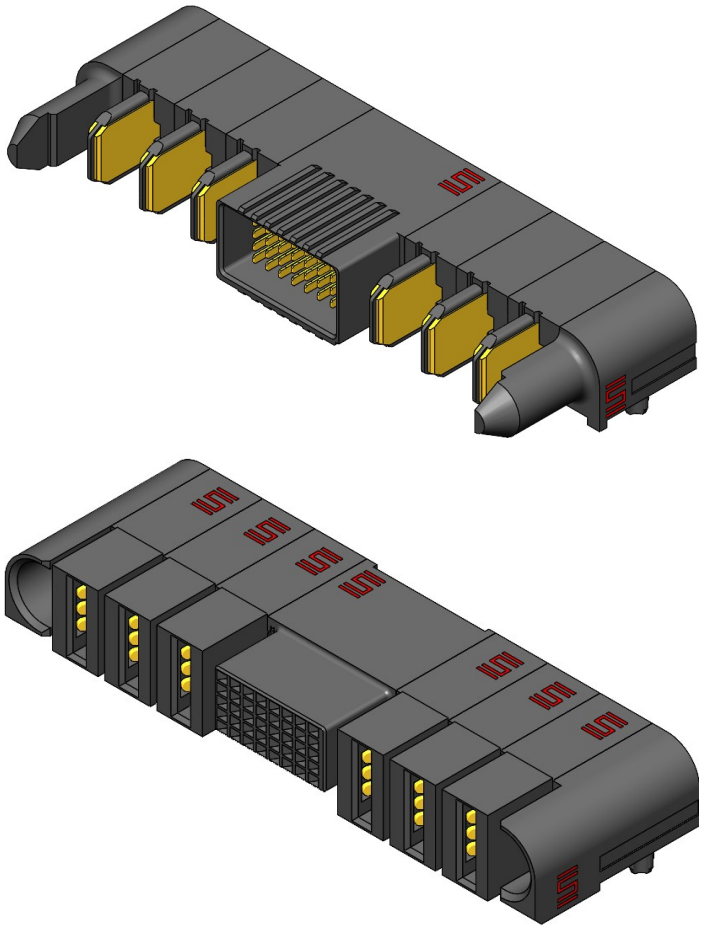
Project: Design Qualification Test Report	Tracking Code: CR-11338901_Report_Rev_1
Requested by: Andy Chen	Date: 11/1/2024
Part #: ET60S-S03-5-08-S03-S-RP-S/ET60T-S03-5-08-S03-S-RP-S-H	
Part description: ET60S/ET60T	Tech: Peter Chen and Kason He
Test Start: 3/27/2024	Test Completed: 7/8/2024



DESIGN QUALIFICATION TEST REPORT

ET60S/ET60T
ET60S-S03-5-08-S03-S-RP-S/ET60T-S03-5-08-S03-S-RP-S-H

REVISION HISTORY

DATA	REV.NUM.	DESCRIPTION	ENG
10/17/2024	**1**	**Initial Issue**	**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 the test plan.

APPLICABLE DOCUMENTS

Standards: EIA Publication 364

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 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 are visually inspected and cleaned if necessary.
7) Any additional preparation will be noted in the individual test sequences.
8) Solder Information: Lead Free
9) Samtec Test PCBs used: PCB-113932-TST/PCB-113935-TST/ PCB-113440-TST/ PCB-113441-TST/ PCB-113442-TST

FLOWCHARTS

Mating/Unmating/Durability

Group 1 ET60T-S03-5-08-S03-S-RP-S-H ET60S-S03-5-08-S03-S-RP-S 8 Assemblies		Group 2 ET60T-S01-5-01-S01-S-RP-S-H ET60S-S01-5-01-S01-S-RP-S 8 Assemblies		Group 3 ET60T-S02-5-05-S02-S-RP-S-H ET60S-S02-5-05-S02-S-RP-S-H 8 Assemblies	
Step	**Description**	**Step**	**Description**	**Step**	**Description**
1.	Contact Gaps	1.	Contact Gaps	1.	Contact Gaps
2.	LLCR (2)	2.	Mating/Unmating Force (3)	2.	Mating/Unmating Force (3)
3.	Mating/Unmating Force (3)	3.	Cycles Quantity = 25 Cycles	3.	Cycles Quantity = 25 Cycles
4.	Cycles Quantity = 25 Cycles	4.	Mating/Unmating Force (3)	4.	Mating/Unmating Force (3)
5.	Mating/Unmating Force (3)	5.	Cycles Quantity = 25 Cycles	5.	Cycles Quantity = 25 Cycles
6.	Cycles Quantity = 25 Cycles	6.	Mating/Unmating Force (3)	6.	Mating/Unmating Force (3)
7.	Mating/Unmating Force (3)	7.	Cycles Quantity = 25 Cycles	7.	Cycles Quantity = 25 Cycles
8.	Cycles Quantity = 25 Cycles	8.	Mating/Unmating Force (3)	8.	Mating/Unmating Force (3)
9.	Mating/Unmating Force (3)	9.	Cycles Quantity = 25 Cycles	9.	Cycles Quantity = 25 Cycles
10.	Cycles Quantity = 25 Cycles	10.	Mating/Unmating Force (3)	10.	Mating/Unmating Force (3)
11.	Mating/Unmating Force (3)				
12.	Contact Gaps				
13.	LLCR (2) Max Delta = 15 mOhm				
14.	Thermal Shock (4)				
15.	LLCR (2) Max Delta = 15 mOhm				
16.	Humidity (1)				
17.	LLCR (2) Max Delta = 15 mOhm				
18.	Mating/Unmating Force (3)				

(1) Humidity = EIA-364-31
Test Condition = B (240 Hours)
Test Method = III (+25°C to +65°C @ 90% RH to 98% RH)
Test Exceptions: ambient pre-condition and delete steps 7a and 7b

(2) LLCR = EIA-364-23
Open Circuit Voltage = 20 mV Max
Test Current = 100 mA Max

(3) Mating/Unmating Force = EIA-364-13

(4) Thermal Shock = EIA-364-32
Exposure Time at Temperature Extremes = 1/2 Hour
Method A, Test Condition = I (-55°C to +85°C)
Test Duration = A-3 (100 Cycles)

FLOWCHARTS Continued

IR/DWV

Split power module single blade

Group 1	Group 2	Group 3	Group 4
ET60T-S03-5-08-S03-S-RP-S-H ET60S-S03-5-08-S03-S-RP-S 2 Assemblies Left Blade To Right Blade	ET60T-S03-5-08-S03-S-RP-S-H 2 Assemblies Left Blade To Right Blade	ET60S-S03-5-08-S03-S-RP-S 2 Assemblies Left Blade To Right Blade	ET60T-S03-5-08-S03-S-RP-S-H ET60S-S03-5-08-S03-S-RP-S 2 Assemblies Left Blade To Right Blade
Step **Description**	**Step** **Description**	**Step** **Description**	**Step** **Description**
1. DWV Breakdown (2)	1. DWV Breakdown (2)	1. DWV Breakdown (2)	1. IR (4) 2. DWV at Test Voltage (1) 3. Thermal Shock (5) 4. IR (4) 5. DWV at Test Voltage (1) 6. Humidity (3) 7. IR (4) 8. DWV at Test Voltage (1)

(1) DWV at Test Voltage = EIA-364-20
Test Condition = 1 (Sea Level)
DWV test voltage is equal to 75% of the lowest breakdown voltage
Test voltage applied for 60 seconds

(2) DWV Breakdown = EIA-364-20
Test Condition = 1 (Sea Level)
DWV test voltage is equal to 75% of the lowest breakdown voltage
Test voltage applied for 60 seconds

(3) Humidity = EIA-364-31
Test Condition = B (240 Hours)
Test Method = III (+25°C to +65°C @ 90% RH to 98% RH)
Test Exceptions: ambient pre-condition and delete steps 7a and 7b

(4) IR = EIA-364-21
Test Condition = 500 Vdc, 2 Minutes Max

(5) Thermal Shock = EIA-364-32
Exposure Time at Temperature Extremes = 1/2 Hour
Method A, Test Condition = I (-55°C to +85°C)
Test Duration = A-3 (100 Cycles)

FLOWCHARTS Continued

Current Carrying Capacity

Group 1
ET60T-S03-5-08-S03-S-RP-S-H
ET60S-S03-5-08-S03-S-RP-S
1 Pins Powered
Power

