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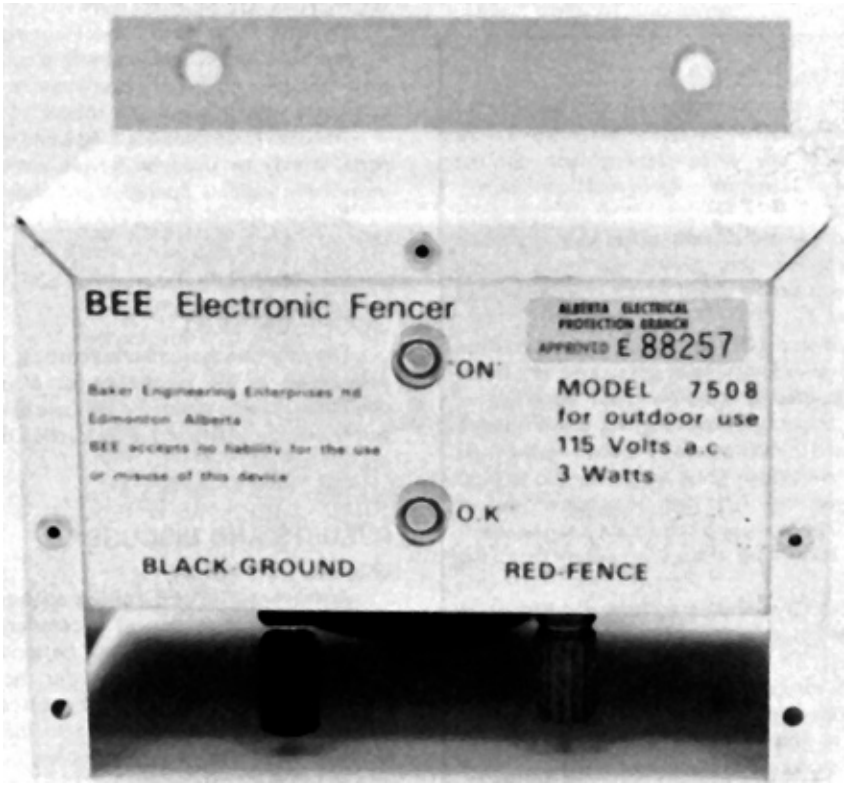
# Evaluation Report 104




## Bee 7508 Electric Fence Controller

A Co-operative Program Between

ALBERTA FARM MACHINERY RESEARCH CENTRE

PAMI
PRAIRIE AGRICULTURAL MACHINERY INSTITUTE

## BEE 7508 ELECTRIC FENCE CONTROLLER

**MANUFACTURER:**

Baker Engineering Enterprises Ltd.
9620 - 27 Avenue
Edmonton, Alberta

**DISTRIBUTOR:**

Alberta: Mitchell Agra Industries
Westlock, Alberta
T0G 2L0

Saskatchewan: St. Walburg Produce
St. Walburg, Saskatchewan
S0M 2T0

**RETAIL PRICE:**

$79.00 (August, 1979, f.o.b. Humboldt)

## THE MANUFACTURER STATES THAT

With regard to recommendation number:

1. The model 7508 was marketed with special provincial Electrical Protection Branch approval pending CSA approval. The 7508 was submitted to CSA for approval with minor changes under the model number 7721. The model 7721 was approved by CSA in January, 1978.
2. Indicator light bulbs are of the non-filament neon discharge type and are not likely to require replacement unless there is a major fault in the controller which would require factory service to ensure electrical safety. Field replacement of indicator light bulbs is not presently being considered.

**ADDITIONAL COMMENTS**

The manufacture of the BEE 7508 has been discontinued in favor of the BEE model 7721 which has minor improvements in reliability, efficiency, and output current. The model 7721 is CSA approved for indoor use. The retail price of the model 7721 is $95.00 (August, 1979 f.o.b. Humboldt).

## SUMMARY AND CONCLUSIONS


The BEE 7508 electric fence controller was very suitable for use over a wide range of fence conditions. Wire insulators were unnecessary for most fences while plant growth did not appreciably affect controller performance in most conditions.

