

Additionally, fence toppers are available for securing a top mounted line post tape or wire. Post spacing is the same as wood posts.

Fiberglass Posts
Fiberglass is a quick and easy option for permanent fences.

Posts are simply driven in the ground using a post driver. Post clips allow for wires to be attached.

These amounts may vary depending on ground contour.

Gallagher Insulated Line Posts
Gallagher now offers an Insulated Line Post. This post is an insulated fiberglass post. A UV protected polyethylene sheath protects the fiberglass core from UV damage and also gives the post the ability to flex when the fence is impacted, preventing broken or bent posts, and minimizing animal injury.

The Insulated Line Post uses a nylon "snap-on" clip to hold wire to the post. A tape clip is also available.

Permanent Fence Tools

Below are some useful tools that will be referred to as you continue reading.

Fencing Pliers & Wire Cutter
G52200

Specifically designed for cutting, stripping and bending electric fence wire with minimum wire damage.

Strainer Handle
G69530

Spring loaded ratchet strainer handle for quick adjustment of wire strainers (fits most varieties of ratchet strainers).

Ratchet Wire Tightening Tool
G645004

In line wire tightener handle with super smooth ratchet action, to be used with Gallagher in-line wire strainers (G64304).

Wire Twisting Tool
G523004

Ideal for installing clips on posts and droppers.

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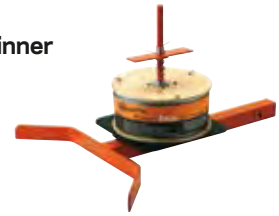
4 Groove Wire Crimping Tool
A609

20" Long 4-groove, robust tool for crimping wire joiners and splicing wire.

Pay Out Spinner
A308



A necessity for building permanent fence. The adjustable break keeps wire from over-spooling and it attaches to a 2" receiver.

Post Driver
G52501

A specially designed driver for the Insulated Line Post.

Tie Down & Handle
G61500 Tie Down
G615014 Handle

Ensures a secure fence tie down. Tie down and handle sold separately

TERMS

Insulator - a non-conductive, insulating device used to secure the fence wire to the fence post, providing reflex insulation preventing power loss.

Clips - Like an insulator, clips hold wire on a post. Clips can be metal or plastic.

Brace - Fences with a lot of tension on the wires are braced at the corners and ends to keep the wire from pulling the corner post over.

Corner - Where a straight run of fence meets another straight run of fence from a different direction. Right angle corners are easily braced for stability.

Tie-downs - Are anchors to hold wire down in hollows.

Droppers (Stays) - maintain wire spacing between posts on multi-wire high-tensile electric fencing. Droppers simply rest on top of the ground, and their sole purpose is to maintain vertical wire spacings between posts.

Permanent Fence Building

Corner Post & Brace Installation

Installing Corner Posts & Braces

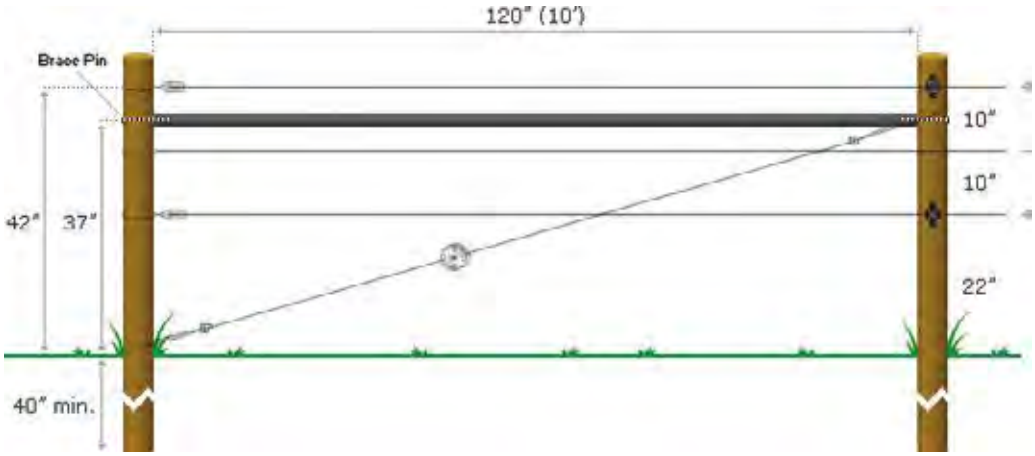
Properly designed and installed brace assemblies, end and corner posts are keys to building a fence that will last a lifetime.

Plan the fence line. Avoid rough, stony or steep areas if possible. Install corners and ends before adding your line posts.

Set your corner posts in position. A 7′ post, 6″ in diameter is usually adequate. If you are planning to hang a heavy gate from the post, ensure the post is strong enough. One of the most common mistakes made is that installers do not set their corner, end and brace posts deep enough.

By far, the most common bracing for end and corner posts is the "H" or horizontal brace. The brace has four different parts: the end or corner post being braced, the brace post, the horizontal cross brace that connects the two posts and the brace wire.

The length of the cross brace should be 2 - 2.5 times the height of the fence. Tighten the brace with a diagonal wire that ties the top of the brace post to the bottom of the end or corner post. Recommend at least two wraps of high-tensile wire.



Posts:
2 - 6″ x 84″ min, Full treated Wood

Rail:
Centered at 37″ above ground level.
1 - 4″ x 120″ Wood or 1 - 2″ x 120″ Thick Wall Pipe

Fittings:
1 - Permanent Wire Tightener
2 - Joint Clamp
2 - Brace Pins, 12″
High Tensile Wire

A variation on the "H" brace is the "N" brace, in which the cross brace runs diagonally from the top of the corner post to the bottom of the brace post, with a bracing wire running in the opposite direction.

Because it's angled, the cross brace in an "N" brace must be longer than in an "H" brace, which can increase the cost.

Although "H" braces afford optimum strength because they consist of two posts in the ground, it's not always easy to accomplish - especially if you're building in rocky soils. When just getting one post in the ground is a challenge, construct a "floating" brace.

This brace also consists of four parts: the post being braced, the brace itself, a brace wire and a brace pad. The assembly works by directing the tension of the fence down the brace.

The most important thing with a floating brace is the angle of the brace You will need to create a 30-60-90 triangle with the post, brace and wire. The brace should be set at 30 degrees from the ground to the brace and 60 degrees from the post to the brace.

For a brace pad, use either a flat rock or a patio stone; either will allow the brace to disperse pressure into the ground. It's critical that the post be set deep otherwise the fence tension will jack the post right out of the ground.

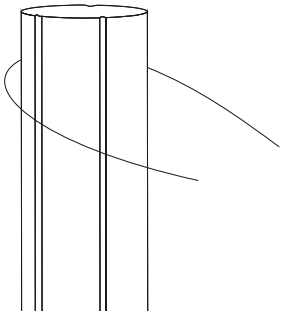
Gate openings need consideration as well. Posts may need to be of larger diameter and set deeper depending on the length and weight of the gate that will hang from it.

TIP

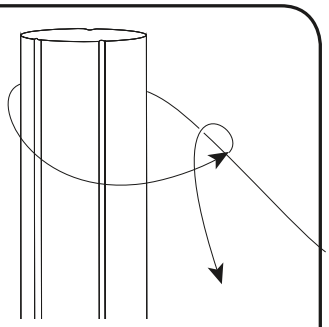
Install a temporary fence for a period of time to see if it works for your needs before installing a permanent fence.

Wire Attachment to End Post Assemblies

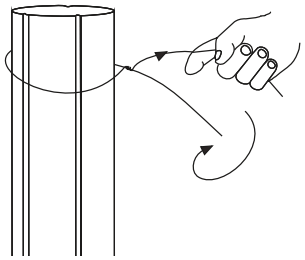
Mark the wire spacings on the corner posts. Tie the strainers no more than 4″ away from the post to prevent animals from pushing through the fence between the post and insulators.



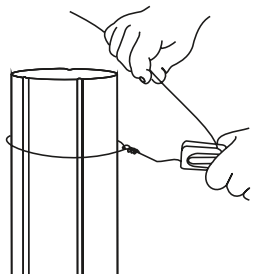
Start with a piece of wire - 3′ in length .



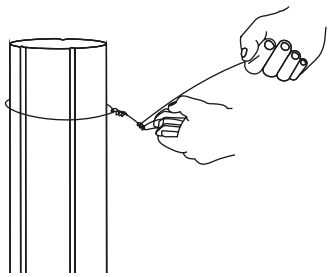
Form a knot as shown and slide it firmly against the post.



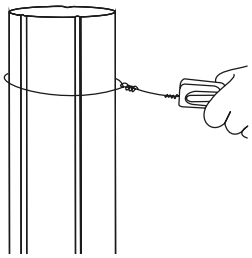
Finish with a tight tie-off. Wrap the wire 3 times around the strain wire. Cut or break off the remaining wire.



Wind the wire once around the insulator. Bend the wire so that the strain is from the center of the insulator.



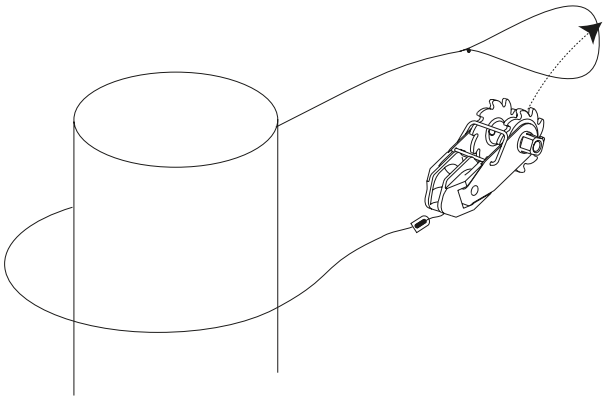
Put a 90° bend in the wire about 6″ beyond the knot to form a crank handle. Wrap the wire neatly and tightly 6 times around the strain wire.



Grasp the wire just beyond the bend and crank it parallel to the fence line (back toward the post or splice). The wire will snap right off.

HANDY HINT

To save time and effort, purchase a Gallagher Termination Kit. This kit includes pre-assembled insulated wire strainer and wire loops for your end posts, eliminating the need for special tools or wire tying.



Angle Posts
If you need to install angle posts, a 4" post is usually sufficient support. If the angle is not sufficient use inline insulators outside of the post.

On sharper corners, you may have to fasten the hot wire on the inside of the post to prevent it from touching the post.

Install line posts

Use a payout spinner to run out the top and bottom wires as guides for positioning line posts. Use 12.5 gauge high tensile wire for electric fencing because it retains its tension far longer than soft wire. It is reasonably easy to use and conducts enough current for most situations when connected in parallel.

Attach the top and bottom wires to corner insulators and any angle or corner insulators. Leave the tails long enough so they can be used for electrical connections later. Next, tension the wires just enough to provide a straight line for positioning the line posts.

Install line posts on rises or hollows first. As each post is installed, attach the wires to them to help decide the position of the next post in the fence line. On sharp rises, line posts may need a block to prevent the post from sinking while posts in hollows may need to be tied down. Fiberglass posts should only be used in straight lines.

Install the remaining line posts where necessary. On flat or level ground use one post up to every 30'. On hilly or uneven ground, posts will need to be closer together to maintain the wire height.

Run out the remaining wires, tie them off to the end strain insulators and attach them to all the posts.

Tension the wires

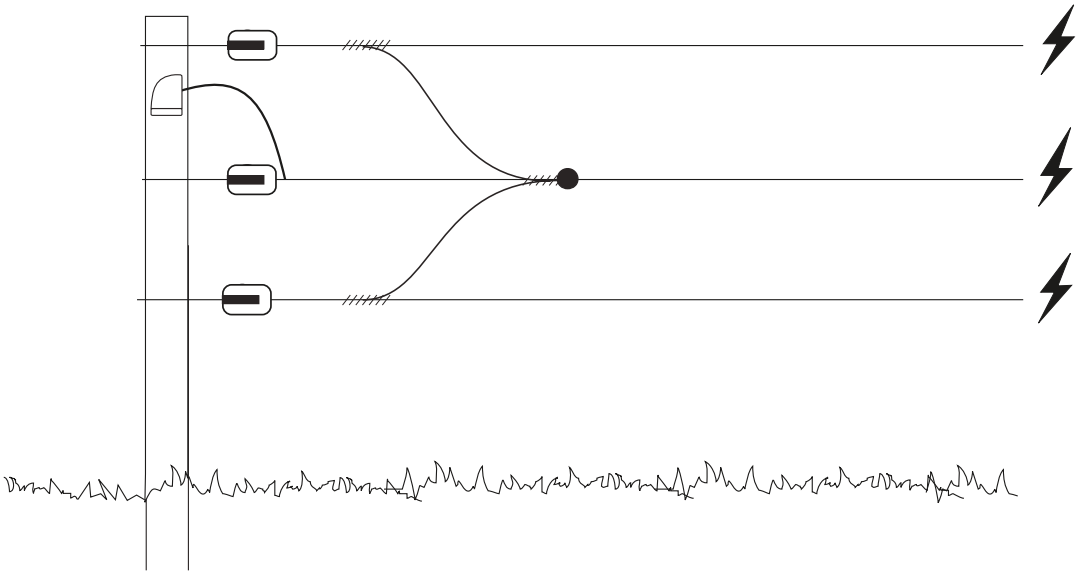
Tension the wires to approximately 200lbs using Permanent Wire Tighteners and a suitable tensioning handle. If wild animal pressure is likely, increase the tension, especially on the bottom wires.

In regions where snow load is a problem or where wildlife may come into heavy contact with the fence, install permanent tension springs to help prevent the wire overstretching. Place permanent wire tighteners in the center of the fence so the wire pulls from both ends.

Electrical connections

Connect all hot wires in parallel at both ends of the fence. This will ensure maximum conductivity. For a three wire fence, bring the tails, previously left long from the top and third wires to the second wire and connect firmly with a Joint Clamp.

Make sure it's tight. Wrap the excess wire around this second wire and beak it off for a smooth finish. Bring the tail from the second fence wire to a Gallagher Cut Out Switch and where necessary break it off. This wiring configuration minimizes the number of joint clamps and creates a clean look.



TIP

Join wire using a figure eight or reef knot. These will give better electrical contact than a double loop join.

Reef knot

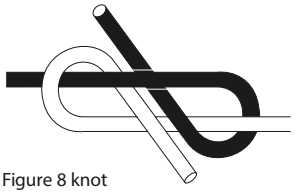
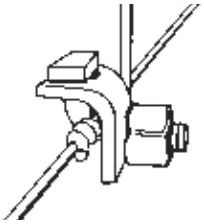


Figure 8 knot

Gallagher Recommends - *re-tightening joint clamps as part of a regular spring fence maintenance program.*



Joint clamps
All other permanent connections should be clamped using Joint Clamps to ensure tight wire connections. Multiple joint clamp options are available.

Cut out switches
Cut out switches are handy for isolating different sections of fence. This is useful when you are looking for faults or carrying out maintenance. Place cut out switches at gateway or junctions where a single or multiple fence line can be turned off.

Connect the undergate cable to one switch terminal and the tail of the second line wire to the other terminal.

Choosing the right insulator for your fence

Gallagher's heavy duty plastic insulators are made from the highest quality polymers infused with UV stabilizer for sun resistance, toughness and durability. Porcelain insulators are fire-resistant and ideal for high fire risk areas.

The type of insulators you require will depend on the type of post and the type of wire that you have selected for your electric fence.

To determine the number of insulators you require: calculate the number of fence posts x the number of strands = number of insulators needed.

For corners and ends, use insulators made specifically to handle the extra wire strain. To determine the number of corner/end post insulators you require: calculate the number of corner/end posts x the number of wire strands = number of corner/end post insulators needed.

Gallagher offers a range of insulators for attaching electric fence wires to your chosen post.

Wood Post Insulators
The Claw insulator provides a strong permanent attachment system with large shield. Alternatively Pinlock insulator products enable the wire to be temporarily removed from the fence while under tension. For example when wires need to be lowered for temporary vehicle access. Insulators are also available for equine fencing products including for tape and Equine Fence Wire. These are all attached to the post using staples, screws or flat head nails.

Steel Post Insulators
Gallagher manufactures quality double pinlock insulators for attaching electric wires to steel t-posts and y-posts as well as a topper cap for securing a top mounted tape or wire.

Fiberglass Clips
Attach wires to Fiberglass posts using metal clips.

Insulated Line Post Clips
Attach wires or tape to Gallagher Insulated Line Posts using specifically designed insulator clips.

Gates and gateways

Gates should be wired so that they are dead when unhooked. Use double-insulated underground wire (placed in a pipe for protection) to run power under he gate - preferably underground.

Seal ends or turn ends of pipe down to keep out moisture. Install the gate with an insulator, and power the gate through the gate handle. Use 1/16″ or 1/8″ galvanized cable for the gate because it is much more flexible than high-tensile wire.

