

Hart InterCivic Verity Vanguard 1.0 Environmental Hardware Test Plan

v3.0

HIN-23003-ENHTP-01

Prepared for:

Vendor Name	Hart InterCivic
Vendor System	Verity Vanguard 1.0
EAC Application No.	HRT-VV-1.0

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***Accredited by the Election
Assistance Commission (EAC) for
Selected Voting System Test
Methods or Services***



Revision History

Date	Release	Author	Revision Summary
7/24/2024	1.0	Darrick Forester	Initial Release
12/10/2024	2.0	Darrick Forester	Continuous Operation Test Approach updated. Added Vanguard Imprinter optional accessory used with Vault
3/10/2025	3.0	Darrick Forester	Updated block diagrams. Results workstation added for running reports outside the chamber. Vault max through put updated from 100 to 90 ballos scan for and 15 minutes each hour for continuous operation testing

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1 INTRODUCTION

This test plan covers the environmental test requirements and methods for the **Hart InterCivic Verity Vanguard 1.0**, hereafter known as the Equipment Under Test (EUT), to the requirements as stated in Election Assistance Commission Voluntary Voting System Guidelines Version 2.0 (EAC VVSG 2.0).

1.1 Qualifications

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

1.2 Hardware Test Lab Facility

Element Materials Technology Denver-Longmont
1601 Dry Creek Drive
Longmont, CO 80503

1.3 Reference Documents

1. Election Assistance Commission Voluntary Voting System Guidelines 2.0
2. Election Assistance Commission Voluntary Voting System Guidelines (VVSG) v 2.0, Test Assertions v 1.3.
3. NIST Handbook 150-2020.
4. NIST Handbook 150-22-2021.
5. Election Assistance Commission Voting System Testing and Certification Program Manual, United States Election Assistance Commission, v 3.0
6. SLI Compliance VSTL Quality System Manual, Rev. 4.1 Aug. 14, 2023



2 Product Description

2.1 Equipment Under Test

Product / Model	Serial Number	Description	Qty
Vanguard Boost	B2520006601	Vanguard Boost (Polling Place Ballot Issuance) is a poll worker facing device designed to improve voter service by optimizing ballot issuance in the polling place. Vanguard Boost can be utilized by poll workers in two ways. Boost may be used to print blank paper ballots on demand, using an attached ballot printer. Boost may also be used to issue VotePasses, which allow voters to access, mark, and print a printed vote record using Vanguard Flex or Adapt. Vanguard Boost does not store vote data.	1
Vanguard Flex	F2520001001	Vanguard Flex (Polling Place BMD) is a universal ballot marking device that produces an auditable summary ballot of a voter's choices. Voters can mark their ballots using the touchscreen interface or a wide variety of accessible controls. Printed summary ballots are then scanned in Verity Vault for tabulation.	1
Vanguard Vault with Imprinter	V2520004401	Vanguard Vault (Polling Place Precinct Scanner) is a polling place scanning device that captures voter choices whether using ballots marked by hand or machine, including summary ballots (printed vote records (PVRs)).	1
Vanguard Adapt	A2520009201	Vanguard Adapt (Polling Place Limited Dexterity Mark, Verify and Cast Device) is an all-in-one voting device that produces an auditable summary ballot of a voter's choices. Voters can mark their ballots using the touchscreen interface or a wide variety of accessible controls. Vanguard Adapt enables voters to	1



		mark, verify, and cast their ballot all without touching a piece of paper.	
<p>Vanguard Capture (Central Scan) Workstations:</p> <p>Server - HP Z2 SFF G4 Workstation with / Security key, HDMI adapter, keyboard and mouse</p> <p>Client - HP Z2 SFF G4 Workstation with / Security key, HDMI adapter, keyboard and mouse</p> <p>(COTS)</p>	<p>MXL401233Q</p> <p>MXL4233CZC</p>	<p>Vanguard Capture is used by officials for paper ballot scanning, contest resolution, and conversion of voter selection marks to electronic Cast Vote Records (CVRs). Once the CVRs are written to vDrive(s) they can be transferred into Vanguard Results for vote tabulation and reporting of election results. Vanguard Capture records cast vote records only; it does not tabulate.</p> <p>Continuous Operation – Varied Envir. Conditions Low / High Temp/Humidity – Testing Only</p>	2
P24 G5 Monitors (COTS)	CNC3471MMG CNC3471MLW	<p>Workstation Displays</p> <p>Continuous Operation – Varied Envir. Conditions Low / High Temp/Humidity – Testing Only</p>	2
Canon DR-G2110 High-Speed scanner with Imprinter (COTS)	JG313298	<p>COTS high-speed scanner use with Vanguard Capture</p> <p>Continuous Operation – Varied Envir. Conditions Low / High Temp/Humidity – Testing Only</p>	1
Canon DR-G2140 High-Speed scanner with Imprinter (COTS)	JF306475	<p>COTS high-speed scanner use with Vanguard Capture</p> <p>Continuous Operation – Varied Envir. Conditions Low / High Temp/Humidity – Testing Only</p>	1

