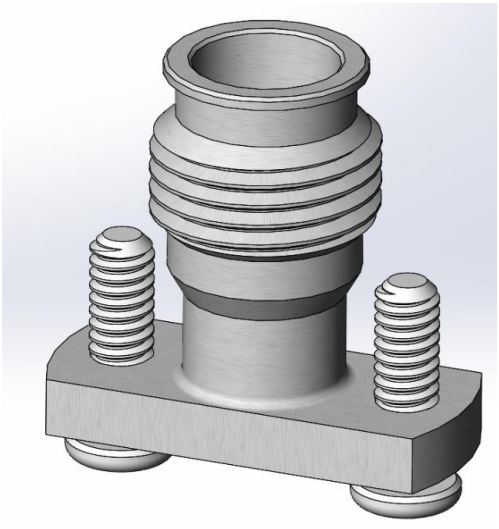
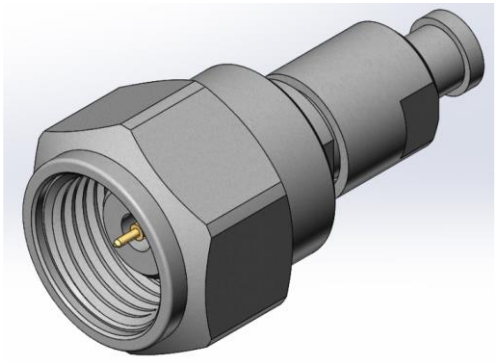
Project Number: Design Qualification Test Report	Tracking Code: 2705729_Report_Rev_2
Requested by: Tommy Kuhn	Date: 11/19/2021
Part #: 135-J-P-VP-ST-CM-2/PRF13-P-C-VP-047A-SS-5050	
Part description: 135/PRF13	Tech: Tony Wagoner
Test Start: 3/9/2021	Test Completed: 4/30/2021





DESIGN QUALIFICATION TEST REPORT

135/PRF13
135-J-P-VP-ST-CM-2/PRF13-P-C-VP-047A-SS-5050

REVISION HISTORY

DATA	REV.NUM.	DESCRIPTION	ENG
6/23/2021	**1**	**Initial Issue**	**KH**
11/19/2021	**2**	**Remove the test data of the IR/DWV group.**	**KH**

CERTIFICATION

All instruments and measuring equipment were calibrated to National Institute for Standards and Technology (NIST) traceable standards according to IS0 10012-l and ANSI/NCSL 2540-1, as applicable.

SCOPE

To perform the following tests: Design Qualification test. Please see test plan.

APPLICABLE DOCUMENTS

Standards: MIL-PRF-39012, MIL-STD-202

TEST SAMPLES AND PREPARATION

1) All materials were manufactured in accordance with the applicable product specification.
2) All test samples were identified and encoded to maintain traceability throughout the test sequences.
3) After soldering, the parts to be used for LLCR and DWV testing were cleaned according to CO-SC-WI-3029.
4) Either an automated cleaning procedure or an ultrasonic cleaning procedure may be used.
5) The automated procedure is used with aqueous compatible soldering materials.
6) Parts not intended for testing LLCR and DWV are visually inspected and cleaned if necessary.
7) Any additional preparation will be noted in the individual test sequences.

FLOWCHARTS

Mating/Unmating/Durability

Group 1

135-J-P-VP-ST-CM-2

PRF13-P-C-VP-047A-SS-5050

1 Assemblies

Step	Description
1.	Interface Gaging *Note: Measure and record center contact recess from interface reference plane*
2.	DWV at Test Voltage (1) - Non Standard DWV = 500 VAC
3.	LLCR (2) - Non Standard *Note: Signal and ground.*
4.	Cycles Quantity = 100 Cycles *Note: By hand. Torque each time to 0.9-1.13 N-m (8-10 in-Lb.). Rotate plug coupling nut only. Do not rotate entire assembly. MIL-PRF-39012, Paragraph. 4.6.12 Air blow interface after each set of cycle intervals.*
5.	Air Blow Debris *Note: Blow debris from the threads or interface surfaces at intervals of not less than 100 cycles. Solvents or tools shall not be used for cleaning.*
6.	LLCR (2) - Non Standard Max Delta = 15 mOhm *Note: Signal and ground.*
7.	Interface Gaging *Note: Measure and record center contact recess from interface reference plane*
8.	Cycles Quantity = 100 Cycles

