NATIONAL CERTIFICATE
IN AGRICULTURE

Agriculture
NEW ZEALAND
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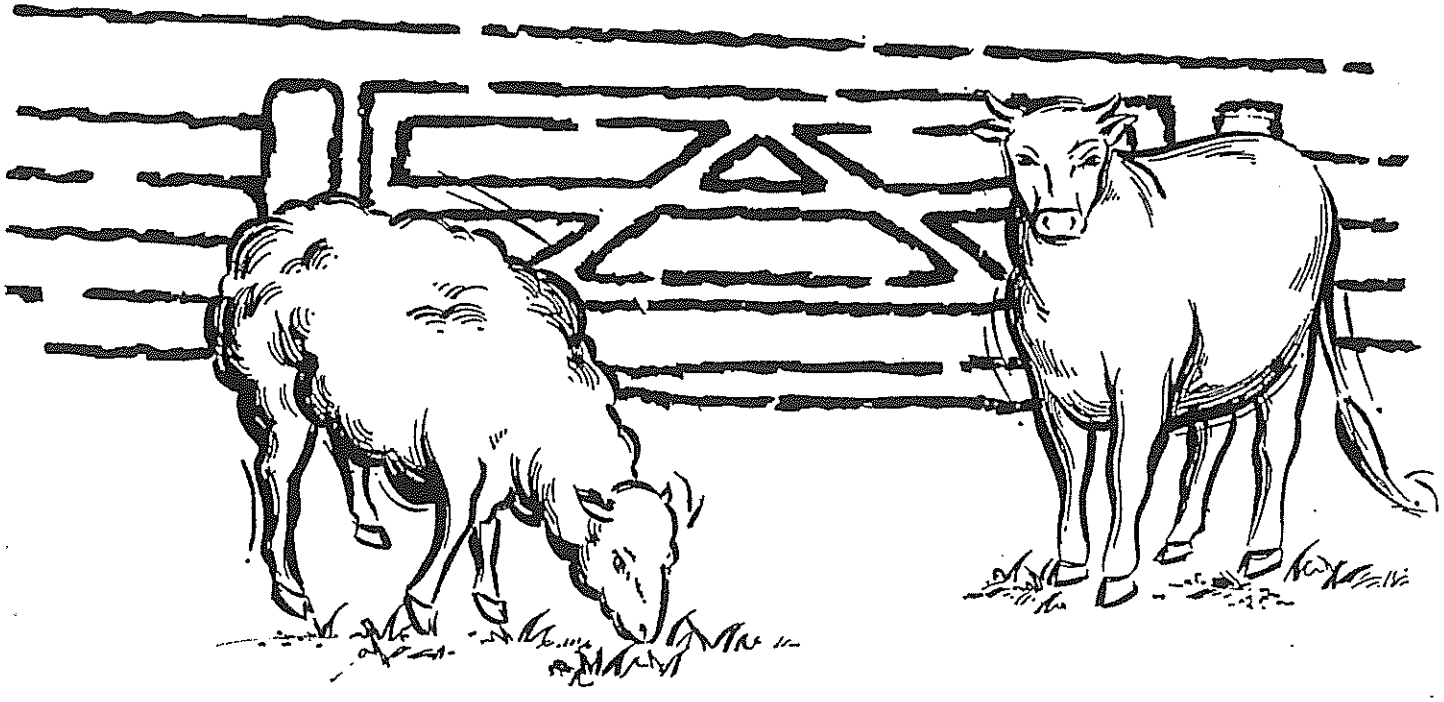
Unit Standard 572

DEMONSTRATE KNOWLEDGE OF FENCING, & ELECTRIC FENCE ENERGIZERS & INSTALL EARTHING SYSTEMS

Level 4
Credit 4



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DEMONSTRATE KNOWLEDGE OF FENCING AND ELECTRIC FENCE COMPONENTS

What will I learn?

On completion of this unit, students will be able to:

- Demonstrate knowledge of the animal containment properties of fences;
- Demonstrate knowledge of the performance characteristics of different types of fence energizers;
- Describe types of joule ratings and their applications. Range – joules output available, stored joules, high and low mode;
- Install and test an earthing system;
- Describe safety considerations for fence earthing system installations;
- Describe or install a lighting diverter.

