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# EMC/EMI, Environmental, Safety

## Test Plan

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## Change History

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| Version | Date | Author(s) | Description |
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| A.00 | 26Jun2014 | Hart InterCivic | Initial Draft |
| A.01 | 11Jul2014 | Hart InterCivic | Added Environmental and Safety tests |
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| A.03 | 22Oct2104 | Hart InterCivic | Added EUT requirements |

# Table of Contents

# 1 INTRODUCTION

## 1.1 What is the purpose of this document?

Provides complete description of pre-certification testing performed by and success criteria for voting machines per the Voluntary Voting Standards Guidelines 2005

# 2 TEST REQUIREMENTS

## 2.1 Summary of Test Requirements

| Specification | Name | VVSG Ref | Requirement | Comments |
|---|---|---|---|---|
| **Electromagnetic Emissions Tests** | | | | |
| FCC Part 15.109 per ANSI C63.4 | c | V1, 4.1.2.9<br>V1, 4.1.7.1<br>V1, 2.1.4 (b)<br>V2, 4.8 | Class B | FCC limits, not CISPR-22<br>10m Chamber is OK |
| FCC Part 15.107 per ANSI C63.4 | Conducted Electromagnetic Emissions | V1, 4.1.2.9<br>V1, 4.1.7.1<br>V1, 2.1.4 (b)<br>V2, 4.8 | Class B | |
| **Electromagnetic Immunity Tests** | | | | |
| IEC 61000-4-2 (2008) Ed.2.0 | Electrostatic Disruption | V1, 4.1.2.8<br>V1, 4.1.7.1<br>V1, 2.1.4 (b)<br>V2, 4.8 | Vote scanning and counting equipment for paper-based systems, and all DRE equipment, shall be able to withstand ±15 kV air discharge and ±8 kV contact discharge without damage or loss of data. The equipment may reset or have momentary interruption so long as normal operation is resumed without human intervention or loss of data. Loss of data means votes that have been completed and confirmed to the voter.<br><br>The test levels stated in IEC 61000-4-2, Edition 2.0<br>Contact discharge, are the test method and shall be applied at the specified test level only, 8 kV.<br>Air discharge shall be used where contact discharge cannot be applied and all test | Voting systems are required to be immune to ESD up to the limits of 8 KV, contact discharge, and 15 KV, air discharge. During exploratory pre-testing investigation of the possibility of windowing effects should be explored. If there are indications that a unit has sensitivity at a lower voltage, but not at a higher voltage, test levels shall be added to evaluate the immunity at lower voltage levels. (RFI 2010-01) |

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| | | | levels shall be used (2, 4, 8, 15 kV). (RFI 2010-01) | |
| IEC 61000-4-3 (1996) | Electromagnetic Susceptibility | V14.1.2.10<br>V1, 4.1.7.1<br>V1, 2.1.4 (b)<br>V2, 4.8 | A field of 10 V/m modulated by a 1 kHz 80% AM modulation over the frequency range of 80 MHz to 1000 MHz | |
| IEC 61000-4-4 (2004-07) Ed. 2.0 | Electrical Fast Transient | V1, 4.1.2.6<br>V1, 4.1.7.1<br>V1, 2.1.4 (b)<br>V2, 4.8 | ±2kV AC & DC external power lines<br>±1kV all external wires control<br>Repetition Rate 100 kHz | The Standard specified in Volume II Section 4.8 is mistakenly cited as IEC 61000-4-4 (1995-01), and should instead properly be cited as IEC 61000-4-4 (2004-07) Ed. 2.0 which supports the 100 kHz repetition rate for all transient pulses specified in Volume I, Section 4.1.2.6(c). (RFI 2008-10) |
| IEC 61000-4-5 (1995-02) | Lightning Surge | V1, 4.1.2.7<br>V1, 4.1.7.1<br>V1, 2.1.4 (b)<br>V2, 4.8 | ±2 kV AC line to line;<br>±2 kV AC line to earth;<br>±0.5 kV DC line to line >10m;<br>±0.5 kV DC line to earth >10m;<br>±1 kV I/O sig/control >30m. | |
| IEC 61000-4-6 (1996-04) | Conducted RF Immunity | V1, 4.1.2.11<br>V1, 4.1.7.1<br>V1, 2.1.4 (b)<br>V2, 4.8 | 10V rms,150 KHz to 80 MHz with an 80% AM with a 1 KHz sine wave AC & DC power 10V rms sig/control >3 m, 150 KHz to 80 MHz with an 80% AM with a 1 KHz sine wave | |
| IEC 61000-4-8 (1993-06) | Magnetic Fields Immunity | V1,4.1.2.12<br>V1, 4.1.7.1<br>V1, 2.1.4 (b)<br>V2, 4.8 | 30 A/m at 60 Hz | |
| IEC 61000-4-11 (1994-06) | Electrical Power Disturbance | V1, 4.1.2.5<br>V1, 4.1.7.1<br>V1, 2.1.4 (b)<br>V2, 4.8 | Voltage dip of 30% of nominal @10 ms;<br>Voltage dip of 60% of nominal @100 ms & 1 sec<br>Voltage dip of >95% interrupt @5 sec<br>Surges of +15% line variations of nominal line voltage<br>Electric power increases of 7.5% and reductions | |

