Test Report - VxScan Feature Acceptance Criteria: Storage, Stacking, & Handling

Dates of testing: May 6, 2024 - Oct 30, 2025
Updated Nov 3, 2025 by Pius Wong

Summary

This report documents a series of smaller-scale tests related to VxScan storage and handling. They evaluate against internal VotingWorks requirements as well as some VVSG requirements listed below.

Applicable VVSG Requirements

Some of the tests listed here *indirectly* support testing these VVSG requirements below, although they are not the final tests for these requirements:

- 8.1-K – Eliminating hazards

Devices Under Test

- VxScan, v4.0, Build 0 & Build 1

Results

Tests were performed on each of the following design feature requirements listed below, with results informing design refinement. Followup plans are included for each test, if applicable.

1. Usability: Easy to stow

a. **Source of requirement**
   i. VotingWorks internal requirements
b. **Acceptance criteria**
   i. **Description**
      1. Effective place to store cords.
      2. Ease of closing and locking the case.
      3. Stability on flat surfaces.
   ii. **Metrics Evaluated**
      1. Is it easy to store the power cord (or other materials) in its intended place? Judgement call from staff, based on level of intuitiveness, time to complete, number of steps needed, and level of protrusion of cord or other items from the system.
      2. Time to close and lock case.
      3. Rest the VxScan on a stable flat surface, on its bottom face, and its back face. Is it stable resting on its bottom face and back face? Stable = no movement observed, won't fall over with light touches.
   iii. **Acceptable Metrics**
      1. Yes
      2. <5 sec
      3. Yes
   iv. **Unacceptable Failure Modes**
      1. No, takes too long, too many steps, too many tries to get it right, cord sticks out too much
      2. >=5 sec
      3. No, falls over or wobbles with light touch.
   v. **Source of Metrics**
      1. VotingWorks internal requirements
c. **Test Results**
   i. All passing metrics.
   ii. Testing performed by VotingWorks in San Francisco, CA, and Austin, TX, from May - July 2024.
d. **Summary Results**
   i. Pass.
e. **Other Notes**
   i. n/a
f. **Followup Plan**
   i. Continued monitoring of units used internally and in the field.
g. **Followup Test Results**
   i. Continued normal results as of October 2025.

2. Usability: Easy to carry when closed

a. **Source of requirement**
   i. VotingWorks internal requirements
b. **Acceptance criteria**
   i. **Description**
      1. Effective and intuitive grip points.
      2. Small enough size and weight.
   ii. **Metrics Evaluated**
      1. Is the closed VxScan able to be carried with one hand comfortably?
      2. Is the closed VxScan able to be carried with 2 hands comfortably in multiple ways? (2 hands on handle, 2 hands on alternate grip points, etc)
      3. Dimensions of closed VxScan case, with all items stowed
      4. Weight of VxScan with all items stowed (duplicate metric with Ballot Receptacle acceptance criteria)
   iii. **Acceptable Metrics**
      1. Yes
      2. Yes
      3. <30" in any dimension
      4. <40 lbs, but ideally <30 lbs
   iv. **Unacceptable Failure Modes**
      1. No
      2. No
      3. Any dimension >=30""
      4. >=40 lbs
   v. **Source of Metrics**
      1. VotingWorks internal requirements
      2. Previous prototypes outperformed given benchmarks for metrics.
c. **Test Results**
   i. All passing metrics.
      1. Metric #3: Shipping dimensions of 20” x 14” x 8”
      2. Metric #4: Shipping weight of 28 lbs
   ii. Testing performed by VotingWorks in San Francisco, CA, and Austin, TX, from May - July 2024.
d. **Summary Results**
   i. Pass.
e. **Other Notes**
   i. n/a
f. **Followup Plan**
   i. Continued monitoring of units used internally and in the field.
g. **Followup Test Results**
   i. Continued normal results as of October 2025.

3. Usability: Must stack multiple units effectively and safely

a. Source of requirement

i. VotingWorks internal requirements

b. Acceptance criteria

i. Description

1. Stacks safely up to 4 ft high.
2. Stacks can be secured during transportation.

ii. Metrics Evaluated

For these tests, only stack units in the vertical direction (z-axis) of the case, right-side-up, and not in any other direction, such that the left, right, front, and back faces of the scanners align within 1 cm. Units shall be stacked on level and solidly supported surfaces.