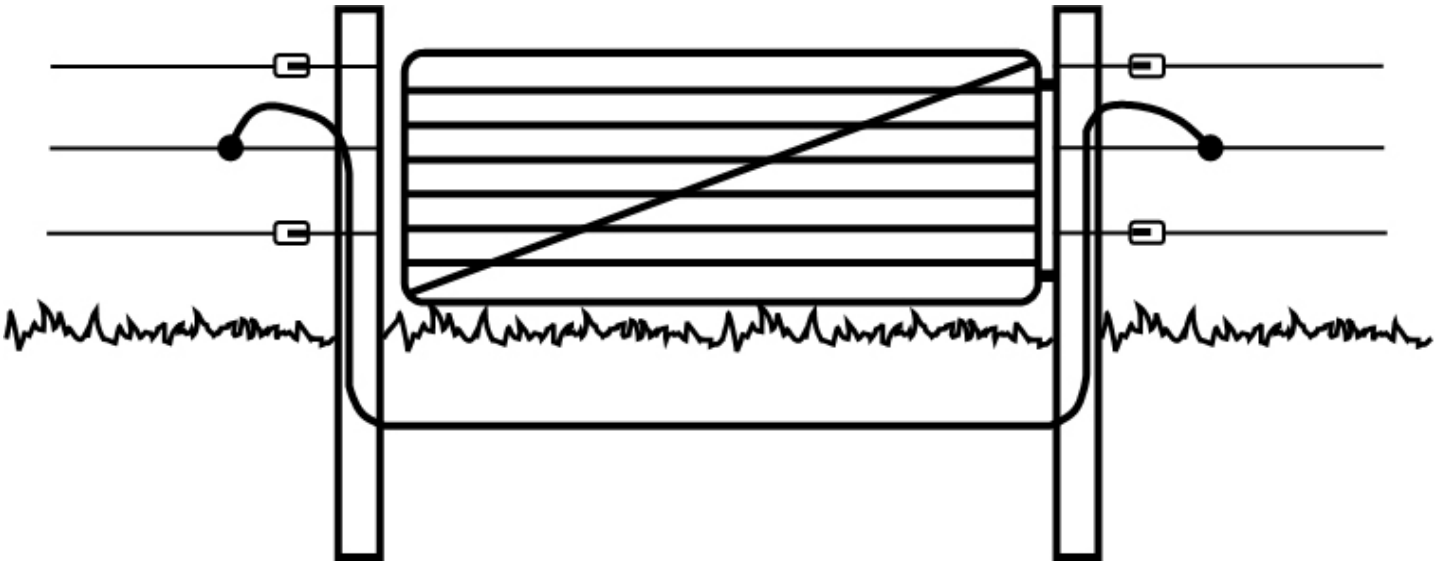
Where possible, position gateways on flat, firm areas, away from steep banks where erosion could occur. Carry the power (and ground return if you have a ground wire return system) across the gateways preferably underground using double insulated cable in a pipe for protection and simple maintenance. Bury the cable/pipe at least 12″ deep and cover with soil that is free of rocks and debris. Connect the cable ends to the fence using join clamps or through a Cut out Switch.

Electrified Gates
Electric gates are low cost, effective and extremely easy to install. Choose from high visibility electrified spring gates, tape gates or bungy gates.

Tape gates provide the most visible gate solution. Choose spring or bungy gates where the gate needs to be stretched across a road to divert animals into the paddock.

CAUTION

Do not rely on electric gates to get power across gateways because when the gates are open power is lost to the fence. Also the conductor in an electric gate is not designed to carry high currents so power will drop even when closed.



2. Offset Fencing

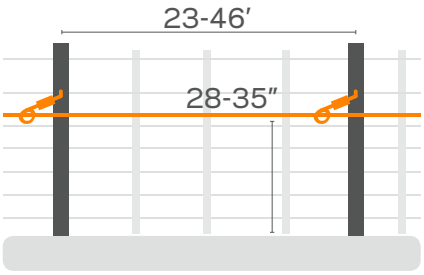
Offset brackets are fitted to a conventional fence with an electrified wire (or wires) on one or both sides of the fence. The wire discourages animals from rubbing or pushing against the fence, thereby extending its life.

A variety of offset brackets are available to attach to wood post or t-post fences, or to mount directly onto the wires of an existing non-electric fence (barbed wire, chain link, etc.).

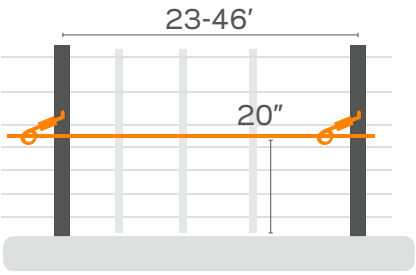
Once you've chosen your products, see below for the recommended offset electric fence set up for cattle, sheep, pigs, goats and horses.

Fence Set Up

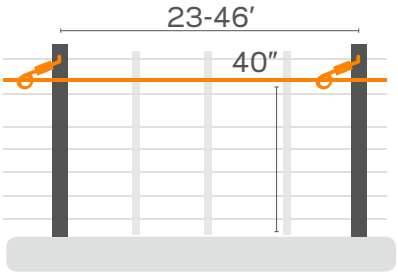
Cattle



Pigs, Sheep, Goats



Horses



Offset electric fencing is an economical and easy to install option if you have an existing or new non-electric fence that you want to protect.

Offsets come in many options including Porcelain. Porcelain insulators will not break down due to sun damage and are resistant to fire.

A side mount pigtail offset is a popular option for wood post fences. Provides complete freedom of the offset wire placement.

Offset wire mounts provide added protection for traditional fences. This protects your fence investment and extends the life of the fence.

Offset Fencing

Selecting Your Offsets

Choosing offset brackets
Conventional fences can be made to last for many more years by attaching offset insulators with an electrified wire on one or both sides of the fence.

Gallagher recommends attaching a single offset wire at two thirds the height of the animal to be controlled. If sheep and cattle are in the same area it is better to use two offset wires (one for sheep, one for cows). However a single wire three quarters the height of the sheep will still protect the fence from both animal types.

If the old fence is tangled or has broken wires, it will need to be repaired. Otherwise you will run the risk of loose non-electric wires causing accidental shorting on the electric offset wire. Change the worst wires and tighten the others where possible.

Wire offsets are made from galvanized high tensile spring wire, these offsets twist onto existing fence wires.

Wood post offsets are made from galvanized high tensile spring wire. This offset is stapled to wooden posts.

Pigtail offsets are driven into wood posts then stapled in place. For hard timbers, pre-drilling a pilot hole is recommended.

Chain link offsets are made from galvanized high tensile spring wire, this offset twists onto existing chain link wires.

T-post offsets extend 5″ and their extra locking tab will fit all t-posts.

Mistakes made with an offset fence
The most common error is the use of soft wire for the fence wire and for the offset bracket. High tensile wire should always be used for the fence wire, and only spring steel wire for the offset brackets. The bracket must be able to spring back in place after impact or it will become entangled with the wire of the old fence and short out.

The second most common mistake is the use of brackets that are too short allowing the hot wire to remain too close to the fence it's attached to. Brackets should hold the hot wire 5-12″ from the old fence. Some brackets on the market are 4″ long or less.

Another important factor: whenever possible offset brackets should not be installed onto the posts of the old fence. They should be installed between posts, or adjacent to the posts if the fence is sagging badly. Installing between the old posts provides flexibility and lets the wire spring back into position after being impacted by an animal or piece of equipment.

The placement/height of the hot wire is also very important. It should be attached at two-thirds the height of the animal to be controlled. Two offset wires, can and often are placed on the same fence. On one side a wire is placed at 30″ to contain cattle, on the other side a wire is placed at 8″ to repel predators.

As simple as it is, offset fencing still must be viewed as a system. One short cut, or one sub-standard component can destroy the effectiveness of the fence.

3. Temporary & Portable Fencing

A temporary/portable electric fence can be powered by any Gallagher Solar or Battery Energizer or can be simply connected to a permanent electric fence supplied by a 110v powered Energizer.

As portable fencing is so easy to move and set up it's a versatile solution for fencing any type of animal, even on the most remote area of your property.

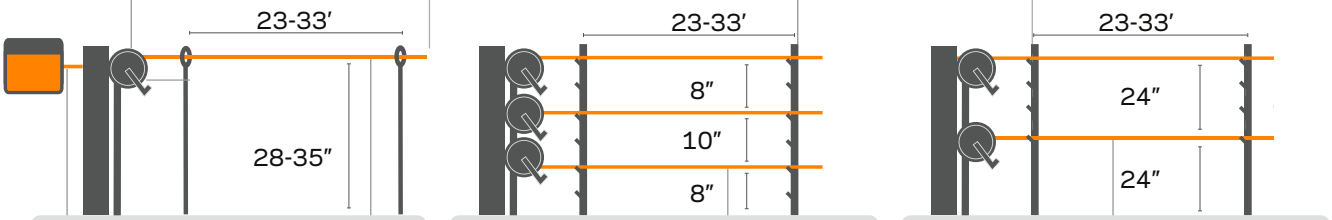
Once you've chosen your products, see below for the basics you'll need for portable fencing and the recommended fence set up for cattle, sheep, pigs, goats and horses.

Fence Set Up

Reels hold the tape, braid or wire for the portable fence. You can use just one reel for single line fences or up to three reels, attached to a reel stand, for multi-wire fences.

Posts are lightweight yet sturdy. Pigtail and Ring Top posts are most popular for cattle fences.

Multi-wire treadins are used for all other animals.



Cattle (no calves) | **Pigs, Sheep, Goats, Calves*** | **Horses**

*Note: Wire spacing will differ depending on the type of post used.

Power Connectors are leads that connect a portable fence to an existing permanent electric fence.

Tapes, Wires and Braids are used on portable fences rather than the galvanized wire used on permanent fences. Gallagher conductors are ideal for portable electric fences as they are light, visible and easy to wind.

The multiple lugs on Multi-wire Treadins allow attachment of a number of wires at different heights to accommodate a variety of animal types.

Ring Top Posts are a popular choice for cattle farmers. A single electrified wire is sufficient to contain even the most temperamental animals.

The Smart Fence 2, is an all-in-one portable fence. This instant fence system combines posts, reels and wire in one easily transportable package.

	Conductor Selection Chart		FENCE VOLTAGE 328' FENCE	1,640' FENCE	3,280' FENCE	RESISTANCE (Ohms/miles)	MIXED METALS*
Braid, Wire, Rope	**Turbo Braid - 3/16"** G62174 656', White G62176 1,312', White	▪ 9 Mixed metal strands ▪ Most user-friendly for horse fencing - visible and safe ▪ Best suited for any distance temp or permanent fence	8kV	7.5kV	7.1kV	125	▪
	Turbo Braid - 7/64" G62148 1,312', White /Blue	▪ 9 Mixed metal strands ▪ Superior heavy duty strength	8kV	7.5kV	7.1kV	125	▪
	Turbo Wire G62054 656' G620564 1,312' G62089 2,624'	▪ 9 Mixed metals ▪ Best suited to distances more than 1/4 mile, where extreme power is required ▪ 40 times more conductive than standard Poly Wire	8kV	7.5kV	7.1kV	130	▪
	Poly Wire G62004 656' G620300 1,640'	▪ 6 Stainless steel strands ▪ Best suited for distances under 1/4 mile	5kV	2kV	1kV	6,000	
.5" Tape	**.5" Turbo Tape** G62354 656' G62356 1,312'	▪ Mixed metals 30x's more conductive ▪ Best suited for distances greater than 1/4 mile	7.8kV	7.1kV	6.4kV	250	▪
	.5" Poly Tape G62304 656'	▪ 6 Stainless steel strands for good conductivity	4.3kV	1.5kV	0.8kV	8,500	
1.5" Tape	**1.5" Turbo Tape *** G624544 656'	▪ 15 mixed strands for ultra high conductivity ▪ Reinforced edges for longer life & open weave for low wind resistance	7.8kV	7.1kV	6.4kV	250	▪
	1.5" Poly Tape * G624044 656'	▪ 15 Stainless steel strands ▪ Ideal for portable electric fences	4.3kV	1.5kV	0.8kV	8,500	

* recommended for horses

Wire

Preferable where wind and adverse weather conditions exist.

Braid

Braided construction is designed not to tangle or overstretch adding durability.

Tape

Generally used where visibility is most important.

Understanding Wire

There are a number of different types of portable electric fence wires, tapes and braids - frequently called "conductors". Knowing which one to choose can be a bit tricky - especially for those new to electric fencing.

The most common portable/temporary fence "conductor" is what is called Poly Wire. Poly Wire is made of plastic strands and embedded thin metal wires used to carry electrical current from a Fence Charger/Energizer. The individual strands of plastic and wire are typically twisted tightly together to form a single wire.

A second option is Poly Tape. Poly Tape threads individual strands of plastic and wire together creating what appears to be a highly visible ribbon. Tape while prone to wind and ice damage, is the most visible "conductor" and is best used in situations where maximum visibility is needed. Poly Tape comes in different width sizes, but the most common are 1/2" and 1 1/2".

A third option is Poly Braid. Poly Braid is thicker and more visible than Poly Wire, and is less likely to be damaged by the wind and ice than Poly Tape.

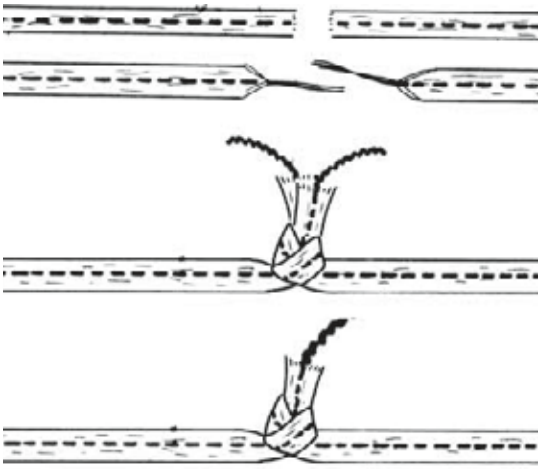
Poly Braid consists of individual strands of plastic and wire that are braided together to form a tight weave making it more durable, and less prone to tangles and overstretching. Poly Braid comes in a number of different diameters (thickness).

Turbo products are always the best choice for distances beyond 1/4 mile where dependable power is required.

Electrical Connections
It is important to have good conductivity through the connection when you join wire or tape.

To do this, separate the metal strands by melting a strip of plastic threads with a match or lighter approximately 2" from the ends of each length. Pull the end off the plastic being careful not to break the steel wires. Tie both ends of the wire/tape together and then twist the steel wires together.

To join 1 ½" Tape use a Tape Joiner. These also give good electrical contact.



So what is Turbo Wire and how is it different from Poly Wire?

Turbo products come in the same wire, tape and braided construction previously described for Poly - with one major difference. Turbo products have 9 strands of conductive metals including copper which make them up to 48X's more conductive than Poly products which only have 6 strands of stainless steel. This means with Turbo, your voltage will stay strong and carry a "shock" further down your fence line than Poly products. Long temporary fences (over 1/4 mile) should always be constructed from Turbo products to ensure maximum livestock control.

Why is copper so important?

Some metals conduct power better than others. Metals that are good conductors are said to have low resistance and metals which are not good conductors have high resistance. Copper happens to be a very low resistance conductor which enables Turbo products to carry power further down the fence line than Poly products. The copper wires in Gallagher's Turbo products are tin coated. This is why if you pull the plastic and metal strands apart, you will not see copper colored wires. The advantages of tinned copper over a non-tinned copper wire is greater longevity. Copper coated in tin is less susceptible to corrosion and even more conductive!

What does it mean that "Turbo is 48X's more conductive than Poly"?

What this means is that if you built two different fences .6 miles long and one was a single strand of Poly Wire and the other was a single strand of Turbo Wire - both fences would read 8,000 volts at the start; however, at the end of the fence you would only read 600 volts on the Poly Wire fence and the Turbo Wire fence would read 6,300 volts.

The resistance of a "conductor" (wire/tape/braid) is measured in Ohms. The lower the resistance, the more conductive the wire/tape/braid will be. As you can see from the values below, Turbo Wire is 48 times more conductive than Poly Wire.

Turbo Wire - 209 Ohms/mile
Poly Wire - 10,000 Ohms/mile

Portable Fence Posts

When installing a temporary fence, there are many durable, portable fence post options available.

Many portable fence posts come with a step-in feature. At the base of a step-in post, there is a footplate that allows you to push the post into the ground with your foot. This is a convenient feature so you won't need to drop your bundle of posts in order to pound them into the ground.

Other factors to consider are visibility, durability and the ability to add multiple wires for the animal needing to be fenced. Weather also influences selection as posts are much more difficult to insert into frozen ground.