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| | | | of 12.5% of nominal specified power for a period of up to four hours at each level. | |
| **Non-operating Environmental Tests** | | | | |
| MIL-STD-810D, Method 516.3, Procedure VI | Bench Handling | V1, 4.1.7.1 V2, 4.6.2 | | |
| MIL-STD-810D, Method 514.3, Category 1-Basic Transportation, Common Carrier | Vibration Test | V1, 4.1.7.1 V2, 4.6.3 | | |
| MIL-STD-810D, Methods 502.2, Procedure I-Storage | Low Temperature Test | V1, 4.1.7.1 V2, 4.6.4 | | |
| MIL-STD-810D, Methods 501.2, Procedure I-Storage | High Temperature Test | V1, 4.1.7.1 V2, 4.6.5 | | |
| MIL-STD-810D, Method 507.2, Procedure I-Natural Hot-Humidity | Humidity Test (85%) Soak | V1, 4.1.7.1 V2, 4.6.6 | | |
| **Operating Environmental Tests** | | | | |
| Election Assistant Commission's Request For Information 2009-06 | Temperature/Power Variation | V2, 4.7.1 | This test is similar to the low temperature and high temperature tests of MIL-STD-810-D, Method 502.2 and Method 501.2, | |
| | Reliability Test | V2, 4.7.3 | Test is performed during Temp/Power Variation testing | |
| | Integrity Test | V1 2.1.4 (d) | Test is performed during Temp/Power Variation testing | |
| **Safety** | | | | |
| OSHA, Title 29, Part 1910 | Safety | V1, 3.4.8 | In order to meet the safety requirements of the 2002 VSS and 2005 VVSG, voting system manufacturers shall submit their systems for review to a Nationally Recognized Testing Laboratory (NRTL.) NRTL laboratories are specifically accredited by OSHA to identify relevant safety standards for a product and to conduct testing that ensures specific products meet the | a. All voting systems and their components shall be designed to eliminate hazards to personnel or to the equipment itself<br>b. Defects in design and construction that can result in personal injury or equipment damage must be detected and corrected before voting systems and components are placed into service<br>c. Equipment design |

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| | | | requirements of the product safety standards identified. | for personnel safety shall be equal to or better than the appropriate requirements of the Occupational Safety and Health Act, Code of Federal Regulations, Title 29, Part 1910.” |

## 2.2 Test Setup

2.2.1 Equipment Under Test

In order to provide maximum flexibility in testing throughout EMC/EMI and Environmental testing, identical models (e.g. multiple EUTs of the same model with unique serial numbers) may be used throughout testing for EMC/EMI or Environmental or both.

2.2.2 Device functionality

All voting machines that are being tested shall be in an operating mode(s) that provides all functionality or approximates all functional features of the device during normal operations:

2.2.2.1 The test can use applications specifically developed for testing the products functionality; the voting machines application is not required to be used during testing.

2.2.2.2 All functions that govern or provide data storage should be tested

2.2.2.3 External interfaces to commercial-off-the-shelf components such as printers or scanners should be tested

2.2.2.4 Excluded – user interfaces (touch displays), push-buttons, controls, are not required to be tested during testing; these interfaces will typically be validated “to be operating normally” with tests performed after the tests have been completed.

