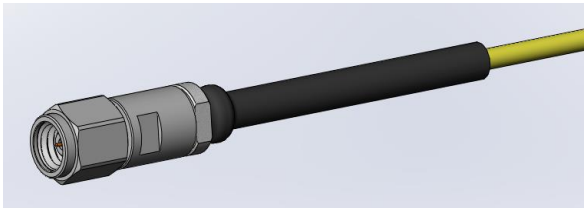
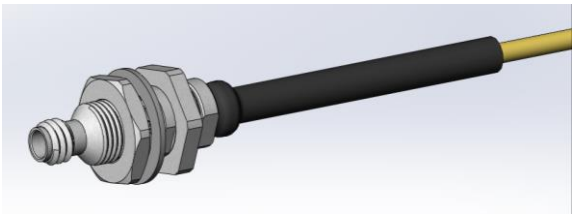
Project: Design Qualification Test Report	Tracking Code: CR-1238701_Report_Rev_1
Requested by: Tom Yahav	Date: 4/11/2025
Part #: LL032-92SP-92SP-0152/LL043-92BJ-92BJ-0152	Tech: Tony Wagoner
Part description: LL032-92SP / LL043-92BJ	Qty to test: 20
Test Start: 03/10/2025	Test Completed: 03/25/2025





DESIGN QUALIFICATION TEST REPORT

LL032-92SP-92SP-0152/LL043-92BJ-92BJ-0152

REVISION HISTORY

DATA	REV.NUM.	DESCRIPTION	ENG
4/1/2025	**1**	**Initial Issue**	**PC**

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

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 IR_DWV testing were cleaned according to TLWI-0001.
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 IR_DWV are visually inspected and cleaned if necessary.
7) Any additional preparation will be noted in the individual test sequences.
8) Solder Information: Lead Free

FLOWCHARTS

Mating/Unmating/Durability

Group 1
LL032-92SP-505050-0152
LL043-92BJ-505050-0152
4 Assemblies

Step	Description
1.	Length & Mass
2.	Interface Gaging
3.	DWV at Test Voltage (1) - Non Standard DWV = 500 VAC
4.	LLCR (2) - Non Standard *Note: Signal and ground.*
5.	Cycles Quantity = 500 Cycles *Note: By hand. Torque each time to 8 in-lbs. Rotate plug coupling nut only. Do not rotate entire assembly. MIL-PRF-39012, Paragraph. 4.6.12*
6.	LLCR (2) - Non Standard Max Delta = 15 mOhm *Note: Signal and ground.*
7.	Interface Gaging

(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

IR/DWV

Pin-to-Ground

Group 1

LL032-92SP-505050-1000

LL043-92BJ-505050-1000

4 Assemblies

Step	Description
1.	Length & Mass
2.	Interface Gaging
3.	IR (2) - Non Standard
4.	DWV at Test Voltage (1) - Non Standard Test Voltage = 500 VAC
5.	LLCR (3) - Non Standard *Note: Signal and ground.*
6.	Thermal Shock (4) - Non Standard
7.	IR (2) - Non Standard
8.	DWV at Test Voltage (1) - Non Standard Test Voltage = 500 VAC
9.	LLCR (3) - Non Standard Max Delta = 15 mOhm *Note: Signal and ground.*
10.	Interface Gaging

(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) IR = Other
Test Condition = 500V DC, 2 Minutes Max
MIL-PRF-39012, Paragraph 4.6.8 per MIL-STD-202-302

(3) 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.

(4) Thermal Shock = Other
Exposure Time at Temperature Extremes = 1/2 Hour
Test Condition = I (-65°C to +125°C)
Test Duration = test condition B except 10 cycles instead of 5.
MIL-PRF-39012, Paragraph. 4.6.17 per MIL-STD-202-107

FLOWCHARTS Continued

Cable Pull

Group 1 LL032-92SP-505050-0152 4 Assemblies 0 Degrees		Group 2 LL032-92SP-505050-0152 LL043-92BJ-505050-0152 4 Assemblies 0 Degrees	
Step	**Description**	**Step**	**Description**
1.	Cable Retention (2) - Non Standard *Note: Pull-to-destruct.*	1.	Length & Mass
		2.	Interface Gaging
		3.	LLCR (3) - Non Standard *Note: Signal and ground.*
		4.	Cable Retention (1) - Non Standard
		5.	LLCR (3) - Non Standard *Note: Signal and ground.*
		6.	Interface Gaging

(1) Cable Retention = Other
Apply 25 pounds (11.3 kg) for Cable Retention test.
MIL-PRF-30192, Paragraph 4.6.21

(2) Cable Retention = Other
Pull-to-destruct.
MIL-PRF-30192, Paragraph 4.6.21

(3) 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.

