

## Chapter Ind 16

### ELECTRIC FENCES

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**Ind 16.01 Intent.** The intent of these orders is to require that the electric energy supplied to fences shall be so limited by controlling devices that the energy which the electric fence can deliver under the most severe condition shall not be hazardous.

**Ind 16.02 Saving clause.** If any order or part of any order, or the application thereof be held invalid, neither the validity of the remainder nor the application to other persons or circumstances shall be affected thereby.

**Ind 16.05 Definitions.** (1) An electric fence is a barrier to animals or fowls consisting of an electrified conductor and an energizing and controlling device.

(2) An electrified conductor may be wire, ribbon, tape, rod, tube, plate, mesh or any other form suitable for its purpose, but may be referred to simply as the fence wire.

(3) The energizing and controlling device is the device or combination of devices by which the fence is electrified and may be referred to simply as the controller.

(4) A battery controller is one for which the power source is a battery or batteries limited to less than 15 volts.

(5) An alternating current controller is one for which the power source is alternating current at voltages normally supplied by electric distributing agencies.

(6) A converter is any device used to allow a battery type controller to be supplied from an alternating current source or from a direct current source of 15 volts or more.

*Note:* 1. The orders of the Wisconsin state electrical code shall be adhered to in so far as they apply.

*Note:* 2. If the controller is located in or on a farm building it is recommended that a suitable lightning arrester be installed outside the building.

**Ind 16.10 Compliance.** (1) All controllers and converters which are sold or installed in Wisconsin after October 6, 1938 shall comply with the requirements in these orders and be approved by the industrial commission of Wisconsin.

(2) All controllers in use prior to October 6, 1938 shall be made to conform to these orders by January 1, 1940.

(3) Controllers supplied by a primary source of power in excess of 15 volts and which do not provide separation by insulation between the primary source of electric energy and the fence, and those of the continuous vibrator type delivering more than 5 milliamperes r.m.s.\* or 25 milliamperes peak shall be prohibited after October 6, 1938.

*Note:* Section Ind 16.10 makes illegal any fence energized by any power source in excess of 15 volts, either directly or through lamps or other resistance.

**Ind 16.20 Approval.** (1) To obtain an approval of a controller, or part of a controller, a stock sample of each type it is desired to distribute in Wisconsin shall be submitted to the industrial commission together with an application for approval and with a certified report of a test of the model made by a laboratory acceptable to this commission.

(2) No device will be approved which fails to comply with these orders.

(3) No device will be approved which is of poor construction or which fails to comply with other requirements of the industrial commission.

**Ind 16.30 Identification.** (1) Electric fences, when installed along public highways, or as property line fences, shall be identified by approved signs clamped to the wire or fastened to the posts at intervals of not more than 200 feet.

*Note:* Section Ind 16.30 does not intend to indicate that electric fences are legal fences. Legal fences are defined in section 90.02, Wis. Stats.

(2) An approved sign shall be as follows: A metal plate or wooden board 4 inches by 8 inches, painted with a pure chrome yellow background on both sides with the following reading on one or both sides "Electric Fence". The lettering to be in black letters not less than one inch high. Other lettering may be placed on one side (the reverse of the side with the required lettering) with letters not over  $\frac{1}{2}$  of an inch high.

(3) An electric fence controller or converter shall be clearly and permanently marked, where it will be readily visible after it has been installed as intended, with the manufacturer's or distributor's name and address, the catalogue or model number, the voltage and type of electrical supply circuit with which it is to be used, the industrial commission's approval, date of such approval, and whether it is designed for inside or outdoor use.

(a) Every controller shall also carry a notice that it must be operated on the supply circuit for which the controller is designed unless an approved device is used to connect it to a different source.

(b) Every converter shall also carry a notice of the type and voltage rating of controller and supply circuit with which it is to be used.

**Ind 16.31 Approved controller required.** No fence shall be charged from any source except through an approved controller.

\* Abbreviation r.m.s. is for root mean square.

**Ind 16.32 Number of controllers.** No metallicly continuous fence or set of electrically connected fences shall be supplied by more than one controller.

**Ind 16.40 Grounding.** (1) One side of the controller output, the core of any transformer used, any metallic enclosure of transformers or equipment, and any shields or barriers that may be used, shall be permanently, mechanically and electrically connected to the inside of the case. These connections shall be free from insulating paints and shall be securely riveted, welded, soldered, or permanently bolted together. The leads used to make these grounding connections shall be of not less than No. 18 A. W. G. stranded and tinned copper wire or the equivalent.

