Project Number: Design Qualification Test Report	Tracking Code: 1691133_Report_Rev_1
Requested by: Jonathan Ochsner	Date: 12/19/2019
Part #: NVAF-DP-04-2-05.0-S-2/NVAM-DP-04-2-02.0-S-2	
Part description: NVAF/NVAM	Tech: Tony Wagoner
Test Start: 9/17/2018	Test Completed: 10/5/2018

DESIGN QUALIFICATION TEST REPORT

NVAF/NVAM
NVAF-DP-04-2-05.0-S-2/NVAM-DP-04-2-02.0-S-2

REVISION HISTORY

DATA	REV.NUM.	DESCRIPTION	ENG
11/13/2018	**1**	**Initial Issue**	**KH**
12/19/2019	**2**	**Update the NF test data**	**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: 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-108592-TST/PCB-108593-TST

FLOWCHARTS

Gas Tight

Group 1
NVAF-DP-04-2-05.0-S-2
NVAM-DP-04-2-02.0-S-2
8 Assemblies

Step	Description
1.	LLCR (2)
2.	Gas Tight (1)
3.	LLCR (2) Max Delta = 15 mOhm

(1) Gas Tight = EIA-364-36

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

FLOWCHARTS Continued

Normal Force

Group 1
NVAF-DP-04-2-05.0-S-2
NVAM-DP-04-2-02.0-S-2
8 Contacts Minimum
NVAF Signal Without Thermals

Step	Description
1.	Contact Gaps
2.	Normal Force (1) Deflection = 0.0145 " Expected Force at Max Deflection = 97 g

Group 2
NVAF-DP-04-2-05.0-S-2
NVAM-DP-04-2-02.0-S-2
8 Contacts Minimum
NVAF MFBL Ground Beam Without Thermals

Step	Description
1.	Contact Gaps
2.	Normal Force (1) Deflection = 0.018 " Expected Force at Max Deflection = 49 g

Group 3
NVAF-DP-04-2-05.0-S-2
NVAM-DP-04-2-02.0-S-2
8 Contacts Minimum
NVAF Flanking Ground Beam Without Thermals

Step	Description
1.	Contact Gaps
2.	Normal Force (1) Deflection = 0.013 " Expected Force at Max Deflection = 83 g

Group 4
NVAF-DP-04-2-05.0-S-2
NVAM-DP-04-2-02.0-S-2
8 Contacts Minimum
NVAF Center Ground Beam Without Thermals

Step	Description
1.	Contact Gaps
2.	Normal Force (1) Deflection = 0.011 " Expected Force at Max Deflection = 101 g

Group 5
NVAF-DP-04-2-05.0-S-2
NVAM-DP-04-2-02.0-S-2
8 Contacts Minimum
NVAF Signal With Thermals

Step	Description
1.	Contact Gaps
2.	Thermal Age (2)
3.	Contact Gaps
4.	Normal Force (1) Deflection = 0.0145 " Expected Force at Max Deflection = 97 g

Group 6
NVAF-DP-04-2-05.0-S-2
NVAM-DP-04-2-02.0-S-2
8 Contacts Minimum
NVAF MFBL Ground Beam With Thermals

Step	Description
1.	Contact Gaps
2.	Thermal Age (2)
3.	Contact Gaps
4.	Normal Force (1) Deflection = 0.018 " Expected Force at Max Deflection = 49 g

Group 7
NVAF-DP-04-2-05.0-S-2
NVAM-DP-04-2-02.0-S-2
8 Contacts Minimum
NVAF Flanking Ground Beam With Thermals

Step	Description
1.	Contact Gaps
2.	Thermal Age (2)
3.	Contact Gaps
4.	Normal Force (1) Deflection = 0.013 " Expected Force at Max Deflection = 83 g

Group 8
NVAF-DP-04-2-05.0-S-2
NVAM-DP-04-2-02.0-S-2
8 Contacts Minimum
NVAF Center Ground Beam With Thermals

Step	Description
1.	Contact Gaps
2.	Thermal Age (2)
3.	Contact Gaps
4.	Normal Force (1) Deflection = 0.011 " Expected Force at Max Deflection = 101 g

Group 9
NVAF-DP-04-2-05.0-S-2
NVAM-DP-04-2-02.0-S-2
8 Contacts Minimum
NVAM Signal Without Thermals