Peak voltage output on a 5.4 km (3.3 mi) single wire fence varied from 3700 V for a well-insulated, grass-free, dry fence to 2495 V for an uninsulated, grass-grown, wet fence. Output was above the 2000 V minimum guard voltage recommended for long-haired animals.

Peak voltage output on a 16 km (10 mi) single wire fence varied from 2450 V for a well-insulated, grass-free, dry fence to 1860 V for an uninsulated, grass-grown, wet 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 5:0 to 3.7 A for a cow. standing in water and from 0.86 to 0.60 A for a normally-grounded cow. The high peak current output indicated that the BEE 7508 generated quite an intense shock and was suitable for fairly long fences or poorly insulated fences.

Total charge delivered by the BEE 7508 varied from 0.06 to 0.33 mC. This was within accepted safety limits for cattle or humans.

The BEE 7508 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 3255 V, only 12% lower than its output at room temperature.

The test machine had not been submitted for CSA certification.

No durability problems occurred during testing.


## RECOMMENDATIONS

It is recommended that the manufacturer consider:

1. Submitting the controller to Canadian Standards Association for certification, to comply with regulations in the prairie provinces.
2. Modifications to permit field replacement of indicator light bulbs.

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

## GENERAL DESCRIPTION

The BEE 7508 electric fence controller is designed for 115 V AC operation and is equipped with a cord and plug for connection to a standard electrical receptable. It is designed for outdoor operation, without a weather shelter.

The BEE 7508 contains solid-state electronics, with no moving parts. It may be used on fences without insulators. Lights are provided to indicate operation and shock intensity.

Detailed specifications are given in APPENDIX I.

## SCOPE OF TEST

The performance characteristics of the BEE 7508 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 BEE 7508 is equipped with a three wire cord and plug for connection to a standard, grounded, 115 V AC receptable. The controller may be mounted outdoors without a weather shelter. The manufacturer recommends that it not be installed in a barn with a damp or corrosive atmosphere.

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:** The manufacturer states that the BEE 7508 may be used on fences without wire insulators. The wire can be stapled directly to wooden posts, but should not be directly attached to live trees, green post, salt-treated wooden posts or steel posts. If the fence is in good repair, 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 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 BEE 7508 is equipped with two indicator lights. One light indicates that the controller is operating, while a second light indicates that a charge is being supplied to the fence. When this light flashes normally, it indicates that the fence is properly charged. Conversely, if this light is not flashing, it

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

indicates that insufficient charge is being placed on the fence, which may be the result of too long a fence or poor insulation. A portable fence tester is supplied with the BEE 7508, to use in locating short circuits in fences.

The controller was sealed from the factory and indicator lights 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 k Ω for an uninsulated, grass-grown, wet fence to well above 500 k Ω 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 k Ω 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 BEE 7508 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 3700 V for a well-insulated, grass-free, dry fence to 2495 V for an uninsulated, wet fence with considerable grass touching the charged wire. The voltage output was well above the 2000 V minimum guard voltage needed for long-haired animals for all fence conditions. From FIGURE 1, it can be seen that the BEE 7508 can be satisfactorily used on this length of fence without wire insulators.

On a 16 km fence (FIGURE 2), peak voltage output ranged from 2450 V for a well-insulated, grass-free, dry fence to 1860 V for an uninsulated, grass-grown, wet fence. Voltage output was above the 2000 V minimum required for long-haired animals for most fence conditions. Wire insulators also were unnecessary for this length of fence.

