Beef Cattle Handbook

BCH-6202

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# Fence Systems for Grazing Management
# 2. Permanent Electric Fence Materials

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One of the initial management considerations in designing grazing systems is selection and installation of the proper fencing system. Three types of fencing are likely to be used in a grazing cell: perimeter, permanent subdivision, and temporary or portable fencing. Perimeter fence and permanent paddock fencing is most satisfactorily done with electrified 12.5 gauge hi-tensile wire. This chapter deals with permanent fence material selection and proper installation of hi-tensile electrified fences for grazing systems.

## Hi-Tensile Wire

Numerous options exist in the hi-tensile wire market today. Wire may be galvanized steel, aluminum, or aluminum clad steel. Several gauges and breaking strengths of wire within the different wire types are available. Each material is touted for its specific advantages while its particular disadvantages are often overlooked.

Hi-tensile steel wire typically carries class 3 galvanization and occasionally class 4. This refers to the amount of zinc coating on the wire. Standard barbwire and woven wire are class 1 galvanization. Class 3 wire carries three times as much zinc coating per unit area as class 1 wire. This translates to more than twice the expected life for the wire. For example, a 12.5 gauge. Class 1 wire would be expected to show rust in 6 - 10 years depending upon climatic conditions while class 3 wire would take 13 - 30 years to show the same amount of rust.

Two different galvanization methods are used in the production of hi-tensile wire. The hot-dip process had been the industry standard for many years. This process can produce a wire with a somewhat dull appearance

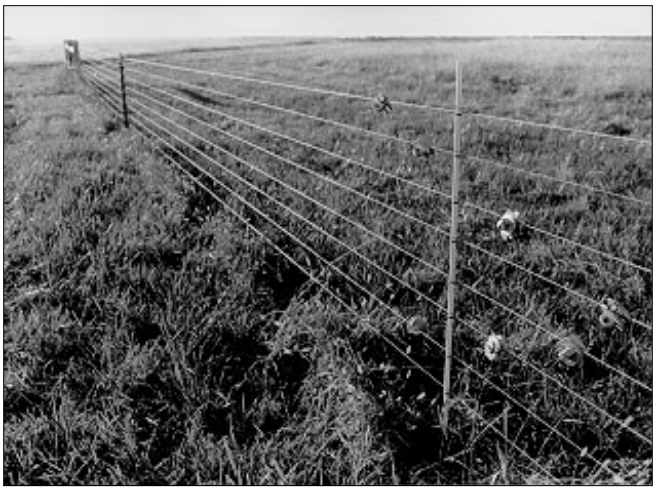

Figure 1.

and slightly roughened surface. Oxidation and flaking of the zinc coating are problems commonly associated with hot-dipped wire with poor quality control. Voltage loss to the atmosphere is greater on this rough surfaced wire than on smoother finished wires and useful life of the fence is shortened. Excellent quality hot-dipped wire is available. The various processes used for cleaning the wire prior to galvanization and wiping the wire after the galvanizing process determine the quality of the finish. New Zealand wire typically has a very good hot-dip finish. New Zealand wire specifications require that a class 3 hi-tensile wire can be wrapped around its own diameter without causing cracking or flaking of the galvanization. When comparing wires, a very smooth glossy

finish generally indicates superior galvanization.

Electro-galvanization results in a smoother finish and brighter wire than the hot-dip process. The zinc coating and steel wire are more tightly bound by this process to minimize cracking potential. It is questionable whether electro-galvanized wire has a significant economic advantage to a good quality hot-dip wire.

Hi-tensile wire is generally marketed on the basis of its breaking strength. Breaking strength for 12.5 gauge wire ranges from 130,000 - 265,000 pounds per square inch (psi). The lower the tensile strength the easier the wire is to handle. Very high breaking strength wires tend to be brittle and not easily worked. For most applications, wire should be 180,000 - 210,000 psi. The lower tensile wires, while being more easily worked, will sag sooner after installation and will require more routine maintenance to ensure a tight, effective fence. All wire classes are marketed on a basis of minimum breaking strength except for 170,000 psi which is a maximum breaking strength rating. The actual minimum breaking strength for 170,000 psi class is 130,000 psi.