Step	Description
1.	CCC (1) Rows = 1 Number of Positions = 1

Group 2
ET60T-S03-5-08-S03-S-RP-S-H
ET60S-S03-5-08-S03-S-RP-S
2 Pins Powered
Power

Step	Description
1.	CCC (1) Rows = 1 Number of Positions = 2

Group 3
ET60T-S03-5-08-S03-S-RP-S-H
ET60S-S03-5-08-S03-S-RP-S
3 Pins Powered
Power

Step	Description
1.	CCC (1) Rows = 1 Number of Positions = 3

Group 4
ET60T-S03-5-08-S03-S-RP-S-H
ET60S-S03-5-08-S03-S-RP-S
4 Pins Powered
Power

Step	Description
1.	CCC (1) Rows = 1 Number of Positions = 4

Group 5
ET60T-S03-5-08-S03-S-RP-S-H
ET60S-S03-5-08-S03-S-RP-S
12 Pins Powered
Power

Step	Description
1.	CCC (1) Rows = 1 Number of Positions = 12

(1) CCC = EIA-364-70
Method 2, Temperature Rise Versus Current Curve
(TIN PLATING) - Tabulate calculated current at RT, 65°C, 75°C and 95°C after derating 20% and based on 105°C
(GOLD PLATING) - Tabulate calculated current at RT, 85°C, 95°C and 115°C after derating 20% and based on 125°C

FLOWCHARTS Continued

Mechanical Shock/Random Vibration/LLCR

Group 1
ET60T-S03-5-08-S03-S-RP-S-H
ET60S-S03-5-08-S03-S-RP-S
8 Assemblies

Step	Description
1.	LLCR (1)
2.	Mechanical Shock (2)
3.	Random Vibration (3)
4.	LLCR (1) Max Delta = 15 mOhm

(1) LLCR = EIA-364-23
Open Circuit Voltage = 20 mV Max
Test Current = 100 mA Max

(2) Mechanical Shock = EIA-364-27
Test Condition = C (100 G Peak, 6 milliseconds, Half Sine)
Number of Shocks = 3 Per Direction, Per Axis, 18 Total

(3) Random Vibration = EIA-364-28
Condition = VB (7.56 gRMS Average, 2 Hours/Axis)

Mechanical Shock/Random Vibration/Event Detection

Group 1
ET60T-S03-5-08-S03-S-RP-S-H
ET60S-S03-5-08-S03-S-RP-S
60 Points

Step	Description
1.	Nanosecond Event Detection (Mechanical Shock) (1)
2.	Nanosecond Event Detection (Random Vibration) (2)

(1) Nanosecond Event Detection (Mechanical Shock)
Use EIA-364-87 for Nanosecond Event Detection:
Test Condition = F (50 nanoseconds at 10 ohms)
Use EIA-364-27 for Mechanical Shock:
Test Condition = C (100 G Peak, 6 milliseconds, Half Sine)
Number of Shocks = 3 Per Direction, Per Axis, 18 Total

(2) Nanosecond Event Detection (Random Vibration)
Use EIA-364-87 for Nanosecond Event Detection:
Test Condition = F (50 nanoseconds at 10 ohms)
Use EIA-364-28 for Random Vibration:
Condition = VB (7.56 gRMS Average, 2 Hours/Axis)

ATTRIBUTE DEFINITIONS

The following is a brief, simplified description of attributes.

THERMAL SHOCK:

1) EIA-364-32, *Thermal Shock (Temperature Cycling) Test Procedure for Electrical Connectors.*
2) Test Condition 1: -55°C to +85°C
3) Test Time: ½ hour dwell at each temperature extreme
4) Number of Cycles: 100
5) All test samples are pre-conditioned at ambient.
6) All test samples are exposed to environmental stress in mated conditions.

HUMIDITY:

1) Reference document: EIA-364-31, *Humidity Test Procedure for Electrical Connectors.*
2) Test Condition B, 240 Hours.
3) Method III, +25° C to + 65° C, 90% to 98% Relative Humidity excluding sub-cycles 7a and 7b.
4) All samples are pre-conditioned at ambient.
5) All test samples are exposed to environmental stress in mated conditions.

MECHANICAL SHOCK (Specified Pulse):

1) Reference document: EIA-364-27, *Mechanical Shock Test Procedure for Electrical Connectors*
2) Test Condition C
3) Peak Value: 100 G
4) Duration: 6 Milliseconds
5) Wave Form: Half Sine
6) Velocity: 12.3 ft/s
7) Number of Shocks: 3 Shocks / Direction, 3 Axis (18 Total)

VIBRATION:

1) Reference document: EIA-364-28, *Vibration Test Procedure for Electrical Connectors*
2) Test Condition V, Letter B
3) Power Spectral Density: 0.04 G^2 / Hz
4) G 'RMS': 7.56
5) Frequency: 50 to 2000 Hz
6) Duration: 2.0 Hours per axis (3 axis total)

NANOSECOND-EVENT DETECTION:

1) Reference document: EIA-364-87, *Nanosecond-Event Detection for Electrical Connectors*
2) Prior to test, the samples were characterized to assure the low nanosecond event being monitored will trigger the detector.
3) After characterization it was determined the test samples could be monitored for 50 nanosecond events

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.

ATTRIBUTE DEFINITIONS Continued

The following is a brief, simplified description of attributes

TEMPERATURE RISE (Current Carrying Capacity, CCC):

1) EIA-364-70, *Temperature Rise versus Current Test Procedure for Electrical Connectors and Sockets*.
2) When current passes through a contact, the temperature of the contact increases as a result of I^2R (resistive) heating.
3) The number of contacts being investigated plays a significant part in power dissipation and therefore temperature rises.
4) The size of the temperature probe can affect the measured temperature.
5) Copper traces on PC boards will contribute to temperature rise:
    a. Self heating (resistive)
    b. Reduction in heat sink capacity affecting the heated contacts
6) A de-rating curve, usually 20%, is calculated.
7) Calculated de-rated currents at three temperature points are reported:
    a. Ambient
    b. 65^o C
    c. 75^o C
    d. 95^o C
8) Typically, neighboring contacts (in close proximity to maximize heat build up) are energized.
9) The thermocouple (or temperature measuring probe) will be positioned at a location to sense the maximum temperature in the vicinity of the heat generation area.
10) A computer program, *TR 803.exe*, ensures accurate stability for data acquisition.
11) Hook-up wire cross section is larger than the cross section of any connector leads/PC board traces, jumpers, etc.
12) Hook-up wire length is longer than the minimum specified in the referencing standard.

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 +2000 mOhms: ----------Unstable
    f. >+2000 mOhms:----------Open Failure
4) The following guidelines are used to categorize the changes in LLCR for power pin only
    a. <= +1.0 mOhms: ----------Stable
    b. +1.1 to +2.0 mOhms: ----------Minor
    c. +2.1 to +5.0 mOhms: ----------Acceptable
    d. +5.1 to +15.0 mOhms:----------Marginal
    e. +15.1 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).

RESULTS

Temperature Rise, CCC at a 20% de-rating

Power pin

- **CCC for a 30°C Temperature Rise----------59.3 A per contact with 1 power contacts (1x1) powered**
- **CCC for a 30°C Temperature Rise----------44.6 A per contact with 2 power contacts (1x2) powered**
- **CCC for a 30°C Temperature Rise----------39.7 A per contact with 3 power contacts (1x3) powered**
- **CCC for a 30°C Temperature Rise----------37.2 A per contact with 4 power contacts (1x4) powered**
- **CCC for a 30°C Temperature Rise----------28.0 A per contact with 12 power contacts (1x12) powered**

Mating/Unmating Forces:

Mating/Unmating Durability Group

- **Initial**
  - **Mating**
    - **Min ---------- 7.40 Lbs**
    - **Max---------- 8.06 Lbs**
  - **Unmating**
    - **Min ---------- 6.27 Lbs**
    - **Max---------- 6.65 Lbs**
- **After 25 Cycles**
  - **Mating**
    - **Min ---------- 6.56 Lbs**
    - **Max---------- 7.44 Lbs**
  - **Unmating**
    - **Min ---------- 5.71 Lbs**
    - **Max---------- 6.43 Lbs**
- **After 50 Cycles**
  - **Mating**
    - **Min ---------- 6.43 Lbs**
    - **Max---------- 7.12 Lbs**
  - **Unmating**
    - **Min ---------- 5.48 Lbs**
    - **Max---------- 6.47 Lbs**
- **After 75 Cycles**
  - **Mating**
    - **Min ---------- 6.28 Lbs**
    - **Max---------- 6.95 Lbs**
  - **Unmating**
    - **Min ---------- 5.38 Lbs**
    - **Max---------- 6.26 Lbs**
- **After 100 Cycles**
  - **Mating**
    - **Min ---------- 6.23 Lbs**
    - **Max---------- 6.81 Lbs**
  - **Unmating**
    - **Min ---------- 5.31 Lbs**
    - **Max---------- 6.12 Lbs**
- **After Humidity**
  - **Mating**
    - **Min ---------- 4.14 Lbs**
    - **Max---------- 5.06 Lbs**
  - **Unmating**
    - **Min ---------- 3.80 Lbs**
    - **Max---------- 4.55 Lbs**

