Hart InterCivic
Verity Scan, Verity Touch Writer, Ballot Box, Standard and Accessible Booths Environmental Test Plan for compliance with 2005 Voluntary Voting System Guidelines (VVSG)

For

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Revision History:

Version	Date	Comments	Contributors
0.9	11/11/13	Initial Release	D. Forester
1.0	3/24/14	Updates based on review. Added section 4.4.3.1	D. Forester
2.0	3/25/14	Updates to Integrity, Temperature / Power Variation, and Reliability sections.	D. Forester M. Santos
3.0	10/13/14	Updates to sections 3.2, 3.4, 3.7, & 4.4.3.1	D. Forester
4.0	11/6/14	Add Central Count for Temperature / Power Variation Test	D. Forester

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1 Introduction

1.1 Overview

This test plan covers the environmental test requirements and methods for the Hart InterCivic Verity Scan, Verity Touch Writer, Ballot Box, Standard / Accessible Booths hereafter known as the Unit Under Test (UUT), to the requirements as stated in Election Assistance Commission 2005 Voluntary Voting System Guidelines.

1.2 Qualifications

The UUT supplied by Hart InterCivic is representative of product produced in their volume manufacturing process.

1.3 Client

Hart InterCivic, 15500 Wells Port Drive, Austin, TX 78728

1.4 Company Restricted Information

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1.5 Test Facility Location

Cascade TEK – Front Range, 1530 Vista View Drive Longmont, CO 80504

1.6 Reference Documents

- Election Assistance Commission: 2005 Voluntary Voting System Guidelines (VVSG) Volume I, Sec. 4
- Election Assistance Commission: 2005 Voluntary Voting System Guidelines (VVSG) Volume II, Sec. 4
- NIST Handbook 150-22. 2008 Edition: National Voluntary Laboratory Accreditation Program – Voting System Testing. May 2008
- EAC: NOC 07-05: Voting System Test Laboratory (VSTL) responsibilities in the management and oversight of third party testing.
- EAC Decision on Request for Interpretation 2007-05 (COTS)
- EAC Decision on Request for Interpretation 2008-01 FINAL (temp and power variation tests)
- EAC Decision on Request for Interpretation 2009-06 (Temperature Power Variation) FINAL.041610
- SLI Standard Lab Procedure SLP-VC-20: Engineering Change Evaluation and Reporting
- SLI Standard Lab Procedure SLP-VC-23: Hardware Test Management
- SLI Standard Lab Procedure SLP-VC-24: Subcontractor Laboratory Management

2 Testing Summary

The following Table 1 shows the tests to be performed on the UUT.

Required	Test	VVSG Reference	Test Specification
Non-Operating Environmental Tests			
X	Bench Handling Test	V2 4.6.2, V1 4.1.7.1	MIL-STD-810D, Method 516.3, Procedure VI
X	Vibration Test	V2 4.6.3, V1 4.1.7.1	MIL-STD-810D, Method 514.3, Category 1- Basic Transportation, Common Carrier
X	Low Temperature Test	V2 4.6.4, V1 4.1.7.1	MIL-STD-810D, Methods 502.2, Procedure I- Storage
X	High Temperature Test	V2 4.6.5, V1 4.1.7.1	MIL-STD-810D, Methods 501.2, Procedure I- Storage
X	Humidity Test (85%) Soak	V2 4.6.6, V1 4.1.7.1	MIL-STD-810D, Method 507.2, Procedure I- Natural Hot-Humid
Operating Environmental Tests			
X	Temperature/Power Variation	V2 4.7.1, V1	This test is similar to the low temperature and high temperature tests of MIL-STD-810-D, Method 502.2 and Method 501.2, See RFI 2009-06
X	Reliability Tests	V2 4.7.3	
X	Integrity	V1 2.1.4 (d)	Protect against ambient temperature and humidity fluctuations

3 Test Hardware & Software

3.1 General

Trade Mark:	Hart InterCivic		
Rated Input Voltage:	115 VAC	Frequency:	60 Hz

3.2 Unit Under Test – Verity Scan

Part No.	Serial No.	Description	Qty	Revision No.
3005350 / 2005350	S1400005009 S1400005809 S1400005909	Verity Scan - is Verity's polling place scanning solution for paper ballots. Scan is paired with a purpose-built ballot box to ensure accurate, secure, and private ballot scanning and vote casting for each voter.	3	B
2005357	X14000102	Ballot Box	2	A

3.3 Unit Under Test – Verity Touch Writer

Part No.	Serial No.	Description	Qty	Revision No.
3005352 / 2005352	W1400006609 W1400007609 W1400007409	Verity Touch Writer - is a polling place ballot marking device solution for paper ballots. Touch Writer is paired with a commercial off the shelf printer to allow the voter to mark then print their vote selections. Using Touch Writer reviewing and acceptance in conjunction with Verity Scan provides the voter with a reviewable paper ballot that is accurately captured through scanning, for tabulation as a voter's cast vote record (CVR).	3	B
2005358	M14000102	Standard Booth	1	A
2005359	L14000102	Accessible Booth	1	A

3.4 Unit Under Test – Central Count (COTS)

Part No.	Serial No.	Description	Qty	Revision No.
HP Z230	2UA4141BP0	Tower Workstation - Central Client Server (COTS)	1	
HP Z230	2UA4141BNS	Tower Workstation – Central Client (COTS)	1	
HP Z230	2UA4141BNR	Tower Workstation – Count (COTS)	1	
HP Z230	2UA4141BNT	Tower Workstation – Build (COTS)	1	
DR-G1100	GG30399	Canon Color Scanner Image Formula (COTS)	1	
DR-G1130	GF300001	Canon Color Scanner Image Formula (COTS)	1	
I5600	47493479	Kodak Scanner (COTS)	1	