Step	Description
1.	Contact Gaps
2.	Normal Force (1) Deflection = 0.0145 " Expected Force at Max Deflection = 97 g

Group 10
NVAF-DP-04-2-05.0-S-2
NVAM-DP-04-2-02.0-S-2
8 Contacts Minimum
NVAM Signal With Thermals

Step	Description
1.	Contact Gaps
2.	Thermal Age (2)
3.	Contact Gaps
4.	Normal Force (1) Deflection = 0.0145 " Expected Force at Max Deflection = 97 g

(1) Normal Force = EIA-364-04

(2) Thermal Age = EIA-364-17
Test Condition = 4 (105°C)
Time Condition = B (250 Hours)

FLOWCHARTS Continued

Thermal Aging

Group 1
NVAF-DP-04-2-05.0-S-2
NVAM-DP-04-2-02.0-S-2
8 Assemblies

Step	Description
1.	Contact Gaps
2.	Mating/Unmating Force (2)
3.	LLCR (1)
4.	Thermal Age (3)
5.	LLCR (1) Max Delta = 15 mOhm
6.	Mating/Unmating Force (2)
7.	Contact Gaps

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

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

(3) Thermal Age = EIA-364-17
Test Condition = 4 (105°C)
Time Condition = B (250 Hours)

FLOWCHARTS Continued

Mating/Unmating/Durability

Group 1
NVAF-DP-04-2-05.0-S-2
NVAM-DP-04-2-02.0-S-2
8 Assemblies

Step	Description
1.	Contact Gaps
2.	LLCR (2)
3.	Mating/Unmating Force (3)
4.	Cycles Quantity = 25 Cycles
5.	Mating/Unmating Force (3)
6.	Contact Gaps
7.	LLCR (2) Max Delta = 15 mOhm
8.	Thermal Shock (4)
9.	LLCR (2) Max Delta = 15 mOhm
10.	Humidity (1)
11.	LLCR (2) Max Delta = 15 mOhm
12.	Mating/Unmating Force (3)

Group 2
NVAF-DP-03-2-05.0-S-2
NVAM-DP-03-2-02.0-S-2
8 Assemblies

Step	Description
1.	Contact Gaps
2.	Mating/Unmating Force (3)
3.	Cycles Quantity = 25 Cycles
4.	Mating/Unmating Force (3)

Group 3
NVAF-DP-02-2-05.0-S-2
NVAM-DP-02-2-02.0-S-2
8 Assemblies

Step	Description
1.	Contact Gaps
2.	Mating/Unmating Force (3)
3.	Cycles Quantity = 25 Cycles
4.	Mating/Unmating Force (3)

Group 4
NVAF-DP-02-1-05.0-S-2
NVAM-DP-02-1-02.0-S-2
8 Assemblies

Step	Description
1.	Contact Gaps
2.	LLCR (2)
3.	Mating/Unmating Force (3)
4.	Cycles Quantity = 25 Cycles
5.	Mating/Unmating Force (3)
6.	Contact Gaps
7.	LLCR (2) Max Delta = 15 mOhm
8.	Thermal Shock (4)
9.	LLCR (2) Max Delta = 15 mOhm
10.	Humidity (1)
11.	LLCR (2) Max Delta = 15 mOhm
12.	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

Pin-to-Pin

Group 1 NVAF-DP-04-2-05.0-S-2 NVAM-DP-04-2-02.0-S-2 2 Assemblies		Group 2 NVAF-DP-04-2-05.0-S-2 2 Assemblies		Group 3 NVAM-DP-04-2-02.0-S-2 2 Assemblies		Group 4 NVAF-DP-04-2-05.0-S-2 NVAM-DP-04-2-02.0-S-2 2 Assemblies	
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)

Row-to-Row

Group 5 NVAF-DP-04-2-05.0-S-2 NVAM-DP-04-2-02.0-S-2 2 Assemblies		Group 6 NVAF-DP-04-2-05.0-S-2 2 Assemblies		Group 7 NVAM-DP-04-2-02.0-S-2 2 Assemblies		Group 8 NVAF-DP-04-2-05.0-S-2 NVAM-DP-04-2-02.0-S-2 2 Assemblies	
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)