Aluminum hi-tensile wire is also available for electric fencing use. Aluminum wire has up to 4 times the conductivity of steel wire of the same gauge and will basically never rust although it will oxidize and lose contact effectiveness when joined to other metals. The breaking strength of the wire itself is only about one-third that of steel wire. As long as the fence remains energized and the cattle don't stress the fence, it is very effective but the fence wire can be easily broken by stampeding livestock.

A combination of these two materials is also available as aluminum clad hi-tensile steel. This is a hi-tensile steel wire with aluminum coating in place of galvanization. This wire has the high breaking strength of steel wire and the conductivity of aluminum. Special care must be taken in the handling and installation of the wire to avoid gouging or chipping off the aluminum coating as the steel below is non-galvanized.

All three of these wire types are available in both heavier and lighter gauges for different use situations. A heavier gauge aluminum wire can be used to increase the physical strength of the fence or a lighter gauge steel wire for easier handling for semi-permanent situations, but 12.5 gauge should be the wire of choice for permanent installation in most cases.

The lighter gauges of hi-tensile wire are frequently used for internal subdivision fences, both permanent and portable. The fence network in a grazing cell can be set up using different wire gauges similar to the way that different pipe sizes are used in a water reticulation system. For the main fence lines, 12.5 gauge wire can be used to ensure good conductivity to the outer reaches of the paddocks. For secondary subdivision fences, the wire gauge might be reduced to 14 gauge and 16 gauge might be used for temporary subdivisions. This approach will lower the cost of the system, but it also significantly lowers the breaking strengths of the wires involved and the total conductivity of the system.

For either the steel or aluminum clad wire, a wire dispenser is a must. The coil size for hi-tensile wire is usually 24 inch in diameter and comes in rolls ranging from 50 - 105 lbs. It is extremely difficult to unroll by hand and attempting to do so may sour the user on ever looking at hi-tensile wire again! Aluminum wire typically comes on spools which may be easily unrolled without the need of specialized equipment.

### Joining Wires

One of the first observations any novice to hi-tensile fencing will make is that the wire is stiff and hard to hand tie. Although some manufacturers tout their wire as being "easily hand-tied", this may not be particularly desirable. Wrapping a hi-tensile wire around its own diameter typically reduces the tensile strength by 30 percent and results in cracking of the galvanization. As the lower psi rated wires are most easily tied, these are the wires that suffer the most from reducing the breaking strength even further. There are two practical alternatives to tying hi-tensile wire.

The most common method for joining two pieces of hi-tensile wire is to use crimping sleeves and crimping pliers. While some fence suppliers complain about the need for three hands to make a joint and the cumbersome nature of the crimping pliers, a little practice makes crimping sleeves a very easy method for joining wires. The joint is very tight and electrical conductivity is very good. The holding strength of the sleeve ranges from about 700 - 900 foot-pounds. To match the breaking strength of the wire, two sleeves per joint are normally used on straight line pulls. A single sleeve may hold the wire adequately until some stress either from livestock or weather causes the single sleeve to slip (Fig 2).

Another method of splicing wires is to use what is known as a twist-link. This is a chinese-handcuff like device that wraps around each end of the wires to be joined. The tighter the wire is pulled, the tighter it is gripped. For high-stress joints, two links should be wrapped to intertwine with one another.

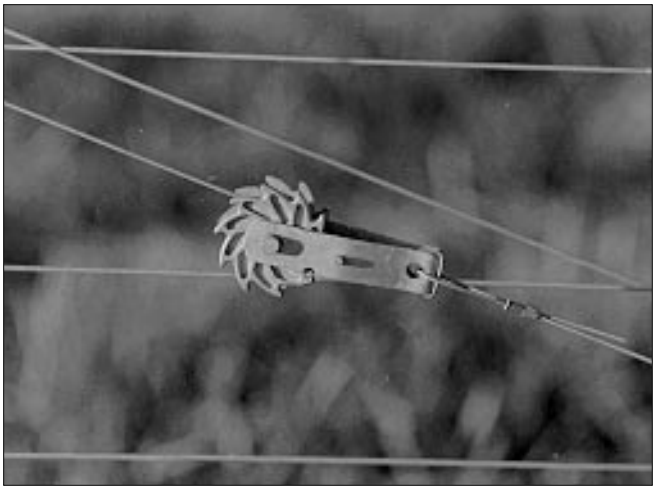

Figure 2.