Plastic Posts
Plastic step-in posts with built-in treads are convenient because they have pre-molded loops for multiple wires at various heights. Plastic posts are made from a heavy duty, UV-resistant polymer plastic and have a steel foot.

Metal Posts
Metal step-in pigtail posts are also available. These posts get their name from the curl loop that holds the wire and looks similar to a pig's tail.

Gallagher's Ring Top posts have a very high strength plastic head and foot coming in both a standard and heavy duty model.

Gallagher's Ring Top post while similar to the Pigtail, has a ring shaped nylon head that prevents wear and reduces tangles. The post's glass reinforced nylon footplate is strong and will not bend. While both pigtail and ring top posts are designed for a single wire, plastic rod post insulators can be attached to the posts so additional wires may be added.

Fiberglass Posts
Fiberglass rods are better for situations when the fence is not going to be moved as often because these have to be pounded into the ground. These rods require the use of wire clips or plastic insulators that slide on the rod to hold the wire in place.

Rolling Posts
The Tumblewheel enables you to quickly and easily roll a fence line to a new position. The Tumblewheel's unique center hub maintains power while the fence is being moved. It can be used on flat very hard and frozen ground. The legs remain live except for two legs that are on the ground.

Where several breaks are needed in one paddock, Tumblewheels are ideal for quick and efficient rationing of grass. We recommend spacing at every 66'.

This fence consists of a number of electrified 'wheels' spaced across the pasture. The wheels are held upright with the tension of the single line fence which passes through the center.

When one or both ends of the fence is moved, the wheels roll along. When you stop, the fence stops.

Reels

Reels are an absolutely essential component of your portable electric fencing equipment.

They are designed to hold your wire, braid or tape and make it extremely quick and easy to roll up your temporary cross-fences.

Gallagher's geared reel comes with a locking device allowing for secure attachment to an ATV or fence wire. Geared reels also have a 3:1 ratio which means for each turn of the handle, the bobbin spins three times allowing you to wind your wire three times faster with each turn of the handle.

Geared reels are designed to hook the spool in place so it does not unravel. The hook allows you to hang the reel off of your permanent high-tensile electric fence.

An alligator clamp (also called a lead connector) is used to create a good electrical connection between the portable electric fence and your permanent electric fence.

Use an insulated handle on the far end of your portable electric fence so the fence is only powered from one side (at the geared reel). This ensures that the portable fence loses power once you disconnect the alligator clamps and geared reel so you can roll up the wire without getting shocked.

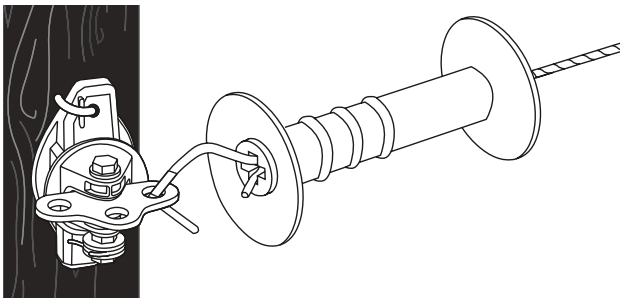
When rewinding long lengths of poly/ turbo wire, braid and tape, the geared reel is a worthwhile, time-saving investment.

Temporary Gates

Give advance thought to the location of gate openings in your fence where people, animals and equipment need easy access to roads, structures or pastures.

Electrified gates are made from the same type of wire as the material used in your fence line. The number of gate strands should match the number of lines in your fence.

For easy assembly, consider using Gallagher's gate kits specific to the type of post or wire you are using. Our kits



include the handle, insulators, hardware and simple installation instructions.

3-Way Gate Anchors as seen in the diagram above, make it easy to attach gate handles to the post and are worth the investment.

Portable Fence Construction

Reels holding wire/tape can be used individually for single line fences or for up to three lines using three reels attached to a reel stand.

Single Wire Fence:

1. Hook the reel to the anchor point (e.g.: permanent fence/reel stand) and disengage the ratchet.
2. Carrying the insulated handle and sufficient portable posts, walk along the proposed line allowing the reel to unwind and connect to the other end.
3. Walk back to the reel, placing a post every 66' (or closer on uneven ground) and locate the wire/tape in the post.
4. At the end of the fence, engage the ratchet and tension the wire.
5. Connect to power – either connect to the permanent fence by connecting leadset to both powered permanent fence line and the portable wire or using a solar or battery Energizer.
6. When you remove the fence, do the same process in reverse.

CAUTION

Do not wind the conductor through the posts as the abrasion will damage the post.

Multi-wire Fence

1. Attach the required reels to a reel stand & chain the reel stand to an anchor point.

2. Hook the insulated handles through the head/lug of the first post to prevent them becoming twisted.

3. Follow steps 2-6 above only this time with multiple lines together not one single one.

   Note – place posts every 33-40′ and use a multi-reel lead connector if using a battery Energizer.

All in one multi-wire portable fence system

A quicker and easier all in one instant fence system, the Smart Fence System includes 4 wires, 10 posts, 328′ length. Energizer is sold separately.

Safety

Here are some safety considerations to follow when installing electric fencing:

1. Only connect one energizer to a fence.

2. There is a misconception that dry vegetation touching an electric fence can cause fires – this is extremely unlikely. In order to create a short, vegetation needs to be damp or green so therefore the vegetation will not ignite. Once vegetation dries out it becomes non-conductive meaning any short created disappears.

The only conceivable but still very unlikely scenario where an electric fence could start a fire is when a wire shorts to an grounded metal object, such as a steel post or wire where insulators have broken, in the presence of abundant dry vegetation. This scenario is very unlikely to occur in practice, and even less so on a well-maintained fence.

Producers with fences on steel posts or those using grounded wires in the fence are advised to ensure the live wires are well insulated and the fence is clear of vegetation. If these factors are of concern then on days of severe or above fire risk, consider turning the energizer off.

3. Ground rods for energizers should be at least 65' from utility grounding fields.

4. Avoid running fences parallel to power lines, and try to install fences so that they cross power lines at right angles. If you can't avoid parallel electric fences and power lines, offset the fences at least 30 feet from the power lines, and make sure the top fence wires are no more than six feet high.

5. Do not attach fence wires to utility poles.

6. Electric fences bordering public thoroughfares are required to have a warning sign at least every 295' feet where the public has access to electric fences, such as along roads.

Check with your local authority for specific regulations.

7. Landowners are responsible for preventing audible interference with telephone lines. Therefore, try to avoid installing electric fences under telephone wires, and minimize the distance that electric fence wires run parallel to underground telephone cables.

This particularly applies if the electric fence wire is carrying high current, such as a leadout wire to a large fencing system.

8. Don't touch fences with your head or mouth. People with pacemakers or other heart problems also should consult their doctors before working with or near electric fences. Always use precautions.

9. Never use barbed wire for electric fence wire because people or animals could more easily become entangled in it.

10. Keep electric fences as far away from radio antennas as possible. Gallagher energizers comply with usual Telecom and International standards and safety regulations. However, problems can arise for a number of reasons and can be difficult to eliminate in areas with poor radio reception.

To avoid radio interference:

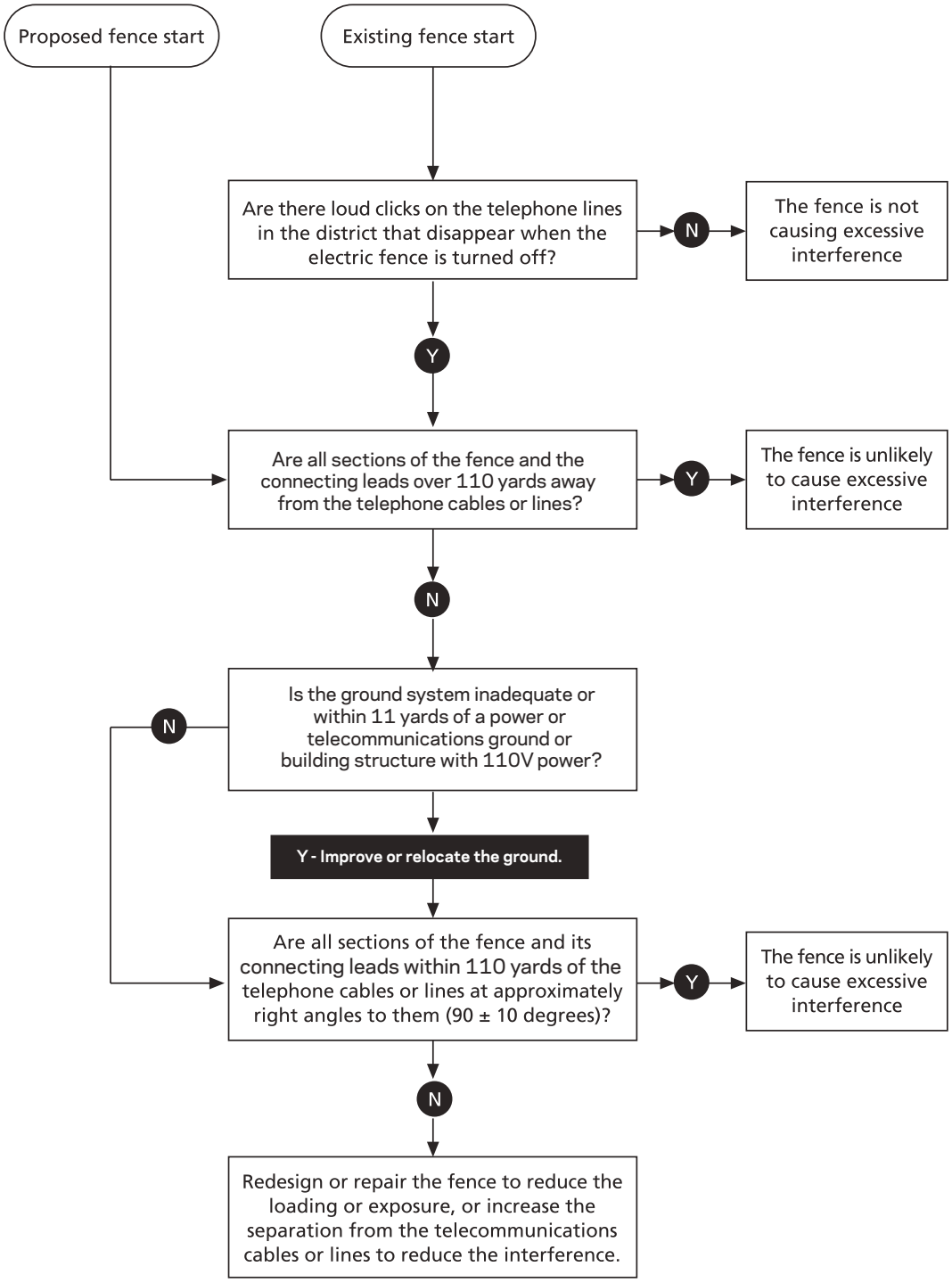
- The energizer ground must be highly conductive
- The energizer must be well away from any electrical power supply
- The energizer should be well away from any water pipes

Do not allow an energizer ground wire to touch a building which can act as a broadcast aerial. Use proper leadout cable to insulate the ground wire. Ground the offending radio and improve its aerial. Try to keep both as far away from the energizer and fence lines as possible.

All types of wire may break and recoil when stretched. Always use hand and eye protection when handling hi-tensile wire.

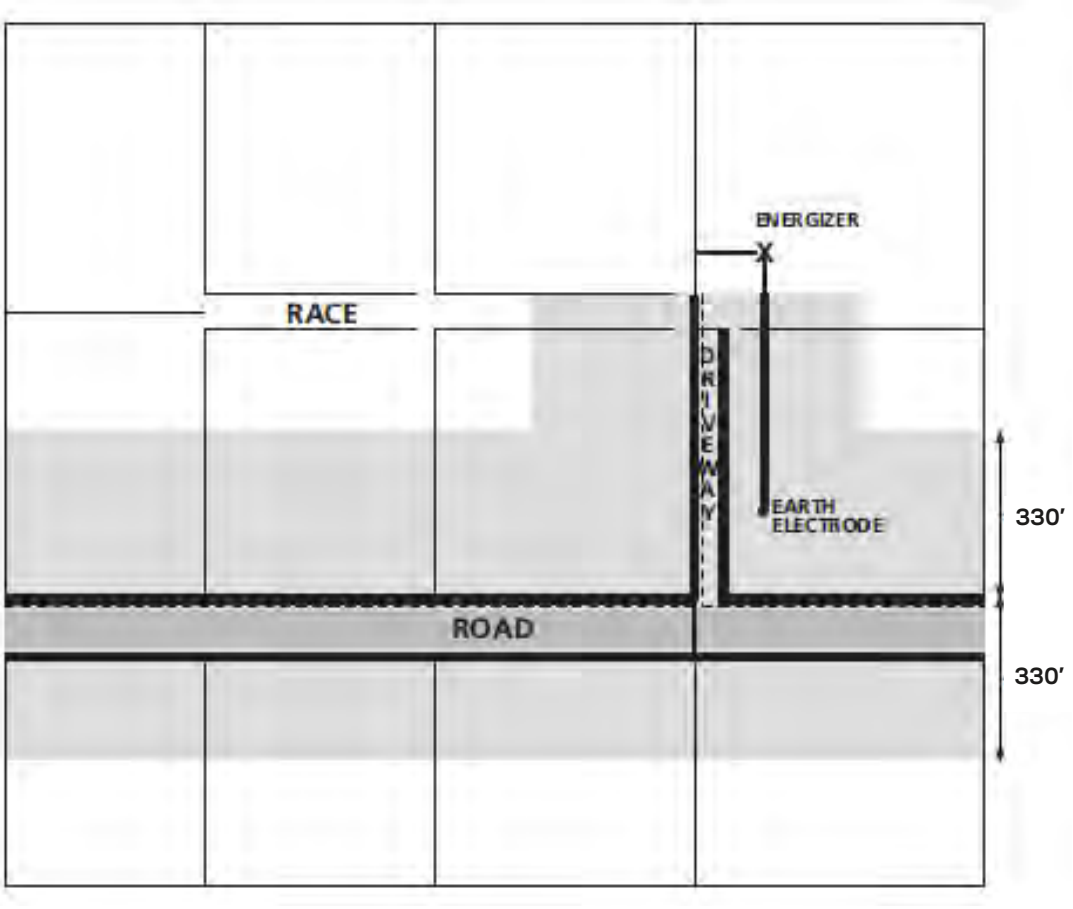
Telephone Interference

Use the following chart flow to determine if your fence is likely to be causing interference on telephone lines.



1. Draw a plan of the property approximately to scale showing:
- All electrified wires.
- The connecting leads between Energizer, fence and ground rods.
- Wires crossing gateways and roads (including underground)
- Communication cables/lines
- A 640' wide shaded stripe centred on each side of the communication cables/lines

2. Highlight any electric fence wires
- Within the shaded area
- That run parallel to communication cables/lines and are within 330' of them (running at right angles is correct)

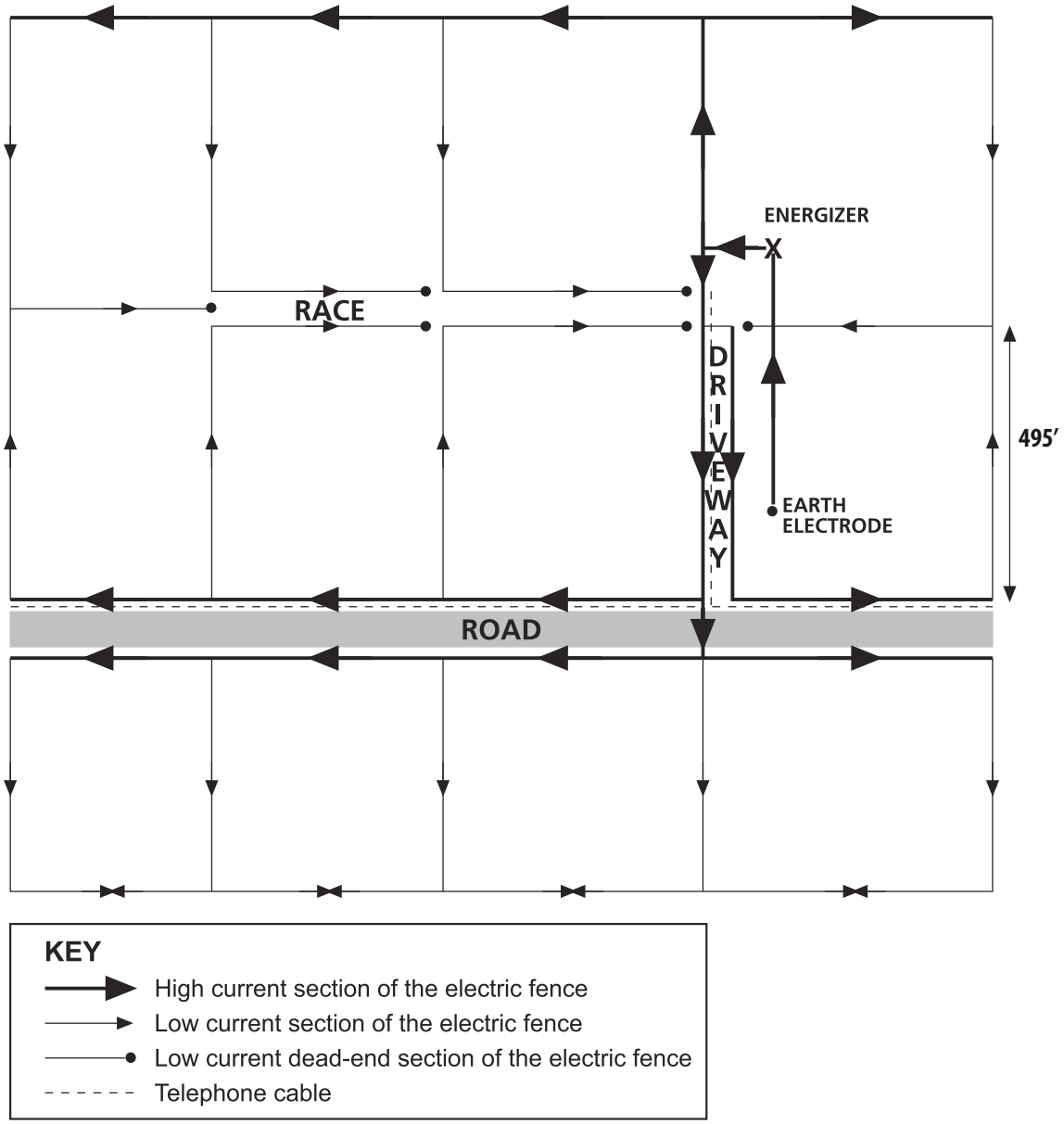


Gallagher Recommends
Use cut out switches to isolate fence sections for easier fault location; a Fault Finder to easily check for higher current levels; and flood gate controllers installed in series to stop water levels causing a hard ground.