RESULTS Continued

Mating/Unmating Basic Group (ET60S-S01-5-01-S01-S-RP-S/ET60T-S01-5-01-S01-S-RP-S-H)

- **Initial**
  - **Mating**
    - **Min ---------- 2.36 Lbs**
    - **Max---------- 2.59 Lbs**
  - **Unmating**
    - **Min ---------- 1.98 Lbs**
    - **Max---------- 2.15 Lbs**
- **After 25 Cycles**
  - **Mating**
    - **Min ---------- 2.30 Lbs**
    - **Max---------- 2.42 Lbs**
  - **Unmating**
    - **Min ---------- 1.66 Lbs**
    - **Max---------- 1.92 Lbs**
- **After 50 Cycles**
  - **Mating**
    - **Min ---------- 2.18 Lbs**
    - **Max---------- 2.43 Lbs**
  - **Unmating**
    - **Min ---------- 1.62 Lbs**
    - **Max---------- 1.83 Lbs**
- **After 75 Cycles**
  - **Mating**
    - **Min ---------- 2.12 Lbs**
    - **Max---------- 2.29 Lbs**
  - **Unmating**
    - **Min ---------- 1.56 Lbs**
    - **Max---------- 1.84 Lbs**
- **After 100 Cycles**
  - **Mating**
    - **Min ---------- 2.07 Lbs**
    - **Max---------- 2.36 Lbs**
  - **Unmating**
    - **Min ---------- 1.53 Lbs**
    - **Max---------- 1.83 Lbs**

RESULTS Continued

Mating/Unmating Basic Group (ET60S-S02-5-05-S02-S-RP-S-H/ET60T-S02-5-05-S02-S-RP-S-H)

- **Initial**
  - **Mating**
    - **Min ---------- 5.14 Lbs**
    - **Max---------- 5.82 Lbs**
  - **Unmating**
    - **Min ---------- 4.26 Lbs**
    - **Max---------- 4.97 Lbs**
- **After 25 Cycles**
  - **Mating**
    - **Min ---------- 4.34 Lbs**
    - **Max---------- 4.92 Lbs**
  - **Unmating**
    - **Min ---------- 3.64 Lbs**
    - **Max---------- 4.55 Lbs**
- **After 50 Cycles**
  - **Mating**
    - **Min ---------- 4.21 Lbs**
    - **Max---------- 4.81 Lbs**
  - **Unmating**
    - **Min ---------- 3.58 Lbs**
    - **Max---------- 4.25 Lbs**
- **After 75 Cycles**
  - **Mating**
    - **Min ---------- 4.10 Lbs**
    - **Max---------- 4.79 Lbs**
  - **Unmating**
    - **Min ---------- 3.53 Lbs**
    - **Max---------- 4.19 Lbs**
- **After 100 Cycles**
  - **Mating**
    - **Min ---------- 4.06 Lbs**
    - **Max---------- 4.71 Lbs**
  - **Unmating**
    - **Min ---------- 3.49 Lbs**
    - **Max---------- 4.14 Lbs**

RESULTS Continued

Insulation Resistance minimums, IR

Split power module single blade

- **Initial**
  - **Mated ---------- 45000Meg Ω ---------- Passed**
  - **Unmated ---------- 45000Meg Ω ---------- Passed**
- **Thermal**
  - **Mated ---------- 45000Meg Ω ---------- Passed**
  - **Unmated ---------- 45000Meg Ω ---------- Passed**
- **Humidity**
  - **Mated ---------- 45000Meg Ω ---------- Passed**
  - **Unmated ---------- 45000Meg Ω ---------- Passed**

Dielectric Withstanding Voltage minimums, DWV

- **Minimums**
  - **Breakdown Voltage ---------- 1854 VAC**
  - **Test Voltage ---------- 1391 VAC**
  - **Working Voltage ---------- 464 VAC**

Split power module single blade

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

RESULTS Continued

LLCR Durability (176 signal and 16 power LLCR test points)

Signal pin

- **Initial ---------- 38.95 mOhms Max**
- **Durability, 100 Cycles**
  - **<= +5.0 mOhms ---------- 176 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**
- **Thermal**
  - **<= +5.0 mOhms ---------- 176 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**
- **Humidity**
  - **<= +5.0 mOhms ---------- 175 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ----------1 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**

Power pin

- **Initial ----------0.31 mOhms Max**
- **Durability, 100 Cycles**
  - **<= +1.0 mOhms ----------16 Points ---------- Stable**
  - **+1.1 to +2.0 mOhms ----------0 Points ---------- Minor**
  - **+2.1 to +5.0 mOhms ----------0 Points ---------- Acceptable**
  - **+5.1 to +15.0 mOhms ----------0 Points ---------- Marginal**
  - **+15.1 to +1000 mOhms----------0 Points ---------- Unstable**
  - **>+1000 mOhms----------0 Points ---------- Open Failure**
- **Thermal**
  - **<= +1.0 mOhms ----------16 Points ---------- Stable**
  - **+1.1 to +2.0 mOhms ----------0 Points ---------- Minor**
  - **+2.1 to +5.0 mOhms ----------0 Points ---------- Acceptable**
  - **+5.1 to +15.0 mOhms ----------0 Points ---------- Marginal**
  - **+15.1 to +1000 mOhms----------0 Points ---------- Unstable**
  - **>+1000 mOhms----------0 Points ---------- Open Failure**
- **Humidity**
  - **<= +1.0 mOhms ----------16 Points ---------- Stable**
  - **+1.1 to +2.0 mOhms ----------0 Points ---------- Minor**
  - **+2.1 to +5.0 mOhms ----------0 Points ---------- Acceptable**
  - **+5.1 to +15.0 mOhms ----------0 Points ---------- Marginal**
  - **+15.1 to +1000 mOhms----------0 Points ---------- Unstable**
  - **>+1000 mOhms----------0 Points ---------- Open Failure**

RESULTS Continued

LLCR Shock & Vibration (176 signal and 16 power LLCR test points)

Signal pin

- **Initial ---------- 39.80 mOhms Max**
- **Shock &Vibration**
  - **<= +5.0 mOhms ---------- 174 Points ---------- Stable**
  - **+5.1 to +10.0 mOhms ---------- 2 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**

Power pin

- **Initial ---------- 0.30 mOhms Max**
- **Shock &Vibration**
  - **<= +1.0 mOhms ---------- 16 Points ---------- Stable**
  - **+1.1 to +2.0 mOhms ---------- 0 Points ---------- Minor**
  - **+2.1 to +5.0 mOhms ---------- 0 Points ---------- Acceptable**
  - **+5.1 to +15.0 mOhms ---------- 0 Points ---------- Marginal**
  - **+15.1 to +1000 mOhms ---------- 0 Points ---------- Unstable**
  - **>+1000 mOhms ---------- 0 Points ---------- Open Failure**

Mechanical Shock & Random Vibration:

- **Shock**
  - **No Damage ---------- ---------- Pass**
  - **50 Nanoseconds ---------- ---------- Pass**
- **Vibration**
  - **No Damage ---------- ---------- Pass**
  - **50 Nanoseconds ---------- ---------- Pass**