What will I gain?

This unit is worth 4 credits at level 4 on the National Qualifications Framework.

To gain credit for this unit you must demonstrate that you can meet the criteria of this unit standard. You can do this by completing the assessment.

ELEMENT ONE
TYPES OF FENCE

There is a large variety of fences that can be built. The one that you choose depends to a large extent on the topography of the farm and also on the kind of stock that is run on your farm and the length of time that you want the fence to last. While a strongly built conventional seven or eight wire fence with battens attached, which is expensive to build, can be justified as a boundary fence, it would not be justified as a temporary fence, to break feed a crop for example.

The different types of fence can be grouped under the following headings:

- Permanent conventional fences (multi-wire conventional).

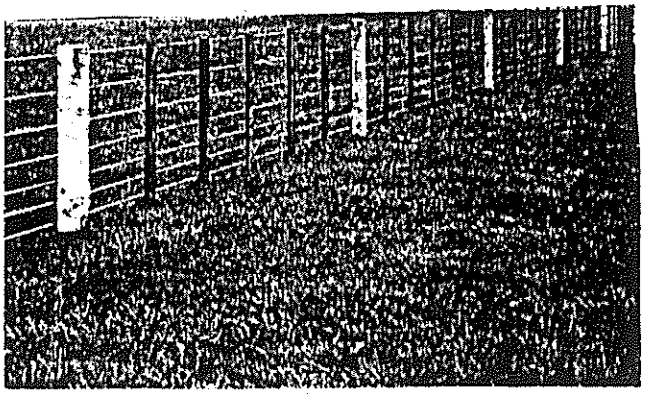

Figure One – Permanent conventional

- Permanent electric fences (multi-wire electric).

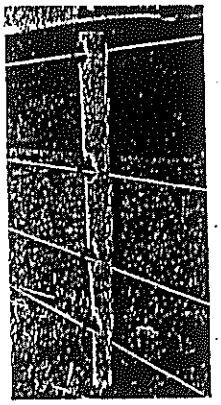

Figure Two – Permanent electric

- Permanent netting fences (fabricated netting).

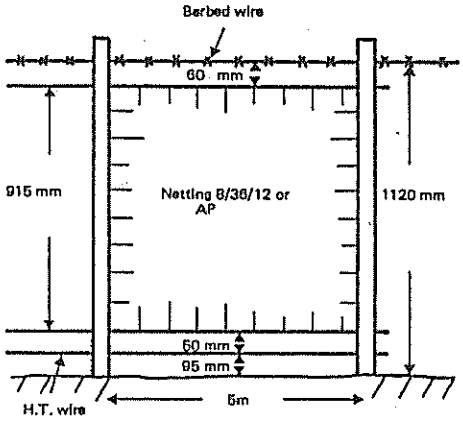

Figure Three – Permanent netting

- Temporary break fences (electric fence reels and standards).

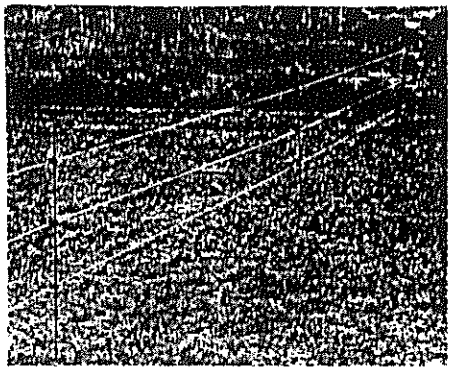

Figure Four – Temporary electric

Animal Containment Properties *(Performance Criteria 1.1, 1.2 and 1.3)*

On a farm that is running sheep and beef cattle you are likely to find fences with seven or eight wires and they will normally have a number of battens between each post. You may also find fences built with prefabricated netting instead of individual wires. Netting fences can be built without battens as they have stay wires already in their construction. For break fencing on this type of farm you will need to use a fence consisting of more than one electrified wire.