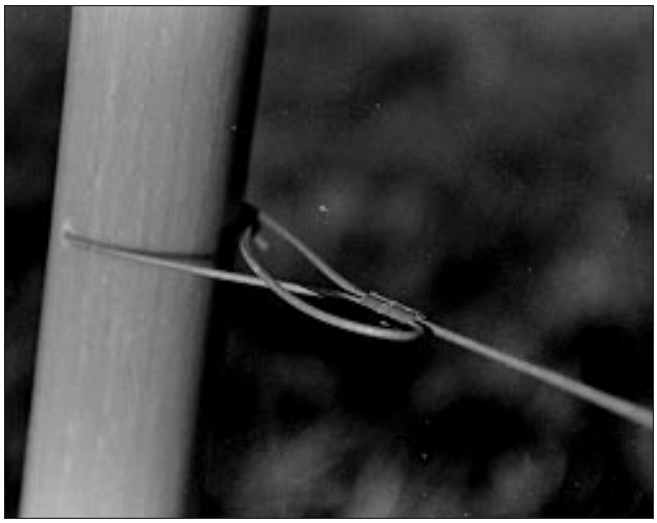

Figure 3.

### Strainers And Springs

All hi-tensile fences should be installed with an in-line strainer in each wire in the fence line (Fig 3). This device allows slack to be periodically taken up in the wires to maintain a tight fence. There are several types available but all work on the principle of an in-line spool to hold excess wire. With higher tensile strength wires, tightening of strainers may be required on a 3 - 4 year frequency. Lower tensile strength wire such as the 170,000 psi wire may require annual maintenance.

Strainers should be installed in every fence or one per 1/4 mile on fences longer than 1/4 mile. If pulling around a bend, place the strainer in the longer stretch. If each side of the bend exceeds about 500 ft, place a strainer in each stretch.

On short stretches of fence, those less than 200 ft, it may be desirable to place tension springs in the fence line. In a pasture situation this is generally not necessary except in alleyways or around watering points where stock pressure may be high.

### Posts And Post Spacing

One of the great advantages of hi-tensile fencing is its ability to remain tight over long distances and rolling terrain. This inherent tautness of the wire allows post spacings to be much wider than with conventional electric fence wire. On level or evenly sloping terrain, line posts may be up to 120 feet apart for a single wire paddock fence. Most Missouri conditions are not so favorable and a 40 - 60 feet spacing is more realistic. In extremely rolling ground posts may need to be even closer. (Fig. 4)

Posts must be rigid enough to support the weight of the wire and downward pull when passing over hill crests and small rises. Any type of a post will work as long as a durable reliable insulator or a self insulating post is used.

Fiberglass posts are the most common self insulating post and require nothing more than a means of attaching the wire to the post. Posts are available in many sizes, ranging from 3/8 inch to greater than 2 inches. Spring grip clips are commonly used on the smaller diameter posts and cotter pins through drilled holes on the larger posts (Fig. 5). Spring clips used on posts for

Figure 4.

