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Evaluation Report 258

Dyna-Charge Super 21 Electric Fence Controller

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

DYNA-CHARGE SUPER 21 ELECTRIC FENCE CONTROLLER

MANUFACTURER:

International Electric Co.
6809 Harriet Avenue
Minneapolis, Minnesota 55423

RETAIL OUTLETS:

Peavy Mart Stores and Wheelers Wholesale Ltd.

RETAIL PRICE:

$56.00 (December, 1981, f.o.b. Humboldt)

SUMMARY AND CONCLUSIONS

The Dyna-Charge Super 21 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 2460 V for a well-insulated, grass-free, dry fence to 70 V for an uninsulated, grass-grown, wet fence. Output was above the 700 V minimum guard voltage recommended for short-haired animals, for most normal fence conditions, while it was above the 2000 V minimum guard voltage required for long-haired animals, for fence insulation values greater than 50 kΩ.

Peak voltage output on a 16 km (10 mi) single wire fence varied from 1520 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 well-insulated 5.4 and 16 km (3.3 and 10 mi) single wire fence varied from 0.14 to 0.13 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 Dyna-Charge Super 21 generated an inadequate shock on well-insulated fences longer than 5.4 km (3.3 mi).

The Dyna-Charge Super 21 was very 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 2300 V, only 7% lower 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 Dyna-Charge Super 21 electric fence controller is designed for 12 V DC operation. It is meant to be mounted in a suitable weather-proof enclosure.

The Dyna-Charge Super 21 uses both electrical and mechanical components to produce charge pulses. A test light is provided to indicate operation.

Detailed specifications are given in APPENDIX I.

SCOPE OF TEST

The performance characteristics of the Dyna-Charge Super 21 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 Dyna-Charge Super 21 is equipped with wire 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 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: 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.

For cattle fences, in areas with normal ground conditions, a single charged wire provides a suitable fence. For very dry or frozen soil, which provides poor ground conditions, a two-wire fence, with one charged wire and one ground wire, may be necessary.

Operation: The Dyna-Charge Super 21 is equipped with a test light that flashes to indicate that the fence is properly charged. If this light does not flash, 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 bulb could be replaced without disassembly of the controller.

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 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 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 Dyna-Charge Super 21 for 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 2460 V for a well-insulated, grass-free, dry fence to 70 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 most fence conditions, while it was above the 2000 V minimum guard voltage needed for long-haired animals for fence insulation values greater than 50 kW.

On a 16 km (10 mi) fence (FIGURE 2), peak voltage output ranged from 1520 V for a well-insulated, grass-free, dry fence to 60 V for an uninsulated, grass-grown, wet fence. Voltage output was below the 2000 V minimum required for long-haired animals for all fence conditions, while it was above 700 V minimum guard voltage required for short-haired animals for fence insulation values greater than 8 kΩ.

As can be seen from FIGURES 1 and 2, wet weather reduced

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

the voltage output below the required 700 V minimum guard voltage. The Dyna-Charge Super 21 will only work effectively on very short fences during wet weather.

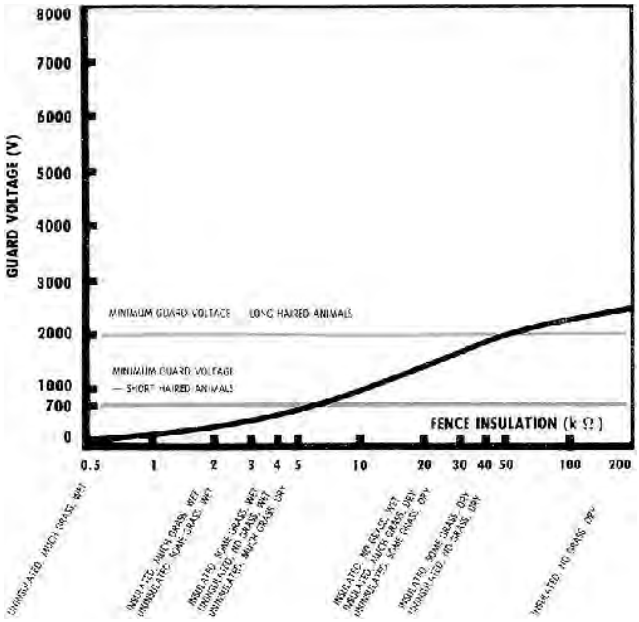

FIGURE 1. Guard Voltage Produced on a 5.4 km Single Wire Fence.

