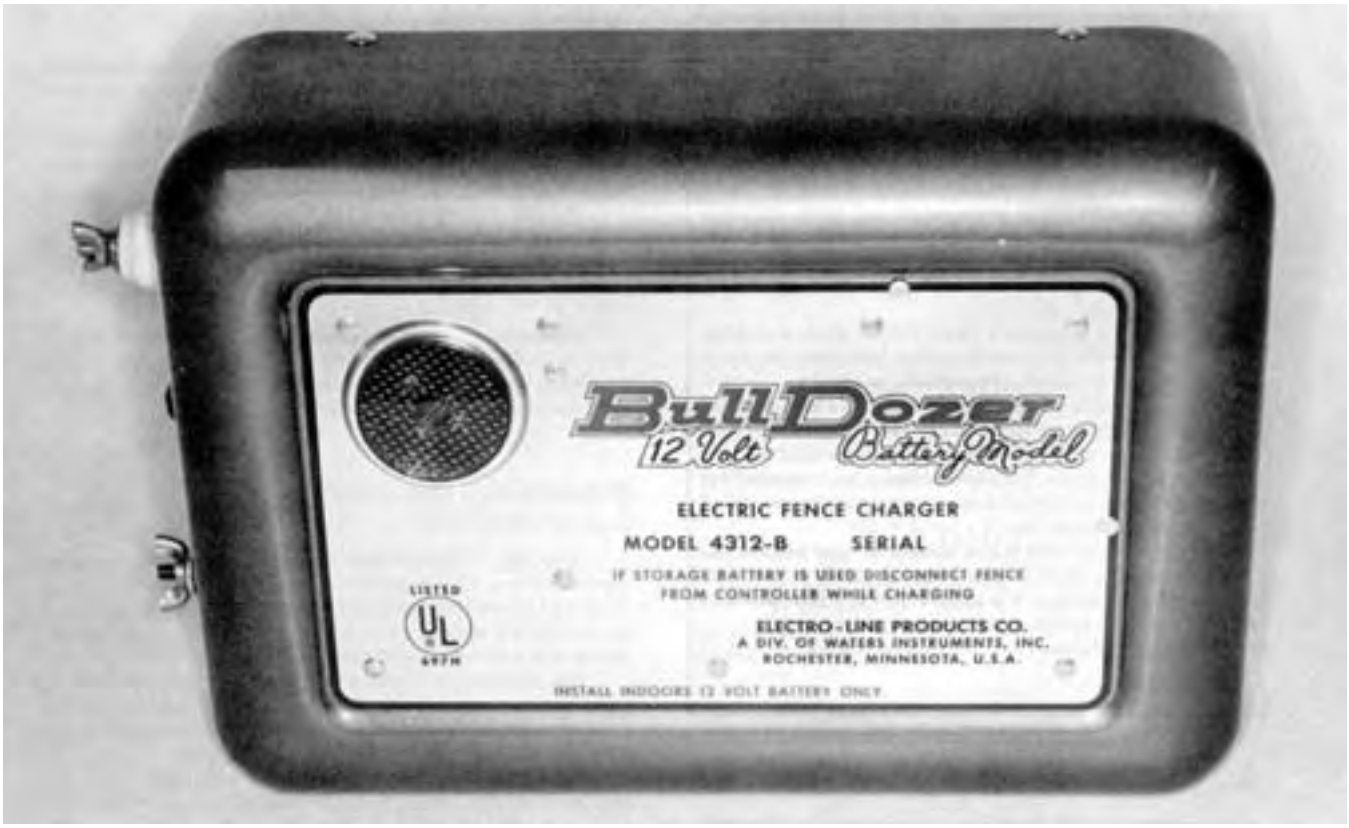
Printed: December, 1981
Tested at: Humboldt
ISSN 0383-3445

# Evaluation Report 253




## Bull-Dozer 4312-B Electric Fence Controller

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

## BULL-DOZER 4312-B ELECTRIC FENCE CONTROLLER

**MANUFACTURER:**

Electro-Line Products Company
P.O. Box 6117
Rochester, Minnesota 55901
U.S.A.

**DISTRIBUTOR:**

Crist Products Ltd.
P.O. Box 640
Broadview, Saskatchewan
S0G 0K0

**RETAIL PRICE:**

$62.00 (December, 1981, f.o.b. Humboldt)


## SUMMARY AND CONCLUSIONS

The Bull-Dozer 4312-B 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 1860 V for a well-insulated, grass-free, dry fence to 60 V for an uninsulated, grass-grown, wet fence. For some normal fence conditions, output was below 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.

