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Evaluation Report 115

Shur Shock 6 Volt Electro-Mechanical Fence Controller

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

SHUR SHOCK 6 VOLT ELECTRO-MECHANICAL FENCE CONTROLLER

MANUFACTURER:

J. C. Hallman Manufacturing Company Ltd.
80 Alpine Road
Kitchener, Ontario
N2E 1A1

RETAIL OUTLETS:

Co-op Label -- Interprovincial Co-operative Ltd., Manitoba & Saskatchewan
Shur Shock Label -- Other retail outlets in the prairie provinces

RETAIL PRICE:

$39.95 (August, 1979, f.o.b. Humboldt)

SUMMARY AND CONCLUSIONS

The Shur Shock 6 Volt Electro-Mechanical fence controller was suitable for use over a limited range of fence conditions.

With the voltage switch in the low-position, peak voltage output on a 5.4 km (3.3 mi) single wire fence varied from 1070 V for a well-insulated, grass-free, dry fence to 115 V for an uninsulated, grass-grown, wet fence. For some normal fence conditions, output was above the 700 V minimum guard voltage recommended for short-haired animals, while for all conditions it was below the 2000 V minimum needed for long-haired animals. The Shur Shock 6 Volt Electro-Mechanical could be used to control short-haired animals on this fence length, but a shorter fence would ensure more effective control for all fence conditions.

With the voltage switch in the low-position, peak current flow through a cow touching a well-insulated 5.4 km (3.3 mi) single wire fence varied from 0.23 A for a cow standing in water to 0.12 A for a normally-grounded cow. The peak current output indicated that the Shur Shock 6 Volt Electro-Mechanical was suitable only for fences shorter than 5.4 km (3.3 mi) in length.

Total charge delivered by the Shur Shock 6 Volt Electro-Mechanical varied from 0.22 to 0.48 mC.

The Shur Shock 6 Volt Electro-Mechanical was suitable for cold weather use on short feeding fences, only if a heated enclosure was provided for the controller.

No durability problems occurred during testing.

RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Revising the instruction sheet to provide information on low temperature operation, the use of insulators and types of fence arrangements suitable for livestock.
2. Modifications to permit field replacement of the indicator light bulb.

Chief Engineer -- E. O. Nyborg
Senior Engineer -- L. G. Smith
Technical Officer -- J. M. Williams

THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. Instruction sheets have been replaced with labels. Since labels have already been procured for the 1979-80 production run, changes are not possible until next year.
2. Our bulbs have a special gas fill. Since basings are not available at realistic prices, we decline to redesign the pilot lamp mounting.

GENERAL DESCRIPTION

The Shur Shock 6 Volt Electro-Mechanical fence controller is designed for 6 V battery operation and for outdoor use, without a weather shelter.

The Shur Shock 6 Volt Electro-Mechanical uses both electrical and mechanical components to produce the charge pulses. It has a two position shock intensity switch and a light to indicate shock intensity.

Detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The performance characteristics of the Shur Shock 6 Volt Electro-Mechanical 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 Shur Shock 6 Volt Electro-Mechanical is equipped with wire leads for connection to a 6 V fencer battery. The cover of the controller is removed and the battery is installed inside the controller. The controller is designed for outdoor use, without a weather shelter.

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. Two wires and a clip are supplied for connecting to the ground rod and fence wire.

Fence Condition: It is recommended that the Shur Shock 6 Volt Electro-Mechanical be used only on well-insulated fences.

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 Shur Shock 6 Volt Electro-Mechanical is equipped with a two position shock intensity switch. The high-position increases the voltage output and is used for training livestock to respect an electric fence.

The indicator light may flash slightly all the time. Bright flashes indicate that insufficient charge is being placed on the fence, which may be the result of too long a fence or poor insulation.

Since the controller was not sealed, the indicator light bulb could be replaced by means of solder connections. It is recommended that the manufacturer consider modifications to permit indicator light bulb replacement without the need for soldering.

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 k. for a well-insulated, grass-free, dry fence. The higher the fence insulation

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

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: FIGURE 1 shows the peak voltage output of the Shur Shock 6 Volt Electro-Mechanical for a 5.4 km length of single wire fence over a range of insulation resistances. With the voltage switch in the low-position, peak voltage output varied from 1070 V for a well-insulated, grass-free, dry fence to 115 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 fence insulation values greater than 8 kΩ, while it was below the 2000 V minimum guard voltage needed for long-haired animals for all fence conditions. From FIGURE 1, it can be seen that the Shur Shock 6 Volt Electro-Mechanical could be used to control short-haired animals if the fence is kept clean of plant growth during wet weather. A shorter fence would ensure more effective animal control.

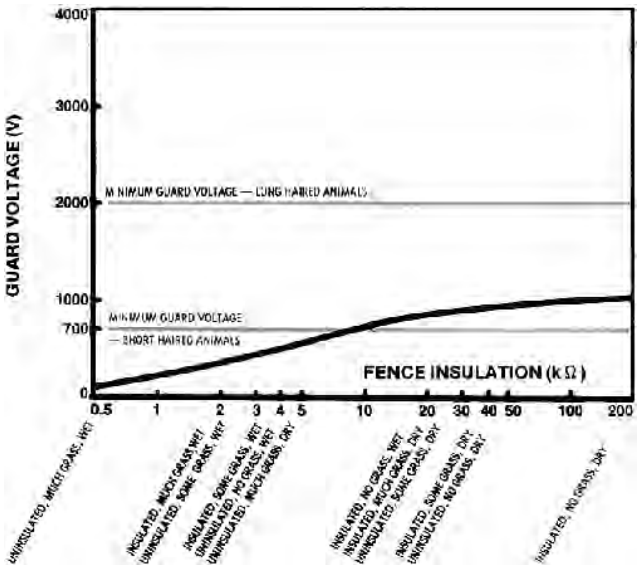

FIGURE 1. Guard Voltage Produced on a 5.4 km Single Wire Fence.

