Technical Requirements for Electronic Pet Training and Containment Collars

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Revision History

Revision	Date	Changes
3.2	20-Nov-07	Correction to measurement wiring and statement on invalid animals.
3.3	5-March-2008	Added an explanation of the limit shown in Figure 3. The limit of energy in a worst case second was changed from 2.0 to 2.5J to more closely follow the IEC. The wording of sections in 3.3 was changed to improve readability. Section numbers were corrected to show their logical order.
4.0	15-May-2008	Changed measurement of peak voltage and current to use RMS relative to the limits of current and pulse duration. This brings this document more in line with the IEC. Added to 4.1 clarifications that the training instruction may be provided in the form of a DVD or Cassette. This version includes all feedback to date from all ECMA members, and represents a fully ratified version within ECMA.

1.0) Scope

1.1) Static Correction Collars

E-training and containment collar systems utilizing static correction technology

2.0) Construction

2.1) IEC 60950

All devices, excluding the static output voltage and associated coupling mechanism (probes) must meet the requirements of IEC/UL 60950

2.1.1) Indoor/Outdoor Use

Collar worn devices must meet the requirements for outdoor use.

2.2) Drop Resistance

Normal operation after the drop test in UL 746C, no abnormal operation that would violate the limits contained within this document.

2.3) Probe Spacing

The distance between collar contact points shall not exceed 60mm.

3.0) Performance

3.1) Conditioning of Test Sample

3.1.1) Rechargeable Batteries

All electrical tests on battery operated equipment powered by a secondary or rechargeable battery shall be conducted using a fully charged battery following a conditioning cycle of 5 discharges and recharges. If regulated voltage is supplied to the static output circuit, then the battery conditioning is not required, in this case tests shall be conducted using a fully charged battery. The battery may be conditioned by removing it from the product and carrying out the discharge/recharge cycles at a rate not to exceed C/1, where C=capacity in AHr, or the maximum allowed by the battery specification, whichever is lower. The battery may be provided for test pre-conditioned by the manufacturer.

3.1.2) Primary Batteries

Electrical systems that utilize a primary or non-rechargeable battery type instead of a rechargeable battery, shall have electrical tests preformed using a fresh, unused battery.

3.2) Measurement Equipment Requirements

3.2.1) Oscilloscope

For the purpose of determining the output characteristics of the static pulse, an oscilloscope with a bandwidth of no less than 100MHz, with area or integral calculation capability, must be used. As an alternative, the trace may be captured into test automation software and the calculation made external to the O-scope, however if this method is used, the software must be printed and included in the test report for review. A mathematical estimation based on the general wave shape, a triangle for example, may be used; however measurement data will take precedence in cases of disagreement.

3.3) Test Load

3.3.1) Fixed Load for Output Current Measurement

The test load shall be a non reactive load equal to 500 O. Compliance is determined by comparison with the limit shown in Figure 3.

3.3.2) Variable Load for Output Worst Case Energy Measurement

The test shall be repeated and the load varied between 500 O and 100 kO to find worst case energy output. The method of varying the load shall utilize fixed resistors. A bracketing technique may be employed to quickly determine the worst case energy point. The bracketing would involve starting at 500, then 100k, then perhaps 30k, then adjust the value of the resistor in the direction of the maximum, using as many steps as are required. This process is continued until the load that yields the highest energy output is determined to within 10%. The final test load used, and the result, shall be stated in the test report. Compliance is determined by comparison with the limits of 3.6.2.

3.4) Measurement Requirements

3.4.1) Required Output Measurements

Using the load of 3.3.1, with the device under test set to maximum output, plots, screen captures or scope photos shall be taken to show:

a) The duration of a single pulse, the pulse width in µS. Where the width is defined as the duration of that part of the impulse that contains 95% of the overall energy and is the shortest interval of integration of $I^2(t)$ that gives 95% of the integration of $I^2(t)$ over the total impulse.
b) The time from the start of a pulse to the start of the next pulse, in µS.
c) The RMS current of the pulse in mA, taken over the pulse duration.
d) The duration of a pulse train, or group of pulses in mS.
e) The total number of pulses in a worst case second of stimulation.
f) The length of correction time available up to the point where automatic controls prevent further static correction / initiate a lock out period. If no automatic control or lockout is in place it shall be noted in the test report. Tests shall be carried out to determine the lock out period once it is initiated.