3.5 Product Dimensions

Description	Dimensions
Verity Scan	Storage/Shipping Carton - 21½"Wx17½"Dx19 ¾"H Device Closed – 18.8"Wx17.39"Dx7.72"H Device Open – 18.8"Wx21.41"Dx20.86"H
Ballot Box	Collapsed for Storage - 26"Wx5.23"Dx28.25"H

	Deployed for Use – 26"Wx23.25"Dx28.25"H
Verity Touch Writer	Storage/Shipping Carton - 21½"Wx17½"Dx19 ¾"H Device Closed – 18.8"Wx17.39"Dx7.72"H Device Open – 18.8"Wx21.41"Dx20.86"H
Standard Booth	Collapsed for Storage – 28.72"Wx5.57"Dx39.69"H Deployed for Use – 28.54"Wx23.17"Dx33.56"H Privacy Screen – adds 23.31" to Height
Accessible Booth	Collapsed for Storage – 38.8"Wx5.83"Dx33"H Deployed for Use – 38.8"Wx25.45"Dx30.19"H Privacy Screen – adds 23.31" to Height

3.6 Product Weight

Description	Dimensions
Verity Scan	27lbs
Ballot Box	26.5lbs
Verity Touch Writer	27lbs
Standard Booth w/ storage bag	13lbs
Accessible Booth w/ storage bag	14lbs
Tower Workstation	29lbs

3.7 Support Equipment (SE)

Model No.	Part No.	Description	Qty	Revision No.
Verity Access	2005-010	Audio-Tactile Interface (ATI) module	2	N/A
OKI	B431d	Ballot Printer: AK46022066A0, AK47007784A0, AK47007782A0	3	N/A
Verity Key	N/A	Passwords	1	N/A
USB Thumb-Drives	N/A	PDF Reports	8	N/A
vDrives	N/A	Per-loaded election data / election data	12	N/A

3.8 Power Supplies

Manufacturer	Model	Input	Output and Type
XP Power	AHM85PS24 – 85W	~1.0A	@ 100V – 0.4A @ 240V

3.9 Accessories

Type	Model	Function
Test Ballots, Precinct 101-A	N/A	Processing Ballots and writing and stores electronic CVRs

3.10 Software

Type	Version	Description

Type	Version	Description
Test Software	0.17.11.16874	Scan
Test Software	0.17.11.16874	Touch Writer
Verity Central	Sprint 18 RC3	Verity Central
Verity Count	Sprint 18 RC3	Verity Count

3.11 Engineering Changes

Engineering Change (EC)#	Description
N/A	

4 Test Requirements

4.1 Test Procedures

4.1.1 Operating Environment

Equipment used for election management activities or vote counting (including both precinct and central count systems) shall be capable of operation in temperatures ranging from 50 to 95 degrees Fahrenheit.

4.1.2 Transit and Storage

Equipment used for vote casting, or for counting votes in a precinct count system, shall meet specific minimum performance standards that simulate exposure to physical shock and vibration associated with handling and transportation by surface and air common carriers, and to temperature conditions associated with delivery and storage in an uncontrolled warehouse environment.

- High and low storage temperatures ranging from -4 to +140 degrees Fahrenheit, equivalent to MIL-STD-810D, Methods 501.2 and 502.2, Procedure I-Storage;
- Bench handling equivalent to the procedure of MIL-STD-810D, Method 516.3, Procedure VI;
- Vibration equivalent to the procedure of MIL-STD-810D, Method 514.3, Category 1- Basic Transportation, Common Carrier; and
- Uncontrolled humidity equivalent to the procedure of MIL-STD-810D, Method 507.2, Procedure I-Natural Hot-Humid.

4.2 DESIGN, CONSTRUCTION AND MAINTENANCE

4.2.1 Physical Attributes

The following physical attributes will be examined to assess reliability:

a. Presence of labels and the identification of test points
b. Provision of built-in test and diagnostic circuitry or physical indicators of condition
c. Presence of labels and alarms related to failures
d. Presence of features that allow non-technicians to perform routine maintenance tasks (such as update of the system database)

4.2.2 Additional Attributes

The following additional attributes will be considered to assess system maintainability:

a. Ease of detecting that equipment has failed by a non-technician
b. Ease of diagnosing problems by a trained technician
c. Low false alarm rates (i.e., indications of problems that do not exist)
d. Ease of access to components for replacement
e. Ease with which adjustment and alignment can be performed
f. Ease with which database updates can be performed by a non-technician
g. Adjust, align, tune or service components

4.3 Non-Operating Environmental Tests

4.3.1 Data Retention Requirements

Electronic memory storage devices are required to retain their data for at least 22 months to meet the United States Code Title 42 requirements and various sections of the VVSG. The data retention capability of the devices will be verified by engineering analysis including a review of the manufacturer's specifications to ensure that it exceeds the requirement. In the absence of other information, such as field failures, the results of this analysis will be used to determine compliance with the 22 month retention requirement.

4.3.2 Operational Status Check

Normal operation shall be verified by conducting an Operational Status Check diagnostic that verifies that internal subsystems within the UUT are operating correctly. Prior to and following the conduct of each of the environmental hardware non-operating tests, an Operational Status Check is performed to determine that the operational state of the equipment is within acceptable performance limits.