Troubleshooting

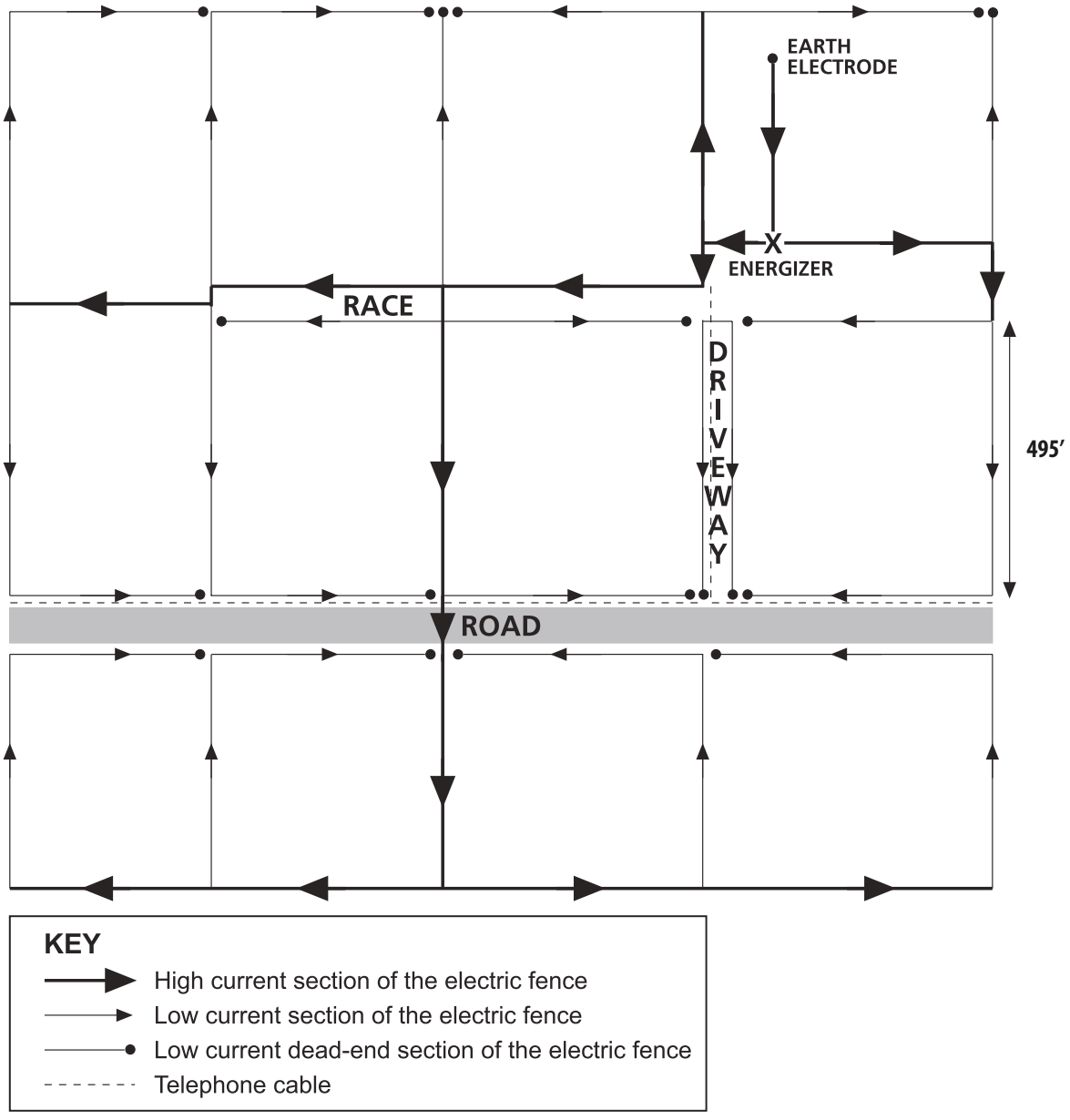
What Not to Do – an interference heavy layout

1. Highly conductive lead out line runs down the driveway/road, adjacent to communication cables/lines
2. Ground rods are connected in parallel to communications cables/lines
3. Highly conductive lead out line is less than 330′ from and not at right angles to, communication cables/lines when it crosses the road



What To Do – a clean fence

1. Energizers and lead out are at least 330′ away from communication cables/lines.
2. Sections of the fence that are less than 330′ away are as short as possible and left open-circuited at the far end (i.e. nothing connected to the far end).
3. Electric fence ground is separate from all other grounding systems, is as short as possible, and is routed away from communication cables/lines.



Troubleshooting

Common electric fencing issues & solutions

#1 Energizer is not on or there is no volt meter reading across the energizer output terminals with the energizer disconnected from the fence.

Potential Causes:

1) Mainline power outage or blown fuse on input circuit
Solution: Restore power or replace blown fuse

2) Energizer is switched off
Solution: Check energizer "on-off" switch.

3) Dry cell batteries are dead; wet cell batteries are discharged
Solution: Recharge or replace batteries

4) Battery terminals are corroded
Solution: Clean terminals

5) Energizer is faulty
Solution: Have energizer serviced

#2 Energizer is on, but volt meter reading is low across the energizer output terminals when disconnected from fence.

Potential Causes:

1) Energizer is switched to "low" setting
Solution: Check energizer output switch

2) Weak batteries
Solution: Recharge or replace batteries

3) Battery terminals are corroded
Solution: Clean battery terminals
Troubleshooting

#3 Energizer is operating, but there is no volt meter reading on the fence with the energizer connected

Potential Causes:

1) Ground-return wire is disconnected or broken
Solution: Connect or repair ground-return wire

2) Feed-wire terminals are corroded, disconnected or broken
Solution: Connect or repair feed wire terminals

3) Probable Cause: Broken, corroded or disconnected live wire or ground-return on fence
Solution: Connect or repair live wire or ground-return on fence

4) Soil is dried out
Solution: Install ground-return wire

#4 Low volt meter readings at several locations on fence

Potential Causes:

1) Energizer is on low setting or is inadequate for length of fence
Solution: Switch energizer to high setting; install more powerful unit

2) Weak batteries
Solution: Recharge or replace batteries

3) Terminals corroded
Solution: Clean terminals

4) Ground system is inadequate or deteriorated
Solution: Repair or replace ground system

5) Soil is dried out
Solution: Install ground-return wire

#5 No volt meter readings at several locations on fence

Potential Causes:

1) Broken or disconnected fence wire, jumper wire or ground wire
Solution: Connect or repair wire; remove cause of short; replace jumper connection

2) Broken or faulty insulators
Solution: Replace faulty insulators

3) Ground connection rod deteriorated
Solution: Replace ground connection rod

#6 Volt meter reading on one wire is higher than on another wire, or there is no reading from one live wire to ground-return or soil

Potential Causes:

1) Broken or disconnected fence wire, jumper wire or ground wire
Solution: Connect or repair wire; remove cause of short; replace jumper connection

2) Broken or faulty insulators
Solution: Replace faulty insulators

3) Ground connection rod deteriorated
Solution: Replace ground connection rod

#7 Radio, TV or telephone interference

Potential Causes:

1) Ground system inadequate
Solution: Increase grounding capacity

2) Antenna too close to fence
Solution: Relocate antenna or telephone wires

3) Fence is parallel with antenna wires or telephone lines
Solution: De-electrify or relocate segment of fence that is parallel to or too close to antenna or wires

Troubleshooting

Common faults to look for and fix:

- Poor connections at the rods, ground return wire or in the connecting wire
- Rusty or corroded ground rods
- Not enough ground rods (on a ground return wire system rods can be installed at various places around the fencing system & connected to the ground return wire)
- Broken ground wire connecting the rods
- Rods too close together or too short

Searching for a fault

A short is a fault somewhere on the fence that has caused it to lose power. The most common types are vegetation overgrowth, loose wires and broken insulators.

Gallagher has some great tools for testing and finding these quickly and easily.

- Fault Finder – shows voltage, current and direction of fault
- Fence Volt Meter - a digital read out of the voltage at that point on the fence
- Live Fence Indicator – sits on your fence line and flashes with each pulse over 2kV so you can see from a distance

To trace a fault using a volt meter travel along the fence line and check the voltage about every 330' . If the short is serious, the voltage will continue to fall until the fault is reached. If the fault is passed the voltage will remain fairly constant. You should then backtrack to find it. At fence junctions isolate different fences with a Cut Out Switch.

Using a Fault Finder

1. Put the Fault Finder into current measurement mode
2. Place it on the fence with the wire in the measurement slot and making good contact with the contact plate.
3. The arrow on the LCD display will indicate which direction the current is flowing. The amount of Amps will show on the display. The higher the number, the bigger the fault.

Progress as above. If the current reading drops significantly the fault is back towards your previous reading. The process is similar to finding water leaks, where the Fault Finder is reporting the amount and direction of the flow.

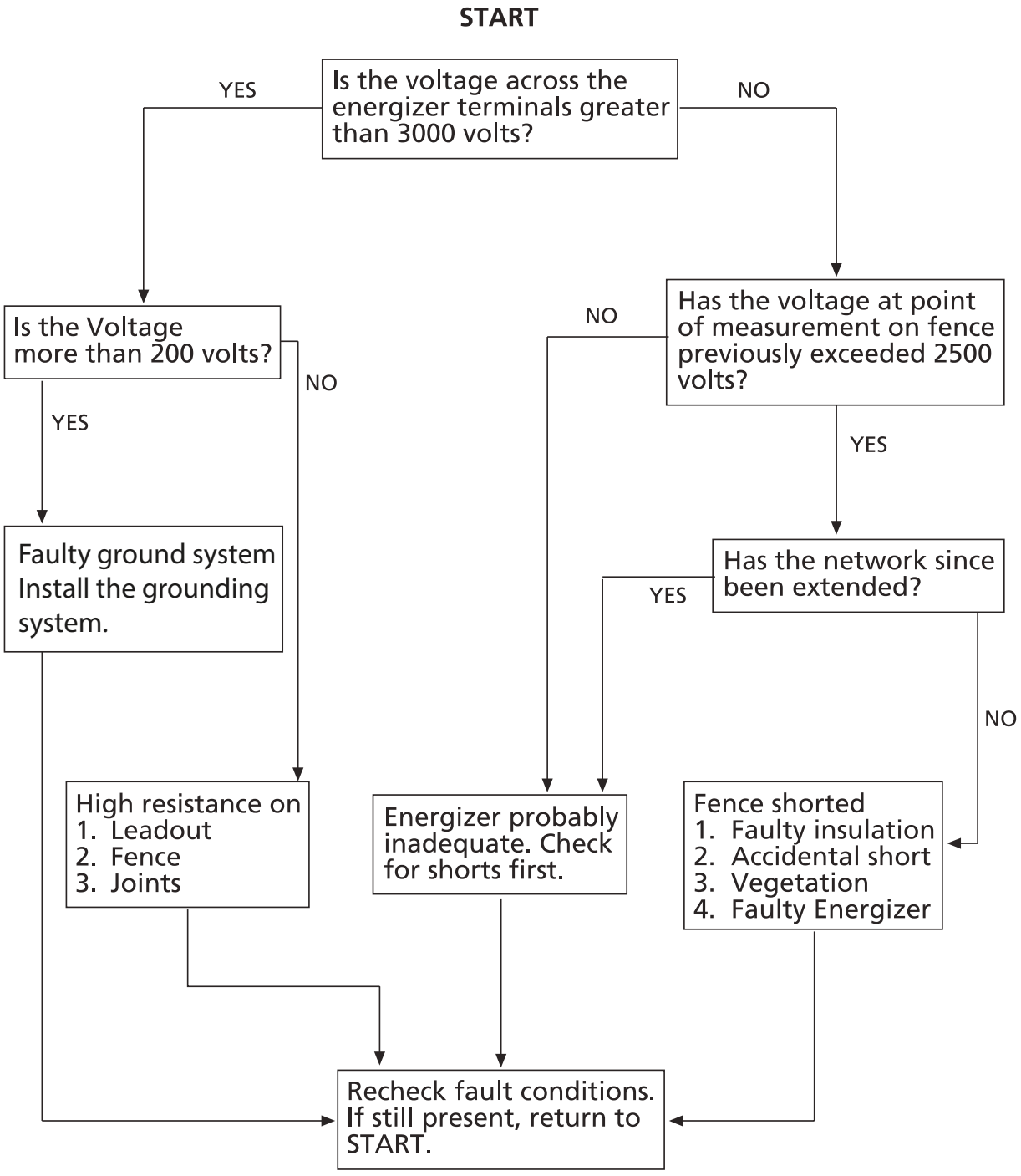
Induction

Induction is the transfer of voltage from a live wire to a neutral wire by electromagnetic rather than direct physical contact.

If you are getting a small shock from "non-live" wires or steel gates, particular in dry weather, this is likely to be caused by induction. Neutral wires (neither live nor ground) can be charged from live wires (usually leadout or offset wires), running in parallel. It is not a short and will not reduce fence voltage.

To remove the problem, ground out the offending wires by pushing a heavy gauge galvanized wire as far as possible into the ground next to the strain post and staple it across the offending wires. This will not reduce the voltage on the insulated powered wires.

If you find there is not enough power on your fence follow the chart below to find the most common causes.



Natural Resources Conservation Service Materials

TECHNICAL NOTE

RANGE TECHNICAL NOTE NO. 7 **April 2018**

Fence

I. INTRODUCTION

This technical note is served as a guide for installing a fence according to the Conservation Practice Standards (CPS) (382) found in the South Dakota (SD) Natural Resources Conservation Services (NRCS) Technical Guide. It is the producer's responsibility to maintain this practice for the expected life span.

The General-Purpose Fence is designed to contain or control movements of livestock where heavy concentrations or pressures are not expected. The Protective Fence is designed for uses such as excluding livestock from agricultural waste storage structures, spring development areas, portions of stock water impoundments, seeps, critical area plantings, or other areas where a high degree of protection is desired. Protective fence is not necessarily a requirement in these situations, and the need for protective fence will be determined by the operator and the planner.

All materials used in construction of a fence will be of high quality and durability. Any materials or construction features that exceed these specifications, or that are of different designs that are of equal or greater effectiveness, are acceptable for meeting specifications. Questionable materials or construction features require prior approval of the State Resource Conservationist.

A. GENERAL PURPOSE FENCE

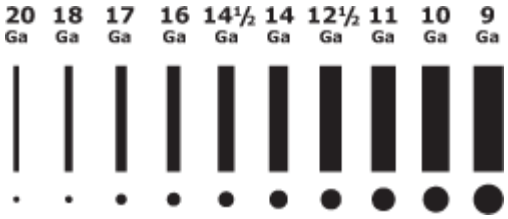
General Purpose Fence (three- or more wire barbed, and woven-wire). For construction details, please see SD Job Sheet 382-1, General Purpose Fence.