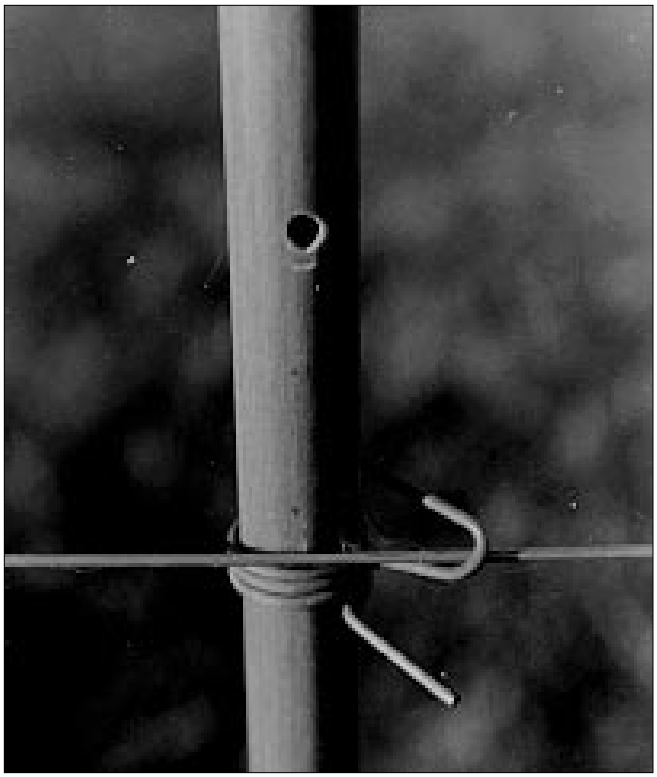

Figure 5.

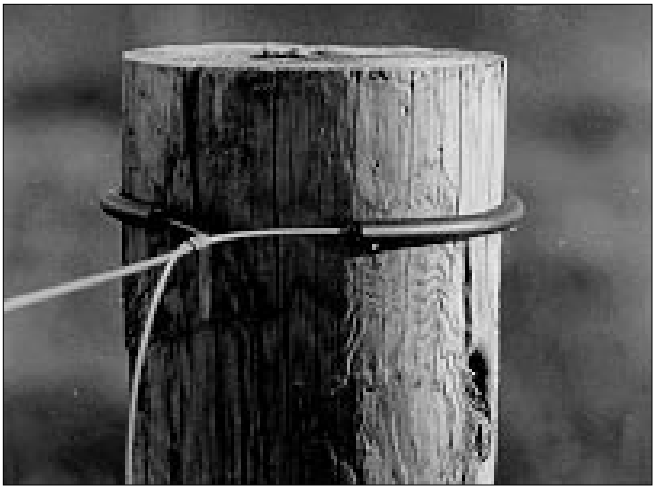

Figure 6.

permanent installation should have a long enough tail to wrap around the post and back around the wire to hold the wire loosely to the post. Some builders thread the wire through drilled holes in the larger posts. This is time consuming and also is very abrasive on either galvanized or aluminum clad wires and is not recommended. For permanent fences, the oil field suckerrod posts are a very good choice. These are typically available in 1

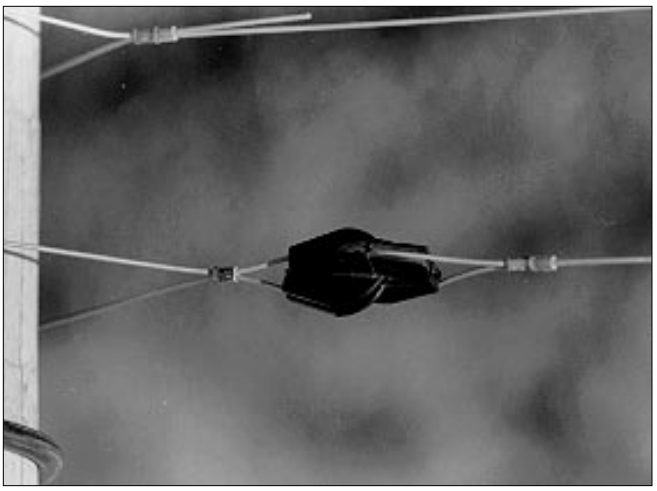

Figure 7.

inch or 1.25 inch diameters. Fiberglass T-posts are also available in several sizes.

On a permanent installation do not attempt to use only 3/8 inch posts as the fence will be very unstable and on uneven terrain will bend down towards the ground on high spots. The least cost single-wire fence construction is usually the lightweight fiberglass posts used in combination with either heavier fiberglass, steel, or wood posts.

All fiberglass posts tend to become rough over time with numerous splinters ready to aggravate the hands. Used in permanent situations this problem is not too serious, but in temporary situations can be quite a nuisance. A high grade post should be selected. Typically the better grade fiberglass posts have a glossy finish and are very smooth to the touch. A post that is rough in the store will rapidly become much worse in the field. Plastic coated posts that are designed to minimize the hazard of splintering are also available.