The following procedures shall be followed to verify the equipment status:

Step 1: Arrange the system for normal operation.

Step 2: Turn on power, and allow the system to reach recommended operating temperature.

Step 3: Perform any servicing, and make any adjustments necessary, to achieve operational status.

Step 4: Operate the equipment in all modes, demonstrating all functions and features that would be used during election operations.

Step 5: Verify that all system functions have been correctly executed.

4.3.2.1 Failure Criteria

Upon completion of each non-operating test, the system hardware shall be subject to the Operational Status Check to verify continued operability. If any portion of the voting machine or precinct counter hardware fails to remain fully functional, the testing will be suspended until the failure is identified and corrected by the vendor. The system will then be subject to a retest.

4.3.3 Space Requirements

There is no restriction on space allowed for the installation of voting systems, except that the arrangement of these systems shall not impede performance of their duties by polling place officials, the orderly flow of voters through the polling place, or the ability for the voter to vote in private.

4.3.4 Bench Handling Test

The bench handling test simulates stresses faced during maintenance and repair of voting machines and ballot counters.

4.3.4.1 Applicability

All systems and components, regardless of type, shall meet the requirements of this test. This test is equivalent to the procedure of MIL-STD-810D, Method 516.3, and Procedure VI.

4.3.4.2 Procedure

Step 1: Place each piece of equipment on a level floor or table, as for normal operation or servicing.

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.

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.

Step 4: Release the elevated edge so that it may drop to the test surface without restraint.

Step 5: Repeat steps 3 and 4 for a total of six events.

Step 6: Repeat steps 2, 3, and 4 for the other base edges, for a total of 24 drops for each device.

4.3.5 Vibration Test

The vibration test simulates stresses faced during transport of voting machines and ballot counters between storage locations and polling places.

4.3.5.1 Applicability

All systems and components, regardless of type, shall meet the requirements of this test. This test is equivalent to the procedure of MIL-STD-810D, Method 514.3, Category 1- Basic Transportation, and Common Carrier.

4.3.5.2 Procedure

Step 1: Install the test item in its transit or combination case as prepared for transport.

Step 2: Attach instrumentation as required to measure the applied excitation.

Step 3: Mount the equipment on a vibration table with the axis of excitation along the vertical axis of the equipment.

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.

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.)

Step 6: Remove the test item from its transit or combination case and verify its continued operability.

4.3.6 Low Temperature Test

The low temperature test simulates stresses faced during storage of voting machines and ballot counters.

4.3.6.1 Applicability

All systems and components, regardless of type, shall meet the requirements of this test. This test is equivalent to the procedure of MIL-STD-810D, Method 502.2, and Procedure I-Storage. The minimum temperature shall be -4 degrees F.

4.3.6.2 Procedure

Step 1: Arrange the equipment as for storage. Install it in the test chamber.

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.

Step 3: Allow the chamber temperature to stabilize. Maintain this temperature for a period of 4 hours after stabilization.

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.

Step 5: Allow the internal temperature of the equipment to stabilize at laboratory conditions before removing it from the chamber.

Step 6: Remove the equipment from the chamber and from its containers, and inspect the equipment for evidence of damage.

Step 7: Verify continued operability of the equipment.

Figure 1 Low Temp Profile
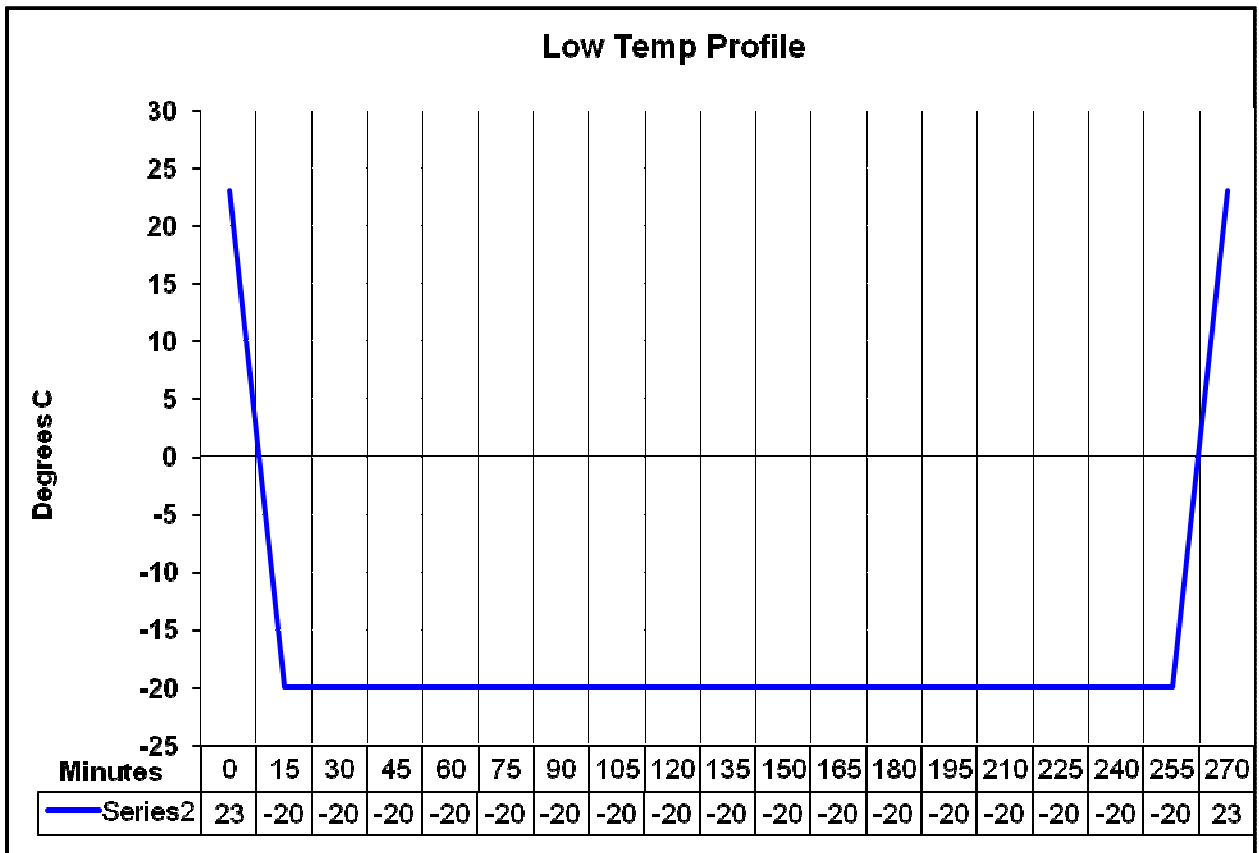
4.3.7 High Temperature Test