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*
2) Test Condition: I (-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.

MATING/UNMATING:

1) Reference document: EIA-364-13, *Mating and Unmating Forces Test Procedure for Electrical Connectors*.
2) The full insertion position was to within 0.003" to 0.004" of the plug bottoming out in the receptacle to prevent damage to the system under test.
3) One of the mating parts is secured to a floating X-Y table to prevent damage during cycling.

LLCR:

1) EIA-364-23, *Low Level Contact Resistance Test Procedure for Electrical Connectors and Sockets*.
2) A computer program, *LLCR 221.exe*, ensures repeatability for data acquisition.
3) 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

ATTRIBUTE DEFINITIONS Continued

The following is a brief, simplified description of attributes

INSULATION RESISTANCE (IR):

To determine the resistance of insulation materials to leakage of current through or on the surface of these materials when a DC potential is applied.

1) PROCEDURE:
    a. Reference document: EIA-364-21, *Insulation Resistance Test Procedure for Electrical Connectors*.
    b. Test Conditions:
        i. Between Adjacent Contacts or Signal-to-Ground
        ii. Electrification Time 2.0 minutes
        iii. Test Voltage (500 VDC) corresponds to calibration settings for measuring resistances.
2) MEASUREMENTS:
3) When the specified test voltage is applied (VDC), the insulation resistance shall not be less than 5000 megohms.

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) PROCEDURE:
    a. Reference document: EIA-364-20, *Withstanding Voltage Test Procedure for Electrical Connectors*.
    b. Test Conditions:
        i. Between Adjacent Contacts or Signal-to-Ground
        ii. Barometric Test Condition 1
        iii. Rate of Application 500 V/Sec
        iv. Test Voltage (VAC) until breakdown occurs
2) MEASUREMENTS/CALCULATIONS
    a. The breakdown voltage shall be measured and recorded.
    b. The dielectric withstanding voltage shall be recorded as 75% of the minimum breakdown voltage.
    c. The working voltage shall be recorded as one-third (1/3) of the dielectric withstanding voltage (one-fourth of the breakdown voltage).

ATTRIBUTE DEFINITIONS Continued

The following is a brief, simplified description of attributes

CABLE PULL:

1) Secure cable near center and pull on connector
    a. At 0°, in-line with cable

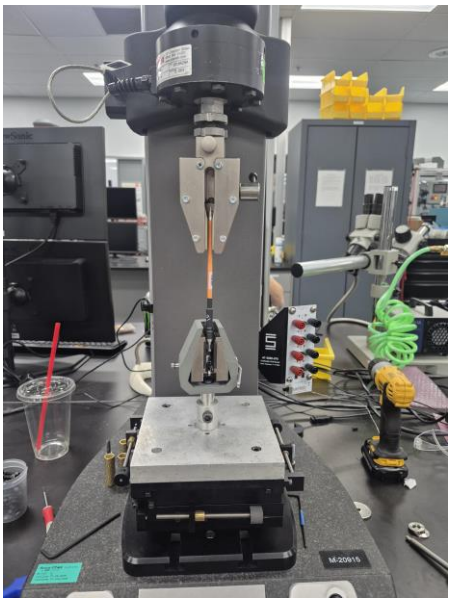


Fig. 1
0° Connector pull, notice the electrical continuity hook-up wires.

RESULTS

Cable Pull force

SP

- **Min ----------79.39 lbs**
- **Max ----------84.61 lbs**

Insulation Resistance minimums, IR

Pin to Ground

- **Initial**
  - **Mated ----------45000 Meg Ω ---------- Passed**
- **Thermal Shock**
  - **Mated ----------45000 Meg Ω ---------- Passed**