If using steel T-posts, a very high quality, durable insulator is a must. Many plastic insulators that are commonly available are not UV stabilized and become brittle with exposure to sunlight. Broken insulators on steel posts is a sure path to a shorted fence. Select only UV stabilized high-density polyethylene or high-density polypropylene insulators for use on steel T-posts. Some of the New Zealand steel post insulators claim to have a 20 year useful life expectancy. Use of steel posts should be kept to a minimum to avoid potential shorts in the fence when insulators do break or deteriorate. The same recommendations apply to insulators for use on wood posts.

One unique product available for line posts is a very dense wood post known as Insultimber®. This comes from tropical wood that dries to a fairly non-conductive state and can be used as lineposts without insulators. The product comes in various lengths with pre-drilled holes and the wires are attached with a cotter-key type pin. In the Midwestern environment under wet conditions some voltage loss may occur across the wet surface of the timber. Seasoned hedge or osage orange has similar properties and can be used without insulators if the user is willing to accept some voltage loss under prolonged wet conditions.

### Corner Insulators

As with line insulators, the best choice of material is UV stabilized HDPE or HDPP. These can either be wrap-around tube type insulators (Fig 6) or double-U (Fig 7) or double hole terminal insulators. Do not use the wrap-around types if going to an existing corner with a lot of old wire around it, unless the old wires are all cut away. Either type of insulator can work satisfactorily.

A common mistake in using the double-hole or figure-8 insulators is failure to have the two wires cross over one another in the figure-8 pattern. If the wires simply come off opposite ends of the insulator, the insulator may pull in half. The difference is that in the figure-8 configuration the plastic in the insulator is being compressed while in the incorrect configuration the plastic is stretched.

Porcelain insulators will work if very good quality (Fig 8). Many "farm store" quality insulators will crack under the strain of hi-tensile wire. Moisture will infiltrate the crack and can create a short if the tie-off wire is touching a grounded wire. There are quality porcelain insulators available from specialty fence suppliers.

### Corner Assemblies And Wire Spacings

The figures and table on the following pages diagram construction techniques for different bracing assemblies used in hi-tensile fence construction. Numerous variations on these types are recommended by different fenc-

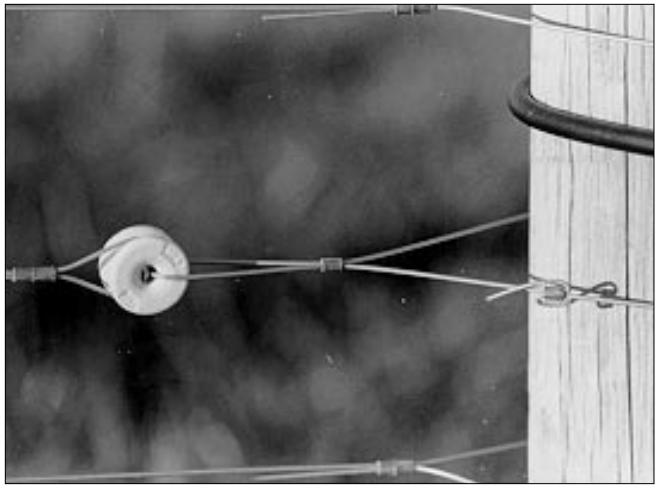

Figure 8.

ing suppliers. Most corner assemblies will work if care is taken in construction. The main points to remember are that depth of the corner post and alignment of the brace are the two most important factors in determining the strength of a corner. An improperly braced 12 inch corner post has less bearing strength than a properly braced 6 inch corner post.

The wire spacings shown in table 1. are taken from manufacturers recommendations and our experience as to what has worked effectively. For cows and calves a single wire fence is almost always adequate unless it is critical for the calves to always remain with their dams. Calves may do some forward grazing under single wire fences if set high enough. Single wire fences work quite well for stockers. While some producers have success keeping sheep and goats in with one or two wires, more consistent results are obtained by using three wires.

Corner post is an 8 feet by 5 inch wood post. The deadman is 24 inch by 5 inch. This corner arrangement works well with either driven or tamped posts.

