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# Evaluation Report 112


## Shur Shock HL MK II Electric Fence Controller

A Co-operative Program Between

ALBERTA FARM MACHINERY RESEARCH CENTRE

PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

## SHUR SHOCK HL MK II ELECTRIC 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:**

$49.95 (August, 1979, f.o.b. Humboldt)


### SUMMARY AND CONCLUSIONS

The Shur Shock HL MK II electric fence controller was suitable for use over a limited range of fence conditions.

Peak voltage output on a 5.4 km (3.3 mi) single wire fence varied from 1650 V for a well-insulated, grass-free, dry fence to 160 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 HL MK II 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.

Peak voltage output on a 16 km (10 mi) single wire fence varied from 1000 V for a well-insulated, grass-free, dry fence to 100 V for an uninsulated, grass-grown, wet fence. Plant growth touching an insulated, dry fence or wet weather, reduced the voltage output below the required 700 V minimum guard voltage. Animal control would not be effective on this length of fence.

Peak current flow through a cow touching well-insulated 5.4 and 16 km (3.3 and 10 mi) single wire fences varied from 0.32 to 0.20 A for a cow standing in water and from 0.14 to 0.11 A for a normally-grounded cow. The peak current output indicated that the Shur Shock HL MK II was suitable only for fences shorter than 5.4 km (3.3 mi) in length.

Total charge delivered by the Shur Shock HL MK II varied from 0.16 to 0.44 mC. This was within accepted safety limits for cattle or humans.

The Shur Shock HL MK II was suitable for cold weather use on 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&2. This model has been discontinued.

#### GENERAL DESCRIPTION

The Shur Shock HL MK II 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 weather-proof enclosure.

The Shur Shock HL MK II uses both electrical and mechanical components to produce the charge pulses. A light is provided to indicate shock intensity.

The controller was CSA approved.

Detailed specifications are given in APPENDIX I

#### SCOPE OF TEST

The performance characteristics of the Shur Shock HL MK II 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 HL MK II 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.

**Fence Condition:** It is recommended that the Shur Shock HL MK II 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.

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

**Operation:** The Shur Shock HL MK II is equipped with a push button indicator light that flashes brightly when the fence is properly charged. If the light is very dim, it indicates that insufficient charge is being placed on the fence, which may be the result of too long a fence or poor insulation.

The controller was sealed from the factory and the indicator light could not be replaced without factory servicing. Although, for safety reasons, factory sealing is necessary for power line-operated fencers, it is recommended that the manufacturer consider modifications to permit indicator light bulb replacement without chassis disassembly.

## 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 Shur Shock HL MK II for 5.4 and 16 km lengths of single wire fence over a range of insulation resistances. On a 5.4 km fence (FIGURE 1), peak voltage output varied from 1650 V for a well-insulated, grass-free, dry fence to 160 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 5.5 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 HL MK II 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.

On a 16 km fence (FIGURE 2), peak voltage output ranged from 1000 V for a well-insulated, grass-free, dry fence to 100 V for an uninsulated, grass-grown, wet fence. Voltage output was above the 700 V minimum, required for short-haired animals, only for dry, well-insulated fences. Animal control would not be effective on this length of fence.

**Electrical Charge:** FIGURES 3 to 6 show the current output of the Shur Shock HL MK II 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 kΩ, 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 Shur Shock HL MK II varied from 0.32 A for a well-grounded cow touching the 5.4 km fence to 0.11 A for a normally-grounded cow touching the 16 km fence.

