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Evaluation Report 109

Parmak Mark I Electric Fence Controller

A Co-operative Program Between
ALBERTA FARM MACHINERY RESEARCH CENTRE
PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

PARMAK MARK I ELECTRIC FENCE CONTROLLER

MANUFACTURER:

Parker-McCrory Manufacturing Company
3175 Terrace Street
Kansas City, Missouri 64111
U.S.A.

RETAIL OUTLETS:

United Farmers of Alberta Co-op Ltd.
4635 - 1st Street S.E.
Calgary, Alberta
T2G 2L2

RETAIL PRICE:

$63.99 (August, 1979, f.o.b. Humboldt)

SUMMARY AND CONCLUSIONS

The Parmak Mark I electric fence controller was suitable for use over a wide range of fence conditions. Peak voltage output on a 5.4 km (3.3 mi) single wire fence varied from 2500 V for a well-insulated, grass-free, dry fence to 840 V for an uninsulated, grass-grown, wet fence. For most normal fence conditions, output was above the 2000 V minimum guard voltage recommended for long-haired animals, while for extreme conditions it was above the 700 V minimum needed for short-haired animals. For most fence conditions, the Parmak Mark I could be used without wire insulators on this fence length.

Peak voltage output on a 16 km (10 mi) single wire fence varied from 1110 V for a well-insulated, grass-free, dry fence to 590 V for an uninsulated, grass-grown, wet fence. Plant growth touching an insulated, dry fence did not appreciably reduce voltage output.

Peak current flow through a cow touching well-insulated 5.4 and 16 km (3.3 and 10 mi) single wire fences varied from 1.7 to 1.2 A for a cow standing in water and from 0.50 to 0.25 A for a normally-grounded cow. The high peak current output indicated that the Parmak Mark I generated quite an intense shock and was suitable for fairly long fences or poorly insulated fences.

Total charge delivered by the Parmak Mark I varied from 0.18 to 0.52 mC. This was within accepted safety limits for cattle or humans.

The Parmak Mark I was very suitable for cold weather use on feeding fences. Peak voltage output at -37°C on a 5.4 km (3.3. mi) single wire fence was about 2500 V, the same as its output at room temperature.

No durability problems occurred during testing.

RECOMMENDATIONS

Test results did not indicate the need for any modifications.

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GENERAL DESCRIPTION

The Parmak Mark I electric fence controller is designed for 115 V AC operation and is equipped with a cord and plug for connection to a standard electrical receptacle. It is meant to be mounted in a suitable weatherproof enclosure.

The Parmak Mark I contains solid-state electronics, with no moving parts. It has a dual position switch for setting the shock frequency. A light is provided to indicate operation of the controller.

The controller was CSA approved.

Detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The performance characteristics of the Parmak Mark I were determined in the laboratory for a range of simulated fence conditions.* It was evaluated for ease of operation, quality of work, safety and suitability of the instruction manual.

RESULTS AND DISCUSSION

EASE OF OPERATION

Installation: The Parmak Mark I is equipped with a three-wire cord and plug for connection to a standard, grounded, 115 V AC receptacle. The manufacturer recommends that the controller be located in a dry building or suitable shelter to protect it from adverse weather.

The controller is connected to the fence with a length of insulated wire. In addition, a suitable ground rod has to be installed and connected to the controller. Depending on ground conditions, a 2 to 3 m ground rod length may be needed. A ground rod connecting clamp is supplied with the controller.

Fence Condition: The manufacturer recommends that the Parmak Mark I be used only on insulated fences. If the fence is properly insulated, the controller is designed to operate effectively with a certain amount of plant growth touching the charged wire.

The manufacturer recommends that for cattle fences, in areas with normal ground conditions, a single charged wire fence erected about two-thirds of animal height above ground provides a suitable fence. For very dry or frozen soil, which provide poor ground conditions, a two-wire fence, with one charged wire and one ground wire, may be necessary.

Operation: The Parmak Mark I is equipped with one indicator light that flashes when the controller is operating. The indicator light bulb could be replaced without factory servicing. The shock regulator switch could be set in two positions. The operator's instructions indicated that the switch could be used to set the shock frequency, without changing the shock intensity, but failed to indicate its use or purpose.