2.2.3 Device setup

The voting machines shall be physically configured and setup exactly as they would be in the polling place environment;

2.2.3.1 Ballot marking devices shall be securely setup on the ballot booth

2.2.3.2 Ballot scanning devices shall be securely setup on ballot box

2.2.3.3 If the device uses a battery, the battery shall be installed and enabled for all tests

## 2.3 Test Specification

2.3.1 FCC Part 15.109, Radiated Electromagnetic Emissions

<table>
<tr><td>Objective</td><td>To verify that the electromagnetic emissions generated by the product under normal use and in the product’s intended environment are below a level as specified by the VVSG.</td></tr>
<tr><td>Test Method</td><td>FCC Part 15.109, Unintentional generators, per ANSI 63.4<br>Test can be performed in 3m or 10m test chambers</td></tr>
<tr><td>Test Limits</td><td>
<table>
<tr><th>Frequency Band (MHz)</th><th>Class B Limits, 3m dBuV/m</th><th>Class B Limits, 10m dBuV/m</th></tr>
<tr><td>30-88</td><td>40</td><td>29.5</td></tr>
<tr><td>88-216</td><td>43.5</td><td>33.1</td></tr>
<tr><td>216-960</td><td>46</td><td>35.6</td></tr>
<tr><td>960-1000</td><td>54</td><td>43.5</td></tr>
<tr><td>1000-5000</td><td>54</td><td>43.5</td></tr>
</table>
</td></tr>
<tr><td>Pass Criteria A</td><td>Device operates normally throughout the test<br>All quasi-peak measurements are at least -6dB below the test limits, this is to ensure lab-to-lab variations in test measurements should not be an issue</td></tr>
</table>

### 2.3.2 FCC Part 15.107, Conducted Electromagnetic Emissions

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|---|---|
| **Objective** | To verify that the electromagnetic emissions generated by the product under normal use and in the product's intended environment are below a level as specified by the VVSG. |
| **Test Method** | FCC Part 15.107, per ANSI 63.4 |
| **Test Limits** | |

| Frequency Band (MHz) | Class B Limits Quasi-peak dBuV | Class B Limits Average dBuV |
|---|---|---|
| 0.15-0.50 | 66 decreasing with the log of frequency to 56 | 56 decreasing with the log of frequency to 46 |
| 0.50-5.00 | 56 | 46 |
| 5.00-30.0 | 60 | 50 |

| | |
|---|---|
| **Pass Criteria A** | Device operates normally throughout the test<br>All quasi-peak and average measurements are at least -6dB below the test limits, this is to ensure lab-to-lab variations in test measurements should not be an issue |

### 2.3.3 IEC 61000-4-2, Electrostatic Disruption Tests (ESD)

| | |
|---|---|
| **Objective** | To verify that the product performs as intended when exposed to different types of electromagnetic energies that may be encountered under normal use in the product's intended environment. |
| **Test Method** | IEC 61000-4-2<br>With voting machines on ballot boxes and ballot booths, horizontal plane discharge most likely will not be performed; but vertical plane discharge will.<br>Indirect Contact requires 25 discharges<br>Contact requires 25 discharges on an area that discharges occur<br>Air requires 10 discharges on an area that discharges occur |
| **Test Levels** | |

| Test Location | Discharge Voltages, +/- kV |
|---|---|
| Indirect Contact: Horizontal Plane | 2, 4, 8 (may not be required) |
| Indirect Contact: Vertical Plane | 2, 4, 8 |
| Contact Discharge to Conductive Surfaces | 2, 4, 8 |
| Air Discharge to Non-conductive Surfaces | 2, 4, 8, 15 |

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| **Pass Criteria B** | The UUT shall be able to withstand the test without damage or loss of data. The equipment may reset or have momentary interruption so long as normal operation is resumed without human intervention or loss of data. Loss of data means votes that have been completed and confirmed to the voter. |

### 2.3.4 IEC 61000-4-3, Electromagnetic Susceptibility

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| **Objective** | To verify that the electromagnetic emissions generated by the product under normal use and in the product's intended environment are below a level as specified by the VVSG. |
| **Test Method** | IEC61000-4-3, Radiated, Radio-Frequency, Electromagnetic Field Immunity Test |

| | |
|---|---|
| **Test Levels** | <table><tr><th>Frequency Range (MHz)</th><th>Test Level (V/m)</th><th>Modulation/Sweep</th></tr><tr><td>80.0 – 1000.0</td><td>10</td><td>80% AM @ 1kHz<br>1% sweeps with 3-second dwell</td></tr><tr><td>UUT Clock Frequencies</td><td>10</td><td>80% AM @ 1kHz<br>1% sweeps with 3-second dwell</td></tr></table> |
| **Pass Criteria A** | The UUT shall be able to withstand the test without disruption of normal operation or loss of data. |