Pin-to-Ground

Group 9 NVAF-DP-04-2-05.0-S-2 NVAM-DP-04-2-02.0-S-2 2 Assemblies		Group 10 NVAF-DP-04-2-05.0-S-2 2 Assemblies		Group 11 NVAM-DP-04-2-02.0-S-2 2 Assemblies		Group 12 NVAF-DP-04-2-05.0-S-2 NVAM-DP-04-2-02.0-S-2 2 Assemblies	
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
NVAF-DP-04-2-05.0-S-2
NVAM-DP-04-2-02.0-S-2
1 Pins Powered
Signal

Step	Description
1.	CCC (2) Rows = 1 Number of Positions = 1 *Note: single signal pin within single wafer*

Group 2
NVAF-DP-04-2-05.0-S-2
NVAM-DP-04-2-02.0-S-2
2 Pins Powered
Signal

Step	Description
1.	CCC (2) Rows = 1 Number of Positions = 2 *Note: two adjacent signal pins (DP pair) within single wafer*

Group 3
NVAF-DP-04-2-05.0-S-2
NVAM-DP-04-2-02.0-S-2
4 Pins Powered
Signal

Step	Description
1.	CCC (2) Rows = 1 Number of Positions = 4 *Note: Three adjacent signal pins within single wafer*

Group 4
NVAF-DP-04-2-05.0-S-2
NVAM-DP-04-2-02.0-S-2
8 Pins Powered
Signal

Step	Description
1.	CCC (2) Rows = 1 Number of Positions = 8 *Note: 1 wafer, all signal pins powered*

Group 5
NVAF-DP-04-2-05.0-S-2
NVAM-DP-04-2-02.0-S-2
32 Pins Powered
Signal

Step	Description
1.	CCC (2) Rows = 4 Number of Positions = 8 *Note: 4 wafers, all signals powered*

Group 6
NVAF-DP-04-2-05.0-S-2
NVAM-DP-04-2-02.0-S-2
64 Pins Powered
Signal

Step	Description
1.	CCC (2) Rows = 8 Number of Positions = 8 *Note: 8 wafers, all signals powered*

Group 7
NVAF-DP-04-2-05.0-S-2
NVAM-DP-04-2-02.0-S-2
8 Pins Powered
Ground

Step	Description
1.	CCC (2) Rows = 1 Number of Positions = 8 *Note: 1 wafer/shield powered (no signals)*

Group 8
NVAF-DP-04-2-05.0-S-2
NVAM-DP-04-2-02.0-S-2
16 Pins Powered
Ground

Step	Description
1.	CCC (2) Rows = 2 Number of Positions = 8 *Note: 2 wafer/shields powered (no signals)*

Group 9
NVAF-DP-04-2-05.0-S-2
NVAM-DP-04-2-02.0-S-2
32 Pins Powered
Ground

Step	Description
1.	CCC (2) Rows = 4 Number of Positions = 8 *Note: 4 wafers/whield powered (no signals)*

Group 10
NVAF-DP-04-2-05.0-S-2
NVAM-DP-04-2-02.0-S-2
64 Pins Powered
Ground

Step	Description
1.	CCC (2) Rows = 4 Number of Positions = 16 *Note: 2 banks x 4 wafer/shields powered (no signals)*

Group 11
NVAF-DP-04-2-05.0-S-2
NVAM-DP-04-2-02.0-S-2
All Power

Step	Description
1.	CCC - All Power (1)

(1) CCC - All Power = 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

(2) 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
NVAF-DP-04-2-05.0-S-2
NVAM-DP-04-2-02.0-S-2
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
NVAF-DP-04-2-05.0-S-2
NVAM-DP-04-2-02.0-S-2
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:

1) EIA-364-17, *Temperature Life with or without Electrical Load Test Procedure for Electrical Connectors.*
2) Test Condition at 105° C.
3) Test Time Condition B for 250 hours.
4) All test samples are pre-conditioned at ambient.
5) All test samples are exposed to environmental stressing in the mated condition.

THERMAL SHOCK:

1) EIA-364-32, *Thermal Shock (Temperature Cycling) Test Procedure for Electrical Connectors.*
2) Test Condition: -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 stressing in the mated condition.

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 stressing in the mated condition.