The high temperature test simulates stresses faced during storage of voting machines and ballot counters.

4.3.7.1 Applicability

All systems and components, regardless of type, shall meet the requirements of this test. This test is equivalent to the procedure of MIL-STD-810D, Method 501.2, and Procedure I-Storage. The maximum temperature shall be 140 degrees F.

4.3.7.2 Procedure

Step 1: Arrange the equipment as for storage. Install it in the test chamber.

Step 2: Raise the internal temperature of the chamber at any convenient rate, but in any case no more rapidly than 10 degrees F per minute, until an internal temperature of 140 degrees F has been reached.

Step 3: Allow the chamber temperature to stabilize. Maintain this temperature for a period of 4 hours after stabilization.

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.
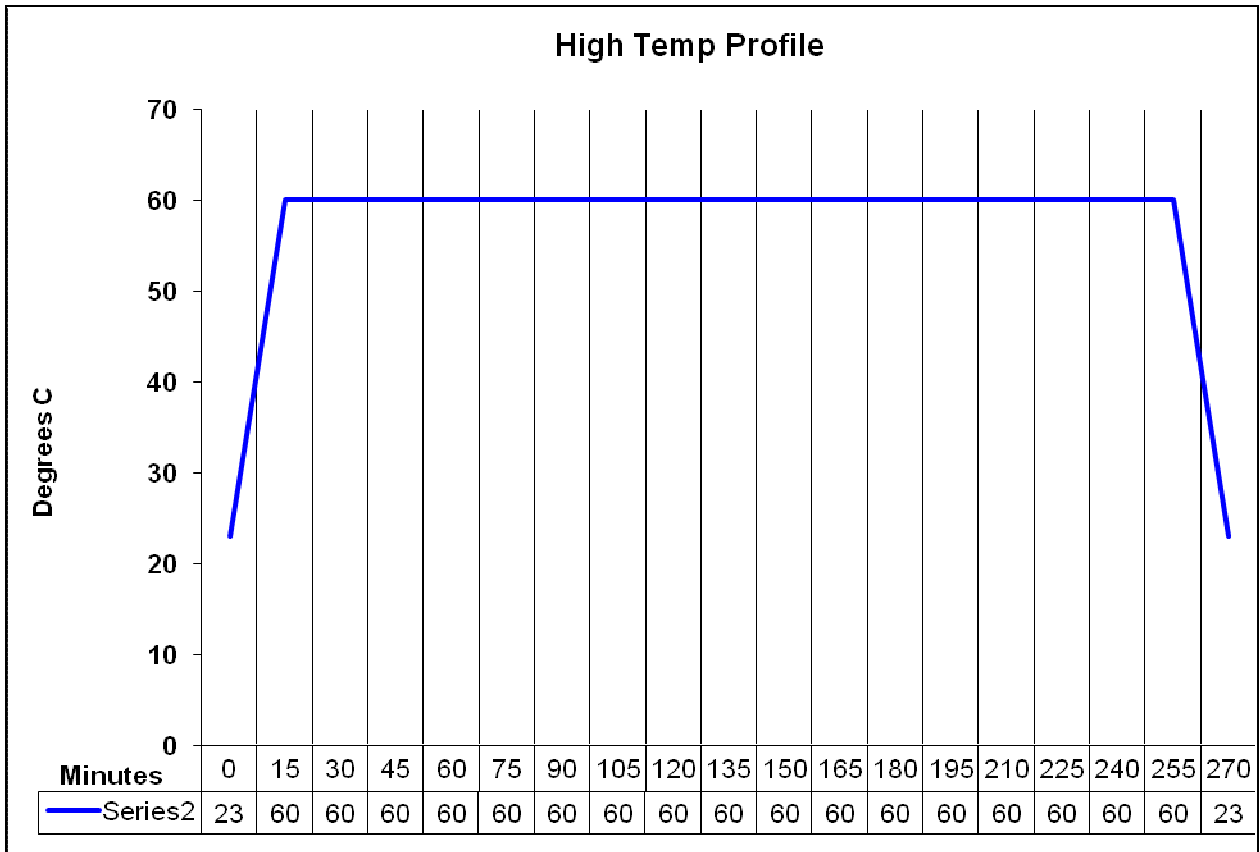
Step 5: Allow the internal temperature of the equipment to stabilize at laboratory conditions

before removing it from the chamber.