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3.4.2) Output Energy Measurement

Using the load of 3.3.2; plots, screen captures or scope photos shall be taken to show:

a) The energy of a single pulse in mJ.

(This data is not required if calculation method is used)

The measurement in a) shall be repeated for the opposite polarity if the pulse is bi-directional. The total energy shall include the sum of the energy from both polarities.

3.5) Test Procedure

3.5.1) Method of Measuring Output Current

The device under test is connected to a non inductive (non wire wound) 500 ohm resistor load, with a 1 ohm current shunt connected in series with the load. A high voltage scope probe is used to measure the voltage developed across the load, while the voltage across the 1O load is used to provide current flow information.

3.5.2) Method of Measuring Output Worst Case Energy

Trace math between Ch1 and Ch2 can provide Volts x Amperes information directly if all corrections are in the O-scope. The result is instantaneous power, which is of little value in assessing the safety of a brief event; however the integral of the instantaneous power over the seconds of time duration of the pulse is equal to the total energy delivered to the load by the pulse in Joules. If it should be necessary to make a scale correction to the data outside of the scope, any details of such external calculation should be stated in the test report.

3.6) Interpretation of Test Results

3.6.1) Output Current Limits

The output current characteristics determined in 3.4.1 shall be below the limit shown in figure 3.

3.6.2) Output Energy Limits

The total energy in a worst case one second period shall be calculated by:

$$E_T = P_E * P_n$$

Where

E_T = the total energy in a worst case second in Joules

P_E= the total energy in 1 pulse from 3.4.2 (including both parts of the pulse if bi-directional).

P_n= the total number of pulses in a worst case second from 3.4.1e.

The sum of the energy in a worst case second, E_T, shall not exceed 2.5J.

3.7) General Requirements

3.7.1) Output Polarity

The output shall be one pulse, or a series of pulses separated by off intervals. Each pulse may be DC or AC in nature.

3.7.2) Pulse Characteristics

The pulse duration, or pulse width, of a single pulse shall not exceed 10mS where pulse width is defined as the points where the pulse voltage increases or decays to 10% of the peak pulse voltage.

3.8) Stimulation Safety Timeout

3.8.1) Duration of Timeout

The length of the stimulation period in a remote controlled trainer, shall be limited by an automatic cut-out.

3.8.2) Maximum Time before Cutout

The maximum stimulation time before automatic cut-out functions take effect shall not exceed 15 seconds followed by an off period. (Exemption: 3.8 does not apply to tone only output)

3.8.2.1) Reset Conditions

The system shall not reset until the receiver has ceased to receive the transmitted command.

3.9) Variable Correction Levels

3.9.1) Variable Levels Required

Devices must have variable levels of correction to suit the needs of the animal and the situation.

(Exemption to 3.9.1) Devices used exclusively for containment are exempt from this requirement.

3.10) Immunity to Radiated Fields

3.10.1) IEC 61000-4-3
Testing to EN/IEC 61000-4-3 Immunity to RF fields shall be conducted at the 10V/m level with a 1 kHz 80% AM modulation applied.

3.10.2) FM Modulated RF
In addition to the immunity required in 61000-4-3, a similar test shall be carried out using a 1 kHz FM modulation with a deviation equal to the typical deviation of the DUT if the device uses FM modulation, if the device under test does not use FM modulation, then 10 kHz deviation shall be used on the test signal. The frequency range to investigate shall begin at a frequency equal to the lowest operating frequency minus 10x the operating bandwidth and continuing to a frequency equal to the highest frequency used plus 10 times the operating bandwidth.

3.10.3) RF Immunity Criteria
During the test of 3.10.1 and 3.10.2, DUT shall not produce a static pulse at any time when the unwanted signal is applied.

4.0) Use and Care Instructions

4.1) User Manual Information

All products shall include a user manual containing effective operational and training instructions. (Such instructions may be provided in the form of an included DVD or Video Cassette)

4.1.1) Not for use on Infant and Invalid Animals
Instructions shall state that static correction training products must only be used with animals which are greater than 6 months old, and never on invalid or injured animals without professional assistance.

4.1.2) Pressure Necrosis Education
Instructions shall include advice about avoidance of pressure necrosis, as well as education on what pressure necrosis is. This shall include recommendations that the collar is not worn continually, that the collar fit is checked regularly, and the animal's neck is checked often.