2.3.5 IEC 61000-4-4, Electrical Fast Transient Test

| | |
|---|---|
| **Objective** | To verify that the electromagnetic emissions generated by the product under normal use and in the product's intended environment are below a level as specified by the VVSG. |
| **Test Method** | IEC61000-4-4, Electrical Fast Transient Test |
| **Test Levels** | <table><tr><th>Coupling Mode</th><th>Test Voltage, +/-kV</th></tr><tr><td>AC & DC Line Cord</td><td>2.0 @ 100k burst rate</td></tr><tr><td>All external wires >3m in length</td><td>2.0</td></tr></table> |
| **Pass Criteria A** | The UUT shall be able to withstand the test without disruption of normal operation or loss of data. |

2.3.6 IEC61000-4-5, Lightning Surge Test

| | |
|---|---|
| **Objective** | To verify that the electromagnetic emissions generated by the product under normal use and in the product's intended environment are below a level as specified by the VVSG. |
| **Test Method** | IEC61000-4-5, Lightning Surge Test |
| **Test Levels** | <table><tr><th>Coupling Mode</th><th>Test Voltage, +/-kV</th></tr><tr><td>Differential Mode</td><td>2.0</td></tr><tr><td>Common Mode</td><td>2.0</td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table> |
| **Pass Criteria B** | The UUT shall be able to withstand the test without damage or loss of data. The equipment may reset or have momentary interruption so long as normal operation is resumed without human intervention or loss of data. Loss of data means votes that have been completed and confirmed to the voter. |

2.3.7 IEC61000-4-6, Immunity to Conducted Disturbances, Induced by RF Fields

| | |
|---|---|
| **Objective** | To verify that the electromagnetic emissions generated by the product under normal use and in the product's intended environment are below a level as specified by the VVSG. |
| **Test Method** | IEC61000-4-6, Immunity to Conducted Disturbances, Induced by Radio-Frequency Fields |

<table>
<tr><td>Test Levels</td><td>
<table>
<tr><th>Test Point</th><th>Frequency Range (MHz)</th><th>Test Level (Vrms)</th><th>Modulation/Sweep</th></tr>
<tr><td>AC & DC Power >3m in length</td><td>0.150 to 80.0</td><td>10</td><td>80% AM at 1.0kHz<br>1% steps with 3s dwell</td></tr>
<tr><td>I/O cables >3M in length</td><td>Clock Frequencies</td><td>10</td><td>80% AM at 1.0kHz<br>1% steps with 3s dwell</td></tr>
</table>
</td></tr>
<tr><td>Pass Criteria A</td><td>The UUT shall be able to withstand the test without disruption of normal operation or loss of data.</td></tr>
</table>

2.3.8 IEC61000-4-8, Power Frequency Magnetic Field Immunity Test

| | |
|---|---|
| **Objective** | To verify that the electromagnetic emissions generated by the product under normal use and in the product's intended environment are below a level as specified by the VVSG. |
| **Test Method** | IEC61000-4-8, Power Frequency Magnetic Field Immunity Test, |
| **Test Levels** | 30 A/m at 60 Hz |
| **Pass Criteria A** | The UUT shall be able to withstand the test without disruption of normal operation or loss of data. |

2.3.9 IEC61000-4-11, Voltage Dips and Voltage Variations Immunity Tests

| | |
|---|---|
| **Objective** | To verify that the electromagnetic emissions generated by the product under normal use and in the product's intended environment are below a level as specified by the VVSG. |
| **Test Method** | IEC61000-4-11, Voltage Dips, Short Interruptions and Voltage Variations Immunity Tests |
| **Test Levels** | 30% dip @ 10ms<br><br>60% dip @ 100 ms @ 1 sec<br><br>> 95% interrupt @ 5 sec<br><br>Surges of ±15% line variations of nominal line voltage<br><br>Electric power increases of 7.5% and reductions of 12.5% of nominal specified power supply for a period of up to four hours at each power level Deviations from Test |
| **Pass Criteria C** | The UUT shall be able to withstand the test without damage or loss of data. The equipment may reset or have momentary interruption so long as normal operation is resumed with human intervention or loss of data. Loss of data means votes that have been completed and confirmed to the voter. |