2.2 Product Information

Description	Dimensions	Weight
Vanguard Boost	(L x W x H) 12 x 5 x 10	5.75 lbs.
Vanguard Flex	(L x W x H) 15 x 13 x 19	16 lbs.
Vanguard Vault	(L x W x H) 20 x 15 x 8	16.25 lbs.
Vanguard Adapt	(L x W x H) 36 x 30 x 48	170 lbs.



Vanguard Capture Workstation Server	(H x W x D) 15.2 x 6.65 x 17.5	12.0 lbs.
Vanguard Capture Workstation Client	(H x W x D) 12.1 x 4.0 x 15.1	12.0 lbs.
2, P24 G5 Monitors	(W x D x H) 21.21 x 7.1 x 15.66	3.2 lbs. each
Canon DR-G2110 High-Speed Scanner	(H x W x D) 12.4 x 18.9 x 22.4	55 lbs.
Canon DR-G2140 High-Speed Scanner	(H x W x D) 12.4 x 18.9 x 22.4	55 lbs.

2.3 Support Equipment (SE)

Product / Model	Serial Number	Description	Qty
Vanguard Imprinter	I2520012401	Optional Vault accessory that is designed to better support a ballot-level risk limiting audit (RLA). The imprinter prints a unique ID onto the ballot after the ballot has been cast. This ID enables searchability and traceability at the individual ballot level.	1
Accessibility Controller (ATI)	Part No. 3007080	Optional accessibility controller for users with low dexterity.	3
Two-button switch (Jelly Switch)	Part No. 2007510	Optional attachment to the accessibility controller for users with greater dexterity challenges.	3
Headphones COTS	Part No. 2005230	Optional attachment to the accessibility controller for users with visual impairments.	3
Motorola/Zebra DS4308 handheld AutoBallot COTS barcode scanner	N/A	Optional device to activate ballot style is based on the barcode generated by a pollbook on check-in. Used with Vanguard Boost, Flex, and Adapt.	3
HP LaserJet Pro 4001dn series mono laser printer	VNL0714117	Optional COTS laser printer for printing blank paper ballots for use with Vanguard Boost.	1
HP Officejet 200	N/A	Optional COTS laser printer for printing blank paper ballots for use with Vanguard Adapt. Continuous Operation – Varied Envir. Conditions Low / High Temp/Humidity – Testing Only	1



Ballot Box	Part No. 3007060	Purpose made plastic, collapsible ballot box for use with Vanguard Vault .	1
Ethernet Switch	TBD	Networked Vanguard Capture with one Server and one Client. Continuous Operation – Varied Envir. Conditions Low / High Temp/Humidity – Testing Only	1
Define/Deploy/Results: HP Z4 G4 Workstation with / Security key, HDMI adapter, keyboard and mouse, P24 G5 Monitors (COTS)	MXL4233CZW	Vanguard Results are used by officials to complete post-voting functionality to tabulate election results and generate reports. Located outside the test chamber	1

2.4 EUT Software / Firmware

Type	Version	Description
Vanguard Software (all)	1.0 / TB2	Election software for operational status check.
Vanguard Baseboard Microcontroller Firmware	TBD	Vanguard Devices.

2.5 Accessories

Type	Model	Function
Test Ballots	N/A	Pre-mark Test Ballots
Verity Key - Security Key	N/A	User authentication and configuration of election security.
Verity vDrive	N/A	Load election definitions, record CVRs and audit logs.