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

NORMAL FORCE (FOR CONTACTS TESTED IN THE HOUSING):

1) Reference document: EIA-364-04, *Normal Force Test Procedure for Electrical Connectors*.
2) The contacts shall be tested in the connector housing.
3) If necessary, a "window" shall be made in the connector body to allow a probe to engage and deflect the contact at the same attitude and distance (plus 0.05 mm [0.002"]) as would occur in actual use.
4) The connector housing shall be placed in a holding fixture that does not interfere with or otherwise influence the contact force or deflection.
5) Said holding fixture shall be mounted on a floating, adjustable, X-Y table on the base of the Dillon TC^2, computer controlled test stand with a deflection measurement system accuracy of 5.0 µm (0.0002").
6) The nominal deflection rate shall be 5 mm (0.2")/minute.
7) Unless otherwise noted a minimum of five contacts shall be tested.
8) The force/deflection characteristic to load and unload each contact shall be repeated five times.
9) The system shall utilize the TC^2 software in order to acquire and record the test data.
10) The permanent set of each contact shall be measured within the TC^2 software.
11) The acquired data shall be graphed with the deflection data on the X-axis and the force data on the Y-axis and a print out will be stored with the Tracking Code paperwork.

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 rise.
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 four temperature points are reported:
    a. Ambient
    b. 85^{o} C
    c. 95^{o} C
    d. 115^{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.

ATTRIBUTE DEFINITIONS Continued

The following is a brief, simplified description of attributes

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

GAS TIGHT:

To provide method for evaluating the ability of the contacting surfaces in preventing penetration of harsh vapors which might lead to oxide formation that may degrade the electrical performance of the contact system.

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) Procedure:
    a. Reference document: EIA-364-36, *Test Procedure for Determination of Gas-Tight Characteristics for Electrical Connectors, Sockets and/or Contact Systems*.
    b. Test Conditions:
        i. Class II--- Mated pairs of contacts assembled to their plastic housings.
        ii. Reagent grade Nitric Acid shall be used of sufficient volume to saturate the test chamber
        iii. The ratio of the volume of the test chamber to the surface area of the acid shall be 10:1.
        iv. The chamber shall be saturated with the vapor for at least 15 minutes before samples are added.
        v. Exposure time, 55 to 65 minutes.
        vi. The samples shall be no closer to the chamber walls than 1 inches and no closer to the surface of the acid than 3 inches.
        vii. The samples shall be dried after exposure for a minimum of 1 hour.
        viii. Drying temperature 50^{o} C
        ix. The final LLCR shall be conducted within 1 hour after drying.

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

Signal pin

- **CCC for a 30°C Temperature Rise----------2.1 A per contact with 1 contacts (1x1) powered**
- **CCC for a 30°C Temperature Rise----------1.7 A per contact with 2 contacts (1x2) powered**
- **CCC for a 30°C Temperature Rise----------1.4 A per contact with 4 contacts (1x4) powered**
- **CCC for a 30°C Temperature Rise----------1.2 A per contact with 8 contacts (1x8) powered**
- **CCC for a 30°C Temperature Rise----------0.7 A per contact with 32 contacts (4x8) powered**
- **CCC for a 30°C Temperature Rise----------0.7 A per contact with 64 contacts (8x8) powered**

Ground pin

- **CCC for a 30°C Temperature Rise----------9.6 A per contact with 8 contacts (1x8) powered**
- **CCC for a 30°C Temperature Rise----------8.3 A per contact with 16 contacts (2x8) powered**
- **CCC for a 30°C Temperature Rise----------7.2 A per contact with 32 contacts (4x8) powered**
- **CCC for a 30°C Temperature Rise----------5.9 A per contact with 64 contacts (4x16) powered**

Signal & Ground pin

- **CCC for a 30°C Temperature Rise----------5.1 A per contact with 64 contacts (4x16) powered. Signals being powered at ½ rated current.**

Mating – Unmating Forces

Thermal aging Group

- **Initial**
  - **Mating**
    - **Min ----------12.45 lbs**
    - **Max----------13.70 lbs**
  - **Unmating**
    - **Min ----------10.37 lbs**
    - **Max----------12.21 lbs**
- **After Thermal**
  - **Mating**
    - **Min ---------- 8.61 lbs**
    - **Max----------11.90 lbs**
  - **Unmating**
    - **Min ---------- 7.04 lbs**
    - **Max---------- 7.88 lbs**