On a dairy farm, while the boundary fences are normally conventional seven or eight wire fences, the internal subdivision fences are frequently only two or three wire permanent electric fences. These are suitable to control the dairy herd and they also allow for easy break feeding of the paddocks using a single wire supported by temporary fence standards. These temporary break fences can be attached to the permanent fences as a power source.

Fences on farms running deer need to be considerably higher than for other stock to prevent the deer from attempting to jump them. They are normally constructed of prefabricated netting. If goats are run on the farm the fences will need to be modified to prevent the goats climbing up the stays, at the end of the fence line or at any angles of the fence, to stop them escaping into other paddocks, or more importantly, into neighbouring bush or forest reserves.

We cannot stress the importance of building the correct fence for the farm and stock class. Poorly built or simply the wrong fence for the stock type can cost you money – broken fences or broken animals!

ACTIVITY – ELEMENT ONE

1.1 Complete the following table by describing where and when the type of fence should be used:

Type of Fence	When and Where It Should Be Used
Multi-wire Conventional	
Multi-wire Electric	
Fabricated Netting	

1.2 Inappropriate fencing can result in damages to fences and stock. Give an example of an inappropriate fence for bulls. What damage could occur to the fence or stock?

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1.3 You have a paddock near the cowshed with an eight wire conventional fence around it. You wish to run two bulls in it. How could you modify this fence to make it more appropriate for handling bulls?

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ELEMENT TWO
FENCE ENERGISERS

The Energizer *(Performance Criteria 2.1)*

The energizer, sometimes referred to as the unit, controller, charger or fencer, is the heart of the electric fencing system. It functions to supply the electric "shock" or "pulses" to the system.

A range of energizers are available, but all fall into three main categories – ones that are mains supply operated, battery operated ones, or solar power.

To compare energizer power, compare the joule figures.

Stop – What is a joule?

A joule (symbol J) is a unit of energy. One joule is one watt for one second. It is the measure of "kick" of a pulse.

The higher the joule figures, the more powerful the energizer. In New Zealand, regulations state that the pulse rate must be kept to a level of 70-80 mm per minute. When these strong and regular pulses are being sent, stock will respect the fence. Although shocks of up to 5000 volts can be given, they are not dangerous because the interval between the pulses allows the animal to escape from the contact point.

Battery vs Mains Energizers *(Performance Criteria 2.2 and 2.3)*

Those energizers that get their power from the mains are capable of supplying an electric shock to a large length of fence; some are large enough to power many kilometres of fence. However, these units do have the disadvantage that you must have access to a mains power source and this may be difficult if the fence you want to build is at the back of a large farm. In this case you will need

to use an energizer that is powered by batteries or run a wire from the power source to the back of the farm. No matter how well this lead out wire is installed, there will be a certain amount of voltage lost, and this will reduce the efficiency of the fence.

If possible, you should try to put the energizer in the centre of the area of the farm that you intend to subdivide with electric fences.

Mains powered energizers are generally considered superior to battery powered units. With battery powered units you have the problem of the batteries going flat and having to be recharged. In isolated areas of the farm this can prove quite a hassle. To overcome this problem you can arrange an on-side charging system using solar panels or windmills to recharge the batteries.

ACTIVITY – ELEMENT TWO

2.1, 2.2 and 2.3

List three types of energizers and briefly describe in what situation you would use each one.

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ELEMENT THREE
JOULE RATING AND APPLICATIONS

Output Ratings *(Performance Criteria 3.1, 3.2 and 3.3)*

As mentioned in the previous section, a joule (J) is a unit of energy. One joule is one watt for one second. It is the measure of "kick" of a pulse. Joules are the most important measure of the power of an energizer.

Stored joules is often quoted for energizers, and is better than joule output available rating because it is independent of external fence load conditions and is more consistent than output energy, which changes according to standard specifications.

The pulse shape is also important. A pulse should travel to the end of the fence line and give animal control for the full length of the fence.