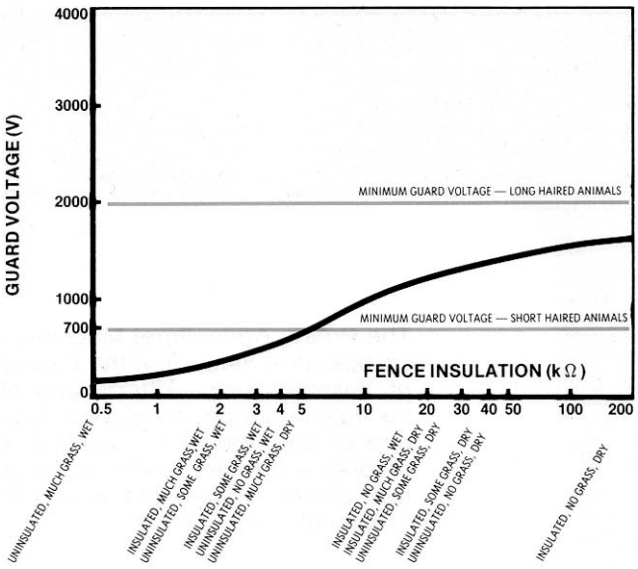


**FIGURE 1.** Guard Voltage Produced on a 5.4 km Single Wire Fence.

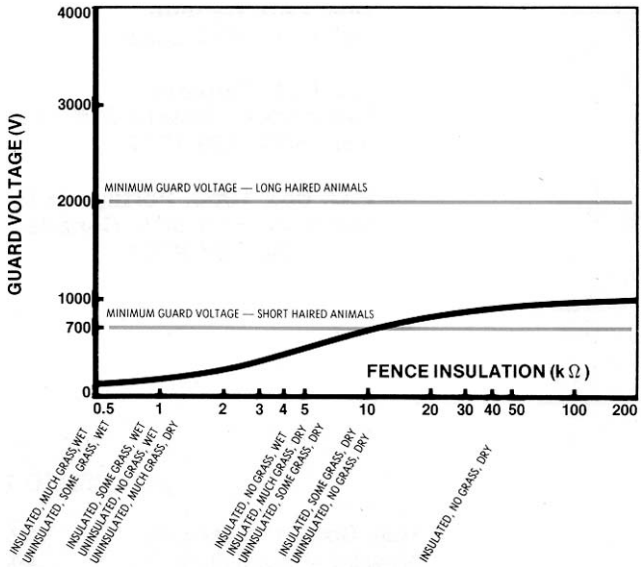


**FIGURE 2.** Guard Voltage Produced on a 16 km Single Wire Fence.

The total charge delivered to the cow was within the accepted safety limits, varying from 0.16 to 0.44 mC. On the 5.4 km fence, the Shur Shock HL MK II gave a minimal shock to a normally grounded cows; but on the 16 km fence, the shock was inadequate for a normally-grounded cow.

About 55 charge pulses per minute were delivered. The number of pulses did not vary with fencer load, however, the on-time was affected by load. On-time varied from about 3.6 to 7.0 ms.

**Low Temperature Operation:** The Shur Shock HL MK II 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 1650 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 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.

The peak voltage output of the controller at -37°C on a 5.4 km single wire fence was about 1650 V, the same as 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.