2.3.10 Bench Handling – non-operational (system operation validated post-test)

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| **Objective** | To verify that the device does not sustain damage that prevents it from operating as a voting machine as specified by the VVSG. |
| **Test Method** | MIL-STD-810D, Method 516.3, Procedure VI |

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| **Test Procedure** | Step 1: Place each piece of equipment on a level floor or table, as for normal operation or servicing.<br>Step 2: Make provision, if necessary, to restrain lateral movement of the equipment or its supports at one edge of the device. Vertical rotation about that edge shall not be restrained.<br>Step 3: Using that edge as a pivot, raise the opposite edge to an angle of 45 degrees, to a height of four inches above the surface, or until the point of balance has been reached, whichever occurs first.<br>Step 4: Release the elevated edge so that it may drop to the test surface without restraint.<br>Step 5: Repeat steps 3 and 4 for a total of six events.<br>Step 6: Repeat steps 2, 3, and 4 for the other base edges, for a total of 24 drops for each device. |
| **Pass Criteria** | After the test, the UUT shall be able to withstand the test without damage that prevents if from functional as required for voting.<br><br><u>The following procedures shall be followed to verify the equipment status:</u><br>Step 1: Arrange the system for normal operation.<br>Step 2: Turn on power, and allow the system to reach recommended operating temperature.<br>Step 3: Perform any servicing, and make any adjustments necessary, to achieve operational status.<br>Step 4: Operate the equipment in all modes, demonstrating all functions and features that would be used during election operations.<br>Step 5: Verify that all system functions have been correctly executed. |

2.3.11 Vibration – non-operational (system operation validated post-test)

| | |
|---|---|
| **Objective** | To verify that the device does not sustain damage during transportation or storage that prevents it from operating as a voting machine as specified by the VVSG. |
| **Test Method** | MIL-STD-810D, Method 514.3, Category 1-Basic Transportation, Common Carrier |
| **Test Procedure** | Step 1: Install the test item in its transit or combination case as prepared for transport.<br>Step 2: Attach instrumentation as required to measure the applied excitation.<br>Step 3: Mount the equipment on a vibration table with the axis of excitation along the vertical axis of the equipment.<br>Step 4: Apply excitation as shown in MIL-STD-810D, Method 514.3-1, “Basic transportation, common carrier, vertical axis”, with low frequency excitation cutoff at 10 Hz, for a period of 30 minutes.<br>Step 5: Repeat steps 2 and 3 for the transverse and longitudinal axes of the equipment with the excitation profiles shown in Figures 514.3-2 and 514.3-3, respectively. (Note: The total excitation period equals 90 minutes, with 30 minutes excitation along each axis.)<br>Step 6: Remove the test item from its transit or combination case and verify its continued operability. |
| **Pass Criteria** | After the test, the UUT shall be able to withstand the test without damage that prevents if from functional as required for voting.<br><br><u>The following procedures shall be followed to verify the equipment status:</u><br>Step 1: Arrange the system for normal operation. |

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| | Step 2: Turn on power, and allow the system to reach recommended operating temperature.<br>Step 3: Perform any servicing, and make any adjustments necessary, to achieve operational status.<br>Step 4: Operate the equipment in all modes, demonstrating all functions and features that would be used during election operations.<br>Step 5: Verify that all system functions have been correctly executed. |

2.3.12 Low temperature – non-operational (system operation validated post-test)

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|---|---|
| **Objective** | To verify that the device does not sustain damage during transportation or storage that prevents it from operating as a voting machine as specified by the VVSG. |
| **Test Method** | MIL-STD-810D, Methods 502.2, Procedure I-Storage |
| **Test Procedure** | Minimum Temperature = -4F (-20C)<br><br>Step 1: Arrange the equipment as for storage. Install it in the test chamber.<br>Step 2: Lower the internal temperature of the chamber at any convenient rate, but not so rapidly as to cause condensation in the chamber, and in any case no more rapidly than 10 degrees F per minute, until an internal temperature of -4 degrees F has been reached.<br>Step 3: Allow the chamber temperature to stabilize. Maintain this temperature for a period of 4 hours after stabilization.<br>Step 4: Allow the internal temperature of the chamber to return to standard laboratory conditions, at a rate not exceeding 10 degrees F per minute.<br>Step 5: Allow the internal temperature of the equipment to stabilize at laboratory conditions before removing it from the chamber.<br>Step 6: Remove the equipment from the chamber and from its containers, and inspect the equipment for evidence of damage.<br>Step 7: Verify continued operability of the equipment. |
| **Pass Criteria** | After the test, the UUT shall be able to withstand the test without damage that prevents it from functional as required for voting.<br><br><u>The following procedures shall be followed to verify the equipment status:</u><br>Step 1: Arrange the system for normal operation.<br>Step 2: Turn on power, and allow the system to reach recommended operating temperature.<br>Step 3: Perform any servicing, and make any adjustments necessary, to achieve operational status.<br>Step 4: Operate the equipment in all modes, demonstrating all functions and features that would be used during election operations.<br>Step 5: Verify that all system functions have been correctly executed. |