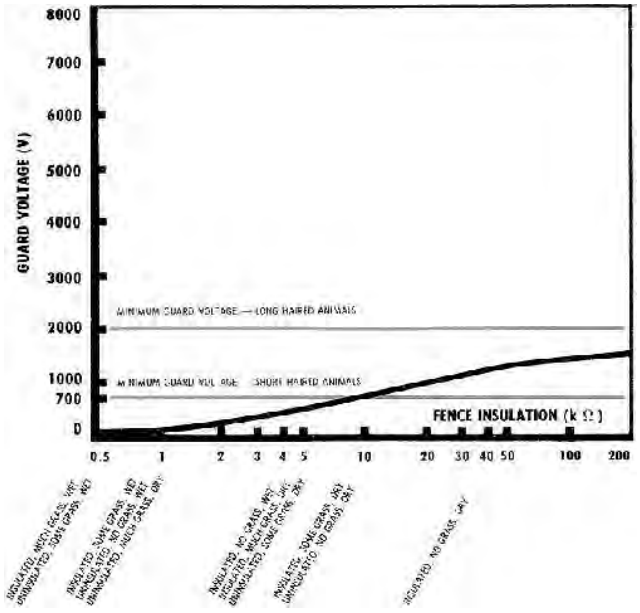

FIGURE 2. Guard Voltage Produced on a 16 km Single Wire Fence.

Electrical Charge: FIGURES 3 to 6 show the current output of the Dyna-Charge Super 21 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 Dyna-Charge Super 21 varied from 0.14 A for a well-grounded cow touching the 5.4 km (3.3 mi) fence to 0.11 A for a normally-grounded cow touching the 16 km (10 mi) fence. The Dyna-Charge Super 21 gave an inadequate shock on well-insulated fences longer than 5.4 km (3.3 mi).

About 48 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 3.3 to 70.0 ms.

Low Temperature Operation: The Dyna-Charge Super 21 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 2300 V, only 7% 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 Dyna-Charge Super 21 was very suitable for feeding enclosures.

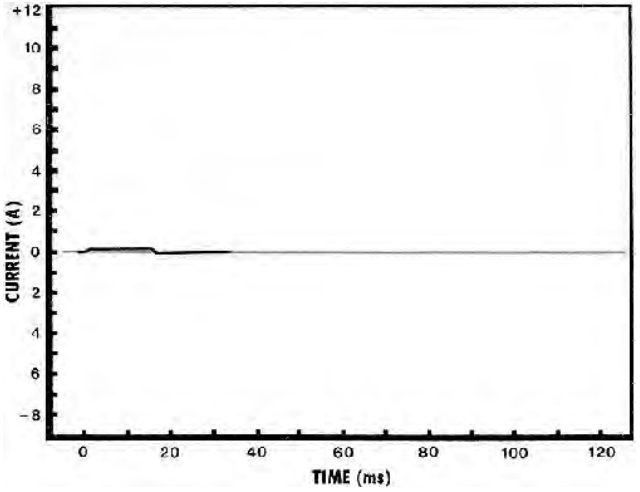

FIGURE 3. Current Delivered to a Well-Grounded Cow Touching a 5.4 km Well-Insulated Fence.

