



CLIENT: VotingWorks

PROJECT: VXScan

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DOCUMENT TITLE: 4.0 Safety Test Report

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1.0 PURPOSE AND SCOPE

The purpose of this test is to verify that the VXScan device meets the requirements for electrical, mechanical and thermal safety.

2.0 REFERENCES

2.1 Internal References

Document Number	Document Title
N/A	VxScan v3.1 and v4.0 Tests of Normal Function, 5/20/2024 Version

2.2 External References

Document Number	Document Title
IEC 62368-1:2018	Audio/video, information and communication technology equipment - Part 1: Safety requirements

3.0 ACRONYMS AND TERMS DEFINED

Acronym	Definition
EUT	Equipment Under Test
NRTL	Nationally Recognized Testing Laboratory

4.0 ITEMS UNDER TEST, MATERIALS, EQUIPMENT, AND CONDITIONS

4.1 Items Under Test

Item	Item #	Rev	Lot #	Sample Size
EUT	VXScan	4.0	n/a	1

4.2 Conditions

The tests are performed at room temperature conditions except for a few of the thermal tests where an elevated ambient temperature is required.

5.0 PROCEDURE

5.1 Input Test

Power is applied to the EUT. The voltage is varied between the minimum and maximum while the current and power factor are measured and recorded.

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5.2 Stored Discharge on Capacitors

The voltage on the power input of the device is monitored with an oscilloscope. When the power is disconnected, the voltage is measured after a predetermined decay time.

5.3 Ambient temperature test

Thermocouples are attached to various locations on the exterior of the case as well as to the lower deck panel and display. The unit was powered up and the temperatures were monitored until they stabilized.

5.4 Elevated temperature test

Additional thermocouples were connected to internal areas of the unit likely to get hot, such as the SBC and power supplies. The instrumented unit was placed in an environmental chamber set for 40°C. The temperatures were monitored until they stabilized.

5.5 Dielectric test

2KV is applied across the inputs/ground of the UPS. The current is monitored to see if it exceeds the failure threshold.

5.6 Touch and ground leakage test

Strips of aluminum foil are taped to various surfaces of the device, both conductive and non-conductive. High voltage is applied between these strips and the line or neutral inputs. If a current flows that is above the failure threshold, the user could be in danger of being shocked when touching the device.

5.7 Ground bond

This test runs 24A at a low voltage from the ground input to the chassis of the device. If the connection opens during the test, it indicates that the ground wire was insufficient to handle the magnitude of the potential fault currents.

5.8 Mechanical tests

Forces were applied to all sides and various internal surfaces of the device. Forces ranged from 10N to 100N, and the size of the force actuator ranged from a small, curved surface to a flat 35mm diameter disk.

The impact test consists of dropping a 50mm metal ball from a height of 1.3m onto all six sides of the unit.

The drop test was skipped due to the possibility of internal damage to the device that would delay other testing. Drops are done from a height of 350 or 500mm onto a 36mm thick board on a concrete floor.

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For the stability test, the device and its stand are placed on a sloped surface angled at 10°. The device is placed on the surface in all four orientations.

5.9 Abnormal conditions test

This test is tailored for the EUT. Faults are inserted into the system to see if it responds safely. Examples of this test are blocked ventilation holes or shorted power supplies.

6.0 ACCEPTANCE CRITERIA

6.1 Input Test

The device continues to operate normally over the voltage range of the test. Current and power factor are within the normal range.

6.2 Stored discharge on capacitors

The voltage at the power input decays rapidly enough to not be a hazard when touched after disconnecting from line voltage.

6.3 Ambient temperature test

No surfaces that can be touched by the user are at an unsafe temperature.

6.4 Elevated temperature test

No temperature measurements are beyond the acceptable operating range. No surfaces that can be touched by the user are at an unsafe temperature.

6.5 Dielectric test

The leakage current remains below the failure threshold.

6.6 Touch and ground leakage test

The leakage current remains below the failure threshold.

6.7 Ground bond

The ground connection within the device remains intact during the test.

6.8 Mechanical tests

The EUT remains undamaged after each test.

For the stability test, if the device does not tip over, it passes.

6.9 Abnormal conditions test

The EUT continues to operate normally after each test.

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7.0 DATA

The test data is in the appendix.

8.0 RESULTS

8.1 Input Test

The EUT continues operating over the range of acceptable input voltage. The input current and power factor remained in the acceptable range. Test passed.

8.2 Stored discharge on capacitors

No significant voltage remains at the power input after power is disconnected. Test passed.

8.3 Ambient temperature test

Test passed.

8.4 Elevated temperature test

Test passed but the SBC reaches temperatures that may affect long term reliability.

8.5 Dielectric test

Test passed.

8.6 Touch and ground leakage test

Test passed.

8.7 Ground bond

Test passed.

8.8 Mechanical tests

Tests passed, but drop tests were not performed.

