Shocks Affecting Animals Version 1.6 24 February 2016

Shocks in farm dairies, also called sheds, cow-sheds, herringbones or rotaries in New Zealand, and swing-overs or sheds in North America, and shocks in water troughs (tanks in USA) have cost some farmers small fortunes over several years in lost milk production and low conception rates in cows.

Shocks were a major problem in New Zealand after the 1960s when steel herringbones and later, steel rotaries, were first built. Problems now occur less often, thanks to the late veterinarian Dr Harry Dewes, who studied the problem in the 1960s, developed sensitive measuring equipment, wrote about it and fixed many previously unsolved problems. Harry's son Peter Dewes peter.dewes@slingshot.co.nz in Hamilton, covers the North Island of New Zealand and Brian Rickard (electrician/electrical inspector for Ashburton Power Board) tests throughout the South Island. Using this same sensitive equipment in 2008, they are both finding and solving shock problems when others can't.

In North America, the power supply system of just two wires (live and earth) can cause severe problems that are difficult to prevent, because their earth (ground) systems can be inadequate, or the soil can be so dry that utility earthing is unsatisfactory, unless an improved earth system is used. This entails the use of a bentonite earthing system available from some electric fence companies. Read Fencing > Permanent & Temporary. As electricity use on farms increases, the loading on power supplier earth systems (which are seldom adequate) increases, causing power to seek other routes to earth - sometimes via the parlour or water pipes and drinking troughs. Cows then drink less so produce less because of shocks.

Stress

It is important to know all the symptoms in cows and to also realise that cow nervousness can be caused by things other than shocks during milking, for example:

- Faulty milking machines with inadequate or fluctuating vacuums, small or inadequate slope or sag in the milk line, causing plugging and vacuum drop, and/or mixed pulsators giving different ratios.
- Bad milking practices, such as rushing cows, rough application and rough removal of clusters and leaving them on for too long.
- Cracked, sore teats.
- Mineral deficiencies.
- Mineral imbalances, such as excess manganese - not magnesium, which is usually deficient and has a calming effect.
- High nitrate pastures and/or forage crops from faulty fertilising and/or incorrect grazing. See www.grazinginfo.com > Animal Health > Nitrates.
- Animals of all kinds can get shocks when trying to drink from troughs that have current flows, so they then become thirsty and stressed.

There are still experienced specialists finding stray currents while some so called "specialists" don't know what to look for and don't have sensitive enough equipment.

Don't place drinking troughs under live wires as done here at Ruakura, because some animals, while drinking, have been pushed by another and have received a severe shock which is never forgotten. When drinking and getting a shock through the mouth and head, the animal may think it came from the water in the trough. The cows waiting, feared being pushed into the live wire over the trough, so the last one didn't get a drink for an hour. Double-insulated undergate cable should be used and supported by pinlock insulators. Bare wires through black plastic tubing is not always safe, because the tube or pipe can be conductive. Black in plastic is usually carbon to protect against the sun's ultra-violet rays. Excess carbon in badly made insulators can be conductive.

Animals are more vulnerable to shocks

As with people, cows vary in their reaction to shocks, so some may not react at all, while others may react strongly. My older brother could stall a six cylinder engine by holding all six spark plugs, and I, if in gumboots, can hold a high power electric fence, at 6,000 volts.

People dislike shocks, but cows hate them, especially through the teats or mouth, and they let us know by hesitating, mucking, reducing their milk production and giving high somatic cell counts. Cows standing on wet concrete or soil on four hooves can be adversely affected by anything over half a volt. In the milking situation, milking cows are twenty times more sensitive to electrical leakage than humans milking with bare feet. We walk around the farm in gumboots and are not jammed up against fences and rails by other people, so we are less likely to receive shocks, and, when we do, the current flow is lower because of our semi insulating footwear and because we have only two feet on the ground, not four.

We know that when we have to touch a live wire we can halve the shock by raising one foot off the ground, and that shocks through a crack in the hand, or tender part, are much more severe than through dry skin. Imagine the shock through a tongue or teat.