2.3.13 High temperature – non-operational

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|---|---|
| **Objective** | To verify that the device does not sustain damage during transportation or storage that prevents it from operating as a voting machine as specified by the VVSG. |
| **Test Method** | MIL-STD-810D, Methods 501.2, Procedure I-Storage |
| **Test Procedure** | Minimum Temperature =140F (60C)<br><br>Step 1: Arrange the equipment as for storage. Install it in the test chamber.<br>Step 2: Raise the internal temperature of the chamber at any convenient |

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| | rate, but not so rapidly as to cause condensation in the chamber, and in any case no more rapidly than 10 degrees F per minute, until an internal temperature of 140 degrees F has been reached.<br>Step 3: Allow the chamber temperature to stabilize. Maintain this temperature for a period of 4 hours after stabilization.<br>Step 4: Allow the internal temperature of the chamber to return to standard laboratory conditions, at a rate not exceeding 10 degrees F per minute.<br>Step 5: Allow the internal temperature of the equipment to stabilize at laboratory conditions before removing it from the chamber.<br>Step 6: Remove the equipment from the chamber and from its containers, and inspect the equipment for evidence of damage.<br>Step 7: Verify continued operability of the equipment. |
| **Pass Criteria** | After the test, the UUT shall be able to withstand the test without damage that prevents if from functional as required for voting.<br><br><u>The following procedures shall be followed to verify the equipment status:</u><br>Step 1: Arrange the system for normal operation.<br>Step 2: Turn on power, and allow the system to reach recommended operating temperature.<br>Step 3: Perform any servicing, and make any adjustments necessary, to achieve operational status.<br>Step 4: Operate the equipment in all modes, demonstrating all functions and features that would be used during election operations.<br>Step 5: Verify that all system functions have been correctly executed. |

2.3.14 Humidity – non-operational (system operation validated post-test)

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|---|---|
| **Objective** | To verify that the device does not sustain damage during transportation or storage that prevents it from operating as a voting machine as specified by the VVSG. |
| **Test Method** | MIL-STD-810D, Method 507.2, Procedure I-Natural Hot-Humidity |
| **Test Procedure** | Step 1: Arrange the equipment as for storage. Install it in the test chamber.<br>Step 2 Adjust the chamber conditions to those given in MIL-STD-810D Table 507.2-I, for the time 0000 of the HotHumid cycle (Cycle 1).<br>Step 3: Perform a 24-hour cycle with the time and temperature-humidity values specified in Figure 507.2-1, Cycle 1.<br>Step 4: Repeat Step 2 until 5, 24-hour cycles have been completed.<br>Step 5: Continue with the test commencing with the conditions specified for time = 0000 hours.<br>Step 6: At any convenient time in the interval between time = 120 hours and time = 124 hours, place the equipment in an operational configuration, and perform a complete operational status check as defined in Subsection 4.6.1.5.<br>Step 7: If the equipment satisfactorily completes the status check, continue with the sixth 24-hour cycle.<br>Step 8: Perform 4 additional 24-hour cycles, terminating the test at time = 240 hours.<br>Step 9: Remove the equipment from the test chamber and inspect it for any evidence of damage.<br>Step 10: Verify continued operability of the equipment. |
| **Pass Criteria** | After the test, the UUT shall be able to withstand the test without damage that prevents if from functional as required for voting. |

| | |
|---|---|
| | The following procedures shall be followed to verify the equipment status:<br>Step 1: Arrange the system for normal operation.<br>Step 2: Turn on power, and allow the system to reach recommended operating temperature.<br>Step 3: Perform any servicing, and make any adjustments necessary, to achieve operational status.<br>Step 4: Operate the equipment in all modes, demonstrating all functions and features that would be used during election operations.<br>Step 5: Verify that all system functions have been correctly executed. |