(2) A suitable corrosion resistant grounding terminal without insulator or bushing shall be provided on the case and marked "Ground" or "Gnd" in a plain and permanent manner. When in use this grounding terminal shall be thoroughly bonded to a ground electrode with No. 12 A. W. G. or larger copper conductor or its equivalent. The ground electrode shall be at least an 8 foot by  $\frac{3}{4}$  inch galvanized pipe or rod or an 8 foot by  $\frac{1}{2}$  inch non-ferrous rod. The electrode is to be driven to its full length.

(3) If a converter is used it may be grounded to the same grounding electrode as the battery type controller if the converter is securely bonded to the battery controller.

**Ind 16.70 Enclosures.** (1) The current limiting and timing devices shall be mounted in an enclosure or enclosures, so sealed as to show clearly when it has (or they have) been opened or subjected to tampering.

(2) The controller or converter assembly shall be in a case that is:

(a) Dust-proof for controllers designed and marked for installation inside of buildings in dry locations.

(b) Dust-proof and weather-proof for controllers designed and marked for installation out of doors or in damp locations.

**Ind 16.80 Controller allowable output.** (1) **INDUCTIVE DISCHARGE TYPE.** During each shock period the value of the product of the rectified current in milliamperes capable of being supplied by the controller and the duration of such periods in seconds shall not exceed 3 milli-ampere seconds (3 millicoulombs). The maximum peak value of the current delivered by the controller with 500 ohms non-reactive resistance in series with the output terminals shall not exceed 500 milliamperes and the duration of shock period shall not exceed 0.1 second. Between shock periods there shall be an "off" period of 0.75 seconds or more during which time no current is delivered to the fence.

(a) A cutout or equivalent device as specified in section Ind 16.81 (3) shall be provided, and the steady current limited to 25 milliamperes, unless the construction is such as to limit the maximum steady current deliverable under any condition to 3 r.m.s. milliamperes. This cutout will not be required in a controller for which the power source is a battery of less than 15 volts.

(2) **CAPACITY DISCHARGE TYPE.** The maximum rectified current-time product capable of being supplied in any interval of 0.1 second to the fence when connected to 500 ohms non-reactive resistance in series

with the fence terminals shall not exceed 3 milliamperere seconds, (3 millicoulombs). The maximum peak value of current delivered by the controller shall not exceed 500 milliamperes and shall not exceed 150 milliamperes after 0.0001 second and shall not exceed 10 milliamperes after 0.1 second, and the maximum steady current deliverable shall not exceed 5 milliamperes.

(3) **INTERMITTENT A-C OUTPUT TYPE.** The maximum current capable of being supplied at the fence terminals when connected to 500 ohms non-reactive resistance shall not exceed 25 r.m.s. milliamperes during the shock period. The time of application of current to the fence shall not exceed 0.1 second and the number of such current applications shall not exceed one per second. A current not exceeding one r.m.s. milliampere is permissible during the nominally "off" period of the controller.

(4) **CONTINUOUS TYPE.** Controllers of the continuous type supplying uninterrupted alternating current to the fence shall not be approved.

(5) **OUTPUT MEASUREMENT.** The output current of all types of controllers, except the continuous type, shall be measured with a magnetic oscillograph having a natural frequency not less than 3000 cycles per second. In measuring the output of the continuous type a milliammeter may be used. No load other than the 500 ohm non-reactive resistance including the measuring device shall be connected to the output terminals during the test. All timing and output tests are to be made at the rated supply voltages and frequencies. The initial and 0.0001 second values of current for the capacitive discharge type of controller shall be computed on the basis of measured capacitance, voltage of charge, and impedance of discharge circuit.

**Ind 16.81 Construction specifications.** (1) The current limiting element or principle used in the device shall be such that the device cannot be readily tampered with (such as by removing, shunting out, replacing the element or tilting in any position) to cause an increase above the current limits specified in section Ind 16.80.

(2) The timing mechanism shall not be easily tampered with and it shall be of such design that the tilting or changing of position will not increase the "shock" period nor decrease the "off" period specified in section Ind 16.80 (1) or (3).