Dielectric Withstanding Voltage minimums, DWV

- **Minimums**
  - **Test Voltage ----------500 VAC**

Pin to Ground

- **Initial DWV ----------Passed**
- **Thermal DWV----------Passed**

RESULTS Continued

Interface Gaging

Mating/Unmating Durability Group

92SP

Initial

- **Min ---------- 0.00010 Inch**
- **Max ---------- 0.00045 Inch**

After 500 cycles

- **Min ---------- 0.00005 Inch**
- **Max ---------- 0.00045 Inch**

92BJ

Initial

- **Min ---------- 0.00025 Inch**
- **Max ---------- 0.00045 Inch**

After 500 cycles

- **Min ---------- 0.00030 Inch**
- **Max ---------- 0.00045 Inch**

IR_DWV Group

92SP

Initial

- **Min ---------- 0.00015 Inch**
- **Max ---------- 0.00030 Inch**

After 500 cycles

- **Min ---------- 0.00000 Inch**
- **Max ---------- 0.00015 Inch**

92BJ

Initial

- **Min ---------- 0.00010 Inch**
- **Max ---------- 0.00080 Inch**

After 500 cycles

- **Min ---------- 0.00015 Inch**
- **Max ---------- 0.00050 Inch**

Cable Pull Group

92SP

Initial

- **Min ---------- 0.00015 Inch**
- **Max ---------- 0.00045 Inch**

After 500 cycles

- **Min ---------- 0.00010 Inch**
- **Max ---------- 0.00050 Inch**

92BJ

Initial

- **Min ---------- 0.00010 Inch**
- **Max ---------- 0.00045 Inch**

After 500 cycles

- **Min ---------- 0.00010 Inch**
- **Max ---------- 0.00030 Inch**

RESULTS Continued

LLCR IR/DWV (4 signal and 4 ground LLCR test points)

Signal Pin

- **Initial ---------- 9.20 mOhms Max**
- **Thermal Shock**
  - **<= +5.0 mOhms ---------- 4 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**

Ground Pin

- **Initial ---------- 12.56 mOhms Max**
- **Thermal Shock**
  - **<= +5.0 mOhms ---------- 4 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**

LLCR Cable Pull (4 signal and 4 ground LLCR test points)

Signal Pin

- **Initial ---------- 9.45 mOhms Max**
- **5 Ib Retention**
  - **<= +5.0 mOhms ---------- 4 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**

Ground Pin

- **Initial ---------- 9.60 mOhms Max**
- **5 Ib Retention**
  - **<= +5.0 mOhms ---------- 4 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

LLCR Durability (4 signal and 4 ground LLCR test points)

Signal Pin

- **Initial ---------- 9.56 mOhms Max**
- **Durability, 500 Cycles**
  - **<= +5.0 mOhms ---------- 4 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**

Ground Pin

- **Initial ---------- 9.37 mOhms Max**
- **Durability, 500 Cycles**
  - **<= +5.0 mOhms ---------- 4 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

Cable Pull Force:

SP	Force (lbs)
Minimum	79. 39
Maximum	84.61
Average	82.04

INSULATION RESISTANCE (IR):

	Pin to Ground
	Mated
Minimum	LL032-92SP / LL043-92BJ
Initial	45000
Thermal Shock	45000

DIELECTRIC WITHSTANDING VOLTAGE (DWV):

Pin to Ground (500 VAC)	
Initial Test Voltage	Pass
After Thermal Shock Test Voltage	Pass

DATA SUMMARIES Continued

INTERFACE GAGING

Mating\Unmating Durability

Interface Gaging (LL032-92SP-505050-0152)			
Sample 1	**Initial**	**Cycles**	**Delta**
1	0.00010	0.00005	0.00005
2	0.00030	0.00030	0.00000
3	0.00045	0.00045	0.00000
4	0.00030	0.00030	0.00000

Interface Gaging (LL043-92BJ-505050-0152)			
Sample 1	**Initial**	**Cycles**	**Delta**
1	0.00035	0.00035	0.00000
2	0.00045	0.00045	0.00000
3	0.00045	0.00045	0.00000
4	0.00025	0.00030	0.00005

IR_DWV Group

Interface Gaging (LL032)			
Sample	**Initial**	**Thermal Shock**	**Delta**
5	0.00015	0.00010	0.00005
6	0.00030	0.00000	0.00030
7	0.00030	0.00015	0.00015
8	0.00030	0.00015	0.00015

Interface Gaging (LL043)			
Sample	**Initial**	**Thermal Shock**	**Delta**
5	0.00010	0.00015	0.00005
6	0.00030	0.00030	0.00000
7	0.00030	0.00030	0.00000
8	0.00080	0.00050	0.00030