3 Environmental Test Requirements

3.1 Test Procedures

3.1.1 Operating Environmental

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.

3.1.2 Environmental Control – Transit and Storage

Equipment used for vote casting or for counting votes in a precinct count system, MUST meet these 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:

2.7-D – Ability to support maintenance and repair physical environment conditions – non-operating.

2.7-E – Ability to support transport and storage physical environment conditions – non-operating.

2.7-F – Ability to support storage temperatures in physical environment non-operating.

3.2 Design, Construction and Maintenance

This covers voting system materials, construction workmanship, and specific design characteristics important to the successful operation and efficient maintenance of the voting system.

3.2.1 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)

3.2.2 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.
- a. Ease of diagnosing problems by a trained technician
- b. Low false alarm rates (i.e., indications of problems that do not exist)
- c. Ease of access to components for replacement
- d. Ease with which adjustment and alignment can be performed



- e. Ease with which database updates can be performed by a non-technician
- f. Adjust, align, tune or service components

3.3 Non-Operating Environmental Test

3.3.1 Operational Status Check

When all tests, inspections, repairs, and adjustments have been completed, normal operation **shall** be verified by conducting an operational status check.

During this process, all equipment shall be operated in a manner and under environmental conditions that simulate election use to verify the functional status of the system. Prior to the conduct of each of the environmental hardware non-operating tests, a supplemental test shall be made to determine that the operational state of the equipment is within acceptable performance limits.

An operational status check shall be performed prior to and after each test to fully exercise the EUT and ensure that no damage has occurred as a result of the test.

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.

3.3.2 Failure Criteria

Upon completion of each non-operating test, the system hardware shall be subject to functional testing 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 manufacturer. The system will then be subject to a retest.

3.3.3 Bench Handling Test

2.7-D – Ability to support maintenance and repair physical environment conditions – non-operating

The bench handling test simulates stresses faced during maintenance and repair of voting machines and ballot counters. All systems and components, regardless of type, **shall** meet the requirements of this test. This test is equivalent to the procedure of MIL-STD-810H, Method 516.8, Procedure VI.



Note: “Due to Vanguard Adapt physical characteristics Hart’s maintenance instructions clearly states for maintenance and or repairs can only be done at ground level and not on the bench”. Not applicable for Bench Handling Test.

3.3.4 Transportation Vibration Test

2.7-E – Ability to support transport and storage physical environment conditions - non-operating

The vibration test simulates stresses faced during transport of voting machines and ballot counters between storage locations and polling places. All systems and components, regardless of type, shall meet the requirements of this test. This test is equivalent to the procedures of MIL-STD-810H, Method 514.8, Procedure I – General Vibration, Transportation.

3.3.5 Low Temperature Test

2.7-F – Ability to support storage temperatures in physical environment – non-operating

The low temperature test simulates stresses faced during storage of voting machines and ballot counters. All systems and components, regardless of type, **shall** meet the requirements of this test. This test is equivalent to the procedures of MIL-STD-810H, Methods 502.7, Procedure I-Storage. The minimum temperature shall be -4 degrees F. Relative humidity **MUST** test the ranges of 25% to 55%

3.3.6 High Temperature Test

2.7-F – Ability to support storage temperatures in physical environment – non-operating

The High temperature test simulates stresses faced during storage of voting machines and ballot counters. All systems and components, regardless of type, **shall** meet the requirements of this test. This test is equivalent to the procedures of MIL-STD-810H, Methods 501.7, Procedure I-Storage. The maximum temperature shall be 140 degrees F. Relative humidity **MUST** test the ranges of 25% to 55% .

3.4 Operating Environmental Tests

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

3.4.1 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 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.

3.4.2 Continuous Operation Test

2.7-C – Continuous operation – varied environmental conditions

Continuous Operation – Varied Environmental Conditions Low / High Temp / Humidity
The voting system MUST withstand continuous operational testing performed in accordance with the high and low temperature specifications of MIL-STD-810-H, Methods 501.7 and 502.7, Procedure II – Operation, cyclic temperature, and humidity exposure.