8.9 Abnormal conditions test

Tests not performed.

9.0 CONCLUSION

The SBC gets too hot during the elevated temperature test. Its rated temperature range is -20°C to 70°C. The highest temperature recorded on the SBC was 87.9°C. The remaining tests that were performed passed.

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APPENDIX 1: DATA

Input test:

B.2.5					
U (V)	Hz	I (A)	P (W)	Pf	Condition/status
92	60	0.09	0.3	0.03	Normal
100	60	0.93	67.04	0.7	Normal
110	60	0.91	68.7	0.68	Normal
120	60	0.84	66.33	0.67	Normal
132	60	0.81	70.2	0.65	Normal
139	60	0.79	71.6	0.64	Normal
92	50	0.08	0.25	0.03	Normal
100	50	0.95	67.5	0.71	Normal
110	50	0.88	68.7	0.69	Normal
120	50	0.84	69.7	0.68	Normal
132	50	0.79	70.4	0.67	Normal
139	50	0.1	0.03	0.53	Normal

Stored discharge on capacitors:

5.5.2.2 TABLE: Stored discharge on capacitors					
Location	Supply voltage (V)	Operating and fault condition ¹⁾	Switch position	Measured voltage (V _{pk})	ES Class
	120	Normal	On	125mV	

Temperature test:

5.4.1.4, 9.3, B.1.5, B.2.6 TABLE: Temperature measurements					
Supply voltage (V)	120	Ambient Temp	120	Chamber Temp	—
Ambient temperature during test T_{amb} (°C)	23				—
Maximum measured temperature T of part/at:	T (°C)	Allowed T_{max} (°C)	T (°C)	Allowed T_{max} (°C)	
Front Left Surface	43.15	70	56.8	70	
Screen	30.56	71	47.9	71	
Power Entry Surface	30.39	70	46.6	70	
UPS Connector	38.1	94	37.6	94	
UPS Enclosure	40.32	94	43.7	94	
Unit Enclosure	28.27	94	47.5	94	
Ambient	23.62	-	42.9	-	
PCB Power	-	-	87.9	105	
PCB Power Connector	-	-	85.4	105	
PCB Metal Enclosure	-	-	77.6	105	
Small PCB	-	-	72.5	105	
12v Power Supply	-	-	51.7	105	
24v Power Supply	-	-	47.5	105	
Supplementary information:					

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Dielectric test:

5.4.9	TABLE: Electric strength tests		
Test voltage applied between	Voltage shape (Surge, Impulse, AC, DC, etc.)	Test voltage (V)	Breakdown after 60 seconds Yes / No
Mains - Gound	DC	2000	NA
Mains – Ground (Case)	DC	4000	No
Mains to Enclosure	DC	4000	No
Supplementary information: Mains – Ground was not able to perform due to UPS protecting the unit.			

Touch and ground leakage:

5.7.2.1			
Location	<u>mVAC</u>	<u>mVDC</u>	
Touch Leakage			
UPS Enclosure, S5=N	6.4	0.2	
UPS Enclosure, S5=R	0.2	0.1	
Screen, S5=N	6.0	0.2	
Screen, S5=R	0.0	0.1	
Unit Enclosure, S5=N	6.5	0.2	
Unit Enclosure, S5=R	0.4	0.1	
Unit Surface, S5=N	1.4	0.2	
Unit Surface, S5=R	4.9	0.2	
Ground Leakage			
Ground, S5=N	374.0	1.1	
Ground, S5=R	377.7	1.0	

Ground bond:

5.6.6			
Location	Test current (A)	Duration (min)	Resistance (Ω)
Ground Pin to Grounded Metal	24	2	101

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Mechanical:

8.6.2.2

Tilt	Orientation	Test Duration (s)	Observation
10	Front	10	Pass
10	Right side	10	Pass
10	Left Side	10	Pass
10	Back	10	Pass

T.2, T.3,
T.4, T.5

TABLE: Steady force test

Part/Location	Material	Thickness (mm)	Probe	Force (N)	Test Duration (s)	Observation
Top	Pelican Case					T2, T3, T4, T5, Pass
Bottom	Pelican Case					T2, T3, T4, T5, Pass
Right Side	Pelican Case					T2, T3, T4, T5, Pass
Left Side	Pelican Case					T2, T3, T4, T5, Pass
Back Side	Pelican Case					T2, T3, T4, T5, Pass
Front Side	Pelican Case					T2, T3, T4, T5, Pass


T.6, T.9

TABLE: Impact test

Location/part	Material	Thickness (mm)	Height (mm)	Observation
Top	Plastic (Pelican Case)			Pass
Bottom	Plastic (Pelican Case)			Pass
Right Side	Plastic (Pelican Case)			Pass
Left Side	Plastic (Pelican Case)			Pass
Back Side	Plastic (Pelican Case)			Pass

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