1 Materials:

a. Barbed wire
   1. Standard weight: Double-strand galvanized wire of 12.5-gauge with two-point 14-gauge wire barbs at a spacing of approximately 4 to 6 inches.
   2. High-tensile strength (110,000 pounds per square inch (PSI): Double-strand galvanized wire of 15.5-gauge with two-point 16.5-gauge barbs at a spacing of 4 to 6 inches.

b. Woven wire:
   1. Standard weight: 26 to 34 inches high netting with 11-gauge top and bottom wires, 14.5 gauge intermediate and stay wires, all galvanized. Mesh size can be 6 inches x 6 inches or 6 inches x 12 inches; 12-inch mesh is recommended for goats to reduce hang-up.
   2. High-tensile strength: 42-inch netting with 12.5-gauge high-tensile strength (179,000 PSI) line wires, 12.5-gauge medium-tensile strength (125,000 PSI) stay wires, all galvanized. Mesh will be 4 inches x 6 inches to 7 inches x 12 inches.

c. Wire size compared to gauge



d. Wood posts: All decay-susceptible wood posts (such as pine) must be treated with proper chemical preservatives for below-ground application. Posts made from rot-resistant woods such as red cedar or Rocky Mountain juniper are suitable without treatment; however, at least half the diameter on the small end of the post should be heartwood.
   1. Line posts: Three-inch or greater diameter, six-foot or longer in length, sound, and reasonably straight.
   2. Corner, gate, and in-line brace posts: Five-inch or greater diameter, seven-foot length or longer, straight and sound wood. Sound railroad ties and telephone poles are acceptable.
   3. Alternative methods for corners can be used for runs under 250 feet or less. This would include using a single post or railroad tie of 6" diameter or greater as a corner. This is not an alternative method for soils that are sandy loam, loamy sand and sand textured
   4. Alternative materials can be used in lieu of wood posts. Manufactured posts must be of high quality and durability and meet or exceed the strength, durability and longevity of a treated wood post

e. Steel Line T posts: Must be at least five and one-half feet in length and have knobs, studs, or grooves for holding wire in place; must be equipped with a sturdy anchor plate firmly attached.

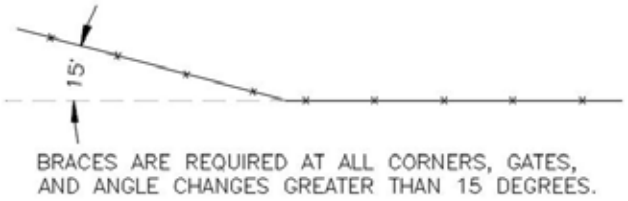
f. Steel Pipe Post: Round pipe or tubular steel, 2-3/8 inch outside diameter (OD) with wall thickness at least 0.125 or equivalent diameter and thickness or greater with a permeant sealed top can be used for corner, gate, and in-line brace posts and line posts.
   1. Steel pipe seven feet in length minimum will be set three feet deep.
   2. The horizontal brace member will be welded or sleeved or clamped. The diameter and weight of the brace member shall match the diameter and weight of the anchor and brace posts.

g. Brace material:
   1. Braces: Straight and sound 4 inches x 4 inches x 7 feet treated lumber or 4-inch diameter post of 7-foot length; or 2 3/8 inches x 7 feet steel pipe, with a wall thickness of 0.125 inches; or 1 5/8-inch x 7 feet solid steel rod. Braces will be securely attached to the vertical posts.
   2. Wire: Either of the following:
      1. Galvanized, double-strand 12.5-gauge.
      2. Galvanized, single-strand 9-gauge.

h. Wire fasteners:
   1. Staples: 9-gauge wire staples, 1-1/2 inches long (1-1/4-inch length may be used for high density hardwoods).
   2. Ties and/or clips: Made especially for the particular style of post used or #12 galvanized wire.

i. Stays: Galvanized, twisted, wire stays shall be long enough to hold each fence wire at specified spacing.

2. Construction:
   a. Post seating depth: All posts should be set deep enough to gain maximum sturdiness consistent with soil conditions. Set posts to the following depth under normal conditions:
      1. Line posts:
         a. Wood - 2 feet.
         b. Steel - 1 ½ fee
      2. Corner, in-line brace, and gate posts will be wood, seated at least three feet deep.
   b. Line post spacing
      1. Barbed-wire fence
         a. Up to 20 feet without stays
         b. Up to 30 feet with at least one stay. Stays must divide the space between posts about equally
         c. Woven-wire fence: Up to 20 feet.
   c. Bracing and anchoring: When fencing over uneven terrain, the fence shall be adequately anchored at low spots. *Braces are required at all corners, gates and definite angle changes (horizontal and vertical) greater than 15 degrees. Sound wood posts a minimum of 4 inches in diameter, buried a minimum of 2.5 feet deep, spaced no more than 12 feet apart are adequate for gentle turns less than 15 degrees.*



      1. In-line brace and end (gate) brace assemblies: Install at 1,320-foot intervals or closer, between corners or other major turns. Set two posts seven feet apart with a horizontal timber between the two. The brace member should be twice as long as it is high. Diagonal wires should run from the base of each post to the back side of the horizontal brace member, or higher, on the opposite posts. The angle between the ground and the brace wire should be not to exceed 30 degrees. A diagonal style brace may be used in place of the standard H-style brace. Gate ends may consist of telephone poles (or equivalent) installed at least 5 feet deep and attached at the top with galvanized wire.

      2. Corner braces: Set brace post-seven feet from the corner post with a horizontal timber between the posts. The brace member should be twice as long as it is high. Wrap and twist one diagonal wire from the bottom of the corner post to the back side of the horizontal brace member, or higher, on the opposite post. The angle between the ground and the

wire should not exceed 30 degrees. A diagonal style brace may be used in place of the standard H-style brace.

d. Wire placement: It is recommended that all line wires will be double-wrapped and stapled at all corners, in-line brace post assemblies, and gate posts.
   1. Barbed wire:
      a. Three-wire: Attach top wire at 40 to 44 inches above ground level at post locations, 42 inches above ground level is recommended. Attach middle and bottom wires so wire-to-wire and wire-to-ground intervals are all about equal.
      b. Four or more wire: Same as above, except operator may attach some wires closer together at their discretion, based on types of livestock involved.
   2. Woven wire
      a. Netting will be supplemented with a barbed wire attached approximately three inches above it. Attach bottom wire of netting about two inches above ground level at post locations.

B. Power Fence

The following are recommendations for a permanent power fence. For permanent power fence construction details, please see SD Job Sheet 382-3, Power Fence. Power fences erected in areas of potential high public use should be properly signed. Barbed wire will not be acceptable wire used for any power fence.

1. Wire
   a. Type: Use smooth, single-strand, 12.5-gauge high-tensile strength (170,000 PSI minimum), type III galvanized or better.
   b. Placement
      a. A single hot wire may be used in situations where the earth will provide an adequate ground to complete the circuit back to the energizer. This single hot wire should generally be located 24 to 32 inches above the ground line for cattle (cows) and at the nose height of the animal to be controlled when it is walking for other species and age classes.
      b. For two or more wires alternate ground and hot wires. The ground wires will be connected either directly to the negative side of the energizer or to the same grounding rod as the energizer. Listed below are suggested wire spacing (first distance is from ground level) and polarities for typical power fence uses.

Wire No.	Use	Spacing and Polarity
2	Cattle cross fence	20”(-), 10”(+)
3	Cattle cross fence	22”(+), 10”(-), 10”(+)
3	Horses	28”(+), 10”(-), 10”(+)
3	Hogs	6”(+), 8”(-), 10”(+)
4	Cattle boundary	12”(-), 10”(+), 10”(-), 10”(+)
5	Cattle boundary	12”(+), 6”(-), 10”(+), 10”(-), 10”(+)
5	Cattle feedlot	14”(+), 8”(-), 8”(+), 10”(-), 10”(+)
5	Horse boundary	18”(+), 6”(-), 6”(+), 8”(-), 10”(+)
5	Sheep, goat boundary	6”(+), 6”(-), 6”(+), 8”(-), 10”(+)
5	Buffalo	20”(+), 10”(-), 10”(+), 10”(-), 10”(+)

6	Sheep, goat boundary predator exclusion	6”(-), 6”(+), 6”(-), 6”(+), 8”(-), 10”(+)
7	Sheep, goat boundary predator exclusion	6”(+), 6”(-), 6”(+), 6”(-), 6”(+), 8”(-), 10”(+)

c. Tension: Tension on each wire shall be sufficient to maintain proper wire spacing between line posts. In-line strainers will be installed on each wire to maintain correct tension on each wire between all brace corners and gate assemblies. Tension springs may be used on each wire to maintain proper tension.

2. Line posts:
   a. Material:
      1. Fiberglass T-posts will be a minimum of one inch by one inch with notches to allow proper wire spacing. Fiberglass rods will be a minimum of seven-eighth of an inch diameter with notches or holes located for proper wire spacing.
      2. Self-insulating wood posts will have a diameter of one and one-half inches or larger. Posts must be treated or made from rot-resistant wood.
      3. Steel T posts will have a firmly attached anchor plate.
      4. Composite posts made of polypropylene and wood will be a minimum of one and one quarter inches in diameter, and be at least 60 inches in length.
   b. Placement requirements
      1. Permanent posts will be driven a minimum depth of 16 inches, except in sand where 24 inches may be required.
      2. For 3 or more wire power fences, line posts are not to exceed 75-foot centers without stays, or 100-foot centers with stays on 50-foot centers between line posts. Generally, posts are spaced to maintain desired wire spacing.
      3. For single-wire and two-wire power fences, line posts are not to exceed 75-foot centers. Stays should not be used on two-wire power fences. Generally, posts are spaced to maintain desired wire spacing.
   c. Corner, Gate, and Brace Assemblies - Braces are required at all corners, gates and definite angle changes (horizontal and vertical) greater than 15 degrees. Sound wood posts a minimum of 4 inches in diameter, buried 2.5 feet, spaced no more than 12 feet apart are adequate for gentle turns less than 15 degrees.
   d Materials and design will meet the same requirements as general-purpose fence.
      1. For permanent power fences, the diagonal or H-style style corner may be used. Gate ends may consist of telephone poles (or equivalent) installed at least five feet deep and attached at the top with galvanized wire.In-line brace assemblies will be spaced at intervals no greater than 4,000 feet on level terrain.Over uneven terrain, provide additional bracing as needed between corner, gate, end, and brace assemblies to put vertical pull of fencing on brace posts instead of line posts. Use properly anchored posts of adequate size with attached deadmen in low spots. On rises, use wood posts of four-inch diameter or larger to counteract downward pull.Fence Fasteners and Insulators
   a. Materials

1. On wood posts and steel posts, use porcelain, ceramic, or high-quality, UV-stabilized polypropylene insulator to which the wire can be attached. Polypropylene insulators shall be of the type that provides adequate spacing from the post to prevent current leakage.
2. Use only manufacturer's recommended insulators at all points where tension from the wire is transferred to corner, gate, end, and brace posts.

b. Attachment
   1. Attach wire to porcelain and ceramic insulators with the appropriate manufacturer's clip or use 12-gauge, galvanized wire.
   2. Attach wire to fiberglass and self-insulating wood posts and fiberglass rods, with the specifically designed manufacturer's fastener or "clip" or use 12.5-gauge galvanized wire tied in a loop to attach wire to post. Instead of using "clips" or wire ties, holes may be drilled in fiberglass rods. Holes should be drilled at the proper spacing. The line wire is not to be threaded through predrilled holes but will be attached with wire or proper fasteners. High-tensile strength wire is attached to the post using a short length of galvanized wire that is looped around the line wire, threaded through the hole in the post, and wrapped back around the line wire on either side of the post ("Cotter key" style fastener).

c. Stays: Fiberglass or self-insulating wood stays will be used.

d. Energizers: Electronic energizers or power-fence controllers shall be Underwriters Laboratory (UL) listed. Installation shall be according to manufacturer's recommendations. The maximum length of wire per controller shall not exceed manufacturer's recommendation for size and type of wire used. Controllers will have the following features and/or meet the following minimum specifications:
   1. High power, low impedance with 5,000-volt peak output, a pulse that is finished within 1/3,000 of a second, and 54-60 pulses per minute.
   2. High impact, weather-resistant cases
   3. Solid-state circuitry (snap-in circuit panels)
   4. Lightning arrester
   5. Safety-pace fuse
   6. Any of the following power requirements:
      a. 110-volt
      b. 220-volt
      c. 12-volt battery powered

e. Electrical Grounding: All power fences must be properly grounded with galvanized ground rods per the energizer manufacturer's recommendation. Inadequate grounding is the leading cause of power fences' failure to control livestock.

f. Insulated cable: To cross gates and other areas where the power fence is located some distance away from the energizer or controller, use 12.5-gauge insulated cable with 56 ohms or less of resistance per mile. Use galvanized wire with two layers of insulation for underground burial or overhead transmission. Where feasible, use overhead transmission to reduce the incidence of short-circuiting, which can occur with underground burial. Do not use copper insulated wire due to corrosion factor and lack of tensile strength.

C. PROTECTIVE FENCE

For details, please see SD Job Sheet 382-2, Protective Fence. Construct standard protective fences by the same method and design as specified for general purpose fence except for the following variations:

1. Construction:
    a. Post seating depth: All posts should be set deep enough to gain maximum sturdiness consistent with soil conditions. Set posts to the following depth under normal conditions:
        1. Line posts
            a. Wood: Two and one-half feet
            b. Steel: Two feet
        2. Line post spacing
            a. Sixteen feet; wood at least every third post. Applicable for barbed and woven-wire protective fence
        3. In-line bracing and anchoring
            a. Maximum 825-foot interval
2. Wire
    a. Minimum of four barbed wires with top wire at least 40 inches above the ground. 42 inches above ground level is recommended. Lower wires to be spaced at the discretion of the operator, based upon types of livestock to be excluded.
    b. Woven wire will have at least one barbed wire attached approximately three inches above the top of the woven wire.

D. CHAIN-LINK FENCE

For use as protective fence where high-hazard risks need to be reduced (i.e., around waste storage structures, power generators, etc.).

1. Materials
    a. Wire:
        1. Fabric wire will be a minimum of 11.5-gauge, 2½ inch mesh, 48 inches high, with zinc coating or equivalent.
        2. Barbed wire: See General Purpose Fence design section for barbed wire specifications
    b. Posts
        1. Line posts: galvanized steel with a minimum outside diameter of 1⅝ inches, a length of 5½ feet, and a wall thickness of .08 inches.
        2. Corner posts: galvanized steel with a minimum outside diameter of 2⅜ inches, a length of 6 feet, and a wall thickness of .125 inches.
        3. Gate posts: galvanized steel with a minimum diameter and length to support the gate width needed according to the manufacturer's recommendations
    c. Top Rail
        1. Will be galvanized steel pipe, or equivalent, with a minimum diameter of 1⅝ inches with a wall thickness of .08 inches
    d. Gates
        1. Gates will be of the size necessary to allow for equipment access
        2. Gates shall be installed according to manufacturer's recommendations
        3. Gates may be single-swing or double-swing with the appropriate fittings for latches, stops, hinges, keepers, and other needed accessories. All materials will be steel with zinc coating or equivalent

e. Chain-link fence accessories
    1. Caps, rail and brace ends, rail sleeves, wire ties and clips, brace bands, tension bands, tension bars, tension wire, barbed wire support arms, and other accessories will be of steel and zinc coated as per manufacturer's recommendations. Install lock, latches, or chains where safety is a concern.
2. Construction - All chain-link fences will be constructed according to the manufacturer's recommendations and/or completed job sheets.

E. Fence Design for specialized livestock management systems and other animals for managed intensive grazing.

Prescribed grazing systems where livestock are rotated rapidly through a series of varying sized temporary paddocks may utilize single polywire electric fencing. The wire, twine, tape, or rope shall contain a minimum of six mixed metal strands consisting of stainless steel and aluminum or tinned copper (all stainless-steel strands are not adequate). Posts and wire will be of high quality, durability, and easily inserted into the ground and have clips or other method of insuring easy attachment of the wire, twine, or tape. Post will generally be spaced about 40 feet apart. Wire height will be set at the height of the nose of the animal to be controlled when walking.

F. Wildlife

Please refer to the Wyoming Game and Fish Department, Habitat Extension Bulletin No. 53, 2004, for additional configurations related to fencing for wildlife.