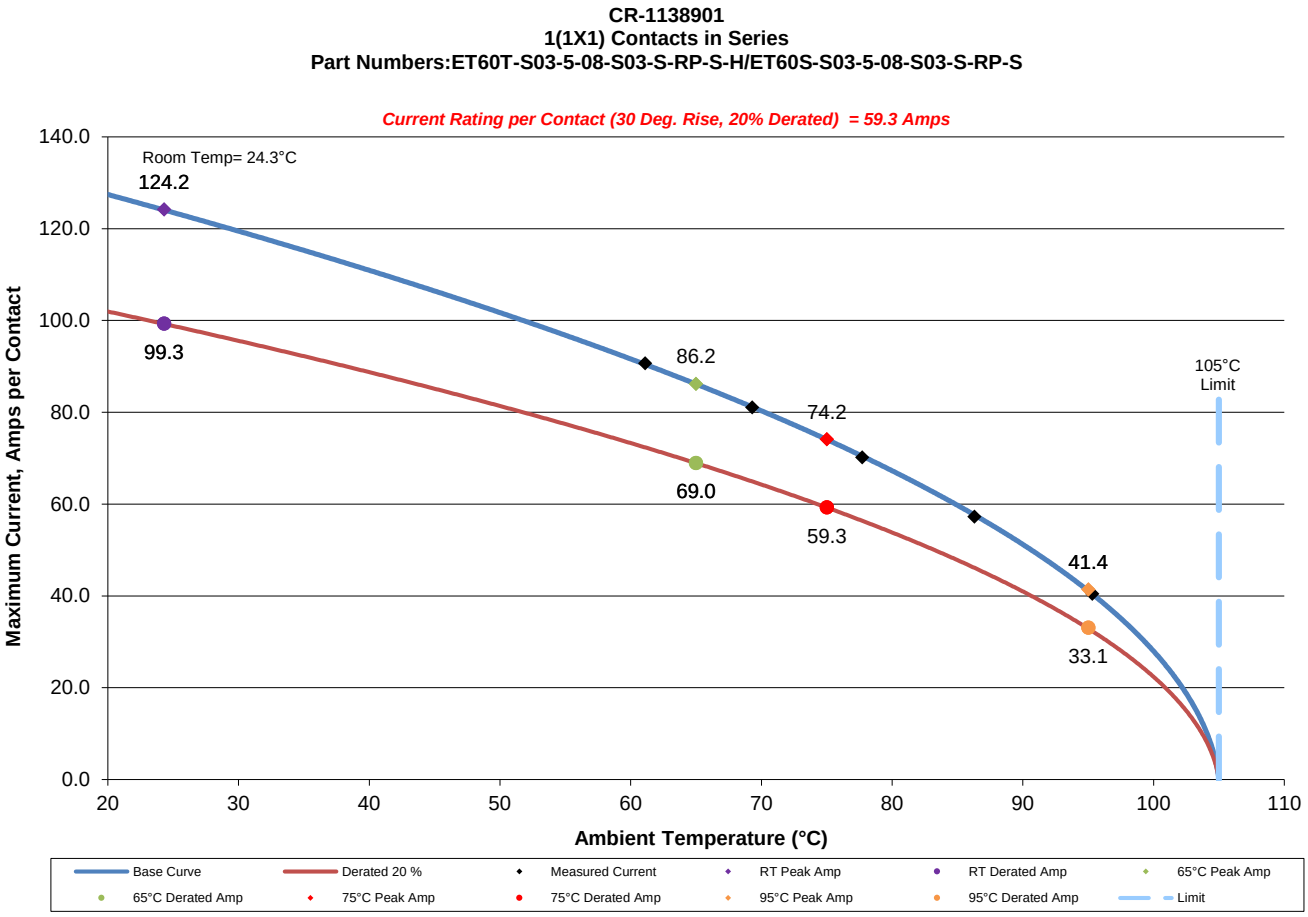
DATA SUMMARIES

TEMPERATURE RISE (Current Carrying Capacity, CCC):

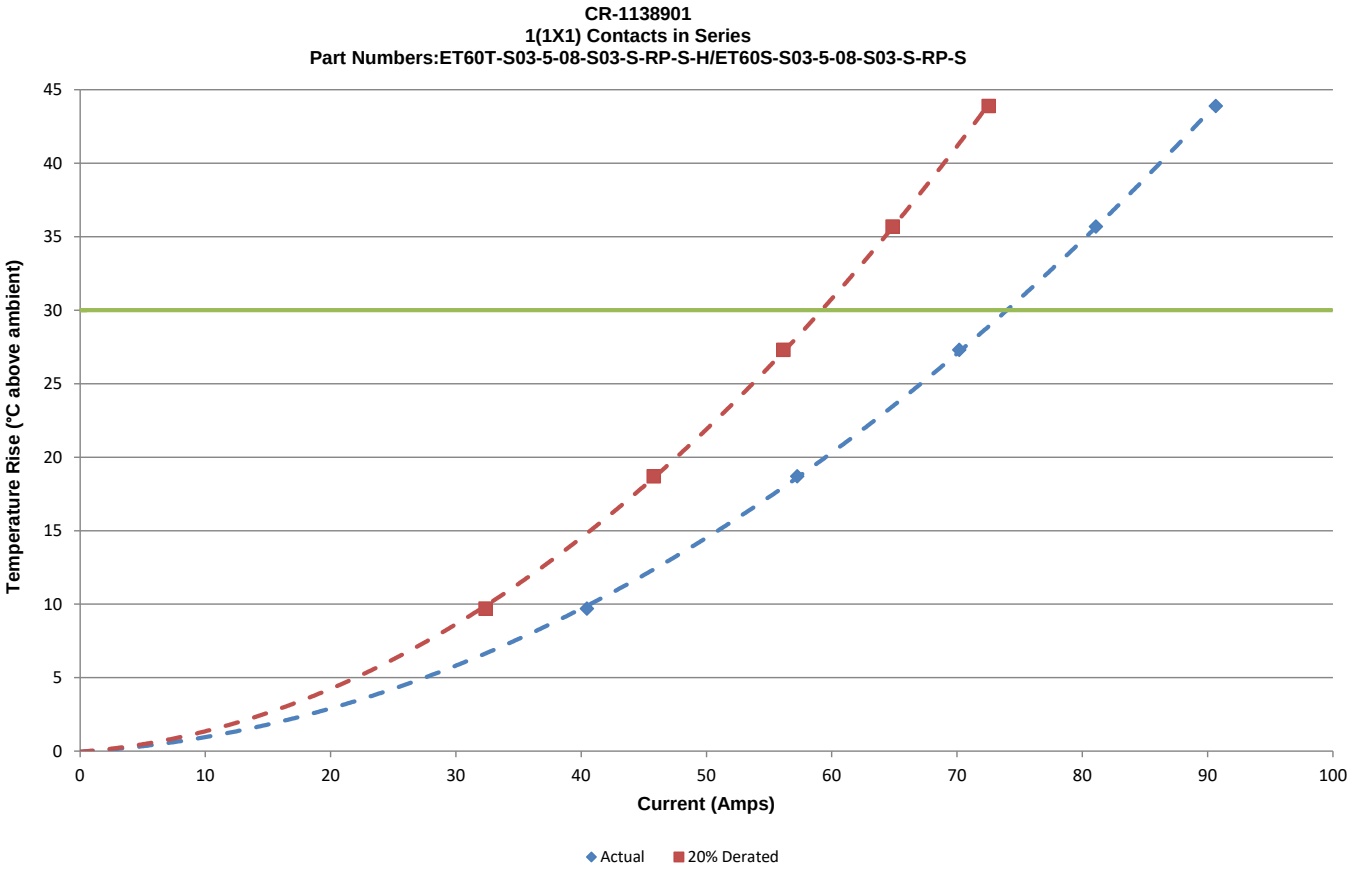
1) High quality thermocouples whose temperature slopes track one another were used for temperature monitoring.
2) The thermocouples were placed at a location to sense the maximum temperature generated during testing.
3) Temperature readings recorded are those for which three successive readings, 15 minutes apart, differ less than 1° C (computer-controlled data acquisition).
4) Adjacent contacts were powered:

Power Pins

a. Linear configuration with 1 adjacent signal conductors/contacts powered

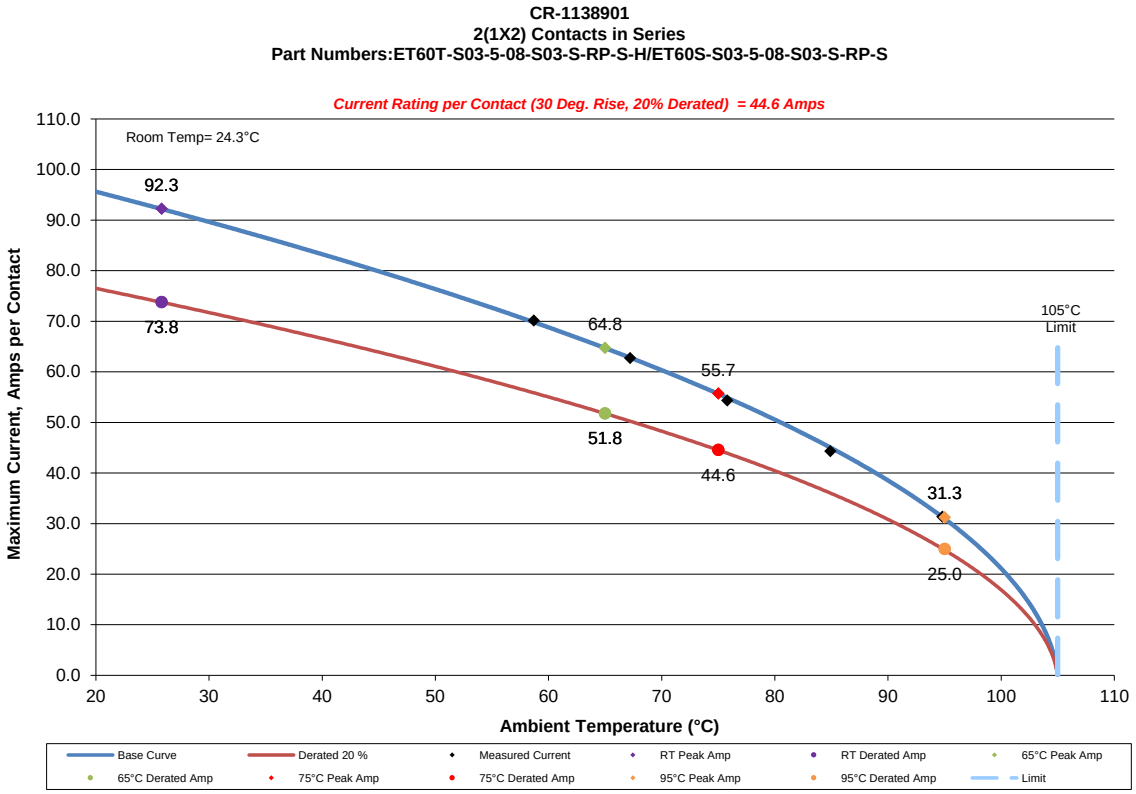


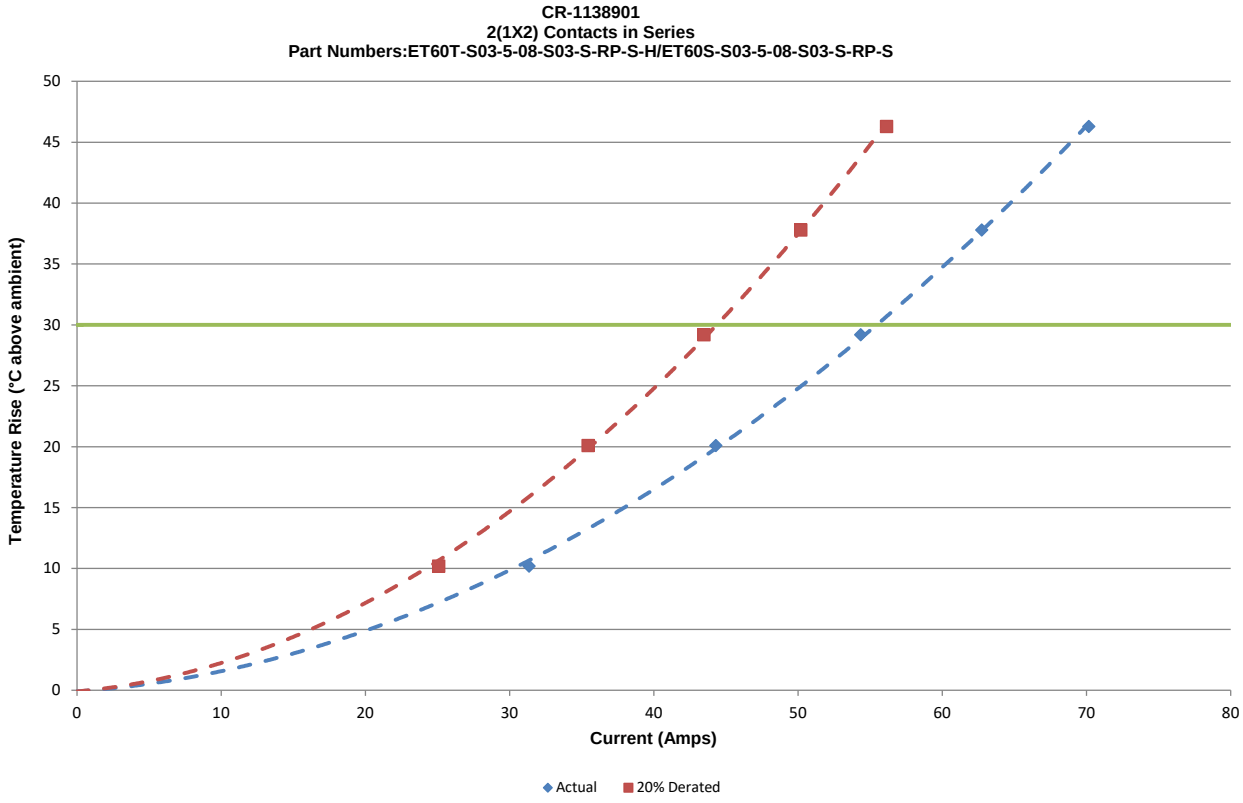
DATA SUMMARIES Continued



DATA SUMMARIES Continued

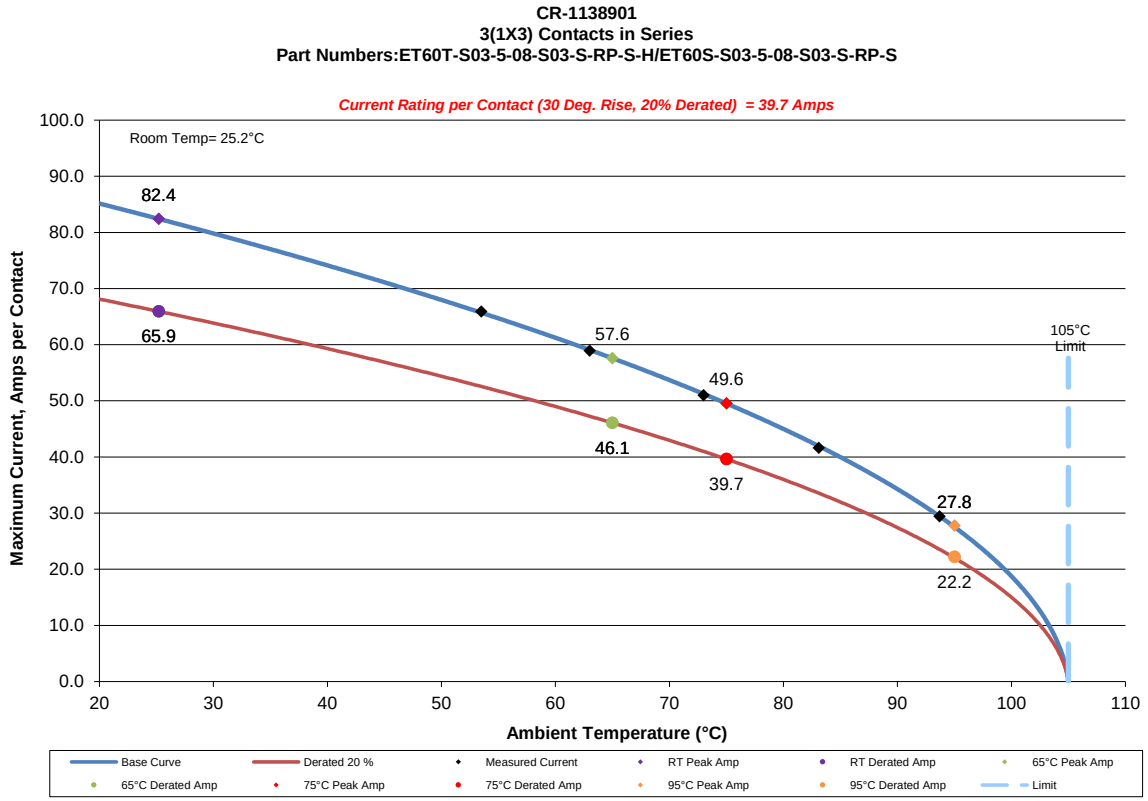
b. Linear configuration with 2 adjacent signal conductors/contacts powered