Every farmer has heard about shocks affecting milk production, but few believe that shocks in water troughs, or power running across lanes can upset stock. Dry-stock farmers rarely give it a thought, but if their troughs are live they'll be losing meat production. A sure sign is animals lingering around the trough as if waiting to drink, that is assuming there is plenty of clean cool water and not a boss cow standing at the trough causing the delay. Another sign of power in trough water is cows lapping at the water rather than immersing their mouths in the water to drink.

Pigs in pens can also be affected.

Causes of shocks

Shocks are caused when an electric current (even a fraction of a volt) can't complete its circuit in a poorly earthed (grounded) item and tries to go to a better earth (ground) or faster way back to its earth. If an animal is between or touches the "live" section, that can be anything steel or reinforced concrete, and another section, the current will flow through it.

Intermittent shocks could be coming from an electrical appliance (energiser, electric motor starting, or any item using electricity) operating even a mile or more away, if on the same transformer. If an appliance is poorly earthed or its earth is , the current will look for an earth and flow along water pipes, or, if the mains supply (utility) earth is inadequate (many are), along the power supply earth wire to a better earth that can be on your property or on a neighbour's.

Sometimes shocks can only occur during dry weather, when earthing becomes less effective, because dry soil is not a good conductor, or after the first rain following a dry period, when the soil surface becomes wet and the subsoil is dry, so the currents flow along the surface and through anything standing on it with legs apart. Standing on one leg - you'll feel nothing.

Leakage through vegetation touching live wires increases current flow. It is important that you disconnect the bottom wires with flexible connectors once vegetation touches them, to reduce current flows. Also, because when the grass becomes live, animals stop eating it and near it, so vegetation grows longer and current flows to the ground increase. The greater the flow, the greater the chance of stray currents.

Lanes with live wires can be a problem, especially with leakage through poor quality insulators and vegetation. Use good quality, large insulators with at least 10 mm of thickness and 25 mm of surface travel.

Unbalanced voltage loads can be a problem, especially in 120 volt systems, and three phase systems where one phase has a lot higher load than another. Water heaters are usually single phase, so put a high load on one phase. Get your electrician to balance the loadings and the loadings of what is on each phase, and get the figures from him because he might not think it is important. Balancing loads is not easily solved because things like water heaters and rotary dairies are not on all the time. Dedicated parlour transformers (transformers usually within 50 metres of the parlour and supplying only the cowshed and maybe a sub-main to the implement shed) aren't affected by unbalanced loads and have few problems with 'voltage spikes' from three phase motors switching on and off.

The most severe shock I've ever had, and I've had hundreds of shocks, was when I touched an electric fence earth stake in Holland while leaning against a steel barn. In Holland, energiser installations have to be done by electricians who can believe that an ordinary one metre long 12 mm diameter rod, as is used for houses, is adequate. It had 3,000 volts on it.

In the beginning, power supply (utility) authorities in New Zealand denied all responsibility, but were forced to accept that bad connections and over-loaded transformers and earth systems could cause problems.

Causes of shocks

- Inadequate earthing. Modern energisers are much more powerful and fences are getting longer, so earth systems need to be larger to cope. See below and www.grazinginfo.com > Fencing > Permanent and Temporary Part 1 and Part 2. They give full details on all aspects of electric fencing, including items such as induction.
- Induction between parallel wires and poor insulation (leakage) from live wires to other wires and parts of buildings.
- The layout of the fences and earth stakes. The dairy should not be in the flow-route to the earth system. See below.
- Overloading the earth system, caused by it being inadequate, and poorly insulated fences, shorts and leakage to vegetation.
- The power supply transformer earth overloaded, especially if it is in dry soil or soil that has poor conductivity.
- Cabling and cabling termination on variable speed drives to vacuum pumps, milk lift pumps and platform drives.
- Leakage from milk lift probes.
- Lots of joins in the neutral power supply line from the transformer.
- Poor neutral connections.
- The transformer being a long way from the cowshed, causing a voltage drop on the neutral return power line.
- If the parlour has been extended (its power demands increased) and the supply power lines haven't been upgraded to cope.

Finding and measuring current flows needs a continuous voltage meter, not an electric fence digital volt meter. Almost every farm suffers from at least one of these, but they may not be affecting milk production.

Having a radio on during milking definitely reduces cow stress, as frights from noises, such as a bucket being dropped or when visitors with different voices arrive, are reduced. Leave the radio on all day because it will discourage birds from entering and making a mess.

