

## **APPENDIX A**

### ***Permanent Fencing Costs for Cattle and Sheep***

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Fencing represents a substantial investment in moving from confinement or continuous grazing systems to a rotational grazing system. The fencing can be either permanent fencing or temporary fencing. Generally, the permanent fencing surrounds the perimeter of the pastures or property while temporary fencing is used to divide pastures into smaller paddocks that are intensively grazed. Permanent fencing around the perimeter of pastures or property functions to keep animals in the pasture and deter predators from entering the pasture.

There are many different types of posts, wire, insulators, and energizers available for construction of permanent fencing. Keep in mind that where you save on materials you usually lose on annual repairs. That is, lower quality materials generally means higher annual repair costs. A well-constructed fence can have a life of 30 years with minimal annual repairs.

The costs presented are based on fence construction materials (retail price) used at the West Central Research and Outreach Center in Morris, MN. Costs for your farm may vary depending on the materials that you use. The budgets are for materials and equipment only. Labor costs are not included. Generally labor cost will equal the material costs. The costs are based on a mile of fencing.

#### ***Materials:***

**Line Posts:** 4" x 6' wood posts or fiberglass posts. They are placed 33 feet apart for sheep and 25 feet apart for cattle. For example, for sheep place wooden line posts every 99 feet with 2 fiberglass posts in between equally spaced. Wooden line posts can be spaced every 100 feet with fiberglass posts placed between them.

**Corner Posts:** 6" x 8' wood posts. Even if fiberglass posts are used, wooden corners are recommended for strength.

**High Tensile Wire:** 7 wires are used for sheep and 3 wires are used for cattle.

**Insulators:** All wires are attached to posts with insulators. Usually only 2 wires are hot or charged with the electrical impulses. Insulating all wires maintains the flexibility of making more wires hot if necessary.

**Energizer:** 12 joule fencer is used to energize the fence. This should be adequate to energize 24,000 feet (4.5 miles) of sheep fencing or 48,000 feet (9 miles) of cattle fencing.

**Miscellaneous Items:** Gates, springs and strainers, jump wires

**Equipment:** Post digger for corner posts and wooden line posts, hammer, high tensile wire cutters.

### Permanent Fencing for Beef or Dairy Cattle

	<b>Cost per Unit</b>	<b>Number per Mile</b>	<b>Cost per Mile</b>
Wood Line Posts	\$4.50	211	\$949.50
Fiberglass Line Posts	\$1.00	211	\$211.00
Corner Posts	\$5.50	10	\$55.00
Insulators for Wood Line Posts	\$0.15	1055	\$158.25
Fiberglass Post Clips	\$0.10	1055	\$105.50
High Tensile Wire	\$0.01 per foot	26,400	\$264.00
Tension Springs	\$5.00	30	\$150.00
Tension Strainers	\$3.50	5	\$17.50
Jump Wires	\$3.00	5	\$15.00
Gate	\$75.00	1	\$75.00
Energizer	\$350.00	0.11	\$38.50
Total Cost – Wood Line Posts			\$1,722.75
Total Cost – Fiberglass Line Posts			\$931.50

One mile equals 5,280 feet.

### Permanent Fencing for Sheep

	<b>Cost per Unit</b>	<b>Number per Mile</b>	<b>Cost per Mile</b>
Wood Line Posts	\$4.50	160	\$720.00
Fiberglass Line Posts	\$1.00	160	\$160.00
Corner Posts	\$5.50	10	\$55.00
Insulators for Wood Line Posts	\$0.15	1120	\$168.00
Fiberglass Post Clips	\$0.10	1120	\$112.00
High Tensile Wire	\$0.01 per foot	37000	\$370.00
Tension Springs	\$5.00	42	\$210.00
Tension Strainers	\$3.50	7	\$24.50
Jump Wires	\$3.00	5	\$15.00
Gate	\$75.00	1	\$75.00
Energizer	\$350.00	0.22	\$77.00
Total Cost – Wood Line Posts			\$1,714.50
Total Cost – Fiberglass Line Posts			\$1,098.50

One mile equals 5,280 feet.

## APPENDIX B

### A STRONGER BRACE

#### *It's Less Expensive & Easier To Build, Too!*

The following is a brace design that is less expensive and a bit easier to build. It's called a *Diagonal Strainer*. This design has been tested and compared to a standard "H" brace on clay soils. The diagonal strainer was 8% stronger than the "H" brace. The brace failed at a load of 8400 pounds (that's over 5 times the load you'd be likely to use on a 7 wire high tensile fence).