4.1.3) Information on Proper Use

Instructions shall provide training and guidance to the animal owner on the proper use of the training or containment system, to include a recommended training method for training the animal. This may include, but is not limited to, providing an educational book or CD to explain or demonstrate the proper techniques for training.

5.0) Product Markings

All static correction products that are compliant with this standard shall be marked as follows:

To Be Determined

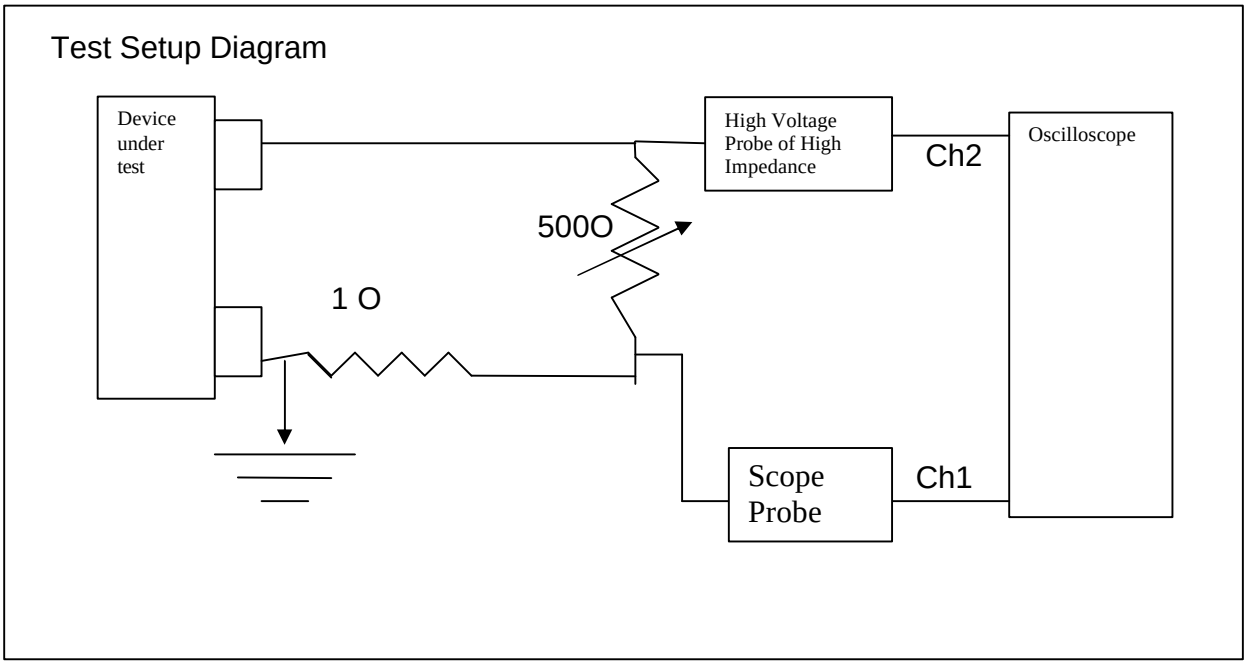


Figure 1 (Measurement Arrangement)