Symptoms of shocks

- Reluctance to enter the milking shed parlour.
- Bad cow behaviour in the parlour, but it could be from a faulty milking machine, stressed cows because of excess manganese in pasture, in the drinking water and/or in supplements, and/or needing magnesium, sodium or other minerals.
- Rapid exit after milking.
- Low milk production. If affecting the water system, cows may not drink as much water as they should.
- Nervous animals, especially first calvers. Dr Doug Philips at Ruakura Animal Research Centre showed, with identical twins, that cows can become accustomed to regular small shocks, and not be affected by them, but are by intermittent shocks, so first calvers are the ones to watch when they first enter the dairy. Heifers and old cows have thinner hooves so they are more sensitive to electrical leakage.
- Increase in somatic cell counts and mastitis.
- Cysts on ovaries.
- Low conception rates.
- Slow and/or incomplete milk let-down.
- Cows resisting being drenched because the drenching gun is live from the pump.
- Animals resisting going through gateways or walking up lanes.
- Cows not wanting to step onto a rotary or come to the area close to it. Fit a spring loaded sliding or revolving contact between the two. The wheel must not have a greased or oiled (insulation) bearing. Most importantly - get rid of the source of the current.
- Animals standing around troughs wanting to drink, lapping water, but not drinking. Animals feel even very low voltages through their mouths. Beef cattle and any dry stock can also be adversely affected.

- If more than 5% of cows muck in a herringbone, or more than 2% in an external rotary, suspect something. One farm I visited during milking, had a cow stress problem, but no shocks. The pulsators ratios were mixed. Some were 70:30, some 60:40 and some 50:50. The farm had sandy pumice soils, so the cows were low in sodium, selenium and cobalt. Solminix, a soluble mix of seven minerals, fed at 30 grams/cow/day through an on line or Peta trough dispenser, calmed the cows, gave them sheen, better health and improved conception rates.
- Animals walking single file or stopping in one place on a lane or avoiding an area in the yard.
- Parts of yards that are not walked on can be affected by current flows from something close to the area.
- Cows not using some free stalls can be because of shocks there.

The unused concrete area shown in this dairy yard was avoided because of current leakage from an effluent pump just through the rails.

There can be a physical obstruction hurting the cows in the areas they dislike, such as sharp pieces on rails or reinforcing rods sticking up from the concrete that they stand on.

If one side of a herringbone parlour is preferred by many cows, especially older ones that have learned over time to avoid getting shocks on the other side, check why, including for rough protrusions that may hurt cows physically when squashed into them.

A shock received a long time before milking doesn't seem to affect production, but those immediately before or during milking can. However, if current flows are to or from the drinking water, they can affect all animal production because water consumption will be reduced.

Finding current flows

Measuring these needs a continuous mini-voltage meter recorder, not an electric fence meter. Conditions can vary, for instance a cow on dry concrete or dry organic soil such as dry peat, may not react, while the same cow subjected to the same current flow on a moist conductive mineral soil would. These, and other factors, have caused some researchers to get different results from the same current flows.

Every milking parlour should be checked annually. Testing should be done during milking or by having water running to the effluent pump, letting water out of heaters so they switch on, items working in the workshop, chillers running, as well as high wattage items in homes. All farms on the same transformer should be doing the same thing at the same time, so as to load the transformer earth (ground) system. Neighbours on the same transformer should have all their equipment working and should work together to check their sheds for shocks while all are running. It is best done during milking when everything is wet. If a current flow is found, turn items off one at a time. If necessary start by switching off the mains of each farm to determine the source.

The only accurate way to check them is to have continuous measuring and recording in milli-Volts during the whole milking, because voltages can vary with motors switching on and off, urine on yards increasing conductivity towards the end of milking and homes turning on high load items such as ovens may send one overload shock.

If a problem is found and it relates to one electrical appliance, clean and tighten all its wires and joins, and/or install a new earth wire to it - there could be an internal break in it. All metal connections in the dairy and all earth wires of all electrical appliances should be tightened and tested annually.

Some countries have laws that allow only registered electricians to do these**.** Check your laws.

Keep switch boards and plugs clean, because dirt and cobwebs in foggy, damp conditions can conduct power from one to another.