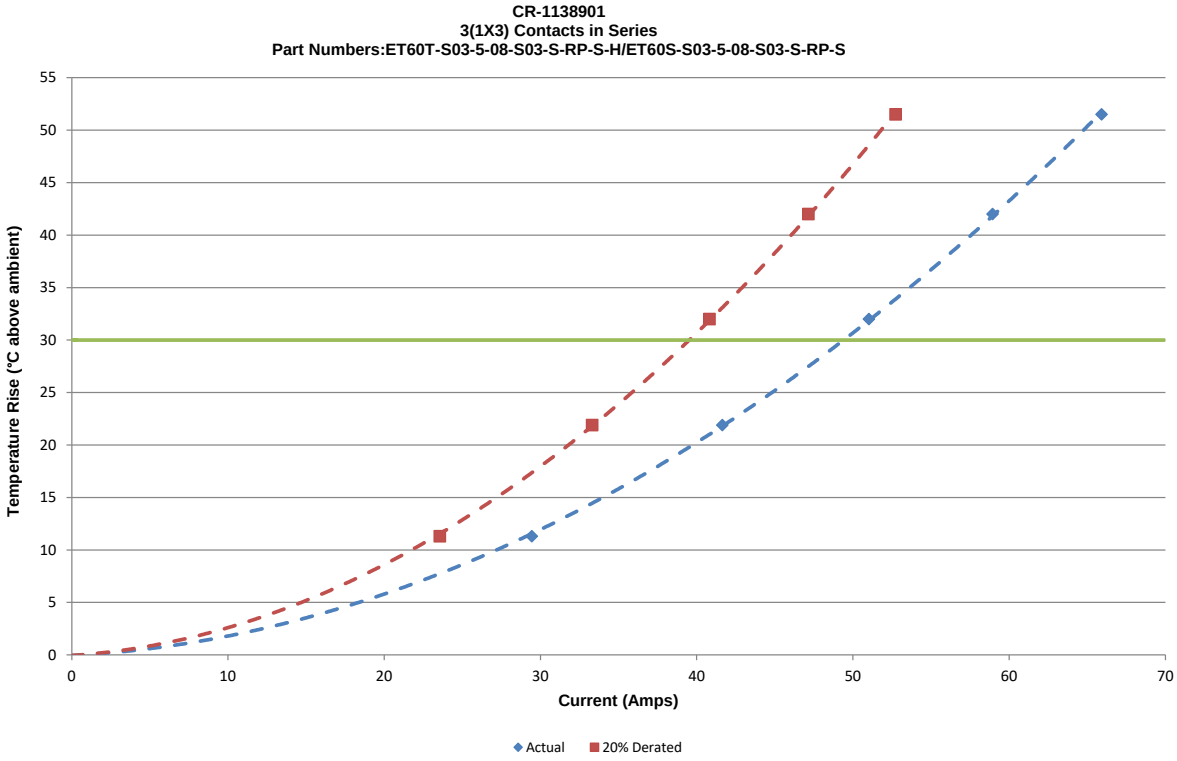




DATA SUMMARIES Continued

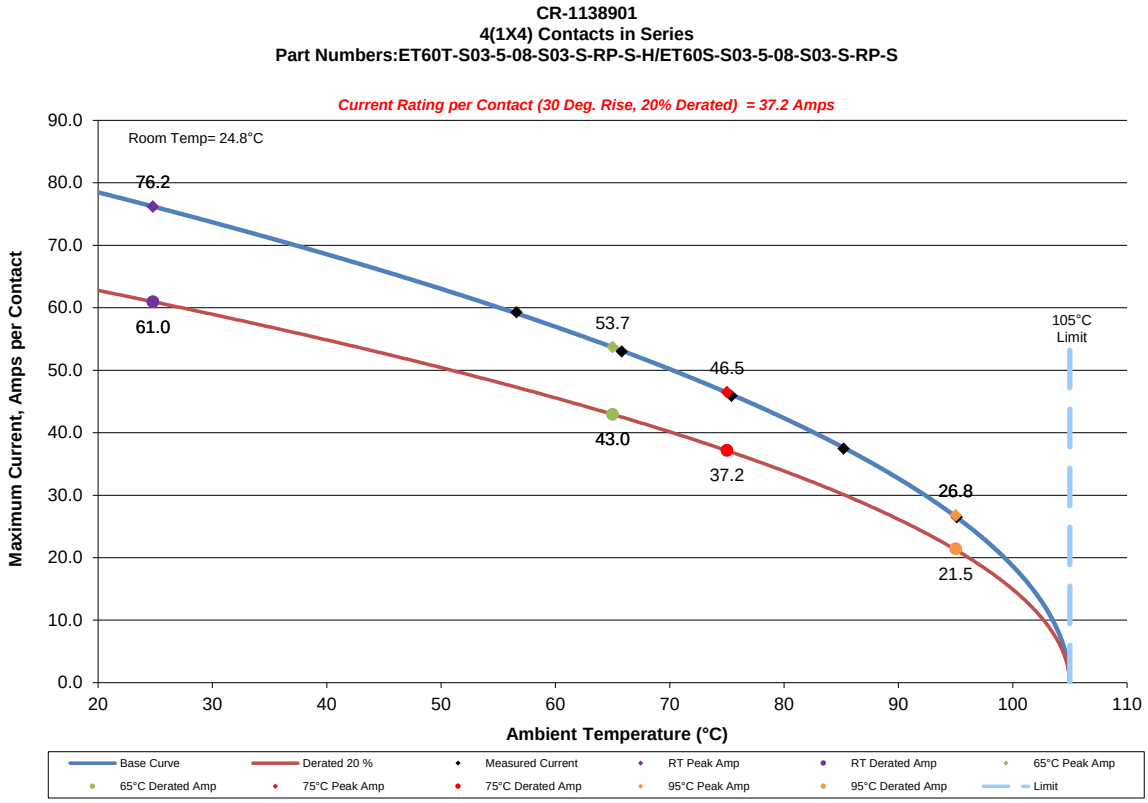
c. Linear configuration with 3 adjacent signal conductors/contacts powered