Peak voltage output on a 16 km (10 mi) single wire fence varied from 1150 V for a well-insulated, grass-free, dry fence to 60 V for an uninsulated, grass-grown, wet fence.

Peak current flow through a cow touching a well-insulated 5.4 and 16 km (3.3 and 10 mi) single wire fences varied from 0.07 to 0.11 A for a cow standing in water and was 0.09 A for a normally-grounded cow. The peak current output indicated that the Bull-Dozer 4312-B generated an inadequate shock on well insulated fences longer than 5.4 km (3.3. mi).

The Bull-Dozer 4312-B was suitable for cold weather use on feeding fences. Peak voltage output at -35°C on a 5.4 km (3.3. mi) single wire fence was about 2200 V, 18% higher than its output at room temperature. No durability problems occurred during testing.


## RECOMMENDATIONS

*A need for recommendations was not apparent.*
*Chief Engineer -- E. O. Nyborg*
*Senior Engineer -- G. E. Frehlich*
*Project Technologist --G. G. Burton*

**NOTE:** This report has been prepared using SI units of measurement. A conversion table is given in APPENDIX II.

## GENERAL DESCRIPTION

The Bull-Dozer 4312-B electric fence controller is designed for 12 V battery operation. It is meant to be mounted in a suitable weather-proof enclosure.

The Bull-Dozer 4312-B uses both electrical and mechanical components to produce the charge pulses. A light is provided to indicate operation.

Detailed specifications are given in APPENDIX I.

## SCOPE OF TEST

The performance characteristics of the Bull-Dozer 4312-B 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.

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



## RESULTS AND DISCUSSION

### EASE OF OPERATION

**Installation:** The Bull-Dozer 4312-B is equipped with leads for connection to a 12 V automotive battery. The controller is to be mounted indoors and if mounted outdoors, it should be placed in an appropriate weather-proof shelter. The manufacturer recommends that it be installed in a dry location.

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 ground rod up to 3 m (10 ft) long may be needed.

**Fence Condition:** The manufacturer recommends that the Bull-Dozer 4312-B be used only on insulated fences. In addition, the manufacturer recommends that for cattle fences, in areas with normal ground conditions, a single charged wire 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 Bull-Dozer 4312-B is equipped with a light that flashes to indicate that the fence is properly charged. If this 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 factory sealed. As a result, if the indicator light should need replacement, the controller would need factory servicing.

## 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.

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 (1 mi) single wire fence typically varied 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 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 Bull-Dozer 4312-B for a 5.4 and 16 km (3.3 and 10 mi) lengths of single wire fence over a range of insulation resistances. On a 5.4 km (3.3 mi) fence (FIGURE 1), peak voltage output varied from 1860 V for a well-insulated, grass-free, dry fence to 60 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.

On a 16 km (10 mi) fence (FIGURE 2), peak voltage output ranged from 1150 V for a well-insulated, grass-free, dry fence to

60 V for an uninsulated, grass-grown, wet fence. Voltage output was above the 700 V minimum required for short-haired animals, for fence insulation values greater than 14 kΩ. It was below the 2000 V minimum guard voltage needed for long-haired animals for all fence conditions.

As can be seen from FIGURES 1 and 2, wet weather reduced the voltage output below the required 700 V minimum guard voltage. The Bull-Dozer 4312-B will only work effectively on a very short fence during wet weather.