The ordinary voltmeters used by power supply authorities and electricians will not detect small current flows. Power supply people usually look for major problems, while animal shocks are usually from minor ones. Sophisticated equipment has been developed to find the smallest of current flows.

A voltage meter that measures fractions of a volt will be needed, with wires long enough to connect to an earth point well away from the unit. Check for voltage between all pipes, steel, slabs of concrete, troughs, etc.

Currents can travel through an animal straddling two sections of concrete, where reinforcing steel

sheets has not been welded to each other. Floors and milking sheds should have all steel welded to adjacent steel. Pipes should be connected at the top, or bottom as shown here, by welding 12 mm (half inch) galvanised pipe in a loop.

Measuring shocks across concrete needs two large bearings (conductors), to get good contact with the concrete, two or more metres apart, with a sensitive gauge.

Ensure that the mains (utility) earth is adequate. Few are satisfactory in modern dairies where so much power is used by a rotary, milking equipment, heaters, pumps, chillers, etc.

There could be a professional in your area who checks for current flows. Some veterinarians claim to do it, but are not skilled, so don't always find the cause and solve it completly. See the top of page 1. In dry areas, bentonite and salt earth systems should be used.

If you have problems while milking, use a timer to turn it off and on again. You may need two, unless you're on the latest growth milking system in New Zealand - once a day milking.

Problems that can occur

A Waikato farmer had some cows abort after they were left in the lane over-night during muddy conditions. An adjacent electric fence short through a junk (tube) insulator was the cause. Vegetation touching wires can do the same thing.

Another Waikato farmer phoned one day because he could not get his cows out of the paddock after the first autumn rains following dry weather. There had been thunder and lightning with it, so the farmer blamed that. It had been very dry, so what was happening was that leakage from thistles touching a live wire near the gateway was conducting current to the soil that was moist to a depth of 2 cm, so the electric fence pulse was travelling along the surface across the gateway (and through cows that walked there) to the energiser earth a few hundred metres away. Turning off the energiser solved the problem. Doing this is a good practice when moving cows and during milking. A timer can be installed on the plug to both turn the power off and on again after milking, but best of all, fix the problem.

Mastitis in one teat of cows could be from applying that shell (cup) first in a situation where there is current in the milking machine, floor or pipe work, so built up current flows through the first shell applied. Cows should not shuffle while clusters are being applied. Doing so indicates a problem of some sort.

Automatic electrically operated feed systems have caused problems, as can any system that runs electrically, especially if it switches on (sudden high load) and off (sudden surge). If my old computer was sleeping and a light on the same outlet was switched off, the computer would wake, because of a surge, despite us living in a reasonably new area of Hamilton with good power supply.

Electric motors must be earthed back to the mains board or sub-mains board earth (ground) system. These mains power (utility) earth pegs must NOT be used as electric fence energiser earths. Electric fence earths must be at least 50 metres away from the cowshed and pipework, or feed pad pipework if it is joined to the cowshed pipework. How far away depends on the current flow line. See below.

All electrical appliance earth connections should be sound, tight and clean. A verdigris covered one (indication of a poor connection) on a drenching system caused cows to get shocks each time they were drenched.

A farmer's wife complained of shocks a second apart in the shower. He couldn't feel them. People with soft, moist skins feel shocks much more than those with dry hard skins. Men's dry, thicker skin can be a poorer conductor. He turned his fence off, but she still felt them. "Ha, ha, you're imagining it" he said. Shocks were later traced to a neighbour's fence not far away, although the energiser was a mile away. The current leaks were coming from an electric fence on the boundary through a water pipe to earth in their house, that was closer than the energiser earth.

The energiser can be anywhere, provided both the live and earth wires from it are all double insulated. However, if the earth wire has to be taken some distance to the earth system, once it is out of the building, it can be connected to several ordinary fence wires on a fence going to the earth that can be in a boundary drain, low wet area or a bentonite and salt earth system.

Preventing shocks

The following are ways of reducing problems.

Improve the insulation on the whole farm by using good pinlock insulators. They outlast cheaper, smaller ones and the tubing, and they allow easy lowering of fences to move anything large, and to move livestock in winter to prevent gateway damage and walking over wet grazed soils.

An inadequate earth system reduces the output of the energiser and increases the chances of shocks in sheds, yards and water troughs as current flows try to find a way to earth. It takes an expert with sensitive measuring equipment to check for shocks in sheds.