1. Bison
    a. Boundary fences: The minimum specification for a bison boundary fence is a standard protective fence with the following exceptions.–The fence will have at least 6 barb wires with a top wire set at least 52 inches in height. 6 ½ foot length steel T posts will be utilized in place of the standard 5 ½ foot length, steel T post. Wood posts will be 7 feet in length.
    b. Internal cross fences: The minimum design criteria are a standard three-wire barbed or two-wire power fence. Fences exceeding minimum criteria will be dependent on producer's need and management
2. Elk
    a. Boundary fences: The minimum height will be eight feet. Woven wire with a 6 x 6 inches even spacing or 3 x 7 inches variable spacing will be used. 7 feet of woven wire with at least two high tensile wires spaced 6 inches apart may also be used. Corner, gate, and inline brace posts will be treated wood and a minimum of 8 inches in diameter and 14 ½ inches length and placed 5 ½ feet in the ground. Line posts will be treated wood with a minimum diameter of 6 inches and 13 ½ feet in length and placed 5 feet in the ground. Maximum line post spacing will be 20 feet.
    b. Internal cross fences: The minimum height will be 6 feet. Woven wire with 6 x 6 inch even spacing or 3 x 7 inches variable spacing will be used. 5 feet of woven wire with at least 2 high tensile wires spaced 6 inches apart may also be used. Corner, gate, and inline brace posts will be a minimum of 6 inches in diameter and 10 ½ feet in length and placed 4 feet in the ground. Line posts will be treated wood and a minimum of 4 inches in diameter and 10 feet in length and placed 3 ½ feet in the ground. Maximum line post spacing is 20 feet. Specifications for power fence may also be used. Power fences will be a minimum of 6 feet tall with 7 wires spaced approximately 10 inches apart, if steel posts are used the posts will be 8 ½ feet long buried 2 ½ feet deep. Posts

should be spaced no more than 45 feet apart with stays every 15 feet. A treated wood post 6-inches in diameter, 9 ½ feet long placed 3 feet in the ground should be installed every 4 posts.

c. Cross fencing for livestock control in elk country: Migrating elk can cause severe damage to standard barbed wire fencing. To reduce elk impacts a 3/8-inch steel cable should be used as a replacement for the top barbed wire. A four-wire fence is required with the steel cable replacing the top barbed wire.

3. Deer
Boundary and internal cross fences: Same requirement as for elk boundary fences except the minimum height will be nine feet for both boundary and cross fences. Power fence will not be used

4. Horses
To minimize or prevent injury, double-strand, galvanized, barbless wire of 12.5-gauge may be substituted for the barbed wire in a general-purpose or protective fence

5. Wildlife Friendly: Antelope and Deer Internal Cross Fence Design
Deer and antelope often share large areas of habitat in SD, and fences that aid the movement of both species can be designed in a manner that serves as a barrier for sheep and cattle. Construct wildlife friendly fences by the same method and design as specified for general purpose fence except for the following variations see SD Job Sheet 382-4:

a. Sheep or Sheep and Cattle Fences: The height of the top wire will be 38 inches above the ground. The distance between the top and second wire must be 12 inches apart to ensure the hind legs of deer or antelope are not entangled in the fence wires if they are not able to clear the wires when jumping. The bottom wire must be smooth 12.5-gauge double strand wire and placed 10 inches from the ground. The remaining wires will be 12.5-gauge barbed wire and will be evenly spaced. Either a 4 or 5 wire design is possible (see deer and antelope fence drawings.)

b. Cattle Fences: The height of the top wire will be 38 to 42 inches above the ground surface, however 40 inches is optimal to maintain a barrier for livestock and aid in wildlife movement. The distance between the top and second wire must be 12 inches apart to ensure the hind legs of deer or antelope are not entangled in the fence wires if they are not able to clear the wires when jumping. The bottom wire will be smooth double strand 12.5-gauge wire and placed 16 to 18 inches from the ground to ensure passage by antelope and young deer. Any remaining wires will be 12.5-gauge barbed wire and will be evenly spaced. Either a 3 or 4 wire design is possible (see deer and antelope fence drawings.)

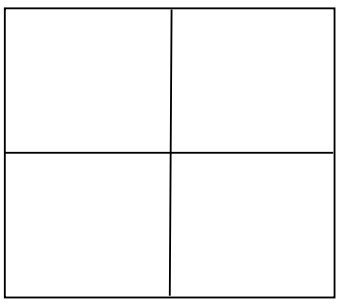
G. Stream Crossing
Because of continual maintenance requirements and potential negative impacts on water quality and threatened and endangered species, construction of fences which cross streams should be avoided whenever possible. When fences that cross streams must be constructed, reasonable precautions should be taken to reduce any negative impact to the stream and associated species. SD JS 382-7, Fence Stream Crossing, describes several methods of constructing fences across streams which will minimize impacts. These methods should be used in place of standard fence building techniques when crossing streams.

SPECIFICATION SHEET FENCING (382)

Type/purpose of Fence: **Power**

	Planned	*Applied*
Tract / Field(s) / CIN	Tract Field(s) CIN	
Length of Fence (feet)		
Wire		Wheel__GPS__Photo__
Wire Type:	Energized Electric Smooth wire	
Number of Wires	3	
Gauge and Galvanization	12.5 gauge type III galvanized or better	
Number of strands per wire	Smooth Single strand wire	
Tensile strength (psi)	High-tensile 170,000 PSI minimum	
Wire wrap at braces	Double wrap wire recommended	
Fasteners	Manufacturer's recommended insulators	
Height (from bottom) & Polarization	Cattle cross fence 22”(+), 10”(-), 10”(+)	
In-line strainers on each wire	Between all braces, corners and gate assemblies	
Line Posts		
Type	Steel T posts	
Material	With firmly attached anchor plate	
Depth	Minimum 16" (except Sand 24")	
Spacing	75' maximum (100' maximum with stays)	
Stays		
Stay Type	Non conductive Material	
Stay Spacing	50' - center in between posts	
Corner, Gate & Brace Posts		
Type and Size	Treated Wood Post 5" dia.	
Post Length and Depth	7' long 3' deep	
H Brace assembly spacing	4000' or less & at Angle Changes > 15 degrees	
Horizontal Brace Material		
Type of material	Treated Lumber	
Size | Diameter & wall thickness	4" x 4" treated lumber	
Length	7.0' minimum	
Energizer		
Features	High power, low impedance 5000 volt peak	
Voltage	12 volt - battery powered 54-60 pulses per minute	
Grounding	Galvanized Rods	

Location Map



Sec. _____

Twp. _____

Rng. _____

Producer:

Planner : *Title:* 6/4/2019 Date

Application Documented by: *Title:* Date

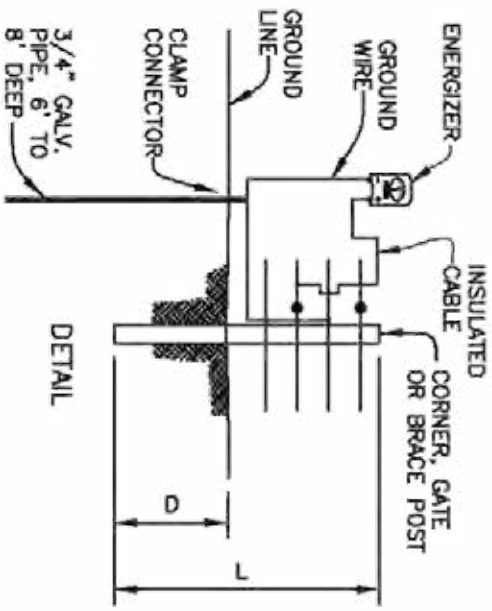
Practice Meets SD Standards and Specifications Yes ☐

If no fully explain on back of this sheet. *No* ☐

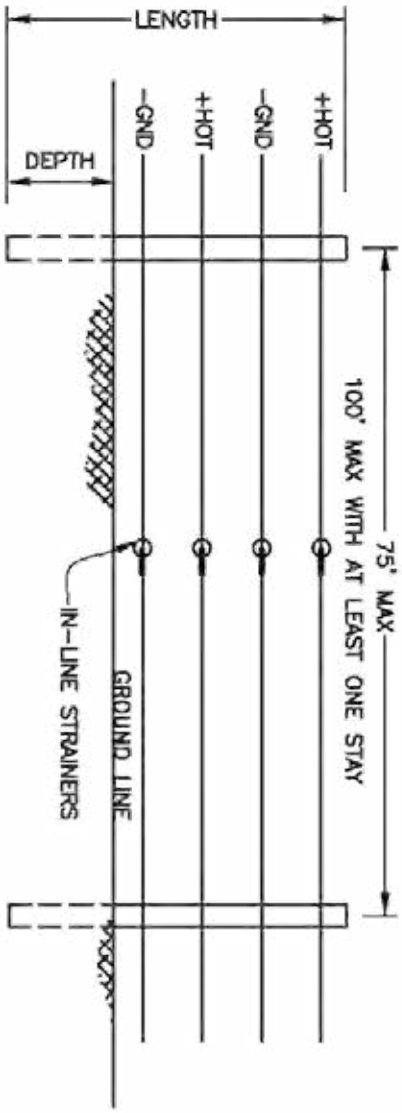
Additional Planning and/or Application Notes

Date:

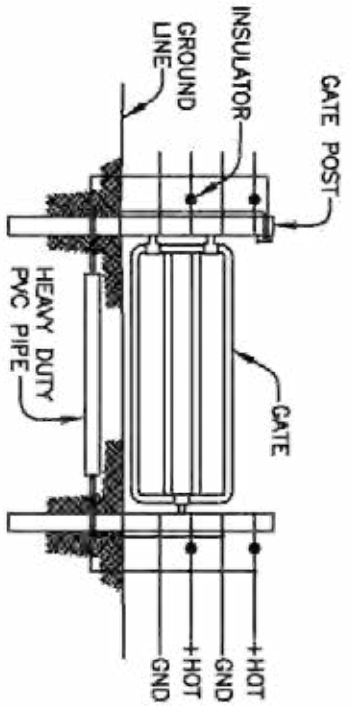
Notes:



DETAIL



LINE PANEL



ROAD CROSSING DETAIL

DRAWING NOT TO SCALE

USDA United States Department of Agriculture Natural Resources Conservation Service	POWER FENCE CLIENT: 0 DRAWN: Jared Gelderman PLANNER: DATE PLANNED: 6/4/2019	Drawing Name 382-3 Date 3/19 Sheet 1 of 2

LINE POSTS

WOOD:

DIA. = 1.5" MIN
DEPTH = 16" MIN EXCEPT 24" IN SAND

ALL WOOD POSTS MUST BE TREATED OR MADE FROM ROT-RESISTANT WOOD.

STEEL "T" POST:

DEPTH= 16" MIN EXCEPT 24" IN SAND

ALL STEEL POSTS WILL HAVE AN ANCHOR PLATE AND STUDDED

FIBERGLASS:

DIA. = $\frac{7}{8}$" MIN OR 1" x 1" MIN
DEPTH = 16" MIN EXCEPT 24" IN SAND

ALL FIBERGLASS POSTS MUST BE NOTCHED TO ALLOW PROPER WIRE SPACING

PLASTIC/COMPOSITE:

DIA. = 1.25" MIN
DEPTH = 16" MIN EXCEPT 24" IN SAND

ALL PLASTIC/COMPOSITE POSTS MUST BE UV PROTECTED

ENERGIZERS

ALL ENERGIZERS SHALL BE INSTALLED AS PER MANUFACTURER'S RECOMMENDATIONS AND BE UNDERWRITERS LABORATORY (UL) LISTED

HIGH POWER, LOW IMPEDANCE WITH 5,000 VOLT PEAK OUTPUT, A PULSE LESS THAN 1/3,000 OF A SECOND, AND 54-60 PULSES PER MINUTE

HIGH IMPACT, WEATHER RESISTANT CASES

ENERGIZERS SHALL HAVE SOLID STATE CIRCUITRY, LIGHTNING ARRESTER, AND A SAFETY PACE FUSE

110 VOLT, 220 VOLT, OR 12 VOLT BATTERY POWER CAN BE USED

WIRE

12.5-GAUGE HIGH TENSILE WIRE, 170,000 PSI MIN. TENSILE STRENGTH WITH TYPE 3 GALVANIZING

FASTENERS

ON WOOD AND STEEL POSTS USE PORCELAIN, CERAMIC, OR HIGH QUALITY, UV-STABILIZED POLYPROPYLENE INSULATOR TO WHICH THE WIRE CAN BE ATTACHED

ATTACH WIRE TO PORCELAIN AND CERAMIC INSULATORS WITH MANUFACTURER'S CLIP OR USE 12-GAUGE, GALVANIZED WIRE

USE MANUFACTURER'S CLIPS OR 12.5-GAUGE GALVANIZED WIRE TO FASTEN WIRES TO FIBERGLASS, AND SELF-INSULATING WOOD POSTS

FIBERGLASS OR SELF-INSULATING WOOD STAYS WILL BE USED

NOTES

BARBED WIRE SHALL NOT BE ELECTRIFIED OR INSULATED FOR ELECTRIFICATION

BRACES ARE REQUIRED AT ALL CORNERS, GATES, AND ANGLES GREATER THAN 15 DEGREES VERTICAL OR HORIZONTAL

ALL ELECTRIC FENCES SHALL BE GROUNDED WITH GALVANIZED GROUND RODS

USE 12.5-GAUGE INSULATED CABLE WITH 56 OHMS OR LESS OF RESISTANCE PER MILE WHERE THE FENCE IS LOCATED SOME DISTANCE FROM THE ENERGIZER

FOR SINGLE-WIRE AND TWO-WIRE POWER FENCES, LINE POSTS ARE NOT TO EXCEED 75' CENTERS

STAYS SHOULD NOT BE USED ON TWO-WIRE POWER FENCES

INSTALL BRACES AT 4,000' INTERVALS OR CLOSER

REFER TO THE SD NRCS STANDARD 382-FENCE, SD-CPA-23 FORM, AND SD NRCS RANGE TECHNICAL NOTE 7 FOR MORE INFORMATION.

Drawing Name 382-3	Date 3/19	Sheet 2 of 2

POWER FENCE

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DRAWN: Jared Gelderman

DATE PLANNED: 6/4/2019

CLIENT:

PLANNER:

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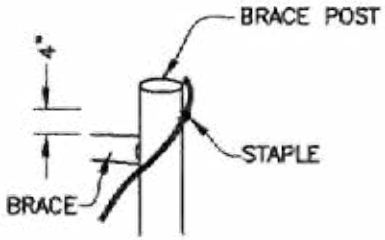
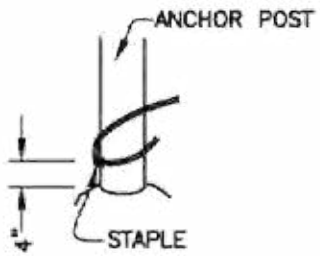
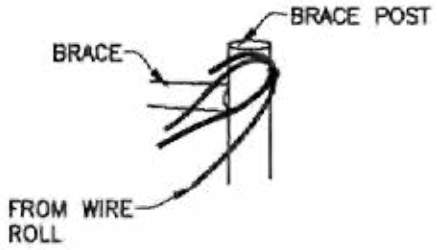
Natural Resources Conservation Service



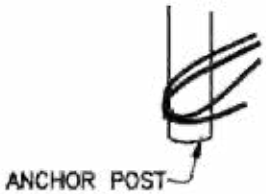
DRIVE STAPLE ABOUT HALF ITS LENGTH INTO BRACE POST ABOUT 4 INCHES ABOVE BRACE MEMBER ON OPPOSITE SIDE FROM BRACE.



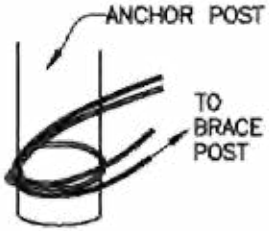
DRIVE STAPLE IN SIMILAR MANNER ON ANCHOR POST ABOUT 4 INCHES FROM GROUND LINE OPPOSITE SIDE OF BRACE.



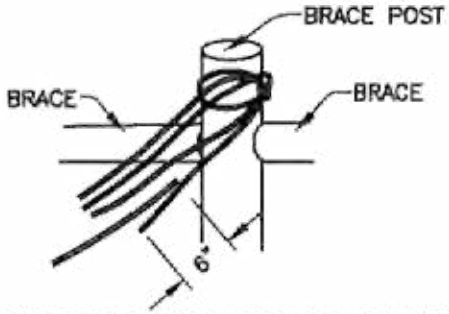
UNROLL ENOUGH BRACE WIRE FOR 2 COMPLETE LOOPS AROUND ANCHOR AND BRACE POST.