QUALITY OF WORK

General: Operation of an electric fence controller is quite complex. To be effective, an electric fence has to deliver a minimum guard voltage to overcome the insulation resistance of the hide and hair of an animal. In addition, once the insulation resistance of the animal is overcome, the controller must deliver a pulse of electrical energy to the animal to create a shock. The amount of energy (charge) delivered is related to the current flow and its duration. If too much energy is delivered, the fence will be hazardous to both animals and humans while if not enough energy is delivered, animal control will be ineffective. For safety reasons, the total electrical charge in each pulse of power line-operated controllers should not exceed 1 mC if it has an on-time less than 14.2 ms. For an on-time of 200 ms, 4 mC is the allowable total electrical charge. Electrical regulations do not apply to battery-operated controllers.

Little is known about the physiological effect of shock pulses on animals. In general, the following guidelines are used in assessing fencer performance: the minimum guard voltage needed to overcome animal insulation resistance should be at least 2000 V for sheep and for long-haired cattle, such as Herefords or Charolais. For shorter haired animals, such as most dairy cows, a minimum guard voltage of 700 V is sufficient. The shape of the current pulse affects what the animal feels when it touches an electrical fence, but little reliable information is available. It has been found that shock intensity is more related to the peak current value in a pulse than to the total value of the electrical charge.

Fence conditions determine the guard voltage produced by a fence controller and limit the amount of charge, which a controller is capable of delivering to an animal. The insulation resistance of a 1.6 km single wire fence typically varies from about 1 kΩ for an uninsulated, grass-grown, wet fence to well above 500 kΩ for a well-insulated, grass-free, dry fence. The higher the fence insulation resistance, the greater is the length of fence on which a certain controller can be effectively used. To receive a shock from a single wire electrified fence, an animal must be sufficiently grounded to permit current to flow from the fence, through the animal. Typical electrical resistances of cattle vary from about 0.5 kΩ for a cow standing in water and licking a charged wire to about 4 kΩ for typical ground conditions. If ground conditions are too poor, animal resistance to ground is so great that no shock occurs.

Peak Voltage Output: FIGURES 1 and 2 show peak voltage outputs of the Parmak Mark I for 5.4 and 16 km lengths of single wire fence over a range of insulation resistances. On a 5.4 km

*PAMI T7850, Detailed Test Procedures for Electric Fence Controllers.

fence (FIGURE 1), peak voltage output varied from 2500 V for a well-insulated, grass-free, dry fence to 840 V for an uninsulated, wet fence with considerable grass touching the charged wire. The voltage output was above the 700 V minimum guard voltage needed for short-haired animals, for all fence conditions, while it was above the 2000 V minimum guard voltage needed for long-haired animals for fence insulation values greater than 4 kΩ. From FIGURE 1, it can be seen that the Parmak Mark I can be satisfactorily used on this length of fence, without wire insulators, in most conditions.

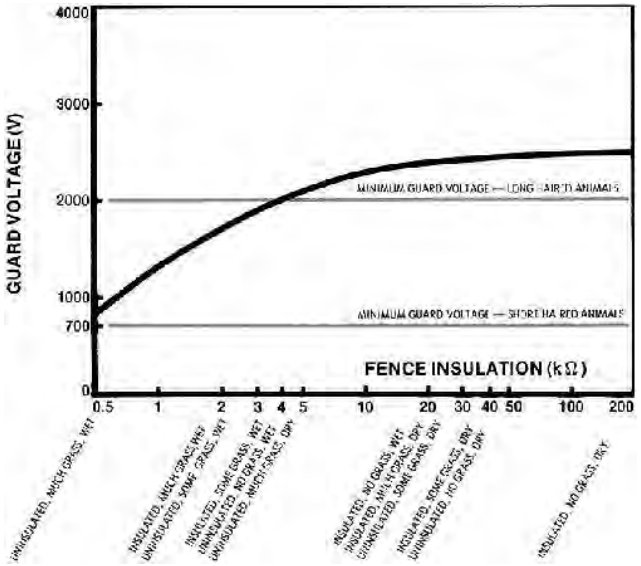

FIGURE 1. Guard Voltage Produced on a 5.4 km Single Wire Fence.

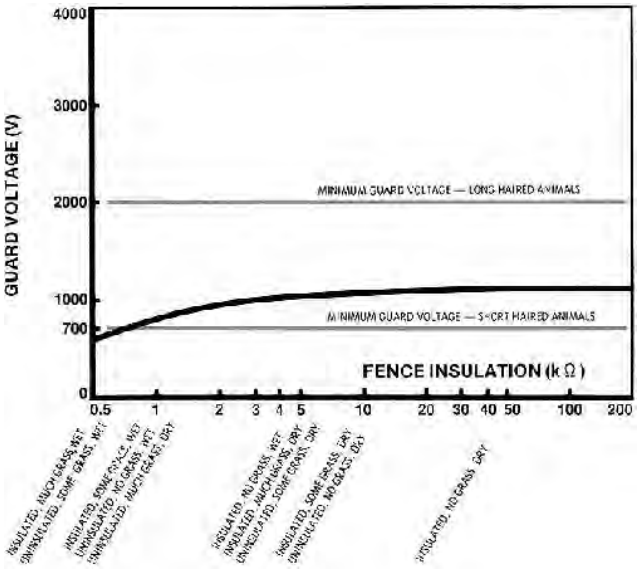

FIGURE 2. Guard Voltage Produced on a 16 km Single Wire Fence.