- The duration of the test MUST be for 104 consecutive hours.
- Continuous operation means exercising ballot-counting cycles, which vary by system type, for 15 minutes of each hour, and at the maximum rate calculated from the manufacturer's documented throughput rates.
- Temperatures MUST range from 50 to 95 degrees for 72 hours of operation.
- Relative humidity MUST range from 25% to 55% for 72 hours of operation.
- Every 12 hours, the humidity and temperature MUST shift between the two extremes.
- The 50-degree Fahrenheit temperature MUST be tested in parallel with 25% humidity and the 95-degree Fahrenheit temperature MUST be tested in parallel with 55% humidity.
- Temperature and humidity MUST be at normal conditions for 32 hours of operation.
- The interval between reports MUST be no more than once per 4 hours of continuous operation.

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.

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.

Results workstation located outside the chamber to runs reports and verifying results.

Note: Requires 24-hr continuous coverage / support from the hardware test lab for the duration of Continuous Operation Test. Support from the hardware test lab includes monitoring temperature and humidity levels when required base off test plan requirements.



3.4.2.1 Continuous Operation Test Approach

Test election with two contests with four candidates each, and two propositions will be used.

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

Vanguard Boost (Polling Place Ballot Issuance)

- Print and mark 8 ballots every hour.
- 8 ballots voted are then scanned on Vanguard Vault for tabulation.

Vanguard Flex (Polling Place BMD)

- Mark and print 8 ballots every hour.
- 8 ballots voted are then scanned on Vanguard Vault for tabulation.

Vanguard Vault with Imprinter (Polling Place Precinct Scanner)

- Scan and imprint 90 pre-marked ballots every hour. This includes scanning ballots from Vanguard Adapt, Boost and Flex.
 - Vault – 69 ballots every hour.
 - Boost – 8 ballots every hour.
 - Flex - 8 ballots every hour.
 - Adapt - 5 ballots every hour.
- **Total number of ballots every hour = 90**

Vanguard Adapt (Polling Place Limited Dexterity Mark, Verify and Cast Device)

- Mark and vote 5 ballots every hour.
- 5 voted ballots are then scanned on Vanguard Vault for tabulation.

Vanguard Capture (Central Scan) – Central Count System

- 1 – Verity Vanguard Capture (Server) / Canon DRG-2110 high speed scanner
 - Scan 300 pre-marked test ballots every hour.
- 1 – Verity Vanguard Capture (Client) / Canon DRG-2140 high speed scanner
 - Scan 300 pre-marked test ballots every hour.

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.

Additional steps to reduce the change of misreads include cleaning the scanners within the cleaning process/periods that Hart InterCivic declares. The scanner will be cleaned every hour, which requires the scanners to be powered off during cleaning per the manufacturer's specifications.

When required SLI personnel will audit ballots once per hour until testing is completed.

3.4.3 Reliability

2.7-A – Assessment of reliability

The voting system's reliability must be assessed using a combination of evidence items gathered during the entire course of testing, including:

1. Continuous operation of the voting system under typical environmental conditions.

2. Continuous operation of the voting system under varied environmental conditions across defined ranges.

3. Resistance of the voting system to electrical surges, interference, and loss of power.

The failure rate is a benchmark for reliability, the need to protect against a single point of failure, and the need for systems to withstand the failure of input and storage devices.

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

1. **Criterion A:** Loss of one or more functions.
2. **Criterion B:** 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 covered under the first failure criterion.
3. **Criterion 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.

4 Environmental Test Summary

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

Test	Test Specification	VVSG 2.0	Comments
Non-Operating Environmental Tests			
Bench Handling	MIL-STD-810H, Method 516.8, Procedure VI.	2.7-D	N/A – for Adapt
Vibration	MIL-STD-810H, Method 514.8, Procedure I – General Vibration, Transportation.	2.7-E	
Low Temperature	MIL-STD-810H, Method 502.7, Procedure I-Storage, cyclic temperature.	2.7-F-1	
High Temperature	MIL-STD-810H, Method 501.7, Procedure I-Storage, cyclic temperature.	2.7-F-1	
Operating Environmental Tests			
Continuous Operation – Varied Envir. Conditions Low / High Temp/Humidity	MIL-STD-810-H, Methods 501.7 and 502.7, Procedure II – Operation, cyclic temperature, and humidity exposure.	2.7-B, C	



Test	Test Specification	VVSG 2.0	Comments
Reliability Assessment	Assessment of reliability.	2.7-A	

End of ENV Hardware Test Plan