Step 6: Remove the equipment from the chamber and from its containers, and inspect the equipment for evidence of damage.

Step 7: Verify continued operability of the equipment.

Figure 2 High Temp Profile

High Temp Profile

Minutes	0	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270
Series2	23	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	23

4.3.8   Humidity Test

The humidity test simulates stresses faced during storage of voting machines and ballot counters.

4.3.8.1   Applicability

All systems and components regardless of type shall meet the requirements of this test. This test is similar to the procedure of MIL-STD-810D, Method 507.2, Procedure I-Natural Hot-Humid. It is intended to evaluate the ability of the equipment to survive exposure to an uncontrolled temperature and humidity environment during storage. This test lasts for ten days.

4.3.8.2   Procedure

Step 1: Arrange the equipment as for storage. Install it in the test chamber.

Step 2 Adjust the chamber conditions to those given in MIL-STD-810D Table 507.2-I, for the time 0000 of the Hot Humid cycle (Cycle 1).

Step 3: Perform a 24-hour cycle with the time and temperature-humidity values specified in Figure 507.2-1, Cycle 1.

Step 4: Repeat Step 2 until 5, 24-hour cycles have been completed.

Step 5: Continue with the test commencing with the conditions specified for time = 0000 hours.

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.
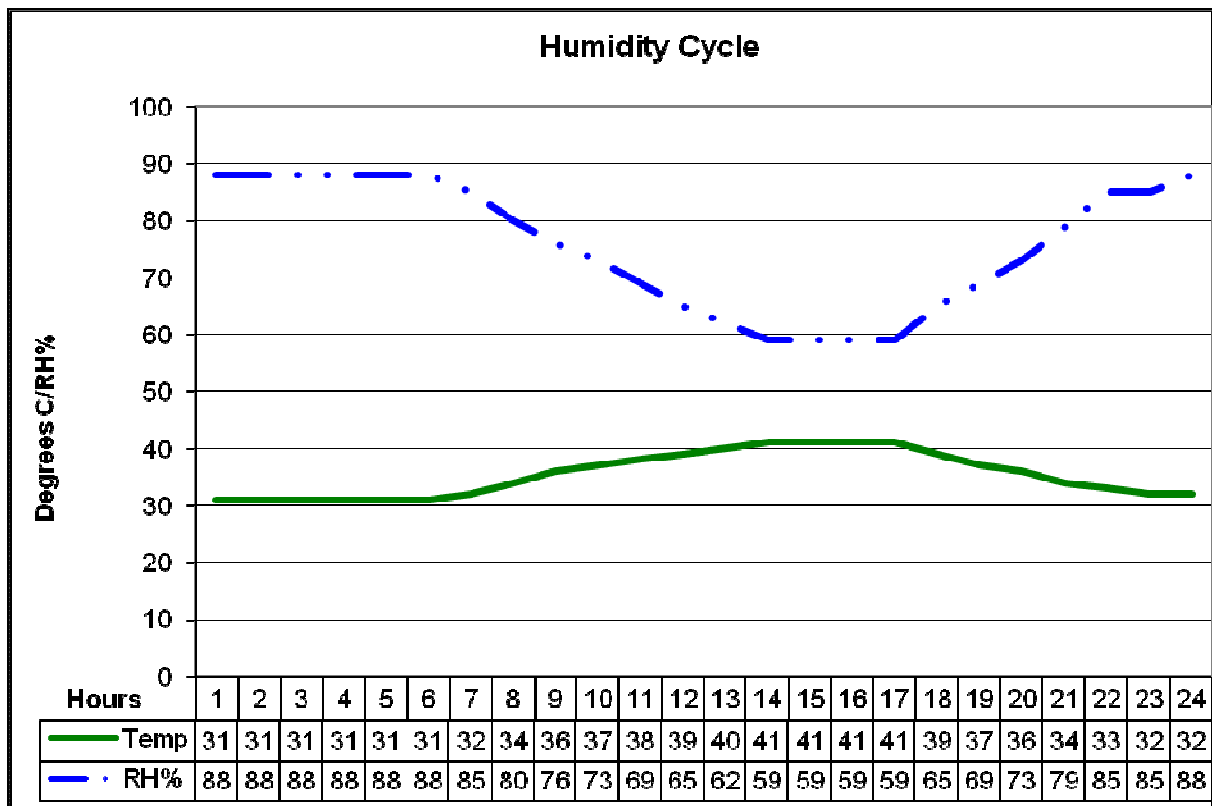
Step 7: If the equipment satisfactorily completes the status check, continue with the sixth 24-hour cycle.

Step 8: Perform 4 additional 24-hour cycles, terminating the test at time = 240 hours.

Step 9: Remove the equipment from the test chamber and inspect it for any evidence of damage.

Step 10: Verify continued operability of the equipment.

Figure 3 Humidity Profile

4.4   Operating Environmental Tests

This section addresses a range of tests for all voting system equipment, including equipment for both precinct count and central count systems.

4.4.1 Simulated Operation Diagnostic

A diagnostic test routine is performed to exercise and diagnose failures from internal subsystems in the UUT. The test performs various operations including writing and reading to storage devices and printing to internal printers. The diagnostic can be looped continuously and will halt if an error is detected while performing an operation.

For DRE equipment, each loop may be very short. For paper ballot scanning devices, a recirculation ballot operation is typically used where the ballot is read, reversed to the input position and then read again. The test will loop continuously until manually interrupted.