As can be seen from both FIGURES 1 and 2, plant growth touching a fence did not appreciably affect controller performance, since the voltage output was above 2000 V for nearly all

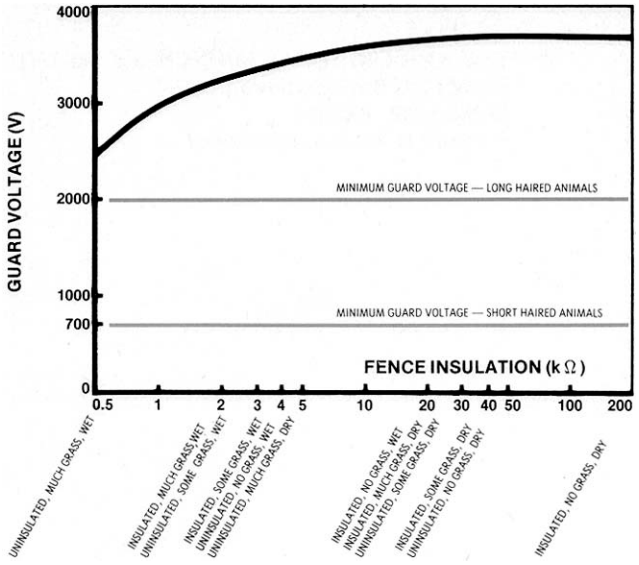



**FIGURE 1.** Guard Voltage Produced on a 5.4 km Single Wire Fence.

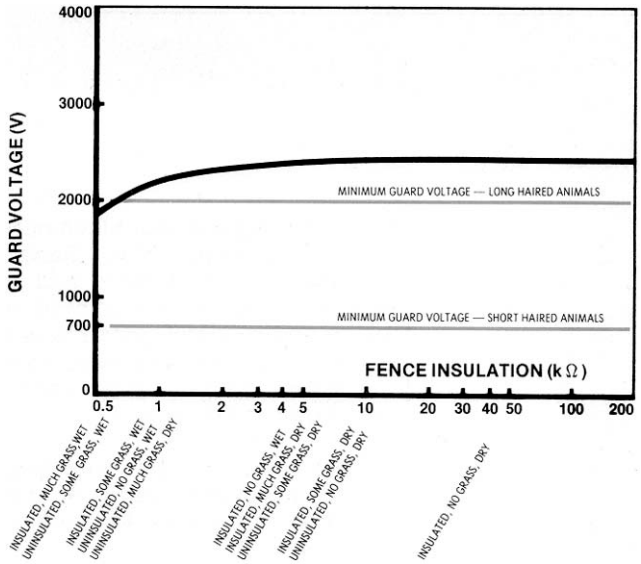



**FIGURE 2.** Guard Voltage Produced on a 16 km Single Wire Fence.

fence conditions. The BEE 7508 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 BEE 7508 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 BEE 7508 varied from 5.0 A for a well-grounded cow touching the 5.4 km fence to 0.60 A for a normally-grounded cow touching the 16 km fence. The total charge delivered to a cow was within the accepted safety limits, varying from 0.06 to 0.33 mC. The BEE 7508 gave quite an intense shock and was suitable for fairly long fence lengths or poorly insulated fences.

About 50 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 0.5 to 0.9 ms.

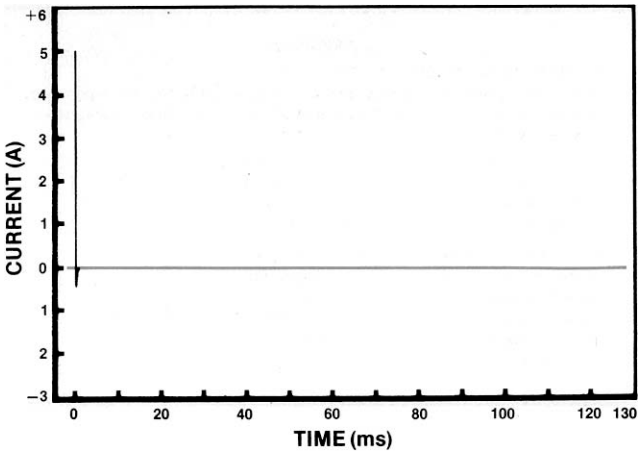
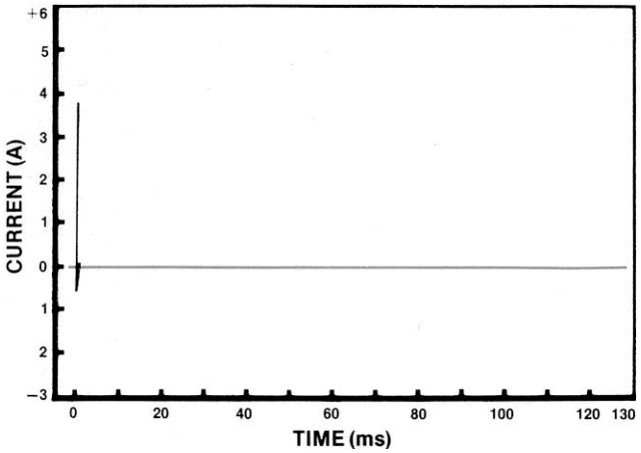