Joule ratings (stored joules) gives us an indicator as to the energizers ability to handle fence load and maintain an effective shock. Energizers range from 40 joules of stored energy (eg, Gallaghers M4000 Turbo powered energizer) with an output voltage of up to 8 kV through to 0.1 joules of stored energy with up to 7.5 kV (eg, Gallaghers B10 Mini Strip grazer battery energizer).

ELEMENTS FOUR AND FIVE
EARTHING SYSTEMS

Note: The following is from the Gallagher Power Fence Manual and refers to Gallagher products.

What Is An Earthing System? And How Does It Work?

The earth (ground) system of the energizer is like the antenna or aerial of a radio. A large radio requires a large antenna to effectively collect sound waves and a high powered energizer requires a large earth (ground) system to collect the large number of electrons from the soil.

Your earth (ground) system must be perfect so that the pulse can complete its circuit and give the animal an effective shock.

Soil is not a good conductor so the electrons spread out and travel over a wide area inclining towards moist mineral soils. Dry soils have a very high resistance. If possible, choose an area for the energizer earth site which is damp all the year.

EARTH (GROUND) RULE 1 2 3 3

In areas with highly conductive moist soil all year round:

1 = One continuous wire to join pegs (G627);
2 = Galvanised earth (ground) pegs (G619) must be two metres (six foot) long;
3 = Minimum of three x two metre (six foot) long pegs;
3 = Minimum of three metres (ten foot) between pegs.

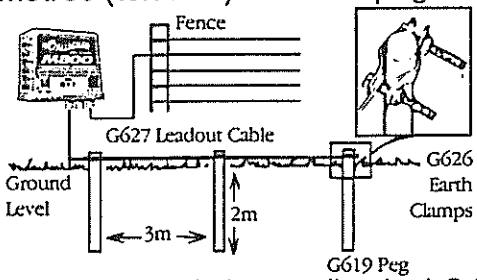

Figure Five – Earth (ground) rule 1 2 3 3

Ensure that they are at least ten metres (33 foot) from any power supply earth (ground) peg, underground telephone or power cable.

Note I – Do not use thinly electroplated or painted items or ungalvanised material because they quickly rust and create resistance.

Note II – Use G627 Double Insulated Leadout Cable where the wire from the energizer to earth (ground) stakes is likely to come in contact with soil, yards, water pipes or buildings.

Note III – If there is a milking shed nearby, use G627 to prevent the possibility of the energizer earth (ground) system making contact with buildings, fences, the milking shed or milking machine which could draw electrons through the milking cows to the detriment of milk production. Cows are sensitive to even a few volts delivered through the milking machine or pipework yards.

The earth (ground) system should be tested immediately after installation (and then at least once a year).

Two Types of Fence Wire Systems

There are two types of fence wire systems. These are as follows:

i) All Live Wire System;
ii) Earth (Ground) Wire Return System.

All Live Wire System

The all live system should be used where there is relatively even rainfall and where there is some green vegetation most of the year, or in areas with highly conductive soils.

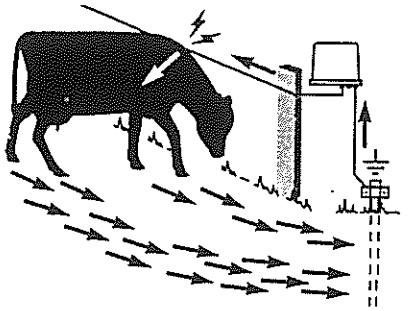

Figure Six – Electron flow in damp areas in all live system

The all live system should be used as much as possible. It should be used, with very few exceptions, in New Zealand, United Kingdom, North and Central Europe, and other areas where there is some green vegetation year round.

Earth (Ground) Wire Return System

The earth (ground) wire return system should be used where there is low rainfall stony and dry soil conditions most of the year.

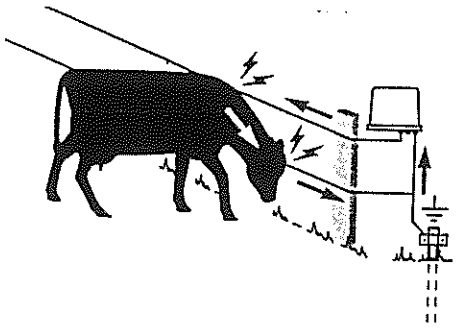

Figure Seven – Electron flow in earth wire return fence as used in dry areas

The earth (ground) wire return system overcomes the problem of dry, non-conductive, or frozen soils not allowing sufficient current to flow through the animal's feet back to the energizer. The fence should have live and earth (ground) wires. By touching both live and earth (ground) wires on the fence, the animal receives the full shock.

