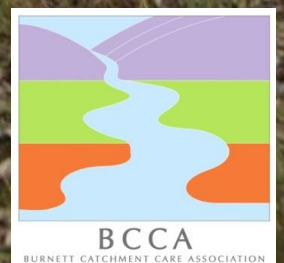


# Electric fencing basics

*Some tips, hints and ideas*





# Contents

Introduction.....	1
Advantages of Electric Fencing.....	1
Types of electric fence.....	2
Earth-return system.....	2
Bi-polar system.....	2
Fence-return system.....	3
Fence-return system design basics.....	3
Three wire fence.....	3
Two-wire fence.....	4
Fence component essentials.....	4
Wire.....	4
Strainer posts.....	4
Fence posts.....	5
Post spacing.....	5
Insulators.....	5
End insulators.....	6
Gates.....	6
Under gate connections.....	6
Hooking it all up.....	7
Earthing the system.....	7
Isolating fence sections.....	8
Do you always need a live bottom wire on a three-wire fence?.....	8
Fence testing.....	9
Some basic rules.....	10
Energisers.....	10
Components.....	10
Clean up old fences.....	10
Continuity and connection.....	10
Buying components.....	10
Final thoughts.....	10
Notes.....	11

## Introduction

The information presented in this booklet is a result of our experiences with electric fencing; recently on our small farm at Mount Maria, and previously on our 500 ha farm in NSW, where we constructed around 15 kms of permanent electric fence, for cattle and sheep. The information presented or the fence designs suggested may or may not suit some people. The information is presented simply to give people some basic information and essential dos and don'ts, regardless of fence design or application.

This information is for those people looking for alternatives to what is accepted as normal permanent fencing design in this region: that is, split posts at 5 – 6 metre spacing, and four barb wires. This type of fence costs a lot of money, so if you are looking for a more economical and just as (if not more) effective option, consider electric fencing for all of your permanent fences.

The exception to this would be boundary fences, which should not be electrified. The reason for this is twofold: the need for physical strength, and avoidance of litigation.

Anyone who is thinking of putting in electric fencing is encouraged to download some publications put out by the companies who sell the bits and pieces. In particular the *Daken Ag Electric fencing manual*, the *Gallagher power fencing manual*, and the *Speedrite electric fence manual* are recommended reading.

Some of the information presented here has been obtained from these publications, but the majority is from our personal experience.

Some people claim that electric fencing is unreliable and difficult to maintain. In most cases this is because they haven't built the fence properly. A well-constructed electric fence using high quality components, with attention to detail, will result in minimal problems and a highly satisfactory outcome of livestock control.

I don't claim to be an expert. There are many people out there who have as much or more experience as me, and may or may not agree with some of my ideas. I leave it to the individual to decide what is best for their place.

## Advantages of Electric Fencing

- Low cost: an electric fence can perform the same task as a conventional fence using much less material
- Easy to build: lower wire strains and generally lighter construction make much quicker and easier construction, especially in difficult terrain
- Universal application: electric fencing will contain all types of animals and can be a positive deterrent to wild pigs and kangaroos. Educated stock develop greater respect for electric fencing than for any other type of fence
- Flexibility: there is no quicker or easier way to effectively subdivide a paddock for controlled grazing than with an electric fence
- Less stock damage: the shock from your electric fence causes no physical damage. If your stock is forced through the fence by bushfires or dogs, they are at less risk than with a conventional fence
- Low maintenance: once your fence is properly installed and your stock are trained, the maintenance requirements of electric fencing are little different from conventional fences
- Barbed wire is responsible for many injuries and deaths of native wildlife, especially bats. Plain wire is used on electric fences, which is a much safer alternative



*Basic principle: maintaining good grass on both sides of the fence is the secret to success*

# Types of electric fence

## Earth-return system

This fence uses a single live wire only, with the ground being the conductor back to the energiser. This type of fence is mainly used for strip grazing, or for purposes such as isolation of a degraded area for rehabilitation.

An earth return system is generally not suitable for permanent fencing, for the following reasons:

- A single wire is usually only suitable for one class of livestock. For instance, a wire (or tape) at a suitable height to control cows may not be suitable for weaners or calves, and vice versa
- The shock the animal receives depends on the pulse flowing back to the energiser through the ground. If the fence is some distance away from the energiser or if the ground is very dry, the shock effect may not be sufficient to prevent the animal breaking through the fence

The advantage of this type of fence is its ease of construction, and low cost. There are systems in use where a single wire fence (using tape or polywire) can be erected from the seat of a quad bike in a very short time. This is used where the fence is moved regularly for strip or cell grazing.