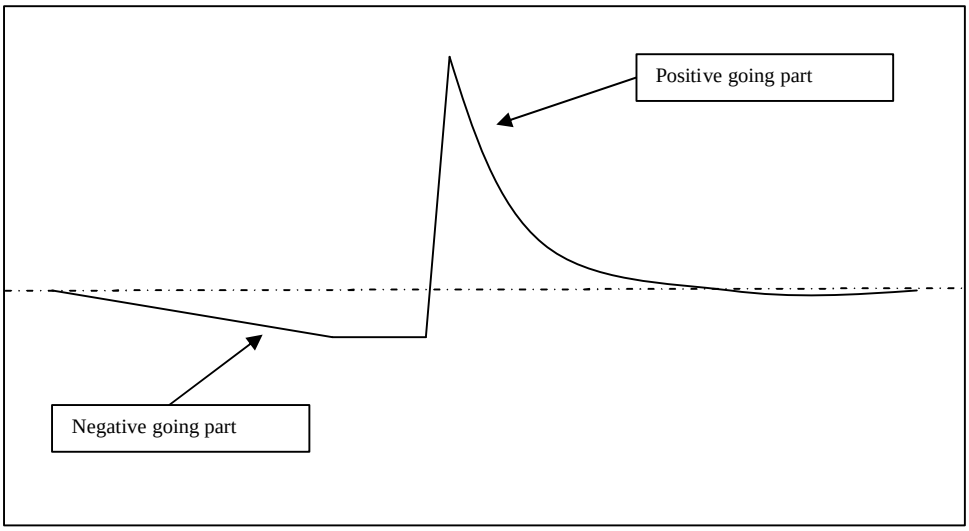
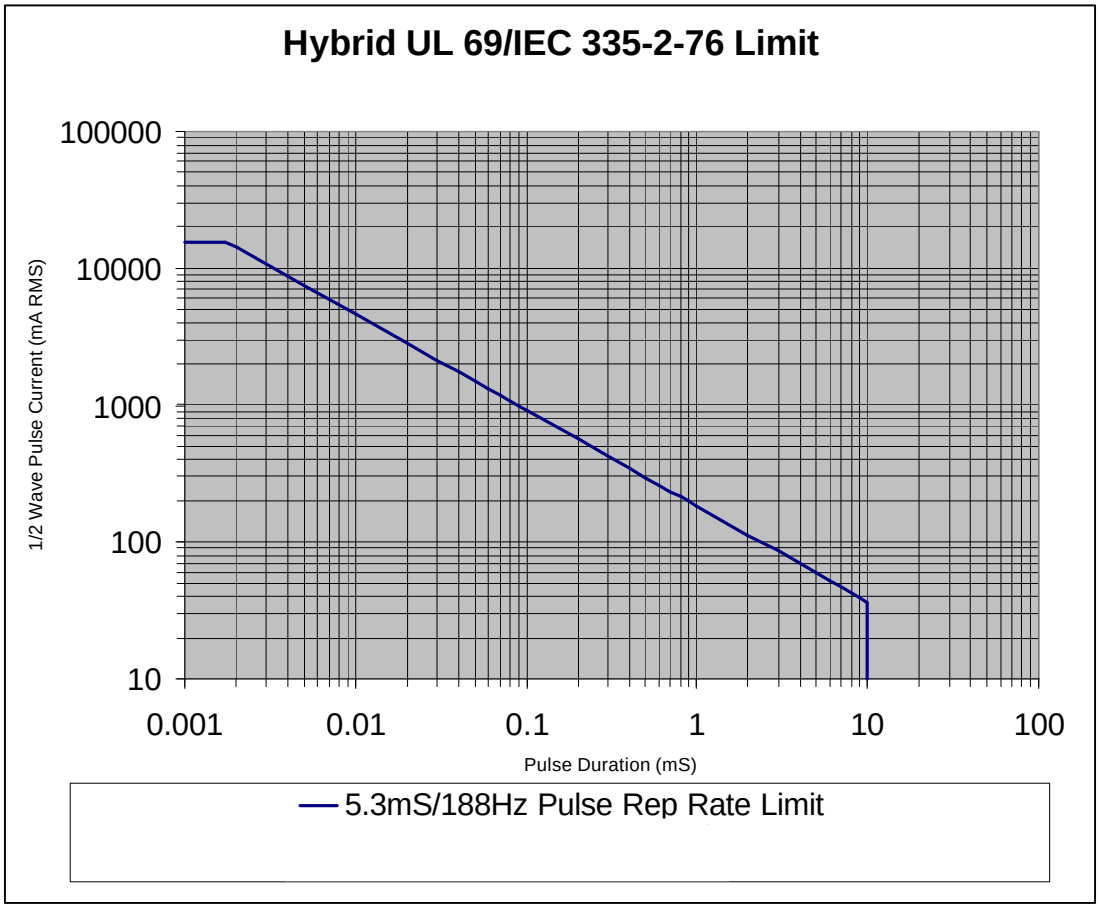


Figure 2 (Typical Pulse Example)



The limit shown is an example based on a repeating pulse with a 5.3mS period.

Limit is expressed by the equation $I=20T^{-0.7}(R^{-0.5})$ where current (I) may never exceed 15,700mA RMS and the duration of a single pulse (T) may not exceed 10 mS. Where:

I is the RMS current of the pulse in milliamperes
T is the pulse duration in seconds
R is the pulse repetition frequency in Hz

Note: pulse repetition frequency can be calculated by $[Period]^{-1}$=Freq where period is in seconds and frequency is in hertz.

Figure 3 (Output Current Limits)