To build this brace you'll need the following materials and tools:

#### **MATERIALS**

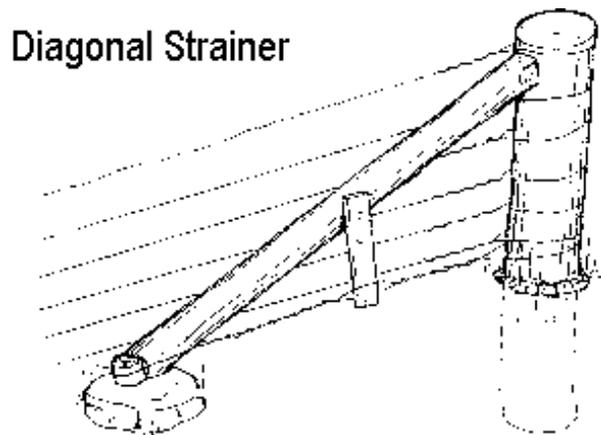
- 2 - 8 foot high quality pressure treated posts
- 1 - 4" x 3/8" brace pin
- 1 - twitch stick or (1) in-line strainer
- 20 feet of 12-1/2 gage high tensile steel fence wire
- 1 - rock (the rock should have a flat side at least 6" x 8")

#### **TOOLS**

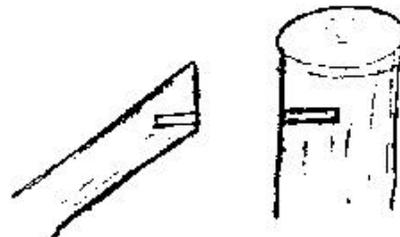
- Post hole digger & rammer
- 3/8" drill (or a chisel)
- Hammer
- Chain saw

#### ***Here's how you build it:***

1. Dig a post hole 4 feet deep (for every 6 inches you set a post beyond 3 feet you double the strength of the post). Place the post against the side of the hole closest to the source of stress. Make sure that this side of the hole is straight so that the post fits flush against it. This will provide a solid surface to pull against and leaves only 3 sides of the hole to pack.
2. Once the post is set, drill a 3/8" hole, 2 inches deep, 4 inches from the top of the post. The hole should face the direction of strain on the fence. If your post hole is less than 4 feet deep you'll either need a longer stay-bar or have to drill the hole lower on the post. The stay-bar should be at least twice as long as the height of the hole drilled in the post.
3. Saw the end of the stay-bar so that it fits flush against the post. Drill a 3/8" hole, 2" deep in the end of the stay-bar.



Note: A mortise was used instead of a brace pin on the brace in this illustration



3/8" holes 2" deep in post and stay

4. Hammer the brace pin into the hole in the post. Slide the stay-bar on to the exposed pin. (As an alternative to brace pins, you can saw the stay-bar so that it fits into a 1/2" deep mortise chiseled into the post. This would replace steps 2-4.)
5. Find a rock or other solid object with a flat surface and place it on the soil surface under the end of the stay-bar in the direction of strain. Do not bury it.
6. Cut the bottom of the stay- bar so that it fits flush on the rock.
7. Take a half-round wood scrap and place it at the end of the stay-bar on the rock.
8. Loop the high tensile wire around the base of the post and around the end of the stay-bar on the rock. Fasten the wire to itself using a figure "8" knot or nicopress sleeves.
9. Insert the twitch stick and make several wraps in the wire until the wire is tight. An in-line strainer can be used instead of a twitch stick.

The force on this post is transferred through the stay-bar to the ground. It looks weird but it makes a solid brace.

## ***APPENDIX C***

# ***20 COMMON MISTAKES TO AVOID WHEN BUILDING A GOOD ELECTRIC FENCE***

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### ***1. POOR EARTH GROUNDING***

Lots of folks still think you can skimp when it comes to adequate earth grounding. What we must all learn to do, is install several ground rods – at least three that are 6 to 8 feet long, galvanized, and attached with good ground clamps. The electricity must complete a full circle back to the charger through the ground. Poor grounding gives weak shocks. Think of the ground rods as radio antennas – the more reception, the better the shock.

### ***2. USING DIFFERENT TYPES OF METALS***

Don't do it. When you hook up steel wire to copper, something called electrolysis happens and the metal becomes corroded, making a poor contact and weakening shocking power.

### ***3. INADEQUATE ANIMAL TRAINING***

Each and every animal must learn that the fence hurts, so please build a handy training fence, preferably on heavy wet soil. Flag the fence for visibility, and entice the animal to test the fence.