Check your parlour twice a year and your yards in many positions at the height of dry weather and the height of the wet period. Check the energiser and mains switchboard earth and live wire connections for corrosion. Make sure that the connections and pins on three pin plugs are kept tight and clean, and that all earth wires are kept secure. This includes those in pump sheds, your home, and any other place. After doing these things, get the parlour checked for stray currents.

Our parlour was affected by electric fence current flow in 1960 because the earth stakes were 30 metres behind it, 30 metres away and 90% of the electric fences on the opposite side of the herringbone. We moved the earth stakes to the boundary drain and used a multi-wire cross fence to connect it back to the energiser, and cured the problem.

If an energiser earth is on the opposite side of the parlour to where most of the fencing is on the farm or of a current leak, the current can flow under and/or through the building and through the cows. Energiser earth systems are best placed in damp areas, well to the side of sheds and away from water pipes, so that current leaks from fences on the farm don't flow down water pipes or anywhere near the parlour. Plastic water pipes are worse that steel pipes because the currents flow through the water.

The correct layout is for the earth stakes to be well (more than 50 metres - 166 feet) to one or both sides of the dairy. Stakes on both sides allows current flows from paddocks to the side of the parlour to collect flows rather than go through the parlour.

Five three-metre or longer earth stakes, each at least seven metres apart, in a square with one in the centre, is a good earth system, especially for lightning, provided a lightning diverter is connected between the fence and it.

If the dairy is in the centre or towards the centre of the farm, have two earthing systems for the energiser - one on each side of the cowshed, or use two energisers - one for one side of the farm, away from the cowshed and the other for the other half. Connect a 2.5 mm core double insulated earth cable to each stake and make sure you use one continuous wire from the energiser to the last stake. Use proper galvanised earth clamps and check them annually in hot weather. Replace rusty earth stakes, rusty clamps and rusty electrified fence wires, because they are all bad conductors.

When it comes to shocks, one can't be too careful. A dairy farmer friend phoned me and said that his new sharemilker complained of shocks affecting the cows, something the previous one had obviously become accustomed to. The earth was behind the herringbone. Moving it to the boundary drain solved the problem.

Water troughs

A herd in the 1970s had infertility problems caused by cysts on the ovaries (a stress symptom). Harry Dewes suggested to the farmer that his cows must be stressed. The farmer and herd were very relaxed at milkings. Harry checked for stray voltage during milking and found nothing. Perplexed, he walked across to a water trough in an adjacent paddock, set up his sophisticated measuring system and there it was - a pulse from the energiser. He found that most of the water troughs were live, through the energiser in the pump shed having its un-insulated earth wire touching a pipe.

The energiser and earth system were moved to the implement shed, and milk production increased. The farmer estimated that he had lost NZ$30,000 over three years from lower milk production, after he installed a new energiser in the pump shed. Other cases showed milk solids production drop from 100,000 to 80,000 kilograms, and milk always down in one paddock because that water trough was electrified.

Shocks can even occur in a trough at the back of the farm, because leakage from insulators and vegetation touching live wires travels by the easiest route back to the energiser earth, which can be through an animal drinking. Dry stock farmers need to be aware of this.

It is sometimes difficult to identify whether animals are being put off drinking because of a

fraction of a volt in a trough, or by bad water. To play it safe, even if you don't have a stray voltage problem, earth the water from every trough by pushing a piece of 4 mm (8 gauge) soft, galvanised wire as deep as possible into the ground on the dampest side of the trough, and fold the other end over in to the bottom of the trough.

It is not a good idea to have water troughs under electrified wires. If you have to, support all wires (electrified and non-electrified, which can be live from induced current) with pinlock insulators, so they can't electrify the water system. If you don't do this, and a wire at the back of the farm shorts into a trough, you may wonder why the milk is down, until you find it a month later, or why you have an infertility problem (cysts). Also, there are cattle so scared of shocks that they won't even drink from a trough that doesn't give them a shock, but has a live wire over it. It could have been pushed by another while it had its mouth in the water drinking.

Tubing wears thin and gets damaged, and some is conductive, especially when wet, so don't use it, in case it touches a water trough.