1. Stack 2 units as intended with top and bottom surfaces interlocking (or use simulated units with the same outer surfaces and modified internal weights). Apply minor horizontal bumps (20 N or 5 lb push) on both scanners, on the front, back, left, and right sides, one at a time. Do the 2 units remain stably stacked, not moving out of alignment by more than 1 cm? Ensure that you take photos of the bottom unit stacking faces (bottom and top) before testing, to compare to later.
2. Stack multiple units (or simulated units) no more than 4 feet high (or 6 VxScans of 8” height), around a protected area to catch any falling items. Apply minor horizontal bumps (20 N or 5 lb push) to the top of the stack. Do the multiple units remain stably stacked, not falling over?
3. In a 4 ft high stack of units (or simulated MCMs), does the unit on the bottom of the stack resist damage from the weight on top? Inspect the bottom unit for damage after previous stability testing, and compare to initial photos.
4. Are there reasonable options for how to secure a stack with tie-down straps or inside containers?

iii. Acceptable Metrics

1. Yes to all

iv. Unacceptable Failure Modes

1. No to any metric
2. Noticeably unstable stacks before any testing; no clear way to secure a stack down; damage seen on bottom unit after stacking and stability testing

v. Source of Metrics

1. VotingWorks internal requirements
2. OSHA standard on stacking materials: 1926.250

c. Test Results

i. Not yet fully tested; lower priority testing outside of system specifications.

d. **Summary Results**
    i. Not yet fully tested.
e. **Other Notes**
    i. These tests are not required for VVSG and go beyond VotingWorks supported system use.
    ii. No indicators yet that stacking is an issue. External Safety Testing with Eurofins/MET passed (UL 62368-1, report number MET 132954) Oct 24, 2024.
f. **Followup Plan**
    i. Treat these tests as lower priority; continue this testing after addressing all VVSG-required testing first.
    ii. Continued monitoring of units used internally and in the field.
g. **Followup Test Results**
    i. Continued normal results as of October 2025.

4. Safety & Hazard Prevention: Case should not pose hazard to user or interfacing elements.

a. **Source of requirement**
    i. VVSG 8.1-K – Eliminating hazards
    ii. VotingWorks internal requirements
b. **Acceptance criteria**
    i. Description
        1. Minimal risk to hands and body parts from features
    ii. Metrics Evaluated
        1. Are all features smooth, finished, rounded, and not sharp?
        2. Do the features avoid snagging clothing and accessories?
        3. Are there minimal risks to eyes or other body parts from parts in compression/tension?
        4. Are electronics sufficiently protected from the user, and vice versa?
    iii. Acceptable Metrics
        1. Yes to all
    iv. Unacceptable Failure Modes
        1. No to any
    v. Source of Metrics
        1. VotingWorks internal requirements
c. **Test Results**
    i. All passing metrics.
    ii. Testing performed by VotingWorks in San Francisco, CA, and Austin, TX, from May - July 2024.
d. **Summary Results**
    i. Pass.

e. **Other Notes**
    i. External Safety Testing with Eurofins/MET passed (UL 62368-1, report number MET 132954) Oct 24, 2024 .
f. **Followup Plan**
    i. Continued monitoring of units used internally and in the field. Keep note especially of any reported issues with the tear bar or wiring.
g. **Followup Test Results**
    i. Continued normal results as of October 2025.

5. Cleanability: Easy to clean closed case

a. **Source of requirement**
    i. VotingWorks internal requirements
b. **Acceptance criteria**
    i. **Description**
        1. Resists damage from cleaning.
    ii. **Metrics Evaluated**
        1. Can you clean all outer surfaces of the closed MCM with microfiber cloth and alcohol without causing damage? Check labels, grip points, and possible ports of ingress.
    iii. **Acceptable Metrics**
        1. Yes
    iv. **Unacceptable Failure Modes**
        1. No
        2. Detaching of labels, easy to cause cosmetic damage, etc.
    v. **Source of Metrics**
        1. VotingWorks internal requirements
c. **Test Results**
    i. Yes; all surfaces cleanable with microfiber cloth wetted with alcohol.
    ii. Testing performed by VotingWorks in San Francisco, CA, and Austin, TX, from May - July 2024.
d. **Summary Results**
    i. Pass.
e. **Other Notes**
    i. n/a
f. **Followup Plan**
    i. Continued monitoring of units used internally and in the field.
g. **Followup Test Results**
    i. Continued normal results as of October 2025.

6. Stability: Stable when on flat surface, not locked

a. **Source of requirement**

i. VotingWorks internal requirements
ii. VVSG 8.1-K – Eliminating hazards

b. Acceptance criteria

i. Description

1. Static tipping angle

ii. Metrics Evaluated

1. Does the unit fall over easily when pushing on the touchscreen? Subjective judgment.
2. Find the minimum angle from gravity when the unit falls over on its own, when tilting it backward when the case is open as if pushing on the touchscreen.

iii. Acceptable Metrics

1. No
2. 30 degrees or greater

iv. Unacceptable Failure Modes

1. Yes
2. <30 degrees

v. Source of Metrics

1. VotingWorks internal requirements
2. Previous v3.1 prototype tips at 42 degrees from gravity.

c. Test Results

i. Passing results.
ii. Testing performed by VotingWorks in Austin, TX, from May - July 2024.

d. Summary Results

i. Pass.

e. Other Notes

i. External Safety Testing with Eurofins/MET passed (UL 62368-1, report number MET 132954) Oct 24, 2024 .

f. Followup Plan

i. Continued monitoring of units used internally and in the field.

g. Followup Test Results

i. Continued normal results as of October 2025.