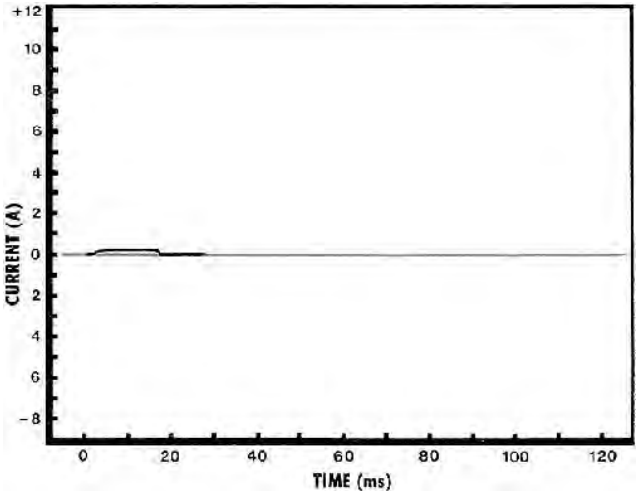

FIGURE 4. Current Delivered to a Well-Grounded Cow Touching a 16 km Well-Insulated Fence.

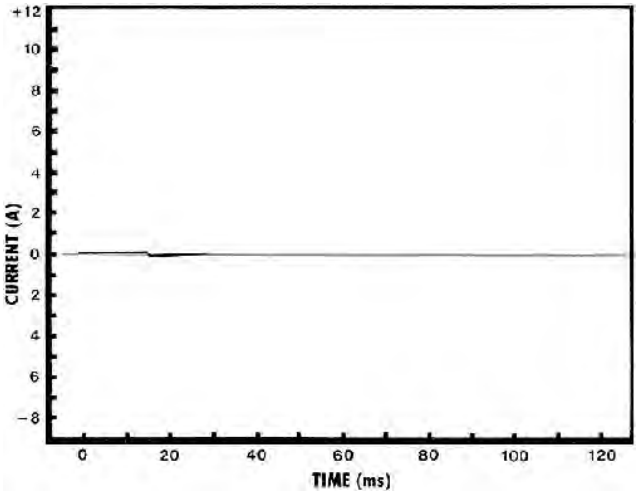

FIGURE 5. Current Delivered to a Normally-Grounded Cow Touching a 5.4 km Well-Insulated Fence

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.

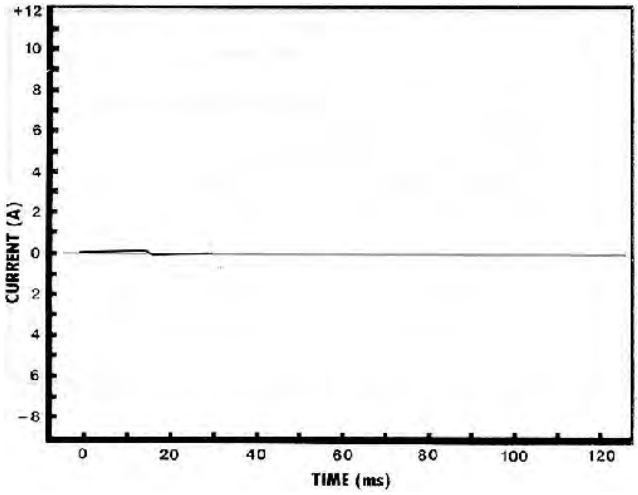

FIGURE 6. Current Delivered to a Normally-Grounded Cow Touching a 16 km Well-Insulated Fence.

Battery Consumption: A 12 V, 70 amp-hour battery will operate the Dyna-Charge Super 21 from five to twelve weeks, 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

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

INSTRUCTION MANUAL

The instruction manual outlined installation, safety considerations and operation of the fence controller.

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:	Dyna-Charge Electric Fence Controller
MODEL:	Super 21
SERIAL NUMBER:	21-12879
TYPE:	Electro-Mechanical
POWER REQUIREMENTS:	12 V DC
WEIGHT:	2.6 kg
OVERALL DIMENSIONS:	
-- length	135 mm
-- width	310 mm
-- height	180 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)

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