1) Staple a 6 feet piece of 12.5 gauge hi-tensile wire along the face of the corner post beginning with the wire bent under the foot of the post. Leave the top 2 feet unstapled.
2) Orient post so that the 6 feet wire is facing the direction of wire pull.
3) Drive or auger post with approximately a 3 degree backward lean. This will allow the corner to come near vertical when the fence is fully tensioned.
4) With a spade, dig out a trench 6 - 8 inch deep in front of the corner post perpendicular to the direction of wire pull. Make the trench only wide and long enough to accommodate the deadman.
5) Loop the free end of the 6 feet wire around the deadman and tamp deadman into the trench while maintaining tension on the wire. When the deadman is firmly tamped into the trench and against the post, staple the wire to the deadman and the free end of the wire to the corner post, bending the loose wire end downward. This keeps frost from heaving out the deadman.
6) Refill trench and tamp dirt firmly around the deadman.

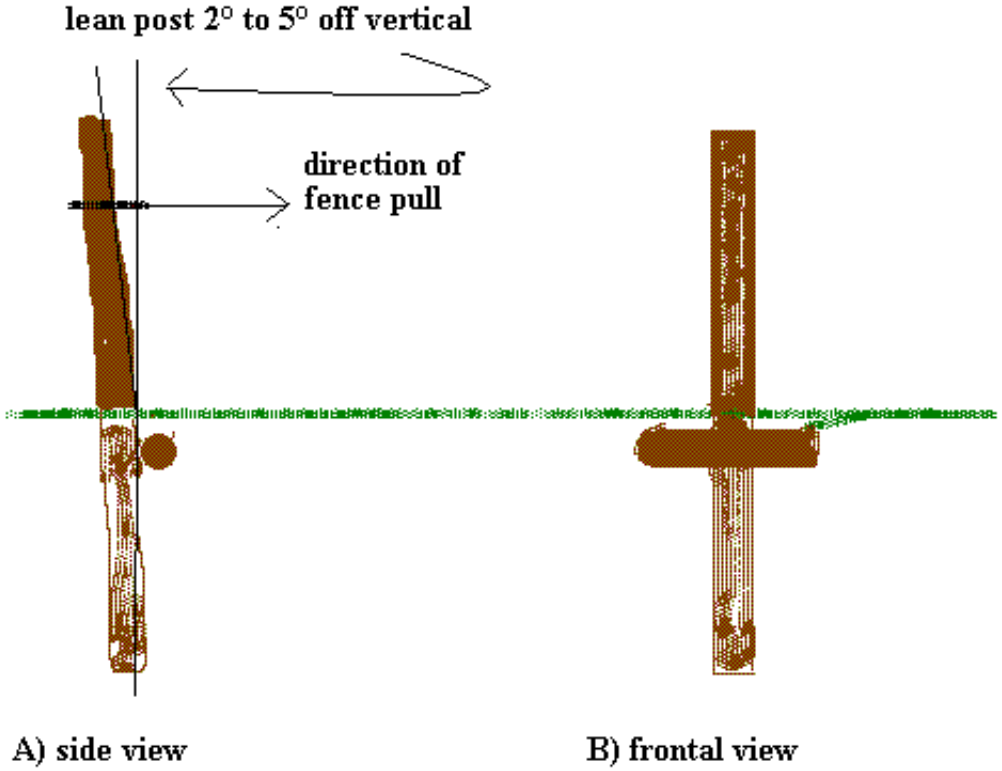


Figure 9. Construction of a Deadman Brace for use with One or Two Wire High-tensile fences.

**Table 1. Wire and Post Spacing for Electrified Hi-tensile Fences for Different Classes of Livestock.**

| Livestock | # of wires | wire heights (feet) | post spacing (inches) |
|---|---|---|---|
| Cow/calf and 40 - 80 | 1 | 28 - 34 | |
| stockers | 2 | 22, 32 | 40 - 60 |
| Cattle with sheep | 3 | 10, 20, 32 | 20 - 40 |
| 20 - 40 | 4 | 8, 18, 30, 42 | |
| Perimeter fence | 5 | 10, 20, 30 ,40, 50 | 20 - 40 |

face should be 6 inch high. Start the notch 30 inch above ground level.