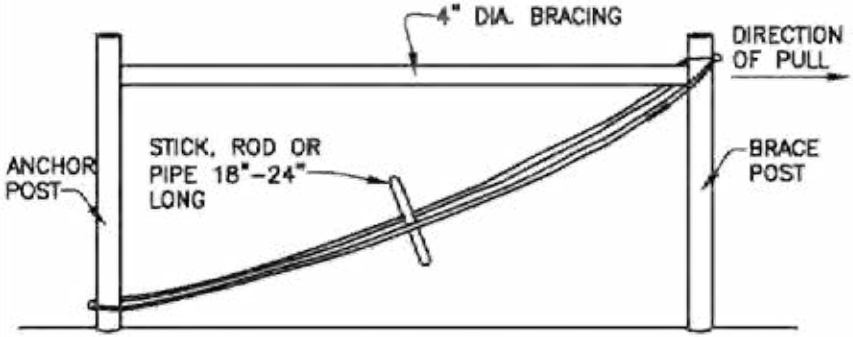
THREAD END OF BRACE WIRE THOUGH 1 STAPLE AND THEN THROUGH THE OTHER. REPEAT TO FORM 3 WIRE STRANDS.

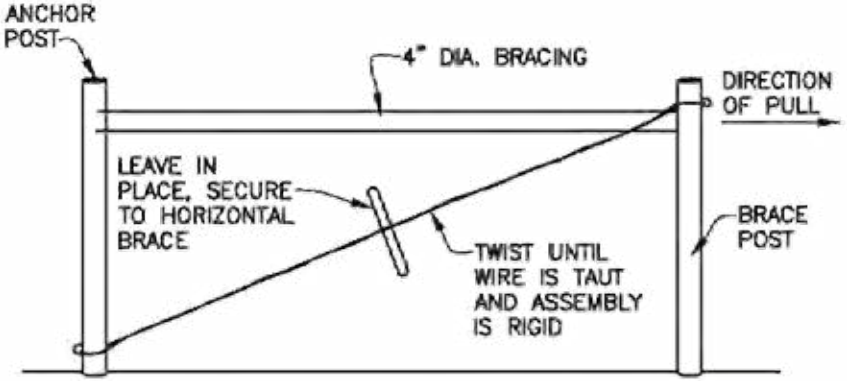


WRAP WIRE AROUND ANCHOR POST AND RETURN TOWARD BRACE POST.



CUT BRACE WIRE FROM ROLL ALLOWING ENOUGH WIRE TO WRAP AROUND BRACE POST AND EXTEND 6 TO 12 INCHES PAST OTHER WIRE END. MAKE SPLICE.





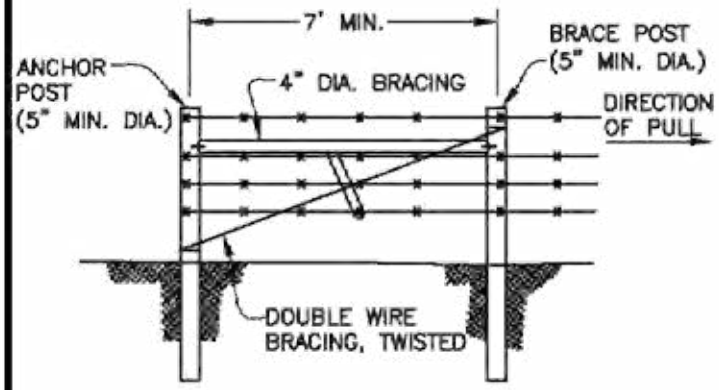
DRAWING NOT TO SCALE

Drawing Name: 382-6
Date: 3/19
Sheet 1 of 2

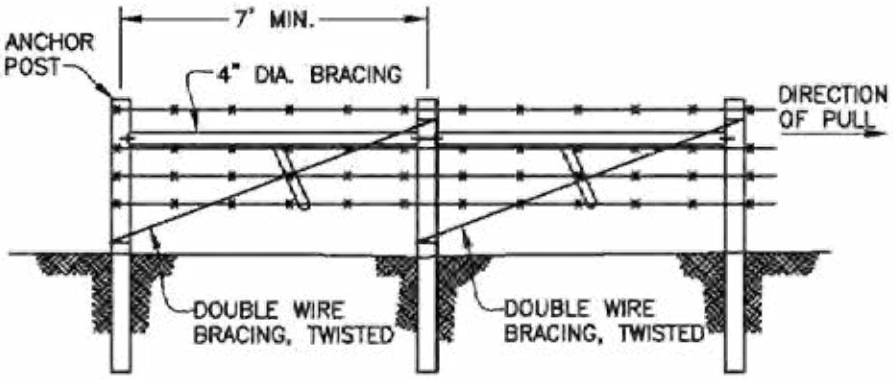
FENCE BRACES

DRAWN: Jared Gelderman
DATE PLANNED: 6/4/2019
CLIENT: 0
PLANNER:

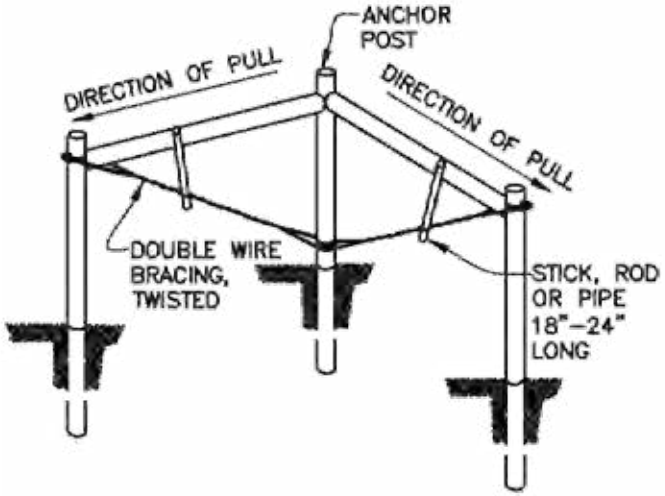
United States Department of Agriculture
Natural Resources Conservation Service



HORIZONTAL END

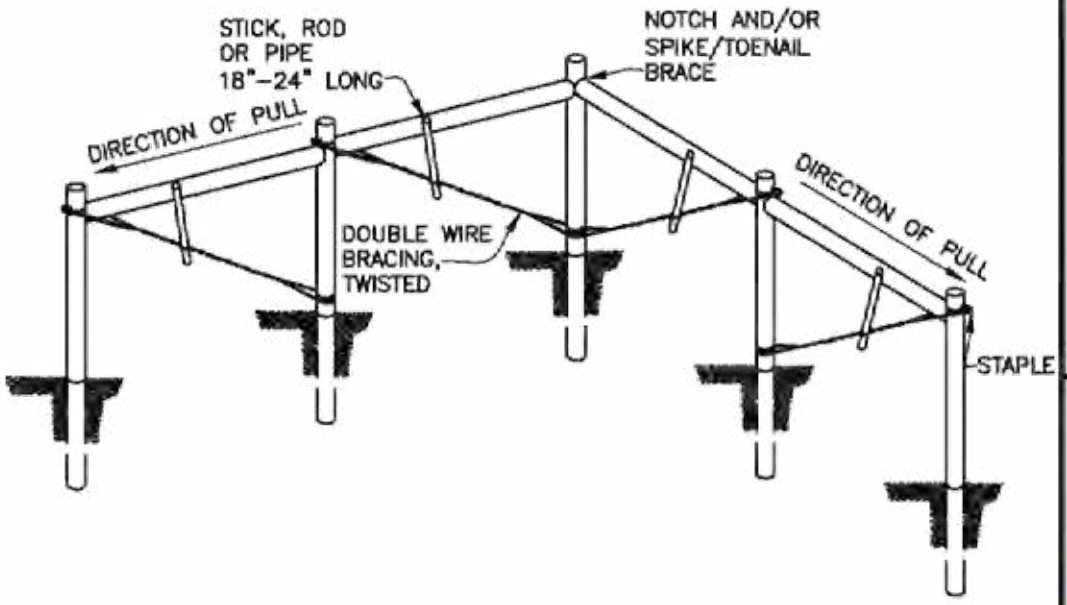


DOUBLE HORIZONTAL END



HORIZONTAL CORNER BRACE DETAIL

CORNER ANGLE 90° OR LESS



DOUBLE HORIZONTAL BRACE

CORNER ANGLE 90° OR GREATER

DRAWING NOT TO SCALE

Drawing Name 382-6 | Date 3/19 | Sheet 2 of 2

FENCE BRACES

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DRAWN: Jared Gelderman

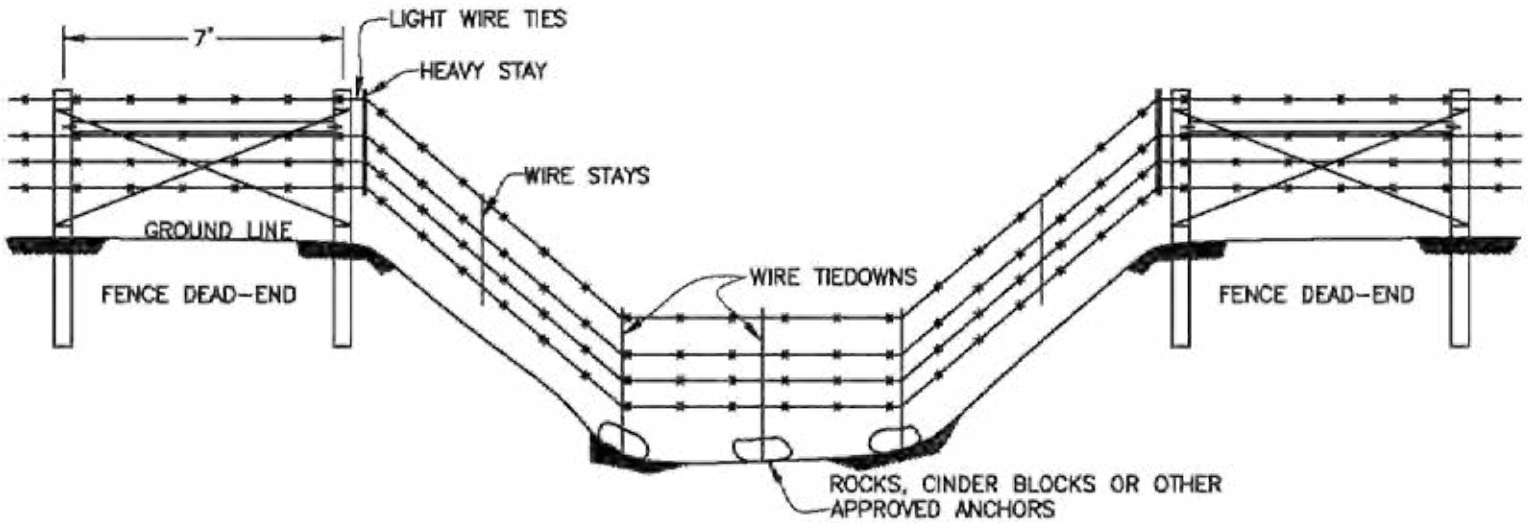
DATE PLANNED: 6/4/2019

CLIENT:

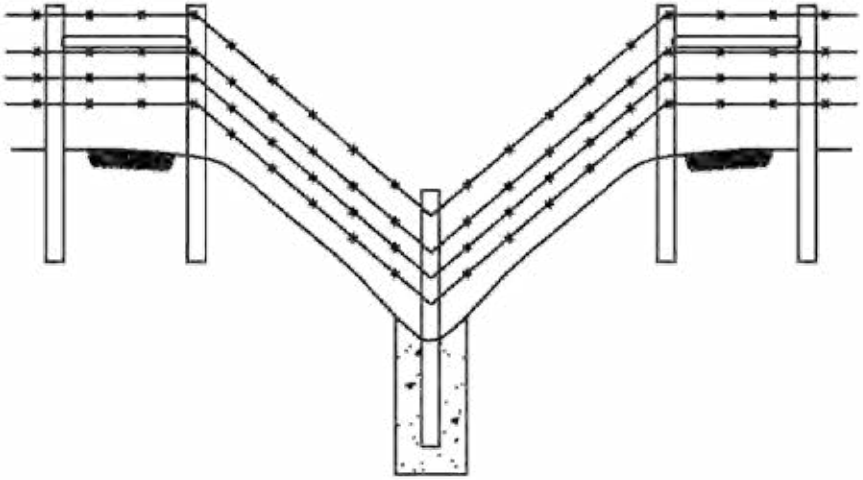
PLANNER:

USDA United States Department of Agriculture

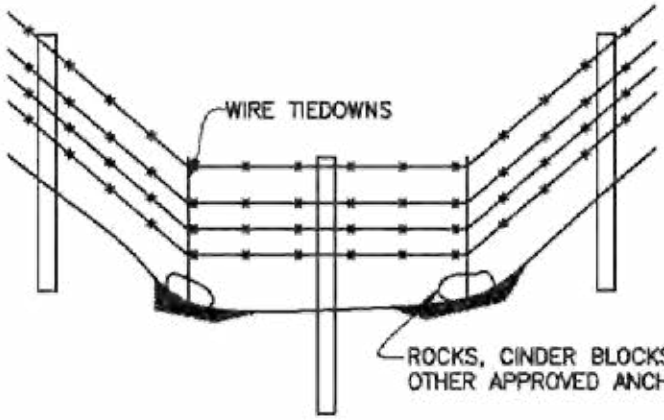
Natural Resources Conservation Service



DETACHABLE WIRE PANEL WITH ANCHORS
FOR DEEP WASHES AND LIVE STREAMS



FENCE POST ANCHOR



ANCHORS IN DRY DRAWS

DRAWING NOT TO SCALE

Drawing Name: 382-7
Date: 3/19
Sheet 1 of 2

DRY DRAW AND STREAM CROSSING FENCE

CLIENT: 0
DRAWN: Jared Gelderman
DATE PLANNED: 6/4/2019
PLANNER:

United States Department of Agriculture
Natural Resources Conservation Service

LINE POSTS

WOOD:

DIA. = 3" MIN.
LENGTH = 6' MIN.
DEPTH = 2' MIN.

ALL DECAY-SUSCEPTIBLE WOOD POSTS MUST BE PRESSURE TREATED

AT LEAST HALF THE DIAMETER OF POSTS MADE FROM ROT RESISTANT WOOD SHALL BE HEARTWOOD.

STEEL "T" POST:

LENGTH = 5.5' MIN.
DEPTH = 1.5' MIN.

ALL STEEL POSTS WILL HAVE AN ANCHOR PLATE AND STUDDED

STEEL PIPE POST:

DIA. = 2-3/8" OUTSIDE DIAMETER MIN.
WALL THICKNESS = 0.125" MIN.

LENGTH = 7' MIN.
DEPTH = 3' MIN.

FASTENERS

STAPLES SHALL BE 9-GAUGE, GALVANIZED STEEL OR HEAVIER

1-1/2" MIN. LENGTH FOR SOFTWOODS

1-1/4" MIN. LENGTH FOR HARDWOODS

MANUFACTURER'S CLIPS/TIES OR 12-GAUGE WIRE MAY BE USED TO FASTEN WIRES TO STEEL POSTS

NOTES

BARBED WIRE SHALL NOT BE ELECTRIFIED OR INSULATED FOR ELECTRIFICATION

BRACES ARE REQUIRED AT ALL CORNERS, GATES, AND ANGLE CHANGES GREATER THAN 15 DEGREES

WIRES SHOULD BE DOUBLE WRAPPED AND STAPLED AT ALL CORNERS, IN-LINE BRACE ASSEMBLIES, AND GATE POSTS

INSTALL BRACES AT 1,320' INTERVALS OR CLOSER

WIRE

DOUBLE STRAND OF 12.5-GAUGE STEEL WIRE OR 15.5-GAUGE HIGH TENSILE WIRE

MIN. 2 POINT BARBS WITH A SPACING OF 4 TO 6 INCHES

11-GAUGE OR HEAVIER FOR TOP AND BOTTOM STRANDS OF WOVEN WIRE

14.5-GAUGE OR HEAVIER FOR INTERMEDIATE AND STAY WIRES, MAX 12" APART SPACING FOR WOVEN WIRE

26-34 INCH HIGH NETTING FOR STANDARD WOVEN WIRE; 42 INCH HIGH NETTING FOR HIGH TENSILE WOVEN WIRE

ALL WIRES SHALL BE GALVANIZED

BRACES

WOOD:
- BRACE MEMBER:
  - DIA. = 4" MIN. OR 4" X 4"
  - LENGTH = 7' MIN.
- VERTICAL POSTS:
  - DIA. = 5" MIN.
  - LENGTH = 7' OR LONGER

STEEL:
- BRACE MEMBER:
  - DIA = 2-3/8" OUTSIDE DIAMETER MIN. OR 1-5/8" SOLID STEEL ROD
  - WALL THICKNESS = 0.125" MIN. IF NOT SOLID STEEL ROD
  - LENGTH = 7' MIN.
- VERTICAL POSTS:
  - ROUND PIPES OR TUBULAR STEEL 2-3/8" MIN. OUTSIDE DIA.
  - WALL THICKNESS = 0.125" MIN. WITH A PERMANENT SEALED TOP
  - BRACE MEMBER WELDED, SLEEVED, OR CLAMPED TO VERTICAL POSTS

WIRE:

GALVANIZED, DOUBLE STRAND 12.5-GAUGE OR GALVANIZED, SINGLE STRAND 9-GAUGE.