On a 16 km fence (FIGURE 2), peak voltage output ranged from 1110 V for a well-insulated, grass-free, dry fence to 590 V for an uninsulated, grass-grown, wet fence. Voltage output was below the 2000 V minimum required for long-haired animals, but was above the 700 V minimum required for short-haired animals, for most fence conditions.

As can be seen from both FIGURES 1 and 2, plant growth touching an insulated, dry fence did not appreciably reduce the voltage output. The Parmak Mark I can be expected to operate well over a wide range of fence conditions.

Electrical Charge: FIGURES 3 to 6 show the current output of the Parmak Mark I when a cow touches 5.4 and 16 km lengths of well-insulated, single wire, fence. FIGURES 3 and 4 are for an animal resistance of 0.5 k., which represent the most extreme condition of a cow standing in water and licking the charged wire, while FIGURES 5 and 6 are for an animal resistance of 4 kΩ., representing more normal ground conditions. The shock intensity is related to the peak current in the pulse; the higher the peak current, the more intense will be the shock. For safety reasons, total charge should not exceed 1 mC.

The peak current delivered by the Parmak Mark I varied from 1.7 A for a well-grounded cow touching the 5.4 km fence to 0.25 A for a normally grounded cow touching the 16 km fence. The total charge delivered to the cow was within the accepted safety limits, varying from 0.18 to 0.52 mC. The Parmak Mark I gave quite an intense shock and was suitable for fairly long fence lengths or poorly insulated fences.

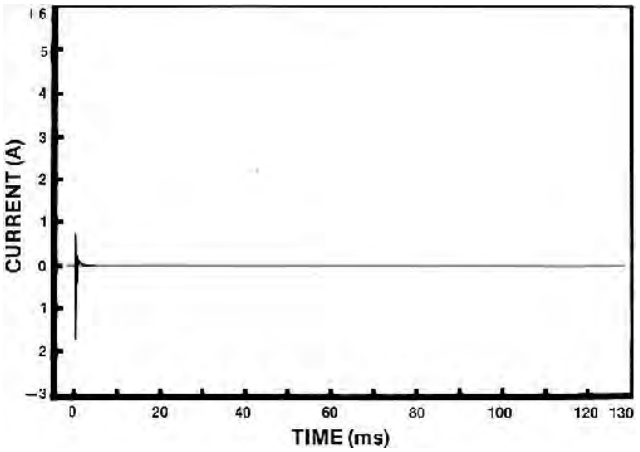

FIGURE 3. Current Delivered to a Well-Grounded Cow Touching a 5.4 km Well-Insulated Fence.

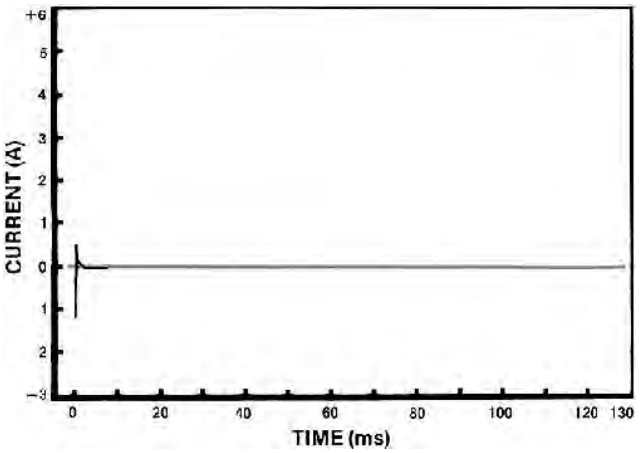

FIGURE 4. Current Delivered to a Well-Grounded Cow Touching a 16 km Well-Insulated Fence.