The earth (ground) wires should be connected to a number of earth (ground) pegs approximately every one kilometre (0.6 miles) along the fence line and back to the energizer earth system. These extra earth (ground) pegs also help give protection against lightning damage to the energizer and they assist in eliminating induced shocks on gates by providing an alternative route for the current.

Areas that become very dry such as Australia (except Tasmania and parts of Victoria), Southern USA, parts of South America and Africa are recommended to use the earth (ground) wire return system.

Earth (ground) wire return systems are particularly ideal for fencing wildlife, feral (wild) animals and predators.

This system may require a very high standard of construction, and more maintenance than an all live system, eg, if the live and earth (ground) wires come in contact, the fence can become ineffective.

Testing The Earth (Ground)

Testing The Energizer Earth (Ground) System

For All Live Wire Systems and Earth (Ground) Wire Return Systems

Energizer earth (ground) systems should be tested at least once a year during the height of the dry period and, if necessary, improved by adding more earth (ground) pegs.

Of course, the quickest way to test your earth (ground) is to touch the earth (ground) system with your other hand on the ground. If you feel a shock, then your earth (ground) system is inadequate!

However, if you prefer a less shocking method, then a Digital Volt Meter (DVM) G503 is essential.

Before testing the earth (ground) system, you will need to place the earth (ground) under heavy load to simulate a fence under heavy vegetation growth. If the fence is clear of vegetation, you can load the fence by placing several steel stakes between the live fence wires and the ground, at least 100 metres (33 foot) from the energizer. The fence voltage should be reduced to 2 kV if possible.

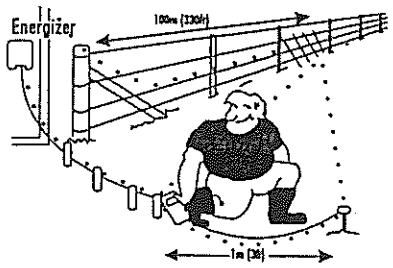

Figure Eight – Inadequate earth system – reading is greater than 200 volts

Using a DVM, measure the voltage between the earth (ground) wire, which is connected to the energizer earth (ground) terminal and an independent growth (ground) at least one metre (or three foot) away from any energizer earth (ground) peg. The independent earth (ground) can be a metal rod over 200 mm (eight inches) long.

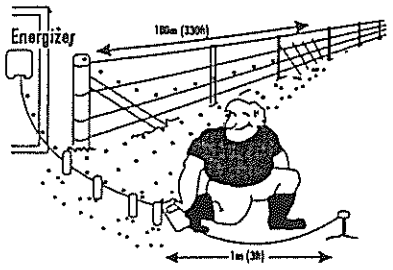

Figure Nine – Adequate earth system – reading is 0-200 volts

Ideally there should be no reading. However, a reading of up to 200 volts is acceptable.

For extra convenience, Gallagher has developed a built-in earth (ground) monitor which is included, for example, in the M1501 and new Smartfence Systems.

Testing The Earth (Ground) Return Wire

For an Earth (Ground) Wire Return System it is also important to test the earth (ground) return wire. This should be done as close to the end of the fence line as possible.

i) Establish an independent earth (ground). An independent testing point should be installed at least 0.3 metres (13 inches) into damp soil.
ii) Measure the voltage with a DVM between the live and earth (ground) return wires.
iii) Measure the voltage with a DVM between the live wire and the independent earth (ground).

Note – The voltage for iii) should not be more than 0.2 kV greater than the voltage for ii). If it is, then the earth (ground) return wire must be checked for loose connections and/or more earth (ground) stakes should be installed along the fence line and coupled to the earth (ground) wire.