Cable Pull Group

Interface Gaging (LL032)			
Sample	**Initial**	**Cable Retention**	**Delta**
13	0.00015	0.00010	0.00005
14	0.00015	0.00010	0.00005
15	0.00035	0.00035	0.00000
16	0.00045	0.00050	0.00005

Interface Gaging (LL043)			
Sample	**Initial**	**Cable Retention**	**Delta**
13	0.00045	0.00030	0.00015
14	0.00020	0.00015	0.00005
15	0.00020	0.00025	0.00005
16	0.00010	0.00010	0.00000

DATA SUMMARIES Continued

LLCR Durability:

1) A total of 4 signal and 4 ground points were measured.
2) EIA-364-23, *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	3/13/2025	3/18/2025		
Room Temp (Deg C)	22	22		
Rel Humidity (%)	39	38 38		
Technician	Samuel Cecil	Samuel Cecil		
mOhm values	Actual	**Delta**	**Delta**	**Delta**
	Initial	**Cycles**	**Therm Shck**	**Humidity**
	Pin Type: Signal 1			
Average	9.24	0.18		
St. Dev.	0.21	0.05		
Min	9.12	0.12		
Max	9.56	0.23		
Summary Count	4	4		
Total Count	4	4		
	Pin Type: GND 1			
Average	8.85	2.83		
St. Dev.	0.48	1.73		
Min	8.31	0.29		
Max	9.37	4.09		
Summary Count	4	4		
Total Count	4	4		

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
Cycles	**8**	**0**	**0**	**0**	**0**	**0**

DATA SUMMARIES Continued

LLCR IR/DWV:

1) A total of 4 signal and 4 ground points were measured.
2) EIA-364-23, *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	3/20/2025	3/26/2025		
Room Temp (Deg C)	22	22		
Rel Humidity (%)	39	38		
Technician	Samuel Cecil	Samuel Cecil		
mOhm values	**Actual**	**Delta**		
	Initial	**Thermal Shock**		
	Pin Type: Signal 1			
Average	9.17	0.07		
St. Dev.	0.02	0.02		
Min	9.15	0.05		
Max	9.20	0.09		
Summary Count	4	4		
Total Count	4	4		
	Pin Type: GND 1			
Average	9.85	0.46		
St. Dev.	1.58	0.31		
Min	8.57	0.01		
Max	12.56	0.67		
Summary Count	4	4		
Total Count	4	4		

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
Thermal Shock	**8**	**0**	**0**	**0**	**0**	**0**

DATA SUMMARIES Continued

LLCR Cable Pull:

1) A total of 4 signal and 4 ground points were measured.
2) EIA-364-23, *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	3/20/2025	3/21/2025		
Room Temp (Deg C)	22	22		
Rel Humidity (%)	38	37		
Technician	Samuel Cecil	Samuel Cecil		
mOhm values	Actual	**Delta**		
	Initial	**Cable Retention**		
	Pin Type: Signal 1			
Average	9.33	0.09		
St. Dev.	0.09	0.06		
Min	9.24	0.04		
Max	9.45	0.15		
Summary Count	4	4		
Total Count	4	4		
	Pin Type: GND 1			
Average	8.98	1.86		
St. Dev.	0.51	0.46		
Min	8.4	1.27		
Max	9.6	2.36		
Summary Count	4	4		
Total Count	4	4		

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
Cable Retention	**8**	**0**	**0**	**0**	**0**	**0**

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: HZ-TCT-01
Description: Normal force analyzer
Manufacturer: Mecmesin Multitester
Model: Mecmesin Multitester 2.5-i
Serial #: 08-1049-04
Accuracy: Last Cal: 3/4/2024, Next Cal: 3/3/2025

Equipment #: HZ-TSC-01
Description: Vertical Thermal Shock Chamber
Manufacturer: Cincinnatti Sub Zero
Model: VTS-3-6-6-SC/AC
Serial #: 10-VT14994
Accuracy: See Manual
… Last Cal: 04/16/2024, Next Cal: 04/15/2025

Equipment #: DG-HPT-01
Description: Hipot Safety Tester
Manufacturer: Vitrek
Model: V73
Serial #: 025866
Accuracy:
… Last Cal: 04/16/2024, Next Cal: 04/15/2025

Equipment #: HZ-MO-05
Description: Micro-ohmmeter
Manufacturer: Keithley
Model: 3706
Serial #: 1285188
Accuracy: Last Cal: 12/17/2024, Next Cal: 12/16/2025