FLOWCHARTS Continued

Note: By hand. Torque each time to 0.9-1.13 N-m (8-10 in-Lb.). Rotate plug coupling nut only. Do not rotate entire assembly. MIL-PRF-39012, Paragraph. 4.6.12

9. Air Blow Debris
   Note: Blow debris from the threads or interface surfaces at intervals of not less than 100 cycles. Solvents or tools shall not be used for cleaning.
10. LLCR (2) - Non Standard
    Max Delta = 15 mOhm
    Note: Signal and ground.
11. Interface Gaging
    Note: Measure and record center contact recess from interface reference plane
12. Cycles
    Quantity = 100 Cycles
    Note: By hand. Torque each time to 0.9-1.13 N-m (8-10 in-Lb.). Rotate plug coupling nut only. Do not rotate entire assembly. MIL-PRF-39012, Paragraph. 4.6.12
13. Air Blow Debris
    Note: Blow debris from the threads or interface surfaces at intervals of not less than 100 cycles. Solvents or tools shall not be used for cleaning.
14. LLCR (2) - Non Standard
    Max Delta = 15 mOhm
    Note: Signal and ground.
15. Interface Gaging
    Note: Measure and record center contact recess from interface reference plane
16. Cycles
    Quantity = 100 Cycles
    Note: By hand. Torque each time to 0.9-1.13 N-m (8-10 in-Lb.). Rotate plug coupling nut only. Do not rotate entire assembly. MIL-PRF-39012, Paragraph. 4.6.12
17. Air Blow Debris

FLOWCHARTS Continued

Note: Blow debris from the threads or interface surfaces at intervals of not less than 100 cycles. Solvents or tools shall not be used for cleaning.

18. LLCR (2) - Non Standard
    Max Delta = 15 mOhm
    Note: Signal and ground.
19. Interface Gaging
    Note: Measure and record center contact recess from interface reference plane
20. Cycles
    Quantity = 100 Cycles
    Note: By hand. Torque each time to 0.9-1.13 N-m (8-10 in-Lb.). Rotate plug coupling nut only. Do not rotate entire assembly. MIL-PRF-39012, Paragraph. 4.6.12
21. Air Blow Debris
    Note: Blow debris from the threads or interface surfaces at intervals of not less than 100 cycles. Solvents or tools shall not be used for cleaning.
22. LLCR (2) - Non Standard
    Max Delta = 15 mOhm
    Note: Signal and ground.
23. Interface Gaging
    Note: Measure and record center contact recess from interface reference plane
24. Visual Inspection
    Note: Visually inspect socket contact for cracks at bottom of slots
25. Cycles
    Quantity = 500 Cycles
    Note: By hand. Torque each time to 0.9-1.13 N-m (8-10 in-Lb.). Rotate plug coupling nut only. Do not rotate entire assembly. MIL-PRF-39012, Paragraph. 4.6.12 Air blow interface after each set of cycle intervals.
26. Air Blow Debris

FLOWCHARTS Continued

Note: Blow debris from the threads or interface surfaces at intervals of not less than 100 cycles. Solvents or tools shall not be used for cleaning.