*A poly tape temporary electric fence*

## Bi-polar system

Normal electric fence energisers have a live and an earth terminal. The Bi-polar energiser has a positive and negative terminal, as well as an earth terminal. Therefore the fence must have at least two live wires to work effectively, one positive and one negative.

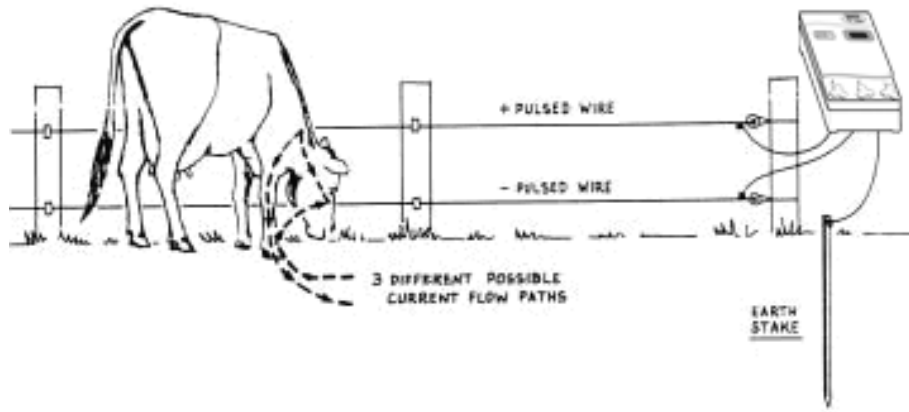
The animal can receive a shock through one of three pathways: by touching one of the live wires (earth return), by touching one live wire and an earth wire (if present) at the same time, or by touching both live wires at the same time.

Advantages of a bi-polar system:

- If one of the live wires is short circuited making it ineffective, the other live wire will generally still have power to it, meaning the fence will not be put out of action
- No need for an earth wire: alternative positive and negative wires is all that is required

Disadvantages of a bi-polar system:

- Energisers are generally more expensive
- Higher construction cost: double the number of insulators, which can be a significant cost over a long distance of fencing



*Basic bi-polar fence design (source: Daken Ag electric fence manual)*

## Fence-return system

This fence has live wires and earth wires. Depending on the class of livestock, there may be multiple live and earth wires. The earth wire is continuously connected all the way back to the energiser.

Cattle can receive a shock from touching a live wire, and if they continue to push through and touch an earth wire as well they get the full dose.

This type of fence is most common in permanent electric fencing. The fence designs referred to in this booklet are earth return systems, so there will be much more information on these on following pages.

## Fence-return system design basics

The fence designs outlined on the following pages are for beef cattle. Designs for sheep or goats will need to be developed using the basic principles, and/or advice from landholders with these animals.

We have used both 3-wire fence and 2-wire fences. The reasons for both and the principles follow.

### Three wire fence

We built this type of fence originally for more security. We have a large garden, shed and house area, so it is essential that these areas have the maximum security. Coming home from town and finding the cows in the garden could lead to divorce. Hence the fencing consists of two live wires and one earth wire, and steel gates. Following initial training of the cattle, the bottom live wire is usually left disconnected (details later).



*Suggested wire heights for a 3-wire fence for cattle:*

112 cms live

80 cms earth

45 cms live

## Two-wire fence

For basic sub-division purposes, a 2-wire fence is perfectly adequate. Wire heights will vary depending on the class of livestock.



*Suggested wire heights for a 2-wire fence for cattle:*

95 cms live

55 cms earth

## Fence component essentials

### Wire

There are a number of brands of plain wire on the market that can be used for electric fencing. The most important principle is to use high tensile wire only, as soft wire will stretch. The most common gauge is 2.5 mm. In some circumstances, a smaller diameter wire can be used, but generally it is not recommended due to its low visibility and low tensile strength.

Some brands of HT wire are very difficult to work with. *Permelec long-life* electric fence wire from Waratah is a medium tensile wire developed specifically for permanent electric fencing. It is easy to work with compared to some of the springier high tensile wire types. HT plain wire is sold in 1,000 metre and in some cases 1,500 metre rolls. A wire spinner is essential for handling HT plain wire.

**Important:** never electrify barb wire, it is dangerous and possibly illegal.

### Strainer posts

End strainers and corner posts can be wood, steel or concrete. We use wooden posts due to a good supply and moderate cost in our area. However, there is no need for large posts. A post diameter of 15 - 20 cms is more than adequate, which saves on costs, and backs!