4.4.2 Integrity

The UUT is subject to integrity verification based on the provisions of Volume I, Section 2.1.4 (d) to ensure system integrity, all system shall protect against ambient temperature and humidity fluctuations. The ambient temperature fluctuations are verified during the temperature and power variation test. The MIL-STD-810D, Method 507.2, Procedure I-Natural Hot-Humid is considered to be industry standard and is selected to verify humidity fluctuations.

4.4.3 Temperature and Power Variation Tests

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 at least 163 hours. 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.

> The scanner can be rebooted as needed when changing election definitions as well as if needed when conducting cleaning operations. Any reboots of the device will be minimized to only when needed.

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.

Test Ballots per Counting Cycle

- Precinct count systems 100 ballots/hour
- Central count systems 300 ballots/hour

The recommended pattern of votes is one chosen to facilitate visual recognition of the reported totals; this pattern shall exercise all possible voting locations. System features such as data quality tests, error logging, and audit reports shall be enabled during the test. Each operating cycle shall consist of processing the number of ballots indicated above.

Other functionality of the scanner will be verified as well, such as any available data quality tests, error logging as well as audit log reports.

The criteria reviewed for this requirement will include:
- The vote data reports generated every 4th hour on devices and Count.
- Error reports generated

- Audit log reports generated
- Any anomalies will be researched in order to determine if it is explainable or is a test failure.

Each operating cycle shall consist of processing the number of ballots indicated above.

Step 1: Arrange the equipment in the test chamber. Connect as required and provide for power, control, and data service through enclosure wall.

Step 2: Set the supply voltage at 117 voltage alternating current.

Step 3: Power the equipment, and perform an operational status check as in Section 4.6.1.5.

Step 4: Set the chamber temperature to 50 degrees F, observing precautions against thermal shock and condensation.

Step 5: Begin 24 hour cycle.

Step 6: At T=4 hrs, lower the supply voltage to 105 vac.

Step 7: At T=8 hrs, raise the supply voltage to 129 vac.

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.

Step 9: At T=12:00 hrs, raise the chamber temperature to 95 degrees Fahrenheit.

Step 10: Repeat Steps 5 through 8, with temperature at 95 degrees Fahrenheit, complete at T=24 hrs.

Step 11: Set the chamber temperature at 50 degrees Fahrenheit as in Step 4.
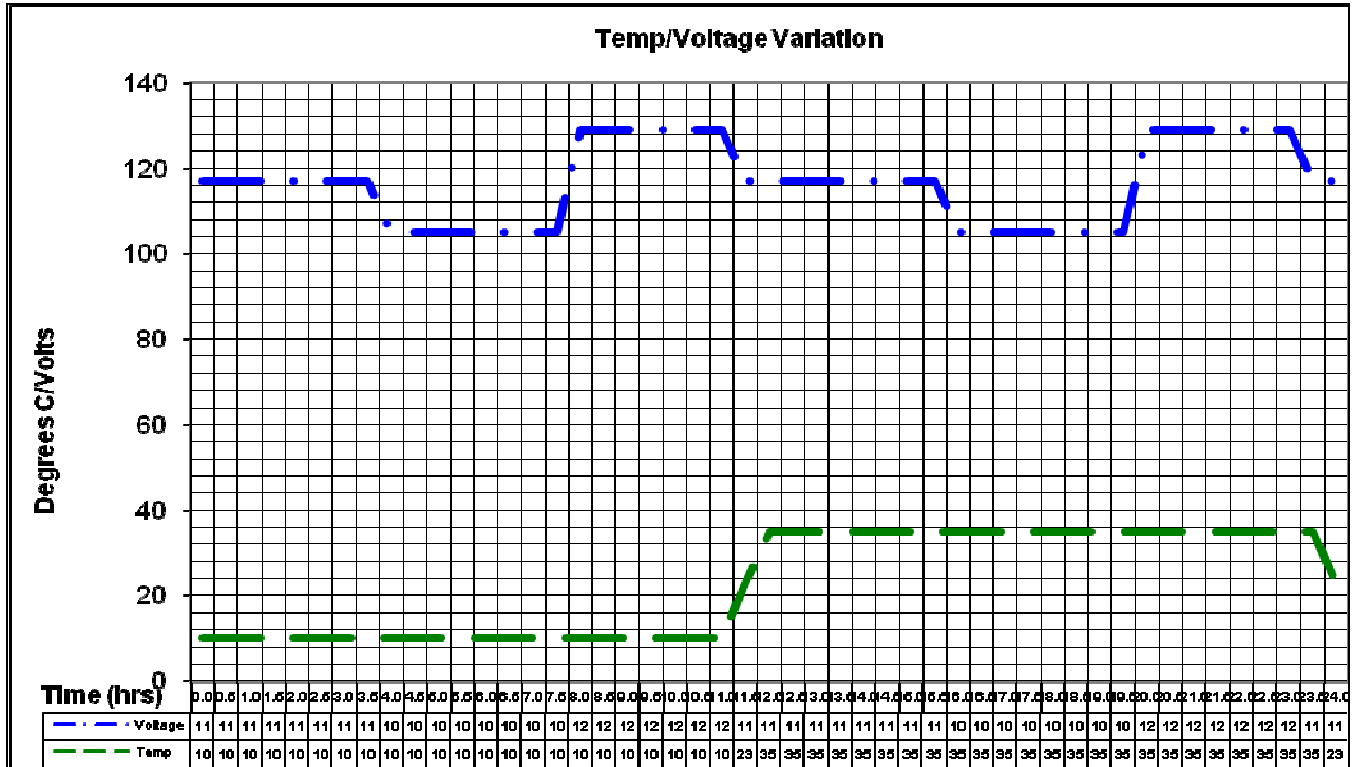
Step 12: Repeat the 24 hour cycle as in Steps 5-10, complete at T=48 hrs.