27. Interface Gaging
    Note: Measure and record center contact recess from interface reference plane
28. Visual Inspection
    Note: Visually inspect socket contact for cracks at bottom of slots
29. Cycles
    Quantity = 500 Cycles
    Note: By hand. Torque each time to 0.9-1.13 N-m (8-10 in-Lb.). Rotate plug coupling nut only. Do not rotate entire assembly. MIL-PRF-39012, Paragraph. 4.6.12 Air blow interface after each set of cycle intervals.
30. Air Blow Debris
    Note: Blow debris from the threads or interface surfaces at intervals of not less than 100 cycles. Solvents or tools shall not be used for cleaning.
31. Interface Gaging
    Note: Measure and record center contact recess from interface reference plane
32. Visual Inspection
    Note: Visually inspect socket contact for cracks at bottom of slots
33. Cycles
    Quantity = 500 Cycles
    Note: By hand. Torque each time to 0.9-1.13 N-m (8-10 in-Lb.). Rotate plug coupling nut only. Do not rotate entire assembly. MIL-PRF-39012, Paragraph. 4.6.12 Air blow interface after each set of cycle intervals.
34. Air Blow Debris

FLOWCHARTS Continued

Note: Blow debris from the threads or interface surfaces at intervals of not less than 100 cycles. Solvents or tools shall not be used for cleaning.

35. Interface Gaging

Note: Measure and record center contact recess from interface reference plane

36. Visual Inspection

Note: Visually inspect socket contact for cracks at bottom of slots

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(1) DWV at Test Voltage = Other

Test Condition = 1 (Sea Level) Test voltage applied for 60 seconds
MIL-PRF-39012, Paragraph. 4.6.14 per MIL-STD-202-301

(2) LLCR = Other

Open Circuit Voltage = 20 mV Max
Test Current = 100 mA Max
MIL-PRF-39012, Paragraph 4.6.13 except current to be 100mA nominal and voltage to be 20 mV maximum.

FLOWCHARTS Continued

Center Contact Retention

Minimum Force

Group 1

135-J-P-VP-ST-CM-1

8 Assemblies

Minimum Force

Note: Test I.A.W. MIL-PRF-39012 par. 4.6.9.

Step	Description
1.	Measure Contact Recess @ Interface
2.	Apply Minimum Force Onto Socket Face *Note: Applied Force = 4 lbf (17.8 N)*
3.	Measure Contact Recess @ Interface
4.	Apply Minimum Force Onto Contact In Opposite Direc *Note: Applied Force = 4 lbf (17.8 N)*
5.	Measure Contact Recess @ Interface

Center Contact Captivation

Group 1

135-J-P-VP-ST-CM-1

8

Maximum Force

Note: This is a distructive test. Apply force to the center socket contact (push on contact from flange end of assembly) and record maximum force at captivation failure and note cause of failure. Examples; Center Contact broke free from captivation, Interface captivation bushing unseated.

Step	Description
1.	Apply Force On The Center Contact From Flange End *Note: Crosshead speed range 0.5–5.0 mm/min will be sufficiant. Maximum force is the load force measured at captivation failure.*

ATTRIBUTE DEFINITIONS

The following is a brief, simplified description of attributes.

THERMAL SHOCK:

1) MIL-PRF-39012, Paragraph 4.6.17 per MIL-STD-202-107, *Thermal Shock (Temperature Cycling) Test Procedure for Electrical Connectors.*
2) Test Condition: -65°C to +125°C
3) Test Time: ½ hour dwell at each temperature extreme
4) Test Duration: test condition B except 10 cycles instead of 5.
5) All test samples are pre-conditioned at ambient.
6) All test samples are exposed to environmental stressing in the mated condition.