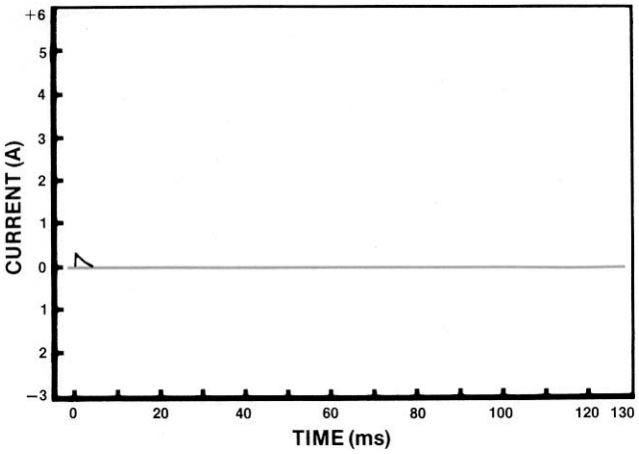


**FIGURE 3.** Current Delivered to a Well-Grounded Cow Touching a 5.4 km Well-Insulated Fence.

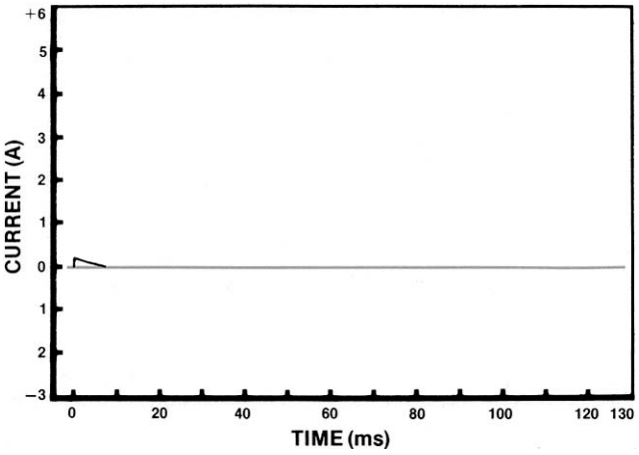


**FIGURE 4.** Current Delivered to a Well-Grounded Cow Touching a 16 km Well-Insulated Fence.

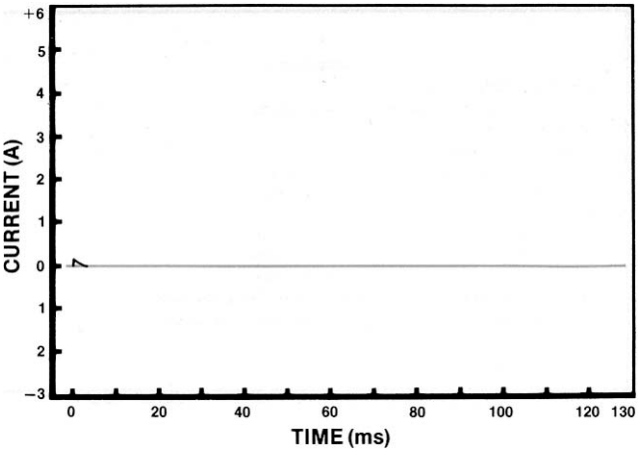


**FIGURE 5.** Current Delivered to a Normally-Grounded Cow Touching a 5.4 km Well-Insulated Fence.

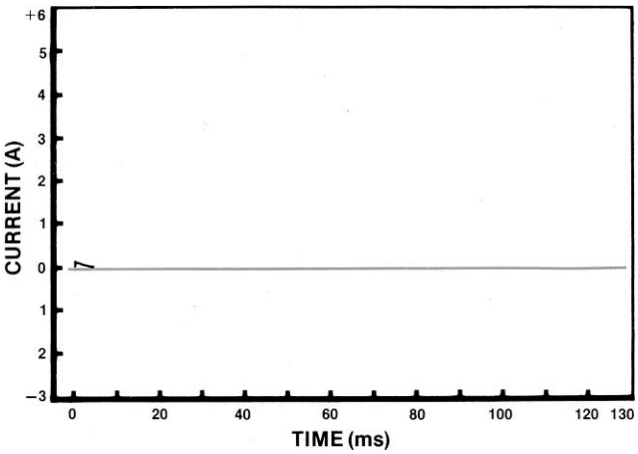


**FIGURE 6.** Current Delivered to a Normally-Grounded Cow Touching a 16 km Well-Insulated Fence.

### SAFETY

The instruction sheet clearly outlined safety considerations. 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 Electric Fence Controller |
| *MODEL:* | HL MK II |
| *TYPE:* | Electro Mechanical |
| *POWER REQUIREMENTS:* | 115 V AC |
| *WEIGHT:* | 4.0 kg |
| *OVERALL DIMENSIONS:* | |
| -- length | 270 mm |
| -- width | 155 mm |
| -- height | 211 mm |
| *NUMBER OF INDICATOR LIGHTS:* | 1 (for shock intensity) |
| *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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