### ***4. FENCEPOSTS TOO CLOSE TOGETHER***

(Note: this is for interior cross fences). Well-intended government agencies recommend lots of fenceposts in their fencing specifications. Fifty-foot spacing on flat land is just too close. You want the fence to act like a rubber band. When something runs into the wire, you don't want to break all the insulators or knock posts out of the ground. If the posts are spread apart far enough – say 80 to 100 feet – the wire will just bend to the ground and pop back up.

### ***5. TOO MANY WIRE TIE-OFFS***

Again, fencing specifications may call for braces every quarter mile wire (1,320') to tie the wire off. However, even 5,280 feet is OK, and actually adds more elasticity in the fence wire. This reduces the chance of wires breaking.

### ***6. WIRES TIED TIGHT TO EACH FENCEPOST***

The wires must float (move) past each line fencepost. This is needed to maintain elasticity (that rubber band effect).

## ***7. BUILDING NEW FENCES NEAR OLD EXISTING FENCES***

Old fence wires seem to be always moving somewhere and coming in contact with the new electrified wires. This almost always causes a complete short in the fence, and away the animals go.

## ***8. BOTTOM WIRE IN CONTACT WITH HEAVY, WET VEGETATION***

Wet grass will suck lots of juice out of any fence charger. Hook up the lower wires separate from the other wires, and install a switch for the lower wires that you can turn them off when the grass is tall. Brush is another problem – buy a BIG charger. When you check a smooth wire fence, drive your vehicle so the wheels will drive over the vegetation and knock some of it down. Four-wheelers work great for this. Don't spray under the wire. You will end up with some weeds growing there.

## ***9. POOR QUALITY INSULATORS***

Be careful here. Sunlight deteriorates plastic. Buy high quality, long lasting insulators. Usually black ones are treated to resist degradation by ultraviolet light. Poor quality insulators may turn white or clear after a few years in direct sunlight and shatter like glass.

## ***10. STAPLES DRIVEN IN ALL THE WAY***

When using plastic tubing as an insulator, don't staple it too tightly. A staple may damage the tubing next to a ground wire, causing a hidden short.

## ***11. SOLAR PANELS NOT DIRECTLY FACING THE SUN***

This seems almost too obvious to be a problem, but a solar panel won't function at its potential if not properly installed. Please read the instructions.

## ***12. DON'T ELECTRIFY BARBED WIRE***

An animal can get caught up in the barbs, and the shock from a big charger could kill the animal.

## ***13. KINKS IN HIGH-TENSILE WIRE***

A small kink in stiff wire will always break. Also avoid hitting this kind of wire with a hammer, as this will easily damage the wire, causing a break. Always cut out a damaged section of high tensile wire and splice it. A hand-tied "square knot" makes the strongest splice.

## ***14. INSTALLING IN-LINE STRAINERS CLOSE TOGETHER***

Wires will flip together once in awhile. If in-line strainers (wrench-like gadget to keep the wire tight) are installed one above the other, they will sometimes hook up. Separate in-line strainers by a fencepost and they will never catch on each other.

## ***15. WIRES TOO CLOSE TO EACH OTHER***

Keep them at least 5 inches apart. When you and a partner are building fence, make a 5" mark in ink on your pants the height of the wire – saves time. Use 31" top wire for cows.

## ***16. WIRE STRETCHED TOO TIGHT***

Use inline-strainers that pull just enough to get the sag out of the wire between the fenceposts.

## ***17. NO VOLTMETER***

Without a voltage meter to check how hot a fence is, you're just guessing. Livestock will find a low voltage fence is a joke and walk right through it.

## ***18. WIRE TOO SMALL***

The larger the wire, the more electricity it will carry. Don't skimp here, especially if you are going long distances. 12.5 gauge wire is good for over 20 miles of hot fence.

## ***19. INADEQUATE CHARGER***

A wimpy fence charger gives you a wimpy fence. Don't skimp here because this is where most fences fail. Build a strong fence and hook it up to a great big fence charger.

## ***20. TOO BUSY TO CHECK THE FENCE***

Yes, these fences are much easier to build and fix. However, without routine checking, they tend to slip and lose effectiveness. Once the animals become untrained, it takes an extra effort to retrain them. Solution: carry a small repair kit with you at all times, install switches away from the charger, turn the fence off and make the necessary repairs as routine as moving the mineral mix.