Current flows, shocks and inadequate earth systems on battery and solar-powered energisers can cause problems if their earth wire touches a water pipe, or the earth is even near drinking water systems or conventional fences that can then conduct induced power to drinking systems.

Energisers with a perfect earth system don't stop the flow of currents along water pipes and through milking sheds to the earth system.

Earth system

Energiser earthing is easy to test and fix, and it must be perfect or the full power of the energiser can't complete the circuit, so can't charge long fences or control animals with a full shock. Modern, large, high power energisers need a large earth system.

Install a permanent testing wire adjacent to the energiser. It should be galvanised wire pushed a few feet into moist ground well away from the energiser earth, and run back to the energiser to facilitate measuring the voltage between it and the energiser earth terminal, NOT to an earth wire that could be disconnected from the energiser or broken. Electric fence booklets that show checking the earth from the end (last) earth stake don't allow for the wire in long grass being disconnected or broken.

There should be no voltage reading on it. If there is, then short out the fence with a dozen steel stakes a few metres apart in a damp area at least a hundred metres from the earth system, and measure again. If there is more than 200 volts (0.2 kV on the DVM), the earth wire and clamps should be checked all the way to the last stake, and if these are OK, then the earth should be extended, using double insulated leadout cable, with at least 2.5 mm galvanised wire in it, and joint clamps. Don't use copper wire. Connecting it to galvanised wire or to stakes causes electrolysis and corrosion, leading to a bad connection. It is a good idea to support the earth cable from the energiser earth terminal to the earth stakes in insulators, so that if, in time, the cable wears through, it won't short on to the building.

Remember that earth wires carry just as much current as live wires.

In soils that are poor conductors - that is most when dry, but especially pumice and peat - it is very difficult to achieve no voltage on the earth system unless the stakes go into permanently moist clay or into a bentonite and salt earth system.

Four three-metre deep, galvanised earth stakes are better than six two-metre deep ones. Rusty pipes and Waratah standards are useless because the rust is not conductive.

Prevent shocks from affecting your animals by using double insulated leadout cable (**not household or workshop cable, that is not made for 5,000 volts**) between the earth terminal and all stakes, and don't allow it to contact any building or water pipe.

Get the power or electric fencing manuals from your local dealer for more on fencing and earthing. Some of it will be the same as is here, because I wrote one in 1980 which was copied by some. Most of what is here will not be in other manuals.

Eliminate shorts and leaks

Shorts and leaks on fences load the earth system, so increase current flows and animal shock problems. If animals don't like going through gateways, or if they change to single file when walking along a lane, then suspect a short in the area. The leak will cause a current flow along the ground in the immediate vicinity and this could travel through an animal or between touching animals.

Use only good quality, large insulators. Small ones, held on with only one staple, are the worst at leaking, especially after bird droppings, spider webs or sea-spray cover them. The saving in using them

is only a fraction of a cent per metre of fence, while the loss of production and your time finding shorts could add up to thousands of dollars.

Gallagher and some others have volt meters that also help locate shorts (leaks) and can switch the energiser off and on again from anywhere on the fence.

Two voltage readings

Leadout wires from two separate energisers can cause problems when they run parallel over long distances. The symptoms are two readings on each wire - a high reading and a low reading. This is not a problem, as long as the wires don't touch each other, so you can either ignore it or position the leadout wires further apart.

Precautions during milking and when moving stock

Timer switches are available to switch the energiser off during milking and on again after milking, although if everything is correct this is unnecessary.

If problems are still experienced, turn the water heater (a heavy user) off during milking.

Current flowing along the surface that can affect animals being moved through gateways can't always be prevented, except by improving insulation and eliminating leaks through vegetation.

Fence design

The more electrified wires and insulators, the more current flow, so the more likelihood of overload and current leaks. Most dairy farm fences need only one live wire, that is best positioned half way up the fence, rather than low, where it is more likely to shock working dogs (unless it is required to keep stray dogs out), and will cause more shorts and current flows through vegetation touching the wires. Sheep, goat or calf training paddocks may need low live wires.

The lower the live wires, the more leakage through vegetation. However, a live wire too high on the fence is a nuisance when people need to get over. Deer fences on dry soils may need alternating live and earth wires to about 1.5 metres.