(3) The input circuit of intermittent a-c output type and inductive discharge type controllers, when not exempted as in section Ind 16.80 (1), shall be provided with a cutout which will open within 5 seconds at 120° and within 30 seconds at 0° Fahrenheit should the interrupter points stop in a closed position or if a jumper is used across the interrupter points. This cutout shall be so located in the circuit that the controller cannot be used without it, and where it cannot readily be tampered with.

(4) Where pilot or signal lamps are used, the circuit shall be such that the use of any other lamp or a "jumper" will not increase the delivered current beyond the values set in section Ind 16.80.

(5) The input and fence windings of the transformer shall be on separate sections of the transformer core, or otherwise separated so that in case of failure of the insulation of the primary winding the breakdown will be to a grounded metallic barrier.

(6) There shall be a metallic grounded barrier between the input circuit and the fence circuit. This barrier shall adequately separate input and fence circuits. Inductive discharge types (battery operated) shall be exempt from this requirement.

**Ind 16.82 Use.** (1) Controllers designed and approved for battery operation shall not be connected to any other type of power supply or connected to a supply voltage higher than the design voltage except through a device approved for this type of controller by this commission.

(2) Batteries shall not be charged while the fence is in use unless the charging device does not cause the allowable current and timing to be exceeded and meets the requirements of a device to connect the battery controller to another source of power.

(3) Alternating current controllers shall not be connected to any supply circuit having different characteristics than the supply circuit for which the controller is designed.

**Ind 16.85 Converters.** (1) Converters shall be so designed that when used in conjunction with a battery type controller they will not cause the output or timing requirements in section Ind 16.80 to be violated.

(2) When pilot or signal lamps are used, the circuit shall be such that the use of any other lamp or jumper will not increase the delivered current or change the timing in such a way that section Ind 16.80 is violated.

(3) There shall be a metallic grounded barrier between the input circuit and the output circuit of the converter.

**Ind 16.90 Dielectric and leakage tests for battery operated controllers.** (1) 150% maximum rated primary or input voltage shall be applied to the primary circuit for a period of one minute with the fence terminals remaining open. There shall be no breakdown or flashover.

(2) Following the above test and after the complete device has been exposed for 48 hours to an atmosphere having a relative humidity of 90% and a temperature of 90° Fahrenheit, and before being removed from that atmosphere the unit shall withstand the following test.

(a) There shall be no increase in current at the fence terminals above the normal output when maximum rated voltage is impressed on the primary.

**Ind 16.91 Dielectric and leakage test for alternating current controllers.** (1) After the complete controller has been subjected to a temperature of 135° to 140° Fahrenheit for a period of 2 hours it shall immediately be subjected to the following insulation tests and withstand these tests without flashover or breakdown.

(a) Twice rated maximum primary voltage plus 1000 volts (r.m.s. 60 cycle) applied between the primary circuit and the fence ground terminal or case for a period of one minute.

(b) 150% maximum rated primary or input voltage shall be applied to the primary circuit for a period of one minute with the fence terminals remaining open.

(c) With the transformer removed a 3000 volt r.m.s. potential shall be applied between the input or primary windings and the core of the transformer for a period of one minute; also this potential shall be applied between the secondary or fence winding and the core for a period of one minute.

(2) Following the above tests and after the complete device has been exposed for 48 hours to an atmosphere having a relative humidity of 90% and a temperature of 90° Fahrenheit, and before being removed from that atmosphere the unit shall withstand the following tests.

(a) There shall be no increase in current at the fence terminals above the normal output when maximum rated voltage is impressed on the primary.

(b) The insulation shall withstand a 500 volt r.m.s. 60 cycle potential impressed between the input winding and the case for one minute.

**Ind 16.92 Dielectric and leakage test for converters.** (1) The converter shall withstand the following electrical breakdown test.

(a) After the complete converter has been subjected to a temperature of 135° to 140° Fahrenheit for 2 hours, it shall immediately be subjected to the following insulation test and withstand this test without flashover or breakdown:—3000 volts r.m.s., 60 cycle, shall be applied between the primary winding and the converter case for a period of one minute.

(2) After the complete converter has been exposed for 48 hours to an atmosphere having a relative humidity of 90% and a temperature of 90° Fahrenheit, it shall be tested at 500 volts r.m.s., 60 cycle, between the primary winding and the case for a period of one minute.

(a) There shall be no increase in current or voltage above the normal output at the converter terminals, and the wave form shall not be altered, when maximum rated voltage is impressed on the primary.