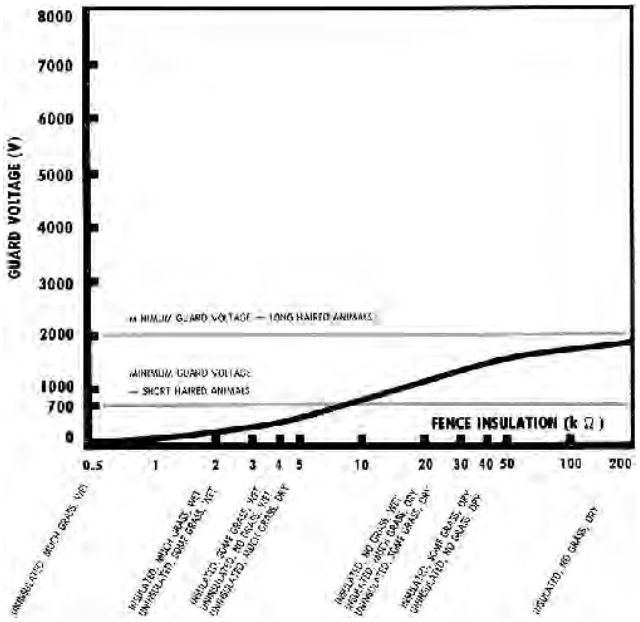



**FIGURE 1.** Guard Voltage Produced on a 5.4 km Single Wire Fence.

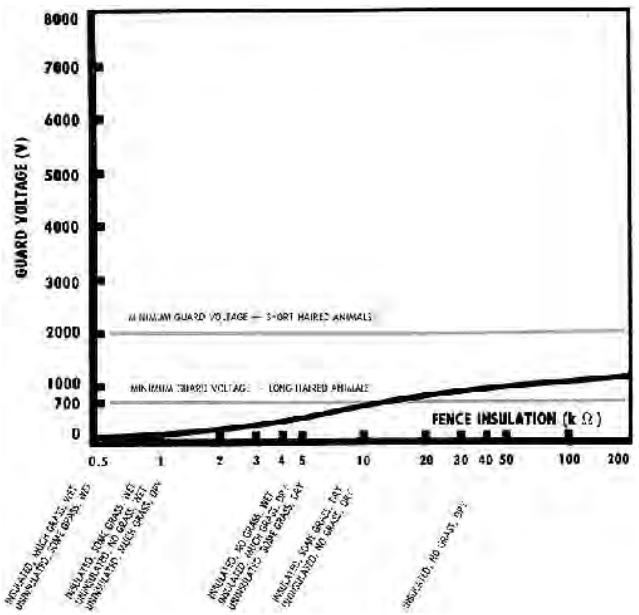



**FIGURE 2.** Guard Voltage Produced on a 16 km Single Wire Fence.

**Electrical Charge:** FIGURES 3 to 6 show the current output of the Bull-Dozer. 4312-B when a cow touches 5.4 and 16 km (3.3 and 10 mi) 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.

The peak current delivered by the Bull-Dozer 431 2-B varied from 0.07 A for a well-grounded cow touching the 5.4 km (3.3 mi) fence to 0.09 A for a normally-grounded cow touching the 16 km (10 mi) fence. The Bull-Dozer 4312-B gave an inadequate shock on well-insulated fences longer than 5.4 km (3.3. mi).

About 70 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 1.8 to 61.7 ms.