Use double insulated electric fence cable under gateways and thread it through alkathene (plastic) piping as a protection against stone damage. Never secure undergate cable or the alkathene piping with staples, because you can damage the plastic and cause leakage. Just tie the piping to the post with wire.

Improve the insulation on the whole farm by using good pinlock insulators. They outlast cheaper small ones and tubing, and allow easy lowering of fences to move large machinery and livestock in winter, to prevent gateway damage and walking over wet grazed pastures. A herd can be moved across a fence at the back of a paddock to save moving the animals to the front, out the gate and in the next gate. Always switch the fence off to avoid the animals getting a shock.

Use white strain insulators and black pinlock insulators on the line. Plastic water pipe or tubing is short lived, speeds wire corrosion, and makes it hard to find leaks. It is not made to be insulating, so if high in carbon (the black), which is conductive, it can conduct currents.

Lanes with live wires can be a problem, with leakage through grass and poor quality insulators. Use good quality, large insulators with at least 10 mm of thickness and 25 mm of surface travel (tracking distance).

Preventing gateway shocks

Induction comes from live wires running parallel to other wires. Non-electrified wires can become live through induction or shorts, so treat them as live and don't allow them to touch gates or water troughs.

If you get a shock at non-electrified gates or anywhere around the farm, from something that should not be live, it could be induction. Don't ignore it. Try to identify whether it is caused by leakage or induction.

To test whether it is leakage or induction, measure the voltage on the power fence (say 4,000 volts), then take a reading on the adjacent non-electrified wires that should not have power in them. They could read a few hundred volts from induction or leakage or even a short.

The shocks you and animals can get at gates can be induced current, which can be eliminated by pushing 4 mm (8 gauge) galvanised wire as deeply as possible into the soil and tying it to the non-electrified wires around the strainer posts. To make a tidy and good job, thread the earth (ground) wire up between the fence wires and then pull it under the fence wires that are around the strainer post. This

makes a good contact and holds it tightly. This won't work where live wires are tied to self insulating strainer posts, so tie the earth wire securely to the non-electrified wires, without touching the live wires.

Check these every few years for corrosion and replace them if necessary, because rusty wire is not a good conductor. In some soil types, the wire will last for 10 to 20 years, whereas in peat and acid soils, they will rust within a few years. If you have a rusting problem - use aluminium or aluminium coated wire. Check the voltage on the live wire before and after shorting out the non-electrified wires, to ensure that the live one is not touching or somehow connected to a non-electrified wire. Earth both ends of strains, because induction builds up along the fence line, and, as we found, you can earth one end, and still have power at the other.

Measure the voltage on the fence before and after doing the above. If it drops, then there is a short. Earthing an induced current doesn't lower the voltage on the live wire unless they are parallel for miles and the induced voltage is in the thousands.

When rain falls after a dry period, currents can travel along the soil surface, across gateways and through the parlour, especially after cows enter and pass their high mineral, highly conductive urine, causing currents to even flow across a concrete surface and through the cows. A short or weeds conducting power off a live wire close to the parlour can result in current flowing through the parlour and/or yard. During dry weather when the soil is dry on top, the current will travel at low depths in a slightly U shape, even if further to travel. After rain, the current flow can change and travel near the surface and across the wet cow yard, adversely affecting animals on it. Moving the earth system well to one side (or half to each side) of the parlour can eliminate these shocks.

The above can occur even when the earth system is perfect, simply because the current flows to it via the best, shortest and fastest route. To avoid this, earth systems should be in a damp area well to the side of the milking parlour, or half the earth stakes on both sides, but never in line with the parlour and where most of the shorts come from, which is the main part of the farm.

Now that you've read all this, don't over-react, because many top producing dairy farmers use electric fencing extensively, but you should take the necessary precautions and think about whether a neighbour's energiser could be affecting your animals, which is only possible when you share the same supply transformer as your neighbour.

Once a farmer phoned and said, "I can't get the cows out of the paddock."

Rain had fallen after a long dry period and leakage from cheap small electric fence insulators and grass and weeds had grown over the fence, caused the current flows to run across the surface of the soil on its way to the energiser earth, so through animals when they went to walk through the gateway. Take your boots off and walk with long strides down the lane, to feel the current flow.

Also Read Fencing > Permanent & Temporary parts 1, 2 & 3.