LLCR:

1) MIL-PRF-39012, Paragraph. 4.6.13 *Low Level Contact Resistance Test Procedure for Electrical Connectors and Sockets*.
2) Except current to be 100 mA nominal and voltage to be 20 mV maximum.
3) A computer program, *LLCR 221.exe*, ensures repeatability for data acquisition.
4) The following guidelines are used to categorize the changes in LLCR as a result from stressing
    a. <= +5.0 mOhms: ----------Stable
    b. +5.1 to +10.0 mOhms:----------Minor
    c. +10.1 to +15.0 mOhms: ----------Acceptable
    d. +15.1 to +50.0 mOhms: ----------Marginal
    e. +50.1 to +1000 mOhms: ----------Unstable
    f. >+1000 mOhms:----------Open Failure

DIELECTRIC WITHSTANDING VOLTAGE (DWV):

To determine if the sockets can operate at its rated voltage and withstand momentary over potentials due to switching, surges, and other similar phenomenon. Separate samples are used to evaluate the effect of environmental stresses so not to influence the readings from arcing that occurs during the measurement process.

1) Test Voltage
    a. 500 Vrms min. at sea level per MIL-STD-202-301.
    b. Test voltage applied for 60 seconds, MIL-PRF-39012, paragraph 4.6.14 per MIL-STD-202-301

RESULTS

Push Force:

Center Contact Captivation Group

135-J-P-VP-ST-CM-1

Push force

- **Min----------11.51 lbs**
- **Max ----------13.12 lbs**

Interface Gaging

Center Contact Retention Group

135-J-P-VP-ST-CM-1

Initial

- **Min---------- 0.00010 inch**
- **Max ---------- 0.00080 inch**

After applied force (4.0 lbs)

- **Min---------- 0.00045 inch**
- **Max ---------- 0.00165 inch**

After applied force (4.0 lbs)

- **Min---------- 0.00000 inch**
- **Max ---------- 0.00070 inch**

Mating-Unmating durability Group

135-J-P-VP-ST-CM-2

- **Initial ---------- 0.00190 inch**

Delta After Cycles

- **After 100 cycles---------- 0.00040 inch**
- **After 200 cycles---------- 0.00060 inch**
- **After 300 cycles---------- 0.00060 inch**
- **After 400 cycles---------- 0.00070 inch**
- **After 500 cycles---------- 0.00090 inch**
- **After 1000 cycles ---------- 0.00120 inch**
- **After 1500 cycles ---------- 0.00130 inch**
- **After 2000 cycles ---------- 0.00130 inch**

RESULTS Continued

LLCR Mating-Unmating Durability (1 signal and 1 ground LLCR test points)

Signal

- **Initial ---------- 47.78 mOhms Max**
- **After 100 Cycles**
  - **<= +5.0 mOhms ---------- 1 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 0 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ---------- 0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ---------- 0 Points ---------- Marginal**
  - **+50.1 to +1000 mOhms ---------- 0 Points ---------- Unstable**
  - **>+1000 mOhms ---------- 0 Points ---------- Open Failure**
- **After 200 Cycles**
  - **<= +5.0 mOhms ---------- 1 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 0 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ---------- 0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ---------- 0 Points ---------- Marginal**
  - **+50.1 to +1000 mOhms ---------- 0 Points ---------- Unstable**
  - **>+1000 mOhms ---------- 0 Points ---------- Open Failure**
- **After 300 Cycles**
  - **<= +5.0 mOhms ---------- 1 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 0 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ---------- 0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ---------- 0 Points ---------- Marginal**
  - **+50.1 to +1000 mOhms ---------- 0 Points ---------- Unstable**
  - **>+1000 mOhms ---------- 0 Points ---------- Open Failure**
- **After 400 Cycles**
  - **<= +5.0 mOhms ---------- 1 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 0 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ---------- 0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ---------- 0 Points ---------- Marginal**
  - **+50.1 to +1000 mOhms ---------- 0 Points ---------- Unstable**
  - **>+1000 mOhms ---------- 0 Points ---------- Open Failure**
- **After 500 Cycles**
  - **<= +5.0 mOhms ---------- 1 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 0 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ---------- 0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ---------- 0 Points ---------- Marginal**
  - **+50.1 to +1000 mOhms ---------- 0 Points ---------- Unstable**
  - **>+1000 mOhms ---------- 0 Points ---------- Open Failure**