Step 13: After completing the second 24 hour cycle, disconnect power from the system and remove it from the chamber if needed.

Step 14: Reconnect the system as in Step 2, and continue testing for the remaining period of operating time.

Figure 4 Temp/Voltage Variation Profile

4.4.3.1 Test Approach

Per test ballots counting cycle requirement, test will be conducted as such:

- 99 pre-marked ballots will be scanned every hour.

- 1 ballot generated from Verity Touch Writer, following marking pattern of pre-marked ballots for the given hour, will be scanned every hour. Verity Touch Writer will be configured with static audio for ballot instructions only.

Note that the Verity Touch Writer ballot will be scanned only once prior to being retired

The test will be conducted to run in 4 hour cycles, such that each cycle is concluded with the generation of a report that details the vote data cast during that period.
Reports generated will be:

- Tally Summary Report by Contest also includes Ballot Count Sums located at the bottom of the report.

  <u>Validating cast votes:</u> Verify the votes cast totals as well as sum total of ballots shown on the bottom of the report against total number of process ballots identify on the screen.

- Tally Report from Count

  <u>Validating cast votes:</u> The vDrive will be verified on Count.

The ballot shall contain 18 contest, 4 choices per contest, and 9 contests on each side of ballot, 3 columns, with 3 contests per column, for a total of 72 ballot positions per ballot.
Voting instructions are not required on the ballot

The ballots will be pre-marked such that:
- For the first ballot, each first choice in each contest should be marked on the ballot
- For the second ballot, each second choice in each contest should be marked on the ballot
- For the third ballot, each third choice in each contest should be marked on the ballot
- For the fourth ballot, each fourth choice in each contest should be marked on the

With these markings, the incremented count for each ballot choice will be such that when the 4th hour report is run, each choice as "100". Any pertinent logs, such as error and/or audit, will be printed at this time as applicable per the scanners abilities to do so.

Test configuration:
- *2 Verity Scan, duration = 85 hours for each unit under test*
- *2 Verity Touch Writer, duration = 85 hours for each unit under test*

Each cycle will utilize Power and Temperature Test SLI RC5 election, as the test runs for 85 hours per device; the test will utilize 6 different vDrives, based off of one election definition. Hart has proposed scanning each ballot 3 times, then retiring it.

Note that this approach will utilize 2836 ballots pre-marked as defined above. This will create 709 batches as defined above.

Number of Ballots required per Scan (assuming each ballot can be scanned 3 times before it is retired).

Total ballots per Scan 2840

1st voting position marked – 710 (rounded up by one ballot)
2nd voting position marked – 710
3rd voting position marked – 710
4th voting position marked - 710

Note that it is recommended that at least 720 of each marked ballot typed be printed in order to account for damaged copies.

The four hour grouping will require 99 ballots for each striping per group.

1st voting position marked – 99
2nd voting position marked – 99
3rd voting position marked – 99
4th voting position marked – 99

Each group will be run 3 times, over a 12 hour period, then retired. One ballot style will be scanned in each hour, rotating through the 4 marking styles.

Additional steps to reduce the chance of miss-reads will include conducting cleaning of the scanner within the cleaning process/periods that Hart declares.

It should be noted that in reference to the individual requirements for Reliability" as well as "Temperature and Power Variation", RFI 2009-06 clearly determines in the conclusions to questions 1, 2 and 4, that the requirements of the Temperature and Power Variation test take precedence.

Central Count

The Central Count systems consist of COTS scanners and COTS workstations.

Test duration is for 163 continuous hours. Only the first 48 hours is required to be in temperature/power variation phase of the test.

Test Configuration = 163 hours (minimum total hours for the statistical model)

> 1 - Count (Server) Workstation - COTS
> 1 - Central (Server) / G1100 scanner station - COTS
> 1 - Central (Server) /G1130 scanner station - COTS
> 1 - Central (Server) / i5600 scanner station - COTS
> 1 - Laptop for copying (123) vDrive images

No printers will be included in the test; all reports will be generated as PDFs

Per test ballots counting cycle requirement, test will be conducted as such:

- 300 pre-marked ballots will be scanned every hour. Then same 300 ballots with be use in each of the scanner workstations. After each hour ballots will be retired.

The test will be conducted to run in 4 hour cycles, such that each cycle is concluded with the generation of a report that details the vote data cast during that period.

Reports generated will be:

- Batch Detail Report from Central

   Validating: Batch of scanned ballots.

- Precinct Detail Report from Central

   Validating: Specific precincts.

- Cumulative Results Report from Count:

   Validating: Contest results per contest and voting type.

- Audit Log Report from Count:

   Validating: Audit trails and actions performed through the system, including successes, warnings, failures and system status. The vDrive will be verified on Count.

The ballot shall contain 18 contest, 4 choices per contest, 9 contests on each side of ballot,3 columns, with 3 contests per column, for a total of 72 ballot positions per ballot.
Voting instructions are not required on the ballot

The ballots will be pre-marked such that:
- For the first ballot, each first choice in each contest should be marked on the ballot
- For the second ballot, each second choice in each contest should be marked on the ballot
- For the third ballot, each third choice in each contest should be marked on the ballot
- For the fourth ballot, each fourth choice in each contest should be marked on the

With these markings, the incremented count for each ballot choice will be such that when the 4th hour report is run, each choice as "300". Any pertinent logs, such as error and/or audit, will be printed at this time as applicable per the scanners abilities to do so.