## APPENDIX D

## Fencing Vendors

AEC Electric Fencing Limited  
Hotline Works  
Brunel Road  
Newton Abbot, Devon,  
TQ124PB, England  
phone: 01626 331188  
fax: 0800 873 7893  
e-mail:  
[sales@hotline-fencing.co.uk](mailto:sales@hotline-fencing.co.uk)  
website:  
[www.hotline-fencing.co.uk](http://www.hotline-fencing.co.uk)

American Farm Works  
2411 Seventh Street NW  
Rochester, MN 55901  
phone: 507-252-3797  
fax: 507-252-3700  
website:  
<http://www.amfarmworks.com>

Baygard  
6 Holtby Avenue  
Brampton, Ontario  
Canada L6X 2M1  
phone: 800-567-4040  
e-mail: [webmaster@forages.css.orst.edu](mailto:webmaster@forages.css.orst.edu)  
website: <http://web.css.orst.edu/Resources/Vendors/Fencing/Baygard/index.html>

Circle J. Sheep Equipment  
29743 Hwy 63  
Bloomfield, Iowa 52537  
phone 515-929-3388  
website: <http://www.case-agworld.com/cAw.circleJ.home.html>

Compass Grazing Systems  
4626 S. Center Hwy  
Suttons Bay, MI 49682  
phone: 800-968-1778  
e-mail: [gingrasj@pilot.msu.edu](mailto:gingrasj@pilot.msu.edu)  
website: <http://www.forages.css.orst.edu/Resources/Vendors/Consultants/Compass.html>

Dare Products, Inc.  
860 Betterly Road  
Battle Creek MI 49015  
phone: 616-965-2307 or 1-800-922-3273  
fax: 616-965-3261  
e-mail: [info@dareproducts.com](mailto:info@dareproducts.com)  
website:  
[webmaster@dareproducts.com](mailto:webmaster@dareproducts.com)

Deutschlander Fencing  
Rt. #4 Box 43  
Pine City, MN 55063  
phone: 320-629-2744  
fax: 320-629-3875  
website:  
<http://www.geocities.com/SouthBeach/Keys/4212/>

Elephence, Ltd.  
Wildlife, Security & Livestock  
Fence Systems  
P.O. Box 16704  
Nairobi, Kenya  
fax: 02 445245  
e-mail:  
[tembo@users.AfricaOnline.Co.Ke](mailto:tembo@users.AfricaOnline.Co.Ke)  
website:  
<http://www.forages.css.orst.edu/Resources/Vendors/Fencing/Elephence/index.html>

Fi-Shock, Inc.  
5360 National Drive  
Knoxville, TN 37914  
phone: 423-524-7380 or 1-800-251-9288  
fax: 423-673-4770  
e-mail:  
[fishock@conc.tdsnet.com](mailto:fishock@conc.tdsnet.com)  
website: <http://www.digits.com/>

Gallagher Power Fence Systems  
P.O. Box 708900  
San Antonio, Texas 78270  
Phone: 800-531-5908 or 210-494-5211  
Fax: 210-494-9364  
e-mail: [gallagherusa@msn.com](mailto:gallagherusa@msn.com)  
Website: [sales@gallagher.co.nz](mailto:sales@gallagher.co.nz)

Geotek – Common Sense Fence  
Geotek, Inc.  
1421 2<sup>nd</sup> Avenue NW  
Stewartville, MN 55976  
phone: 507-533-6076 or 1-800-533-1680  
fax: 507-533-4784  
e-mail:  
[Geosales@Geotekinc.com](mailto:Geosales@Geotekinc.com)  
website:  
[Webmaster@Geotekinc.com](mailto:Webmaster@Geotekinc.com)

Hallman Fence Systems  
4 Terracon Place  
Winnipeg MB  
R2J 4G7  
Canada  
phone 204-223-7777  
fax: 204-233-2998  
e-mail: [info@hallman.mb.ca](mailto:info@hallman.mb.ca)  
website:  
[webmaster@hallman.mb.ca](mailto:webmaster@hallman.mb.ca)

Kellogg's Seed Service  
3367 Neal Road  
Paradise CA 95969  
phone: 530-877-3366  
fax: 530-877-0256  
e-mail: [WLK42@netscape.net](mailto:WLK42@netscape.net)  
website:  
<http://www.paradisedirect.com/kelloggseed/>

Kencove Farm Fence, Inc.  
344 Kendall Lane  
Blairsville, PA 15717-8707  
phone: 724-459-8991 or 1-800-536-2683  
fax: 724-459-9148  
e-mail: [kencove@surfshop.net](mailto:kencove@surfshop.net)  
website: [www.kencove.com](http://www.kencove.com)