RESULTS Continued

Ground

- **Initial ---------- 16.67 mOhms Max**
- **After 100 Cycles**
  - **<= +5.0 mOhms ---------- 1 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 0 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ---------- 0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ---------- 0 Points ---------- Marginal**
  - **+50.1 to +1000 mOhms ---------- 0 Points ---------- Unstable**
  - **>+1000 mOhms ---------- 0 Points ---------- Open Failure**
- **After 200 Cycles**
  - **<= +5.0 mOhms ---------- 1 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 0 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ---------- 0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ---------- 0 Points ---------- Marginal**
  - **+50.1 to +1000 mOhms ---------- 0 Points ---------- Unstable**
  - **>+1000 mOhms ---------- 0 Points ---------- Open Failure**
- **After 300 Cycles**
  - **<= +5.0 mOhms ---------- 1 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 0 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ---------- 0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ---------- 0 Points ---------- Marginal**
  - **+50.1 to +1000 mOhms ---------- 0 Points ---------- Unstable**
  - **>+1000 mOhms ---------- 0 Points ---------- Open Failure**
- **After 400 Cycles**
  - **<= +5.0 mOhms ---------- 1 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 0 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ---------- 0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ---------- 0 Points ---------- Marginal**
  - **+50.1 to +1000 mOhms ---------- 0 Points ---------- Unstable**
  - **>+1000 mOhms ---------- 0 Points ---------- Open Failure**
- **After 500 Cycles**
  - **<= +5.0 mOhms ---------- 1 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 0 Points ---------- Minor**
  - **+10.1 to +15.0 mOhms ---------- 0 Points ---------- Acceptable**
  - **+15.1 to +50.0 mOhms ---------- 0 Points ---------- Marginal**
  - **+50.1 to +1000 mOhms ---------- 0 Points ---------- Unstable**
  - **>+1000 mOhms ---------- 0 Points ---------- Open Failure**

DATA SUMMARIES

Interface Gaging

Center Contact Retention Group
135-J-P-VP-ST-CM-1

Interface Gaging			
Sample #	Initial	4lb Push Force	4lb Push Force
1	0.00015	0.00070	0.00000
2	0.00040	0.00120	0.00010
3	0.00035	0.00045	0.00005
4	0.00040	0.00085	0.00000
5	0.00080	0.00165	0.00070
6	0.00040	0.00120	0.00015
7	0.00080	0.00130	0.00045
8	0.00010	0.00060	0.00000
Min	0.00010	0.00045	0.00000
Max	0.00080	0.00165	0.00070
Average	0.00043	0.00099	0.00018

Mating-Unmating durability Group
135-J-P-VP-ST-CM-2

Interface Gaging		
Sample 1	Initial	Delta Cycles
Initial	0.0019	0.0000
after 100 Cycles	0.0015	0.0004
after 200 Cycles	0.0013	0.0006
after 300 Cycles	0.0013	0.0006
after 400 Cycles	0.0012	0.0007
after 500 Cycles	0.0010	0.0009
after 1000 Cycles	0.0007	0.0012
after 1500 Cycles	0.0006	0.0013
after 2000 Cycles	0.0006	0.0013

DATA SUMMARIES Continued

Connectors were also mounted to a Signal Integrity test board and interface dimension results can be seen below.

PCB p/n	PCB serial number	pre PCB mount J1 (in)	pre PCB mount J2 (in)	post PCB mount J1 (in)	post PCB mount J2 (in)
PCB-111108-SIG-0	**2038-002-020**	0.00037	0.00079	0.00055	0.00051
	2038-002-022	0.00039	0.00043	0.00063	0.00122
	2038-003-004	0.0002	0.00071	0.00098	0.00087
	2038-003-019	0.00055	0.00051	0.00032	0.00024
	2038-003-024	0.00146	0.00087	0.00095	0.00161

DIELECTRIC WITHSTANDING VOLTAGE (DWV):