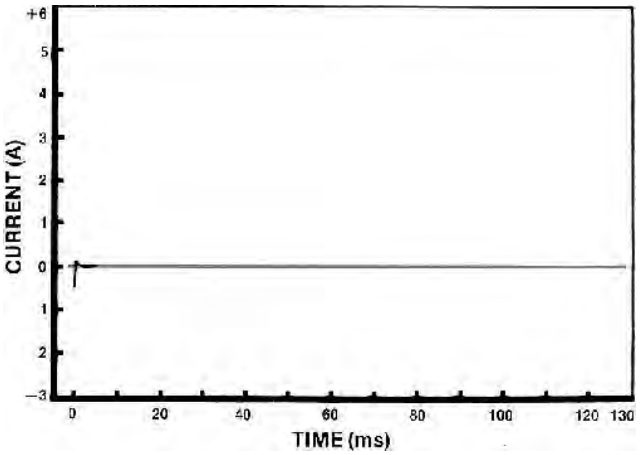

FIGURE 5. Current Delivered to a Normally-Grounded Cow Touching a 5.4 km Well-Insulated Fence.

The dual position shock regulator switch served no useful purpose. With the shock regulator switch in the normal setting, the controller delivered from 54 to 58 charge pulses per minute, while in the high setting, it delivered from 59 to 63 charge pulses per minute. The on-time was also affected by fencer load and varied from about 4.5 to 7.6 ms.

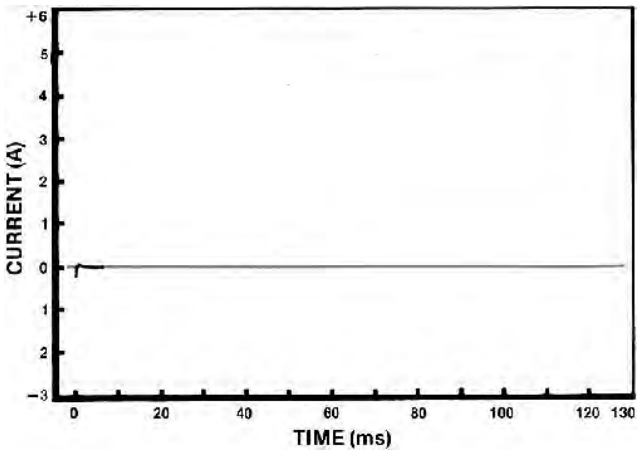

FIGURE 6. Current Delivered to a Normally-Grounded Cow Touching a 16 km Well-Insulated Fence.

Low Temperature Operation: The Parmak Mark I could effectively be used to energize cattle feeding wires during low winter temperatures. The peak voltage output of the controller at -37°C on a 5.4 km single wire fence was about 2500 V, the same as its output at room temperature. A higher peak voltage output could be expected on a short feeding fence. Since the peak voltage output was well above the 2000 V minimum required to overcome the insulation resistance of long-haired animals, the Parmak Mark was very suitable for feeding enclosures.

As frozen ground is often a very poor electrical conductor, two-wire systems, utilizing a separate ground wire, are usually most suitable for winter cattle feeding.

SAFETY

The instruction manual clearly outlined safety considerations. No safety problems were evident if the manufacturer's instructions were followed.

INSTRUCTION MANUAL

The instruction manual was clear, concise and well illustrated. It outlined installation, safety considerations and operation, as well as discussing types of fences suitable for various livestock. It failed to mention the use or purpose of the shock regulator switch.

DURABILITY RESULTS

The intent of the test was functional evaluation. An extended durability evaluation was not conducted. No problems occurred during functional testing.

APPENDIX I
SPECIFICATIONS

MAKE:	Parmak Electric Fence Controller
MODEL:	Mark I
SERIAL NUMBER:	2310131
TYPE:	Solid State Electronic
POWER REQUIREMENTS:	115 V AC
WEIGHT:	3.8 kg
OVERALL DIMENSIONS:	
-- length	323 mm
-- width	150 mm
-- height	177 mm
NUMBER OF INDICATOR LIGHTS:	1 (for operation)
TYPE OF ENCLOSURE:	for indoor operation

APPENDIX II
SI UNITS AND SYMBOLS

(a) In keeping with the Canadian metric conversion program, this report has been prepared in SI units. For comparative purposes, the following conversions may be used:

1 millimetre (mm) = 0.039 inches (in)
1 metre (m) = 3.28 feet (ft)
1 kilometre (km) = 0.62 mile (mi)
1 kilogram (kg) = 2.2 pounds (lb)

(b) The following symbols are used in this report:

electric current = ampere (A)
electric potential = volt (V)
electric charge = coulomb (C)
electric resistance = ohm (Ω)
pulse time = second (s)

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