3) Place brace block approximately 7 feet from corner post in line with fence wire. Set brace post against corner with the lower end resting on the block. Mark head of brace post and saw it flush with notch face.
4) Set brace in place. Sawn head of brace post should fit snugly and evenly against notch face. Drive #40 galvanized nail through brace post into face of notch. If working with hedge or locust posts, drill a 3/8 inch hole through the brace and into the corner. Secure brace with either a lag bolt or drive a 3/8 inch rod through the brace and into the corner post.

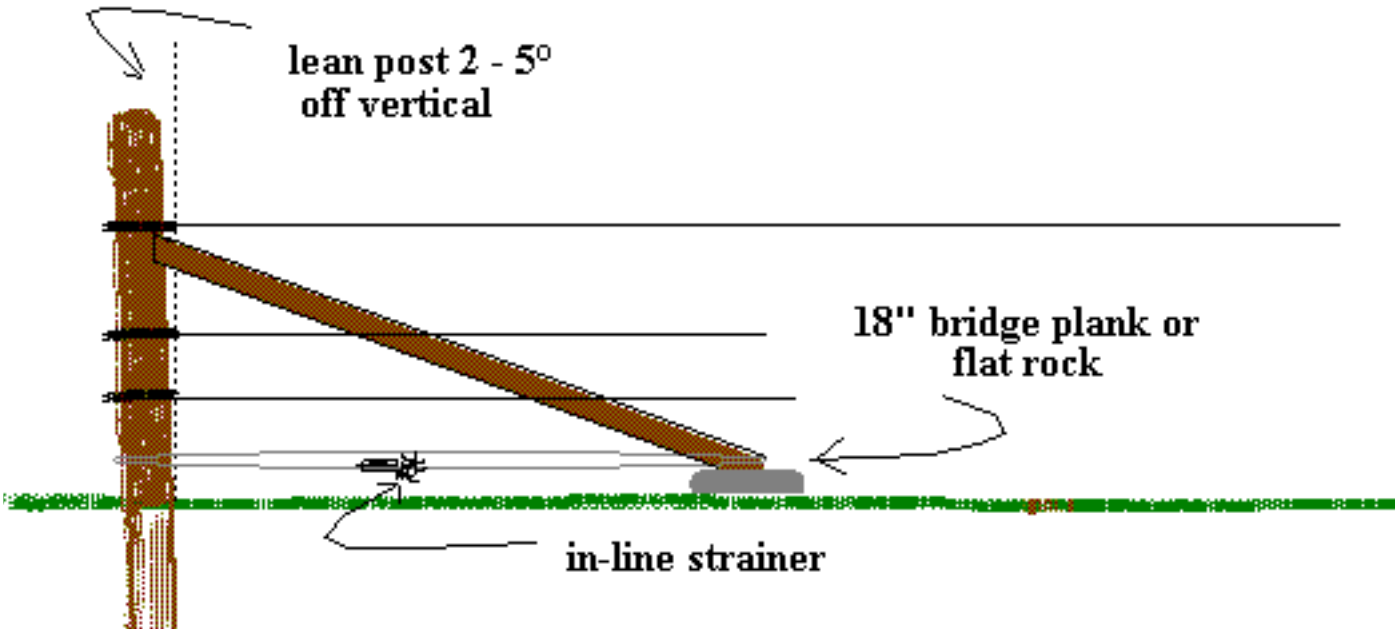


**Figure 8.**

Corner post is a 9 foot by 6 inch wood post. The brace is a 8 foot by 4 inch round post. The base block for the floating brace should be at a minimum a treated 2 by 8 at least 15 inches long. An 18 inch piece of bridge plank is ideal. This corner arrangement can be used with either driven or augered posts.

1) Set corner post and string first wire.
2) With a chainsaw, carefully notch out a flat surface 1 inch deep across the width of the post. The flat sur-

5) Loop a single strand of 12.5 gauge hi-tensile wire around the corner post and the foot of the brace member approximately four inches above ground level. Tighten the wire with either chain pull wire stretcher or with a permanent in-line strainer until the brace post and brace wire are tight.

This corner will be adequate for up to 5 hi-tensile wires. For fewer wires the corner post dimensions may be reduced accordingly.

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