**FIGURE 3.** Current Delivered to a Well-Grounded Cow Touching a 5.4 km Well-Insulated Fence.




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

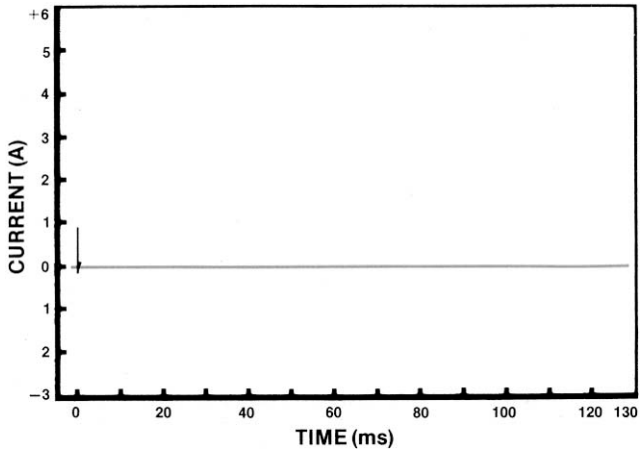



**FIGURE 5.** Current Delivered to a Normally-Grounded Cow Touching a 5.4 km Well--Insulated Fence.

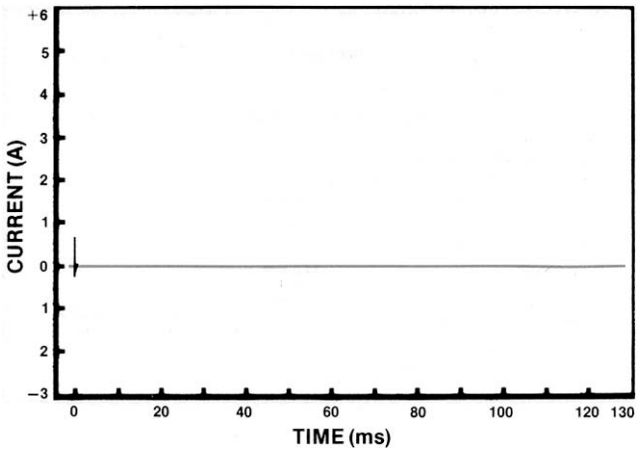



**FIGURE 6.** Current Delivered to a Normally-Grounded Cow Touching a 16 km Well-Insulated Fence.

**Low Temperature Operation:**The BEE 7508 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 3255 V, only 12% lower than its output at room temperature. Since the peak voltage output was well above the 2000 V minimum required to overcome the insulation resistance of long-haired animals, the BEE 7508 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.

The test machine was marketed in Saskatchewan without Canadian Standards Association certification. Since CSA certification of power line-operated fence controllers is a requirement in the prairie provinces, it is recommended that the manufacturer submit the controller for certification.

**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 conditions.

**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:*** | BEE Electric Fence Controller |
| ***MODEL:*** | 7508 |
| ***SERIAL NUMBER:*** | 3049EFL |
| ***TYPE:*** | Solid State Electronic |
| ***POWER REQUIREMENTS:*** | 115 V AC |
| ***WEIGHT:*** | 1.0 kg |
| ***OVERALL DIMENSIONS:*** | |
| -- length | 142 mm |
| -- width | 130 mm |
| -- height | 122 mm |
| ***NUMBER OF INDICATOR LIGHTS:*** | 2 (for operation and shock intensify) |
| ***TYPE OF ENCLOSURE:*** | for outdoor use |

## 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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