There is generally no need for stays on intermediate posts, if they are set in the ground deep enough. Posts are usually placed at a depth of around 90 cms or more. A stay may be needed on an intermediate post if there is a sharp angle in the fence.

Intermediate posts are only needed where there is a bend in the fence. Fence strains can be as long as you like, with strains of 500 metres quite achievable.

## Fence posts

Obviously steel posts are the logical post to use on permanent electric fences. They are relatively cheap and easy to put in the ground. Whether black or galvanised will depend on personal choice and budget.

### *Post spacing*

Some electric fence companies suggest a spacing of 15 metres or more. In the past we built fences on 20 metre spacing, with a treated wooden dropper in between. Given that treated hardwood droppers have gone up in price in recent years, there is really not a lot of advantage in using droppers.

We have found 10 metre spacing is about right in our country, but 15 metres would probably be just as effective.



*A two-wire fence at 10 metre spacing*

## Insulators

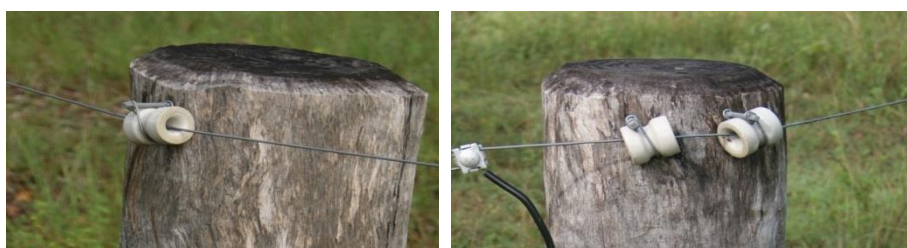
There is a wide range of plastic insulators on the market. They are cheap and easy to attach. However we have found in the past that plastic insulators have two main disadvantages: they burn, and they can be easily broken by animals such as pigs or kangaroos going through the fence.

We recommend the use of porcelain insulators at all times, for steel and wood posts. They may be a bit more expensive and difficult to source, and can be a bit fiddly to attach, but once they are in place they are generally there for good.



*Steel post porcelain insulator: attached with a 6 mm bolt and nylock nut.*

*A battery drill makes attachment easier.*



*Wooden post insulators: supplied with a clip and drive-screw. The post on the right is on a sharper angle so two insulators are used. It is important that the wire does not contact the post as it will short out when wet. The earth wire can be held in place around the post by a large staple, or a notch cut with the chainsaw.*



## End insulators

Normal porcelain bull-nose insulators are used on one end of the strain, and a ratchet tensioner is generally used on the other end. These tensioners are not cheap, but they are a brilliant idea as they are easy to use, and the fence can be re-tensioned or dismantled easily if need be.

Wire strainers are used to pretension the wire on longer strains before inserting the end into the tensioner.



*Insulated ratchet tensioner. A non-insulated tensioner is used on the earth wire.*

## Gates

We use steel gates around our house and garden area, and holding paddock, but tape gates everywhere else. The tape gates are generally one tape only, but we have one small paddock that is used for initial training of cattle brought onto the property which has two tapes on the gateways.

This type of gate is very effective, and very cheap. Using a proper gate handle makes it safe to open and close for most people, even children.



*Tape gate. Note that the gate is not live when disconnected: the handle connects to a bracket or loop of under-gate cable that is connected to the top wire. This means that the tape isn't shorting out on the ground when the gate is open.*

*The height is about the same as the top wire on a two-wire fence.*

## Under gate connections

It is critical that this part of the electric fence is done properly. Remember, good power to all following sections will depend on good work here.

Undergate cable is specifically designed for electric fencing. Cable made with copper wire should not be used, as corrosion will occur at the joints with the galvanised fence wire.

There are two gauges of undergate cable sold: 1.6mm and 2.5mm. We recommend using 2.5 mm, simply as it is more rugged and better insulated. As well, the 2.5 mm cable is only around \$7 more expensive than 1.6 mm for a 25 metre roll.

Both live and earth wires need to be buried across gateways, and they should be placed inside separate poly pipes prior to burial. Normal 12 mm dripper hose is good enough for this purpose, as it is cheap and

easy to use. On heavy traffic gateways (for example where a dozer regularly uses the gateway), heavier poly pipe may be required.

Plain fence wire can be used for the earth wire here, as long as it is placed inside poly pipe.

Note: it essential that the ends of the pipe be turned down so that water cannot enter the pipe.



*Undergate cable end detail. Note downturned ends of the poly pipe.*

*This is a 3-wire fence so the earth wire is connected to the middle wire, and the live wire to the top wire.*

## Hooking it all up

Some people connect their wires simply by twisting them together. This is not recommended as these joints often corrode over time leading to loss of power. The use of good quality line clamps is recommended at all times.