Mating-Unmating Durability Group

DWV (Test Voltaghe = 500)		
Initial	500	Pass

Push Force:

Center Contact Captivation Group

	Force (lbs)
Minimum	**11.51**
Maximum	13.12
Average	12.28

DATA SUMMARIES Continued

LLCR Mating-Unmating Durability:

1) A total of 1 signal and 1 ground points were measured.
2) MIL-PRF-39012, Paragraph. 4.6.13, Low Level Contact Resistance Test Procedure for Electrical Connectors and Sockets.
3) A computer program, LLCR 221.exe, ensures repeatability for data acquisition.
4) The following guidelines are used to categorize the changes in LLCR as a result from stressing.
   a. <= +5.0 mOhms:----------Stable
   b. +5.1 to +10.0 mOhms: ----------Minor
   c. +10.1 to +15.0 mOhms:----------Acceptable
   d. +15.1 to +50.0 mOhms:----------Marginal
   e. +50.1 to +1000 mOhms----------Unstable
   f. >+1000 mOhms:----------Open Failure

	LLCR Measurement Summaries by Pin Type					
Date	2021/4/28	2021/4/28	2021/4/29	2021/4/29	2021/4/29	2021/4/30
Room Temp (Deg C)	22	22	22	22	22	23
Rel Humidity (%)	40	40	39	39	39	40
Technician	Tony Wagoner	Tony Wagoner	Tony Wagoner	Tony Wagoner	Tony Wagoner	Tony Wagoner
mOhm values	**Actual Initial**	**Delta 100 Cycles**	**Delta 200 Cycles**	**Delta 300 Cycles**	**Delta 400 Cycles**	**Delta 500 Cycles**
	Pin Type 1: Signal					
Average	47.78	0.03	0.19	0.13	0.11	1.12
Min	47.78	0.03	0.19	0.13	0.11	1.12
Max	47.78	0.03	0.19	0.13	0.11	1.12
Summary Count	1	1	1	1	1	1
Total Count	1	1	1	1	1	1
	Pin Type 2: Ground					
Average	16.67	0.11	0.17	0.31	1.15	0.11
Min	16.67	0.11	0.17	0.31	1.15	0.11
Max	16.67	0.11	0.17	0.31	1.15	0.11
Summary Count	1	1	1	1	1	1
Total Count	1	1	1	1	1	1

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
100 Cycles	**2**	**0**	**0**	**0**	**0**	**0**
200 Cycles	**2**	**0**	**0**	**0**	**0**	**0**
300 Cycles	**2**	**0**	**0**	**0**	**0**	**0**
400 Cycles	**2**	**0**	**0**	**0**	**0**	**0**
500 Cycles	**2**	**0**	**0**	**0**	**0**	**0**

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: TCT-04
Description: Dillon Quantrol TC21 25-1000 mm/min series test stand
Manufacturer: Dillon Quantrol
Model: TC2 I series test stand
Serial #: 04-1041-04
Accuracy: Speed Accuracy: +/- 5% of indicated speed; Speed Accuracy: +/- 5% of indicated speed;
… Last Cal: 05/29/2021, Next Cal: 05/29/2022

Equipment #: MO-11
Description: Switch/Multimeter
Manufacturer: Keithley
Model: 3706
Serial #: 120169
Accuracy: See Manual
… Last Cal: 09/11/2020, Next Cal: 09/11/2021

Equipment #: TSC-01
Description: Vertical Thermal Shock Chamber
Manufacturer: Cincinnati Sub Zero
Model: VTS-3-6-6-SC/AC
Serial #: 10-VT14993
Accuracy: See Manual
… Last Cal: 06/30/2020, Next Cal: 06/30/2021

Equipment #: HPT-01
Description: Hipot Safety Tester
Manufacturer: Vitrek
Model: V73
Serial #: 019808
Accuracy:
… Last Cal: 05/15/2021, Next Cal: 05/15/2022