Note that this approach will utilize 40,900 ballots pre-marked as defined above. This will create 489 batches as defined above.

The four hour grouping will require 300 ballots for each striping per group.

1st voting position marked – 300
2nd voting position marked – 300
3rd voting position marked – 300
4th voting position marked – 300

One ballot style will be scanned in each hour, rotating through the 4 marking styles.

Additional steps to reduce the chance of miss-reads will include conducting cleaning of the scanner within the cleaning process/periods that Hart declares. Scanner will be clean every hour; this requires the scanner to be power off during cleaning per manufacture's specifications.

4.4.4 Reliability Test

The accredited test lab shall test for reliability based on the provisions of Volume I, Section 4 for the acceptable Mean Time Between Failure (MBTF). The MBTF shall be measured during the conduct of other system performance tests specified in this section, and shall be at least 163 hours. Appendix C of VVSG Vol. II provides further details of the calculation for this testing period.

The "cause for failure" is only limited by the functions being performed by the scanner while in use, as partially denoted by the criteria "Loss of one or more functions", while this list attempts to cover all potential points of failure, if an issue occurs outside of this list will still be reviewed. For this test, the criteria will be defined as any function observed to have failed from its intended purpose, during the conduction of the test. E.g., for the scanner, scanning ballots (physically moving them in and out of the scanner), the screen remains on and active, counters are active, printer continues to function.

A failure is defined as any event which results in either:

1. Loss of one or more functions.
   a. Scanner not scanning ballots, ballot jam etc. – Scan / COTS Scanner
   b. Scanner sensors read inconsistently – Scan / COTS Scanner
   c. USB ports not writing to the vDrive – Scan / Touch Writer / COTS Workstation
   d. Thermal printer not printing – Scan / Touch Writer
   e. Tablet display goes away – Scan / Touch Writer
   f. Tablet display does not function – Scan / Touch Writer
   g. USB printer not printing – Touch Writer
   h. USB printer not functioning – Touch Writer
   i. Static Audio not playing – Touch Writer
   j. Device does not power on or off properly – Scan / Touch Writer / COTS Scanner / COTS Workstation
   k. Loss of ADA functionality, Verity Access– Touch Writer

     l.   Guide lights fail USB printer not printing – Scan

     m. Loss of guide lights for feeding ballots - Scan

     n. vDrive fails - Scan

     o. vDrive data is corrupted – Scan

     p. Error logging is incorrect – Scan / Touch Writer

     q. Audit logging is incorrect – Scan / Touch Writer

     r.   Battery becomes damaged – Scan / Touch Writer

     s. Loss of ATI functionality – Touch Writer

     t.   Loss of Poll Worker functionality - Scan / Touch Writer

     u. Loss of LED functionality - Scan / Touch Writer / Scanner

     v. Operational Status check registers a failure – Scan / Touch Writer

     w. Any "Devices Tests" fail post testing – Scan / Touch Writer

     x. Any other unexpected action that deviates from device documentation – Scan / Touch Writer / COTS Scanner / COTS Workstation

     y. Loss of functionality – COTS Workstation / COTS Scanner

2. Degradation of performance such that the device is unable to perform its intended function for longer than 10 seconds; will look for degradation of performance of the device, as opposed to actual functionality failure of the first failure criteria.

3. **Criteria C**: COTS and support equipment may have temporary loss of function or degradation of performance, the correction of which requires operator intervention or system reset.

5 Handling Hardware Anomalies and Incidents

5.1 Hardware Test Anomalies

An anomaly with the subcontractor's test equipment or a procedural misstep can cause a test to fail. For any suspected test equipment issue or procedural error, analysis will be performed and the decision whether to continue testing based on the severity of the anomaly will be appropriately tracked. The subcontractor test lab will issue a corrective action to address any test equipment and/or procedure errors. This is part of the hardware test subcontractor's quality system process that allows the hardware test lab to train all personnel, repair/calibrate equipment, and prevent any recurrence.

5.2 Hardware Incident Process

For every test failure of any voting system component at the hardware test lab, the lab completes a data sheet (per their laboratory procedures and templates) and immediately informs the SLI Hardware Specialist. This can be communicated in the daily status update, with the data sheet attached.

- Failure Analysis: Once a failure has occurred, the SLI Hardware Specialist will be involved with the subcontractor test lab(s) to identify the hardware discrepancy in the device. The results of the analysis will be documented and tracked in the discrepancy reporting tool, and the ECO database under Hardware Incident. The analysis will focus on the failure, what caused the failure, the severity (minor or major), and possible impacts to other testing.

- Mitigation: The SLI Hardware Specialist monitors any work done by the manufacturer, with the full understanding of what is occurring and why.

    o The Manufacturer will document what work is done and the SLI Hardware Specialist will sign off on or can stop the work at any time.
    o The Hardware Specialist will determine the number of "minor" fixes the manufacturer can incorporate without a re-start of the test.
    o Any modification to the equipment is followed up with the related manufacturer EC(s). All related ECs must be entered into the hardware test report and the certification test report

When issues are identified during hardware environmental testing, they result in discrepancies. Discrepancies are tracked in the ECO database under the "Hardware Test Incident" category. The incident number will be tracked along with the equipment that is taken out of testing due to the failure.