*Joint connection clamp*

## Earthing the system

It is crucial on a fence-return system to ensure adequate earthing. To do this, two things are necessary:

- Adequate earthing near the energiser: one or more earth stakes driven into the ground as deep as possible and connected to the earth wire
- Intermittent earthing along fence sections

Intermittent earthing is carried out by driving an earth stake into the ground on individual sections of fence. We do this every 150 – 200 metres, generally at a strainer post at the end of a section. The earth stake can be a galvanised steel post. We generally drive this post into the ground next to the strainer, as the earth here is still soft. It is sometimes difficult to get the post more than a metre into the ground so cut-off posts are used.

A short piece of wire is bolted to the stake and connected to the earth wire with a clamp.



*Earth stake driven in next to a strainer post. A short piece of wire is fastened to the stake with a bolt and fastened to the earth wire with a line clamp.*

*Note: some people claim that the earth wire running through the steel posts is sufficient to maintain good earthing. This is incorrect, for two reasons: a) there is not a good connection on the post, and b) the post is generally driven into the ground at a shallow depth which has low moisture levels for much of the year*

## Isolating fence sections

It is a good idea to install a switch at the start of each fence section. This has three purposes:

1. You can isolate paddocks that don't have stock in them, so other paddocks have full power.
2. In the event of a fault, switches are invaluable for assisting to locate where the fault is.
3. If a tree or branch has fallen over the fence, you can switch this section off to remove it without having to go all the way back to the energiser.



*Isolating switch. The live wire is connected to the switch by undergate cable.*

## Do you always need a live bottom wire on a three-wire fence?

The answer is generally no. In fact after cattle have been trained, they won't go near this wire anyway. As well as that, this wire tends to have a lot of fresh grass on it over the wet season, and this can reduce the power of the fence. However, calves may require you to keep the bottom wire connected.

A simple connector is a short piece of wire with a hook at the bottom, enclosed in a piece of dripper tube (you could also use undergate cable). The wire is connected to the top wire at the start of each section, to enable simple connection and disconnection of power to the bottom wire.



*Bottom wire hook-up system*

## **Fence testing**

It is important to regularly test your fence for power. Energisers generally put out 5 – 8 kilovolts. Check the voltage close to the energiser, and if it is low it could indicate a short circuit somewhere. It is then a process of elimination to determine where the fault is by isolating sections.

To do this you need a proper fence tester. A normal multimeter won't do the job.



*Fence tester hooked up between a live wire and earth wire.*

*The tester can also be used to see how much voltage you are getting through the ground, by clipping the lead on to a short piece of fencing wire pushed into the ground. This will give an indication of how much of a shock a cow will get by touching a live wire, and how good your earthing system is.*

*(This tester is nearly 30 years old and it still works)*

## Some basic rules

### Energisers

Energisers can be mains powered or solar powered. Solar energisers have come down in price significantly over the past few years. However if mains power is available, it may best to use it. It is more reliable, and a mains powered energiser will only draw an insignificant amount of power (a few watts).

Always buy an energiser much larger than you think you need. Remember, if you have two or more live wires, they all add up to the length of fence. So a two-wire fence 5 kms long is really 10 kms. As well, you will probably always be adding on to the system down the track, so it is a good idea to have some capacity up your sleeve.

### Components

Spend the money and buy good quality components. This includes wire, insulators, undergate cable, switches, line clamps, etc. It will be worth it.

### Clean up old fences

The biggest culprit causing faults is pieces of wire from old fences shorting out the fence. Get rid of all old fence materials, by recycling or burying.

### Continuity and connection

Do not scrimp on connections, especially under gates. Most importantly, don't rely on a tape or something similar to get power from one side of a gateway to the other. Always put it underground.

### Buying components

Most reputable farm supply stores stock a range of electric fencing materials. It is good to support your local supplier, and I'm sure a deal could be struck for bulk purchases.

The exception could be insulators. We found porcelain steel post insulators to be non-existent with the local suppliers I contacted, so we went to a very good on-line supplier, *Electric Fence Australia*. Google it and you will get the web site. They are located in Brisbane and post everything to your mailbox.

### Final thoughts

It is a common misconception that cattle need strong fences to keep them in. Generally stock will only try and break through a fence for one reason: they are hungry. If this is the case, it is better to fix the cause, not the effect.

In other words, stock according to your carrying capacity, and regularly rotate through paddocks. The more paddocks the better. Electric fencing makes this much easier to achieve!



# Notes