2.3.15 Reliability, Temperature and Power Variation – operational

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| **Objective** | To exercise voting machines in a environment with variable temperature and power while the machines are being used for voting. |
| **Test Method** | This test is similar to the low temperature and high temperature tests of MIL-STD-810-D, Method 502.2 and Method 501.2, with test conditions that correspond to the requirements of the performance standards. This procedure tests system operation under various environmental conditions for 163 hours, (this can be reduced by adding more devices to the test). During 48 hours of this operating time, the device shall be in a test chamber. For the remaining hours, the equipment shall be operated at room temperature. The system shall be powered for the entire period of this test; the power may be disconnected only if necessary for removal of the system from the test chamber.<br><br>Operation shall consist of ballot-counting cycles, which vary with system type. An output report need not be generated after each counting cycle. The interval between reports, however, should be no more than 4 hours to keep to a practical minimum the time between the occurrence of a failure or data error and its detection.<br><br>Step 1: Arrange the equipment in the test chamber. Connect as required and provide for power, control, and data service through enclosure wall.<br>Step 2: Set the supply voltage at 117 voltage alternating current.<br>Step 3: Power the equipment, and perform an operational status check as in Section 4.6.1.5.<br>Step 4: Set the chamber temperature to 50 degrees F, observing precautions against thermal shock and condensation.<br>Step 5: Begin 24 hour cycle.<br>Step 6: At T=4 hrs, lower the supply voltage to 105 VAC.<br>Step 7: At T=8 hrs, raise the supply voltage to 129 VAC.<br>Step 8: At T=11:30 hrs, return the supply voltage to 117 VAC and return the chamber temperature to lab ambient, observing precautions against thermal shock and condensation.<br>Step 9: At T=12:00 hrs, raise the chamber temperature to 95 degrees F.<br>Step 10: Repeat Steps 5 through 8, with temperature at 95 degrees F, complete at T=24 hrs.<br>Step 11: Set the chamber temperature at 50 degrees Fahrenheit as in Step 4.<br>Step 12: Repeat the 24 hour cycle as in Steps 5-10, complete at T=48 hrs.<br>Step 13: After completing the second 24 hour cycle, disconnect power from the system and remove it from the chamber if needed.<br>Step 14: Reconnect the system as in Step 2, and continue testing for the |

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| | remaining period of operating time required until the ACCEPT/REJECT criteria of Subsection 4.7.1.1 have been met. |
| **Test Levels** | Precinct count systems 100 ballots/hour |
| **Pass Criteria** | For ballots marked in accordance with vendor specifications, the rejection rate shall be <2%<br><br>For each processing function, the system shall achieve a target error rate of no more than one in 10,000,000 ballot positions, with a maximum acceptable error rate in the test process of one in 500,000 ballot positions. This error rate includes errors from any source while testing a specific processing function and its related equipment.<br><br>This error rate is used to determine the vote position processing volume used to test system accuracy for each function:<br>If the system makes one error before counting 26,997 consecutive ballot positions correctly, it will be rejected. The vendor is then required to improve the system<br>If the system reads at least 1,549,703 consecutive ballot positions correctly, it will be accepted<br>If the system correctly reads more than 26,997 ballot positions but less than 1,549,703 when the first error occurs, the testing will have to be continued until another 1,576,701 consecutive ballot positions are counted without error (a total of 3,126,404 with one error) |

2.3.16 Safety – operational

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| **Objective** | a. All voting systems and their components shall be designed to eliminate hazards to personnel or to the equipment itself<br><br>b. Defects in design and construction that can result in personal injury or equipment<br>damage must be detected and corrected before voting systems and components are placed into service<br><br>c. Equipment design for personnel safety shall be equal to or better than the appropriate requirements of the Occupational Safety and Health Act, Code of Federal Regulations, Title 29, Part 1910 |
| **Test Method** | Occupational Safety and Health Act, Code of Federal Regulations, Title 29, Part 1910 |
| **Test Levels** | |
| **Pass Criteria** | Safety Report from NRTL |

# 3 TERMS AND ACRONYMS

## 3.1 Glossary of Terms

Insert the Voting Systems Glossary document if glossary required

## 3.2 Table of Acronyms

Insert the Voting Systems Acronym document if acronyms required