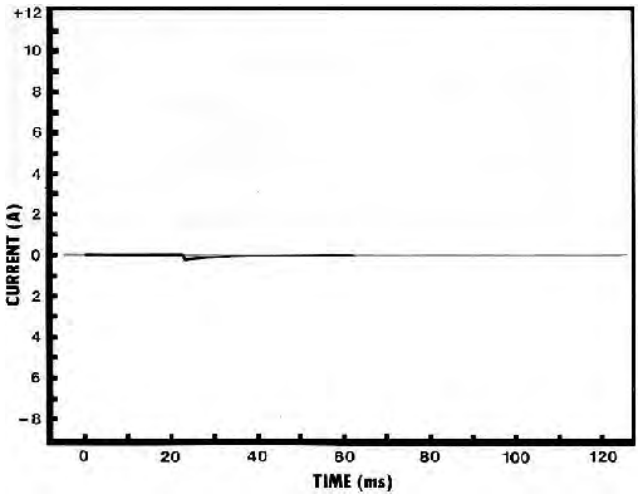



**FIGURE 3.** Current Delivered to a Well-Grounded Cow Touching a 5.4 km Well-Insulated Fence.

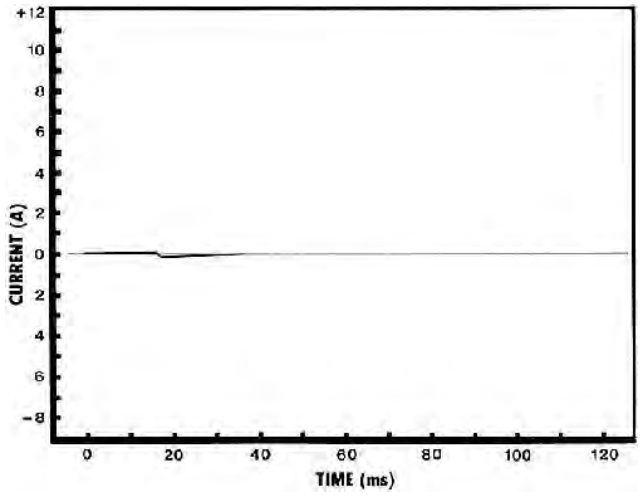



**FIGURE 4.** Current Delivered to a Well-Grounded Cow Touching a 16 km Well-Insulated Fence.

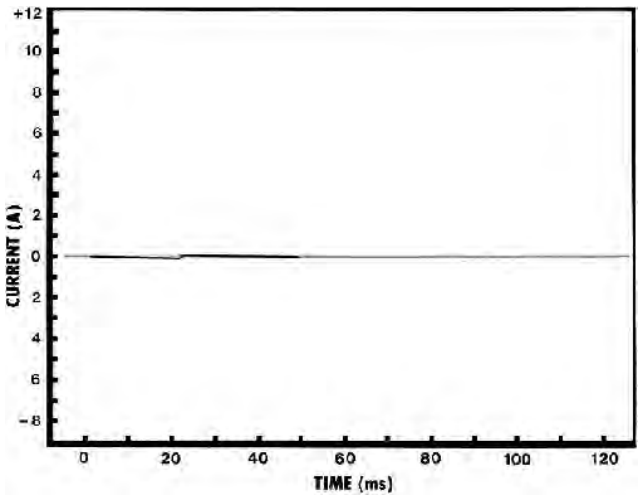



**FIGURE 5.** Current Delivered to a Normally-Grounded Cow Touching a 5.4 km Well-Insulated Fence.

**Low Temperature Operation:** The Bull-Dozer 4312-B could effectively be used to energize cattle feeding wires during low winter temperatures. The peak voltage output of the controller at -35°C on a 5.4 km (3.3 mi) single wire fence was about 2200 V, 18% higher than its output at room temperature. Since the peak voltage output

was above the 2000 V minimum required to overcome the insulation resistance of long-haired animals, the Bull-Dozer 4312-B was suitable for feeding enclosures.

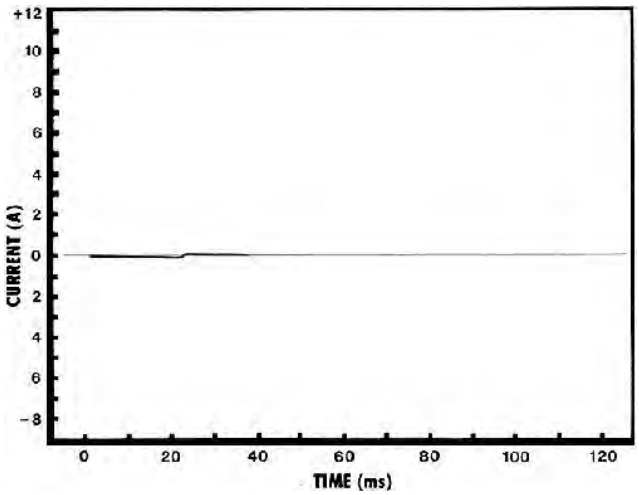



**FIGURE 6.** Current Delivered to a Normally-Grounded Cow Touching a 16 km Well-Insulated Fence.

Since battery voltage is severely reduced at low temperatures, it may be 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.

**Battery Consumption:** A 12 V, 70 amp-hour battery will operate the Bull-Dozer 4312-B from four to seven months, depending upon the naturally-occurring discharge rate and 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

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 suitable fence configurations.

## 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:** | Bull-Dozer Electric Fence Controller |
| **MODEL:** | 4312-B |
| **SERIAL NUMBER:** | 15377 |
| **TYPE:** | Electro-Mechanical |
| **POWER REQUIREMENTS:** | 12 V DC |
| **WEIGHT:** | 3.0 kg |
| **OVERALL DIMENSIONS:** | |
| -- length | 92 mm |
| -- width | 292 mm |
| -- height 2 | 03 mm |
| **NUMBER OF INDICATOR LIGHTS:** | 1 (operation indicator) |
| **TYPE OF ENCLOSURE:** | for indoor use |

**APPENDIX II**
**CONVERSION TABLE**

| | |
|---|---|
| 1 millimetre (mm) | = 0.04 inches (in) |
| 1 metre (m) | = 3.3 feet (ft) |
| 1 kilometre (km) | = 0.6 mile (mi) |
| 1 kilogram (kg) | = 2.2 pounds mass (lb) |

ALBERTA FARM MACHINERY RESEARCH CENTRE

3000 College Drive South
Lethbridge, Alberta, Canada T1K 1L6
Telephone: (403) 329-1212
FAX: (403) 329-5562
http://www.agric.gov.ab.ca/navigation/engineering/afmrc/index.html

**Prairie Agricultural Machinery Institute**
Head Office: P.O. Box 1900, Humboldt, Saskatchewan, Canada S0K 2A0
Telephone: (306) 682-2555

Test Stations:
P.O. Box 1060
Portage la Prairie, Manitoba, Canada R1N 3C5
Telephone: (204) 239-5445
Fax: (204) 239-7124

P.O. Box 1150
Humboldt, Saskatchewan, Canada S0K 2A0
Telephone: (306) 682-5033
Fax: (306) 682-5080