REFER TO THE SD NRCS STANDARD 382-FENCE, SD-CPA-23 FORM, AND SD NRCS RANGE TECHNICAL NOTE 7 FOR MORE INFORMATION.

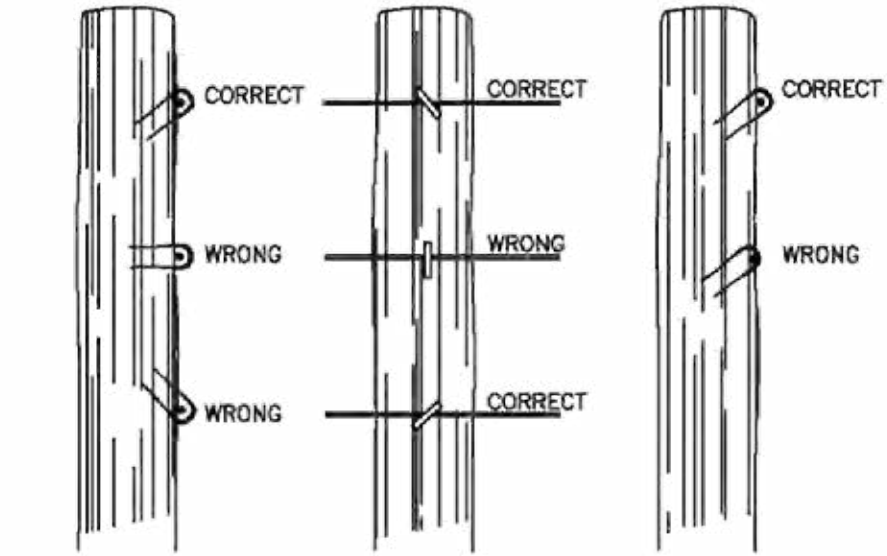
Drawing Name 382-7 | Date 3/19 | Sheet 2 of 2

DRY DRAW AND STREAM CROSSING FENCE

CLIENT: 0 DRAWN: Jared Gelderman DATE PLANNED: 6/4/2019

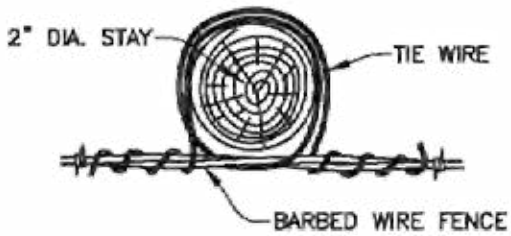
PLANNER:

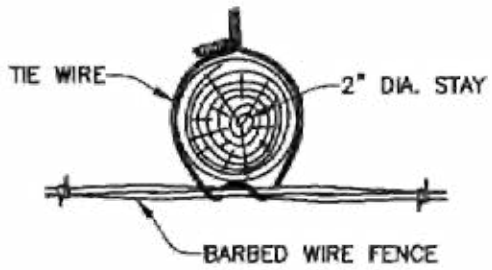
USDA United States Department of Agriculture
Natural Resources Conservation Service



ATTACHMENT

STAPLES





"WESTERN UNION" SPLICE

DRAWING NOT TO SCALE

Drawing Name 382-8 | Date 3/19 | Sheet 1 of 2

STAPLES AND WIRE ATTACHMENT

0

CLIENT:

DRAWN: Jared Gelderman

PLANNER:

DATE PLANNED: 6/4/2019

USDA United States Department of Agriculture
Natural Resources Conservation Service

LINE POSTS

WOOD:

DIA. = 3" MIN.
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DEPTH = 2' MIN.

ALL DECAY-SUSCEPTIBLE WOOD POSTS MUST BE PRESSURE TREATED

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STEEL PIPE POST:

DIA. = 2-3/8" OUTSIDE DIAMETER MIN.
WALL THICKNESS = 0.125" MIN.

LENGTH = 7' MIN.
DEPTH = 3' MIN.

FASTENERS

STAPLES SHALL BE 9-GAUGE, GALVANIZED STEEL OR HEAVIER

1-1/2" MIN. LENGTH FOR SOFTWOODS

1-1/4" MIN. LENGTH FOR HARDWOODS

MANUFACTURER'S CLIPS/TIES OR 12-GAUGE WIRE MAY BE USED TO FASTEN WIRES TO STEEL POSTS

NOTES

BARBED WIRE SHALL NOT BE ELECTRIFIED OR INSULATED FOR ELECTRIFICATION

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INSTALL BRACES AT 1,320' INTERVALS OR CLOSER

WIRE

DOUBLE STRAND OF 12.5-GAUGE STEEL WIRE OR 15.5-GAUGE HIGH TENSILE WIRE

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ALL WIRES SHALL BE GALVANIZED

BRACES

WOOD:
- BRACE MEMBER:
  - DIA. = 4" MIN. OR 4" X 4"
  - LENGTH = 7' MIN.
- VERTICAL POSTS:
  - DIA. = 5" MIN.
  - LENGTH = 7' OR LONGER

STEEL:
- BRACE MEMBER:
  - DIA = 2-3/8" OUTSIDE DIAMETER MIN. OR 1-5/8" SOLID STEEL ROD
  - WALL THICKNESS = 0.125" MIN. IF NOT SOLID STEEL ROD
  - LENGTH = 7' MIN.
- VERTICAL POSTS:
  - ROUND PIPES OR TUBULAR STEEL 2-3/8" MIN. OUTSIDE DIA.
  - WALL THICKNESS = 0.125" MIN. WITH A PERMANENT SEALED TOP
  - BRACE MEMBER WELDED, SLEEVED, OR CLAMPED TO VERTICAL POSTS

WIRE:

GALVANIZED, DOUBLE STRAND 12.5-GAUGE OR GALVANIZED, SINGLE STRAND 9-GAUGE.

REFER TO THE SD NRCS STANDARD 382-FENCE, SD-CPA-23 FORM, AND SD NRCS RANGE TECHNICAL NOTE 7 FOR MORE INFORMATION.

Drawing Name 382-8 | Date 3/19 | Sheet 2 of 2

STAPLES AND WIRE ATTACHMENT

0

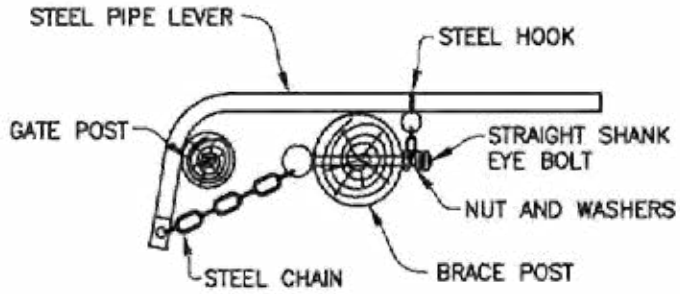
DRAWN: Jared Gelderman

DATE PLANNED: 6/4/2019

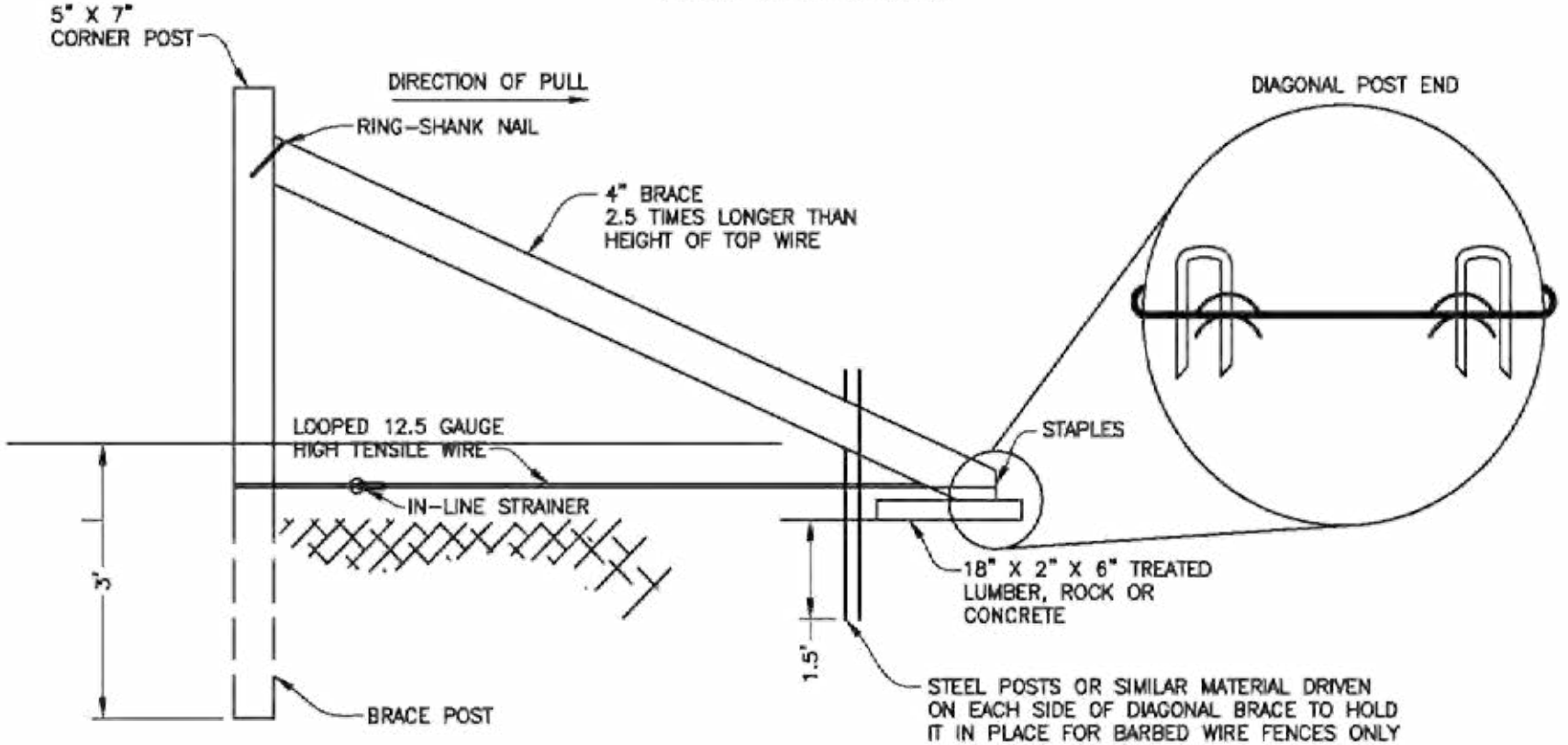
CLIENT:

PLANNER:

USDA United States Department of Agriculture
Natural Resources Conservation Service



PLAN VIEW
METAL GATE CLOSER



FLOATING BRACE ASSEMBLY

DRAWING NOT TO SCALE

Drawing Name 382-9 | Data 3/19 | Sheet 1 of 2

DIAGONAL BRACE AND METAL GATE CLOSER

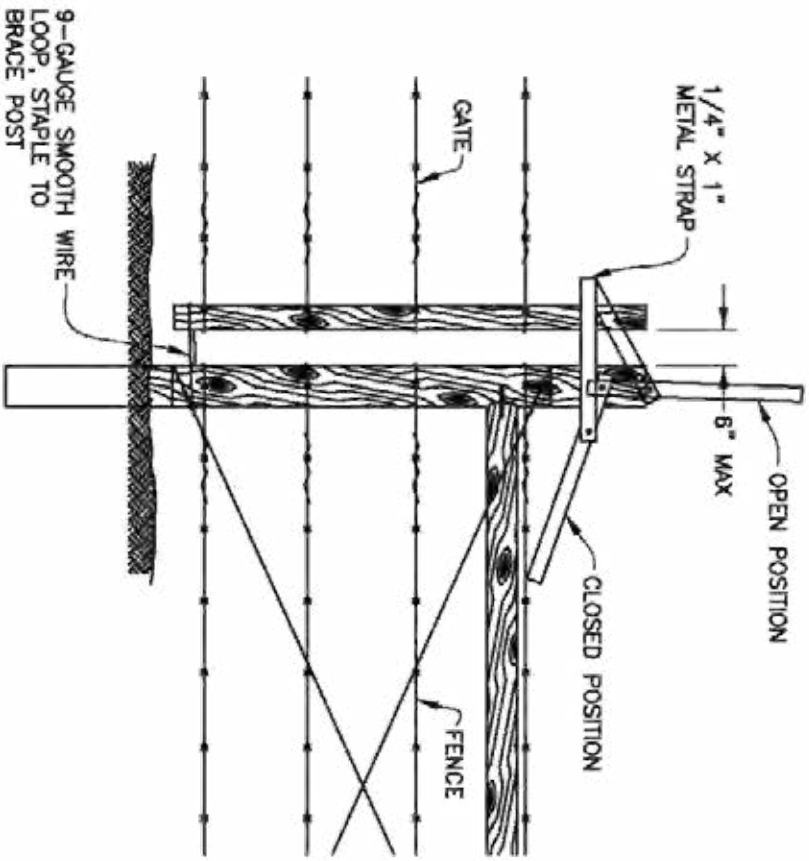
DRAWN: Jared Gelderman

CLIENT: 0

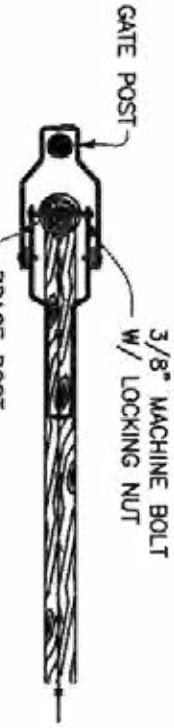
DATE PLANNED: 6/4/2019

PLANNER:

United States Department of Agriculture
Natural Resources Conservation Service



ELEVATION



PLAN VIEW
METAL GATE CLOSER

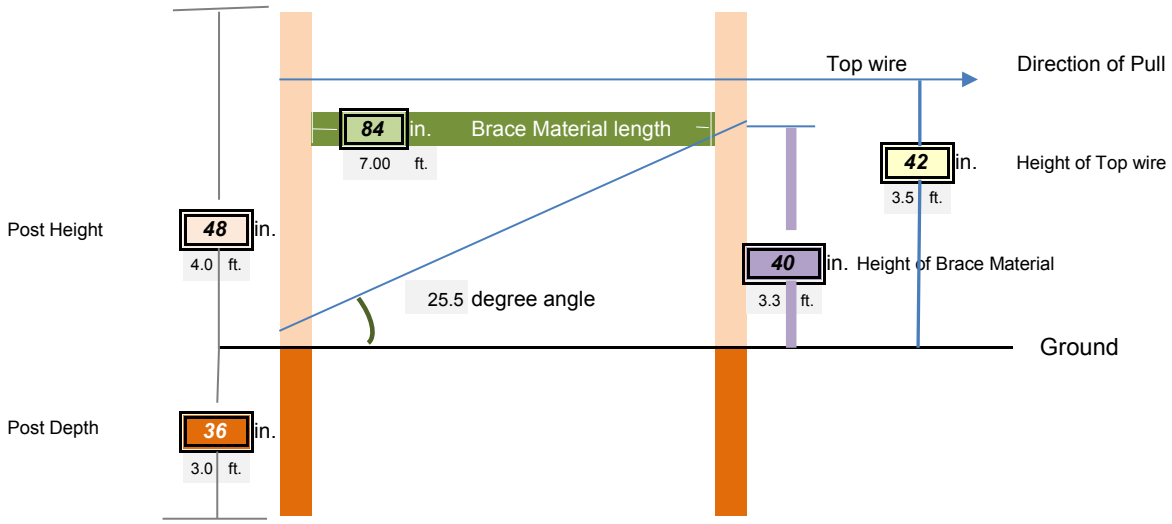
DRAWING NOT TO SCALE

USDA United States Department of Agriculture Natural Resources Conservation Service	METAL GATE CLOSER CLIENT: 0 DRAWN: Jared Gelderman PLANNER: DATE PLANNED: 6/4/2019	Drawing Name 382-9 Date 3/19 Sheet 2 of 2

Corner/Gate and In-line Brace Measurement Checkout Tool

Producer Name	
Field	
Fence Type:	
Number of Wires	
Livestock Type	

Enter measurements in colored cells in the drawing below



Material or construction feature	Measured		SD Range Tech Note 7 Criteria		SD Range Tech Note 7 Criteria Met
Post Height - Above ground	48	in.	48 in.	min	Yes
Post Depth - Below Ground	36	in.	36 in.	min	Yes
Brace Material length	84	in.	84 in.	min	Yes
Brace Material height	40	in.			
Top Wire Height	42	in.	38 in.	min	Yes
Angle (degrees)	25.5	°	30 °	max	Yes
Ratio of Brace length to height	2.1	: 1	2 : 1	min	Yes

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