Kentucky Graziers Supply  
1929 Main Street  
Paris, Kentucky 40361  
phone: 606-987-0215 or 1-800-729-0592  
fax: 606-987-6461  
website:  
<http://www.kygraziers.com/>

Kiwi Fence Systems  
121 Kiwi Road  
Waynesburg, PA 15370-8070  
phone: 724-627-8158  
fax: 724-627-9791  
e-mail:  
[KiwiInfo@kiwifence.com](mailto:KiwiInfo@kiwifence.com)  
website:  
<http://www.kiwifence.com/>

Max-Flex Fence Systems  
U.S. Route 219  
Lindside, WV 24951  
phone: 1-800-356-5458  
fax: 304-753-4827  
e-mail: [mail@maxflex.com](mailto:mail@maxflex.com)  
website:  
<http://www.maxflex.com/>

North Central Plastics, Inc.  
906 Fifth Avenue East  
Ellendale, MN 56026  
phone: 507-684-3721  
fax: 507-684-3722  
e-mail: [ncp@redsnapr.com](mailto:ncp@redsnapr.com)  
website:  
<http://www.redsnapr.com>

Parker McCrory Manufacturing  
Co.  
2000 Forest  
Kansas City, MO 64108  
phone: 816-221-2000  
fax: 816-221-9879  
e-mail: [info@parmakusa.com](mailto:info@parmakusa.com)  
website:  
<http://www.parmakusa.com>  
PEL Industries Ltd  
P.O. Box 51-093  
Auckland New Zealand  
20 Zelanian Drive  
East Tamaki, Auckland  
New Zealand  
phone: +64 9 274 5726  
fax: +64 9 274 6199  
e-mail: [info@pel.co.nz](mailto:info@pel.co.nz)  
website: <http://www.pel.co.nz/>

Phoenix Agritech (Canada) Ltd.  
P.O. Box 10  
Truro, Nova Scotia  
B2N 5B6  
Canada  
phone: 902-662-2444  
fax: 902-662-2888  
e-mail: [phoenix@fox.nstn.ca](mailto:phoenix@fox.nstn.ca)  
website:  
<http://fox.nstn.ca/~phoenix/phoenix.html>

Premier Fence System  
2031 300th  
Washington, Iowa 52323  
phone: 800-282-6631  
e-mail: [premier@se-iowa.net](mailto:premier@se-iowa.net)  
website:  
<http://www.forages.css.orst.edu/Resources/Vendors/Fencing/Premier/index.html>

Southwest Power Fence  
26321 Hwy 281  
North San Antonio, TX 78260  
phone: 830-438-4600 or 1-800-221-0178  
fax: 830-438-4604  
website:  
<http://www.swpowerfence.com/>

Stafix Electric Fencing Ltd.  
241 Ti Rakau Drive  
East Tamaki, Auckland,  
New Zealand  
P.O. Box 51-078  
Pakuranga, Auckland  
New Zealand  
phone: 64 (9) 274-5799  
fax: 64 (9) 274-6367  
website:  
<http://www.stafix.co.nz/>

Stinger Products\*  
2430-80 Ave.  
Edmonton, Alberta  
T6P 1N2  
phone: 780-463-6133  
fax: 780-469-4317  
website:  
<http://www.stinger.okko.com/>

Valferin, S.A. DE C.V.  
AV. Movimiento Obrero 226  
Bodega 2  
Fracc. Jardines de la Fama-  
Santa Catarina, Nuevo Leon –  
Mexico C.P. 66350  
phone: (52)(8) 336-15-29, 336-86-92 or (91)(800) 61-233-00  
fax: (51)(8) 336-15-29  
e-mail: [valferin@sdm.net.mx](mailto:valferin@sdm.net.mx)  
website:  
<http://www.valferin.com.mx/>

Valley Oaks Ranch Supply  
40,000 Bear Creek Road  
Springville CA 93265  
phone: 209-539-3637 or 1-800-477-6908  
e-mail: [valleyoaks@2xtreme.net](mailto:valleyoaks@2xtreme.net)  
website:  
<http://www.waterfordcorp.com/>

Waterford Corporation  
404 North Link Lane  
Fort Collins, CO 80524  
phone 1-800-525-4952  
e-mail: [watrford@frii.com](mailto:watrford@frii.com)  
website:  
<http://www.waterfordcorp.com/>

Wedge-Loc Co. Inc.  
1580 N. Pendleton Drive  
Rio Rico, AZ 85648  
phone: 1-800-669-7218  
e-mail: [sales@wedgeloc.com](mailto:sales@wedgeloc.com)  
website:  
<http://www.wedgeloc.com/>