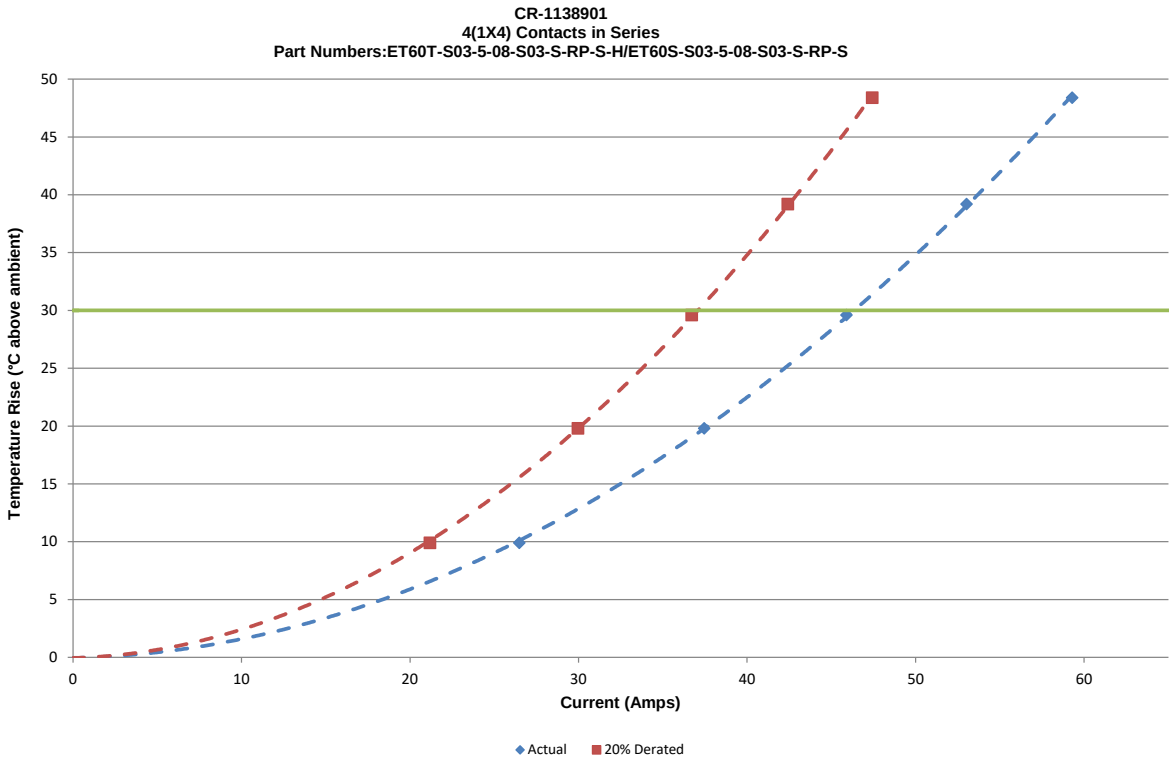




DATA SUMMARIES Continued

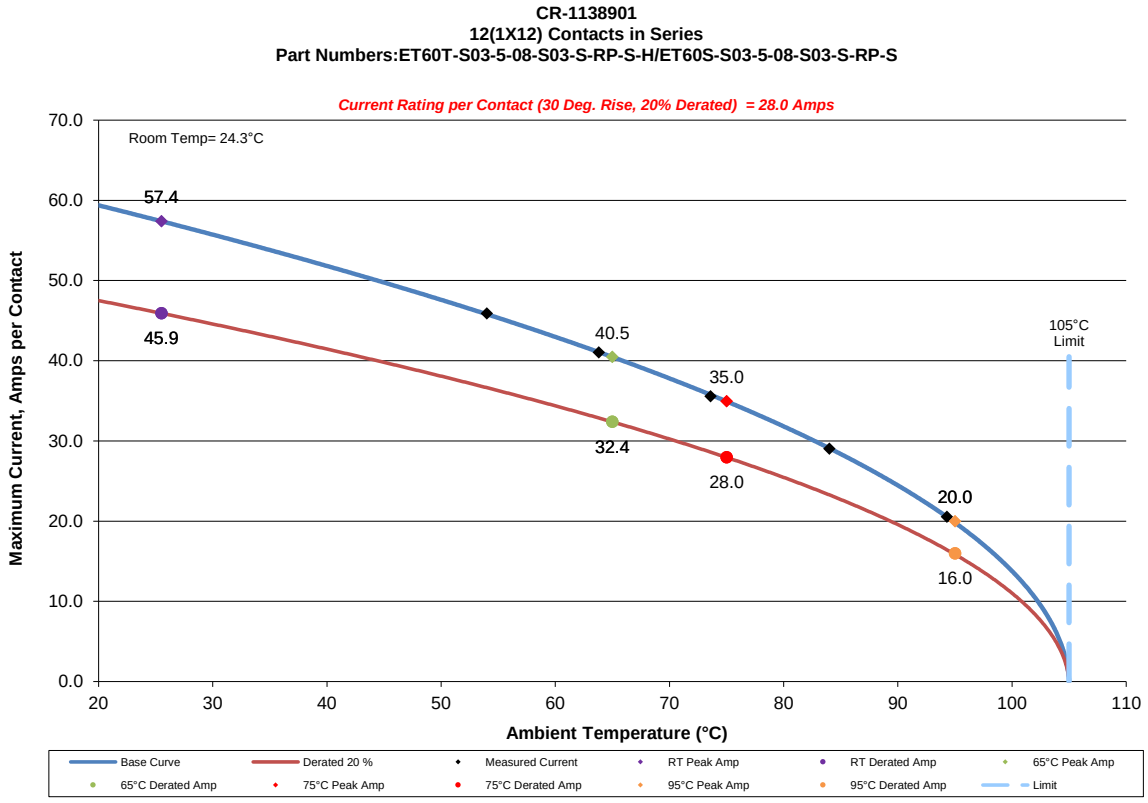
d. Linear configuration with 4 adjacent Signal conductors/contacts powered

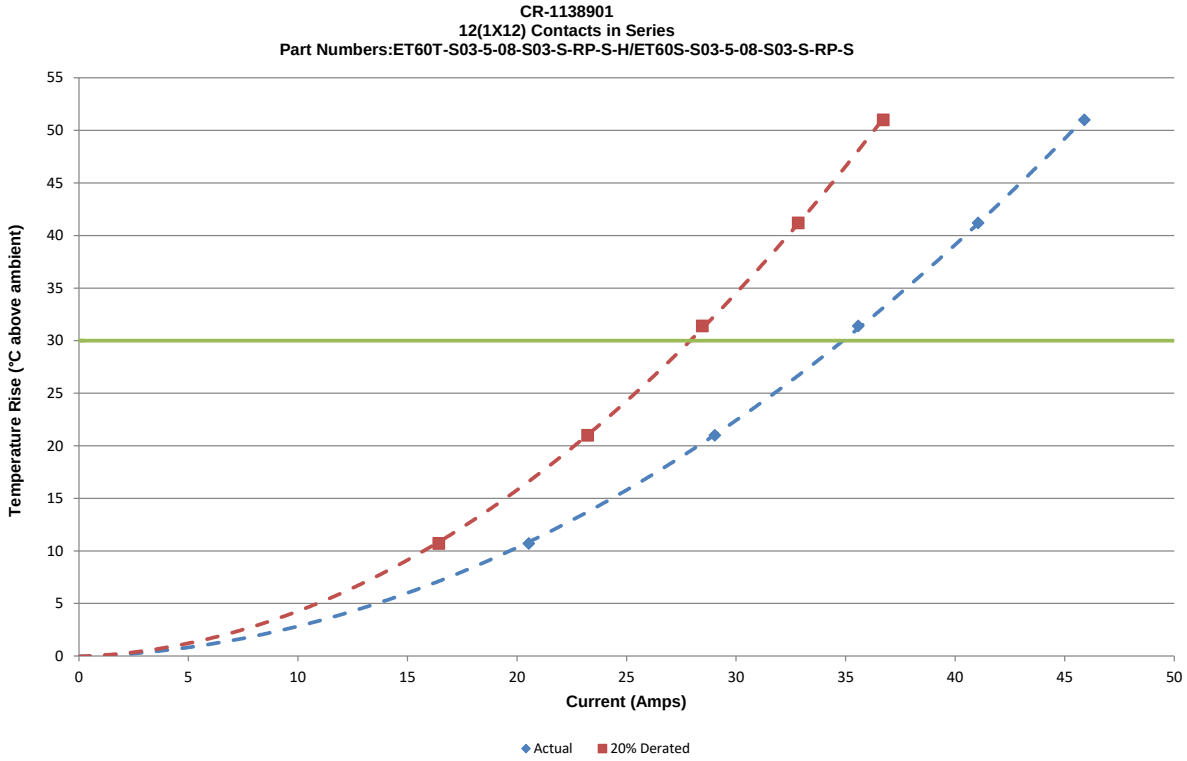




DATA SUMMARIES Continued

e. Linear configuration with all adjacent signal conductors/contacts powered





DATA SUMMARIES Continued

Mating\Unmating Force:

Mating\Unmating Durability Group

	Initial				After 25 Cycles			
	Mating		**Unmating**		**Mating**		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	32.92	7.40	27.89	6.27	29.18	6.56	25.40	5.71
Maximum	35.85	8.06	29.58	6.65	33.09	7.44	28.60	6.43
Average	34.49	**7.75**	28.72	**6.46**	31.02	**6.98**	27.03	**6.08**
St Dev	1.12	0.25	0.69	0.16	1.40	0.31	1.16	0.26
Count	8	8	8	8	8	8	8	8

	After 50 Cycles				After 75 Cycles			
	Mating		**Unmating**		**Mating**		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	28.60	6.43	24.38	5.48	27.93	6.28	23.93	5.38
Maximum	31.67	7.12	28.78	6.47	30.91	6.95	27.84	6.26
Average	30.09	**6.76**	26.34	**5.92**	29.49	**6.63**	25.55	**5.74**
St Dev	1.20	0.27	1.54	0.35	1.15	0.26	1.40	0.32
Count	8	8	8	8	8	8	8	8

	After 100 Cycles				After Humidity			
	Mating		**Unmating**		**Mating**		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	27.71	6.23	23.62	5.31	18.41	4.14	16.90	3.80
Maximum	30.29	6.81	27.22	6.12	22.51	5.06	20.24	4.55
Average	29.04	**6.53**	25.17	**5.66**	20.67	**4.65**	18.85	**4.24**
St Dev	1.02	0.23	1.31	0.30	1.39	0.31	1.09	0.24
Count	8	8	8	8	8	8	8	8

DATA SUMMARIES Continued

Mating\Unmating Basic (ET60S-S01-5-01-S01-S-RP-S/ET60T-S01-5-01-S01-S-RP-S-H):