Check the earth (ground) system and the earth (ground) return wires, as well as the live ones.

If anyone gets shocks where they shouldn't, such as on gates, check the insulators. Induced voltage from the fence line can cause this to happen. Earth (ground) wires behind end insulators and improve the earthing (grounding).

Super Earth Kit

In soils of low mineral content and those which dry out severely, ie, sandy, pumice or volcanic ash soils, a G635 Super Earth Kit system should be used. Trials have shown a ten fold improvement by using this system.

i) Dig or drill holes at least 70 mm (three inches) in diameter, at least ten metres (33 foot) apart to at least 1.2 metres (four foot);
ii) Fill each hole with a wet slurry of the Super Earth Kit mixture;
iii) Push a 1.2 metre (four foot) stainless steel rod down the centre of the hole;
iv) Clamp the energizer earth (ground) wire to the tops of the rods using G626 Earth Clamps.

Note – In drought conditions it may be necessary to water the earthing (grounding) system. The extra effort of putting in the Super Earth Kit can be well worthwhile.

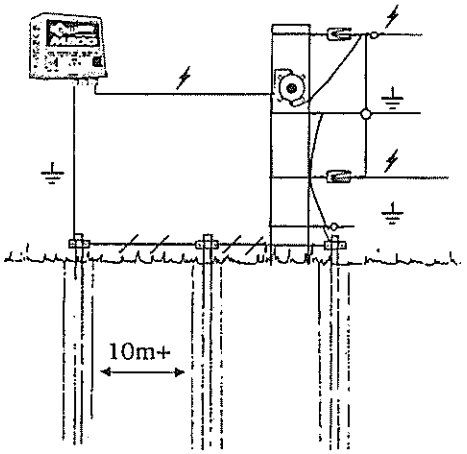

Figure Ten – G635 Super Earth Kit

ELEMENT SIX
LIGHTNING DIVERTERS

Lightning strikes can damage energizers. Damage can be minimised by disconnecting the energizer from the fence line and unplugging it from the power supply during electrical storms.

A lightning diverter such as Gallaghers G648K Lightning Diverter Kit can minimise energizer damage. Lightning always finds the easiest way to earth. Therefore, the earth (ground) system of the lightning diverter must be as good as, or better than, the energizer earth (ground).

The choke causes a blocking effect for the extremely high voltage of the lightning so that it jumps the silicon carbide discs inside the lightning diverter and is diverted to ground.

In areas where lightning is a major problem, there would be an advantage in having additional lightning diverters dispersed over the farm in damp areas.

Note – Using a lightning diverter does not guarantee complete protection and will not protect the energizer against a direct strike, or lightning travelling via a power supply.

In bad lightning areas, earthing (grounding) the top wire of the fence helps significantly.

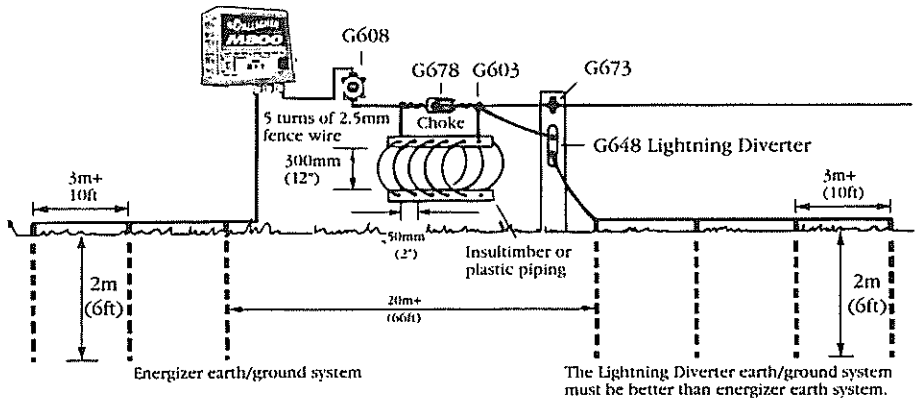

Figure Eleven – Lightning diverter

RECOMMENDED READING AND VIEWING

- Gallagher Power Fence Manual.