With the voltage switch in the high-position, the peak voltage output was above the 700 V minimum guard voltage needed for short-haired animals, for fence insulation values greater than 6.5 kΩ. This increased output had little effect. During wet weather, a clean fence or a shorter fence would still be needed to ensure effective animal control. The voltage switch is usually set in the low-position, once the livestock are trained, to conserve battery life.

Electrical Charge: FIGURES 2 and 3 show the current output of the Shur Shock 6 Volt Electro-Mechanical when a cow touches a 5.4 km length of well-insulated, single wire, fence. FIGURE 2 is for an animal resistance of 0.5 kΩ, which represents the most extreme condition of a cow standing in water and licking the charged wire, while FIGURE 3 is 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.

With the voltage switch in the low-position, the peak current delivered by the Shur Shock 6 Volt Electro-Mechanical varied from 0.23 A for a well-grounded cow touching the 5.4 km fence to 0.12 A for a normally-grounded cow. The total charge delivered to the cow varied from 0.22 to 0.48 mC. The controller gave an adequate shock to a well-grounded short-haired cow, but the shock was minimal for a normally-grounded cow.

About 54 charge pulses per minute were delivered. The number of pulses and the on-time did not vary with fencer load. On-time was about 31 ms.

Low Temperature Operation: The Shur Shock 6 Volt Electro-Mechanical could be used to energize cattle feeding wires during low winter temperatures, only if a heated enclosure is provided for the controller. During normal operation, the peak voltage output on a 5.4 km single wire fence was 1070 V, well above the 700 V minimum required to overcome the insulation resistance of short-haired animals, but below the 2000 V minimum required for long-haired animals. A higher peak voltage output could be expected on a short feeding fence. Since battery voltage is severely reduced at low temperatures, it is necessary to provide a heated battery enclosure to ensure effective winter operation. 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.

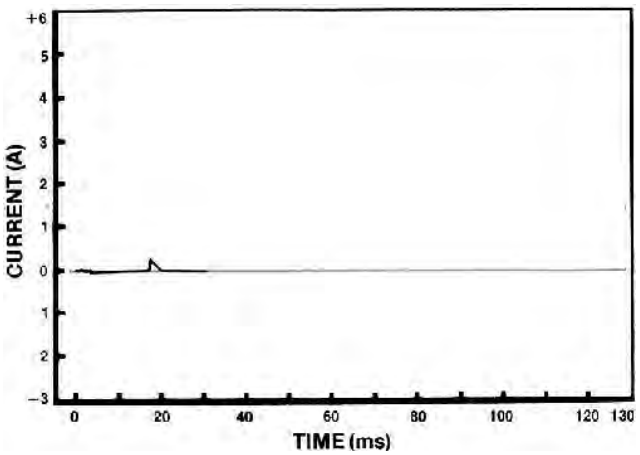

FIGURE 2. Current Delivered to a Well-Grounded Cow Touching a 5.4 km Well-Insulated Fence.

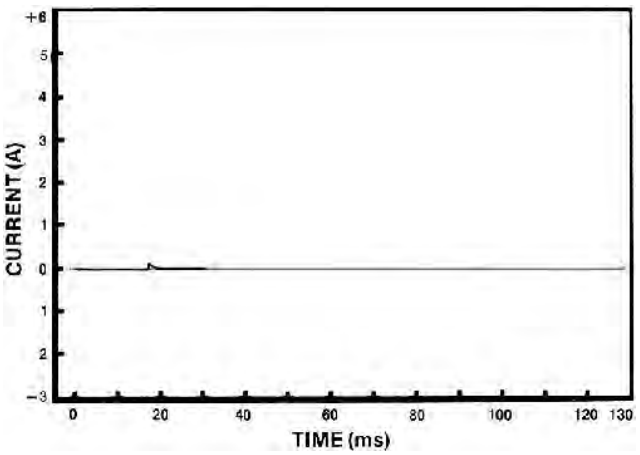

FIGURE 3. Current Delivered to a Normally-Grounded Cow Touching a 5.4 km Well-Insulated Fence.

The peak voltage output of the controller at -37°C on a 5.4 km single wire fence was about 950 V, 11% lower than its output at room temperature. The manufacturer, however, verbally recommended a minimum operating temperature of -18°C since operation during lower temperatures eventually causes internal damage to the controller. It is recommended that a statement to this effect be included in the instruction manual.

Battery Consumption: A 6 V fencer battery will operate the Shur Shock 6 Volt Electro-Mechanical about 3 months depending upon the load on the controller. The consumption rate increased considerably as the load on the controller increased. The battery should be regularly checked to ensure effective controller performance.

SAFETY

No safety problems were evident if the manufacturer's instructions were followed.

INSTRUCTION MANUAL

The instruction sheet was clear and concise. It outlined installation, safety considerations and operation. It is recommended

that additional instructions be provided to advise on low temperature operation, the use of insulators and to include a short discussion on the types of fence arrangements suitable for livestock.

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:	Shur Shock Fence Controller
MODEL:	6 Volt Electro-Mechanical
TYPE:	Electro-Mechanical
POWER REQUIREMENTS:	6 V DC
WEIGHT:	2.6 kg
OVERALL DIMENSIONS:	
-- length	270 mm
-- width	155 mm
-- height	243 mm
NUMBER OF INDICATOR LIGHTS:	1 (for shock intensity)
TYPE OF ENCLOSURE:	for outdoor 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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