	Initial				After 25 Cycles			
	Mating		**Unmating**		**Mating**		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	10.50	2.36	8.81	1.98	10.23	2.30	7.38	1.66
Maximum	11.52	2.59	9.56	2.15	10.76	2.42	8.54	1.92
Average	11.20	**2.52**	9.13	**2.05**	10.44	**2.35**	8.08	**1.82**
St Dev	0.34	0.08	0.28	0.06	0.21	0.05	0.39	0.09
Count	8	8	8	8	8	8	8	8

	After 50 Cycles				After 75 Cycles			
	Mating		**Unmating**		**Mating**		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	9.70	2.18	7.21	1.62	9.43	2.12	6.94	1.56
Maximum	10.81	2.43	8.14	1.83	10.19	2.29	8.18	1.84
Average	10.06	**2.26**	7.80	**1.75**	9.74	**2.19**	7.61	**1.71**
St Dev	0.37	0.08	0.37	0.08	0.29	0.06	0.43	0.10
Count	8	8	8	8	8	8	8	8

	After 100 Cycles			
	Mating		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	9.21	2.07	6.81	1.53
Maximum	10.50	2.36	8.14	1.83
Average	9.62	**2.16**	7.49	**1.69**
St Dev	0.42	0.09	0.44	0.10
Count	8	8	8	8

DATA SUMMARIES Continued

Mating\Unmating Basic (ET60S-S02-5-05-S02-S-RP-S-H/ET60T-S02-5-05-S02-S-RP-S-H):

	Initial				After 25 Cycles			
	Mating		**Unmating**		**Mating**		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	22.86	5.14	18.95	4.26	19.30	4.34	16.19	3.64
Maximum	25.89	5.82	22.11	4.97	21.88	4.92	20.24	4.55
Average	24.48	**5.50**	20.78	**4.67**	20.87	**4.69**	18.11	**4.07**
St Dev	0.96	0.22	1.04	0.23	0.93	0.21	1.41	0.32
Count	8	8	8	8	8	8	8	8

	After 50 Cycles				After 75 Cycles			
	Mating		**Unmating**		**Mating**		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	18.73	4.21	15.92	3.58	18.24	4.10	15.70	3.53
Maximum	21.39	4.81	18.90	4.25	21.31	4.79	18.64	4.19
Average	20.13	**4.53**	17.48	**3.93**	19.73	**4.44**	17.19	**3.86**
St Dev	0.76	0.17	1.13	0.25	0.88	0.20	1.08	0.24
Count	8	8	8	8	8	8	8	8

	After 100 Cycles			
	Mating		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	18.06	4.06	15.52	3.49
Maximum	20.95	4.71	18.41	4.14
Average	19.39	**4.36**	16.95	**3.81**
St Dev	0.87	0.20	1.01	0.23
Count	8	8	8	8

DATA SUMMARIES Continued

INSULATION RESISTANCE (IR):

	Split power module single blade		
	Mated	Unmated	Unmated
Minimum	**ET60T/ET60S**	**ET60T**	**ET60S**
Initial	45000	45000	45000
Thermal	45000	45000	45000
Humidity	45000	45000	45000

DIELECTRIC WITHSTANDING VOLTAGE (DWV):

Voltage Rating Summary	
Minimum	**ET60T/ET60S**
Break Down Voltage	1854
Test Voltage	1391
Working Voltage	464

Split power module single blade	
Initial Test Voltage	Passed
After Thermal Test Voltage	Passed
After Humidity Test Voltage	Passed

DATA SUMMARIES Continued

LLCR Durability:

1) A total of 176 signal points and 16 power 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
5) The following guidelines are used to categorize the changes in LLCR for power pin only
   a. <= +1.0 mOhms:----------Stable
   b. +1.1 to +2.0 mOhms: ----------Minor
   c. +2.1 to +5.0 mOhms: ----------Acceptable
   d. +5.1 to +15.0 mOhms:----------Marginal
   e. +15.1 to +1000 mOhms ----------Unstable
   f. >+1000 mOhms:----------Open Failure

LLCR Measurement Summaries by Pin Type				
Date	2024/3/27	2024/4/2	2024/4/10	2024/5/10
Room Temp (Deg C)	22	22	22	22
Rel Humidity (%)	52	52	52	52
Technician	Kason He	Kason He	Kason He	Kason He
mOhm values	Actual **Initial**	**Delta 100 Cycles**	**Delta Therm Shck**	**Delta Humidity**
Pin Type: Signal 1				
Average	28.69	1.14	1.47	1.34
St. Dev.	7.77	0.74	0.92	0.95
Min	15.2	0.02	0.03	0
Max	38.95	4.57	4.44	5.61
Summary Count	176	176	176	176
Total Count	176	176	176	176
Pin Type: Power 1				
Average	0.28	0.01	0.02	0.05
St. Dev.	0.02	0.01	0.02	0.04
Min	0.25	0	0	0.01
Max	0.31	0.03	0.08	0.11
Summary Count	16	16	16	16
Total Count	16	16	16	16

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
100 Cycles	**192**	**0**	**0**	**0**	**0**	**0**
Therm Shck	**192**	**0**	**0**	**0**	**0**	**0**
Humidity	**191**	**1**	**0**	**0**	**0**	**0**

DATA SUMMARIES Continued

LLCR Shock &Vibration:

1). A total of 176 signal points and 16 power points were measured.
2). EIA-364-23, *Low Level Contact Resistance Test Procedure for Electrical Connectors and Sockets.*
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
4). The following guidelines are used to categorize the changes in LLCR for power pin only
   g. <= +1.0 mOhms: ----------Stable
   h. +1.1 to +2.0 mOhms: ----------Minor
   i. +2.1 to +5.0 mOhms: ----------Acceptable
   j. +5.1 to +15.0 mOhms: ----------Marginal
   k. +15.1 to +1000 mOhms ----------Unstable
   l. >+1000 mOhms: ----------Open Failure

	LLCR Measurement Summaries by Pin Type	
Date	2024/6/26	2024/7/8
Room Temp (Deg C)	22	22
Rel Humidity (%)	58	57
Technician	AR (Contech technician)	BPM (Contech technician)
mOhm values	**Actual Initial**	**Delta Shock & Vibe**
	Pin Type 1: Signal	
Average	28.9	0.9
St. Dev.	7.6	1.0
Min	14.8	0.0
Max	39.8	7.8
Summary Count	176	176
Total Count	176	176
	Pin Type 2: Ground	
Average	0.2	0.0
St. Dev.	0.0	0.0
Min	0.2	0.0
Max	0.3	0.1
Summary Count	16	16
Total Count	16	16

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
Shock & Vibe	**190**	**2**	**0**	**0**	**0**	**0**

DATA SUMMARIES Continued

Nanosecond Event Detection:

Shock and Vibration Event Detection Summary	
Contacts tested	60
Test Condition	C, 100g's, 6ms, Half-Sine
Shock Events	0
Test Condition	V-B, 7.56 rms g
Vibration Events	0
Total Events	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: 4/26/2024, Next Cal: 4/27/2025

Equipment #: HZ-THC-01
Description: Humidity transmitter
Manufacturer: Thermtron
Model: HMM30C
Serial #: D0240037
Accuracy: Last Cal: 3/1/2024, Next Cal: 2/28/2025

Equipment #: HZ-MO-05
Description: Micro-ohmmeter
Manufacturer: Keithley
Model: 3706
Serial #: 1285188
Accuracy: Last Cal: 11/15/2023, Next Cal: 11/14/2024

Equipment #: HZ-TSC-01
Description: Vertical Thermal Shock Chamber
Manufacturer: Cincinnatti Sub Zero
Model: VTS-3-6-6-SC/AC
Serial #: 10-VT14994
Accuracy: Last Cal: 06/28/2024, Next Cal: 06/27/2025

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 #: MO-04
Description: Multimeter /Data Acquisition System
Manufacturer: Keithley
Model: 2700
Serial #: 0798688
Accuracy: See Manual
… Last Cal: 09/11/2023, Next Cal: 09/11/2024

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: SVC-01
Description: Shock & Vibration Table
Manufacturer: Data Physics
Model: LE-DSA-10-20K
Serial #: 10037
Accuracy: See Manual
… Last Cal: 11/30/2023, Next Cal: 11/30/2024

Equipment #: ACLM-01
Description: Accelerometer
Manufacturer: PCB Piezotronics
Model: 352C03
Serial #: 115819
Accuracy: See Manual
… Last Cal: 07/09/2024, Next Cal: 07/09/2025

Equipment #: ED-03
Description: Event Detector
Manufacturer: Analysis Tech
Model: 32EHD
Serial #: 1100604
Accuracy: See Manual
… Last Cal: 06/04/2024, Next Cal: 06/04/2025