RESULTS Continued

Mating – Unmating Forces

Mating/Unmating Durability Group

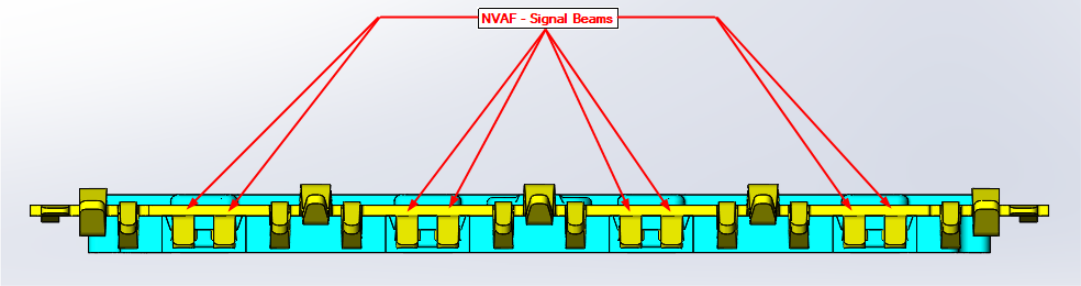
- **Initial**
  - **Mating**
    - **Min ----------11.15 lbs**
    - **Max----------13.62 lbs**
  - **Unmating**
    - **Min ---------- 9.24 lbs**
    - **Max----------11.68 lbs**
- **After 25 Cycles**
  - **Mating**
    - **Min ----------21.91 lbs**
    - **Max----------23.62 lbs**
  - **Unmating**
    - **Min ----------13.62 lbs**
    - **Max----------15.02 lbs**
- **After 50 Cycles**
  - **Mating**
    - **Min ----------20.96 lbs**
    - **Max----------23.63 lbs**
  - **Unmating**
    - **Min ----------13.43 lbs**
    - **Max----------14.89 lbs**
- **After 75 Cycles**
  - **Mating**
    - **Min ----------20.32 lbs**
    - **Max----------22.66 lbs**
  - **Unmating**
    - **Min ----------13.62 lbs**
    - **Max----------14.47 lbs**
- **After 100 Cycles**
  - **Mating**
    - **Min ----------19.56 lbs**
    - **Max----------21.58 lbs**
  - **Unmating**
    - **Min ----------13.52 lbs**
    - **Max----------14.64 lbs**
- **Humidity**
  - **Mating**
    - **Min ----------10.36 lbs**
    - **Max----------12.43 lbs**
  - **Unmating**
    - **Min ---------- 6.36 lbs**
    - **Max---------- 7.72 lbs**

RESULTS Continued

Normal Force at 0.0165-inch deflection

NVAF Signal Pin

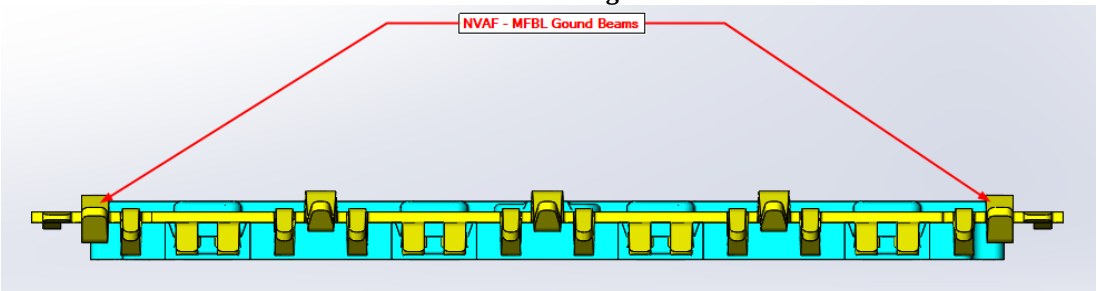
- **Initial**
  - **Min ----------74.30 gf Set ----- 0.0011 inch**
  - **Max ----------81.60 gf Set ----- 0.0014 inch**
- **Thermal**
  - **Min ----------58.70 gf Set ----- 0.0024 inch**
  - **Max ----------69.60 gf Set ----- 0.0033 inch**



Normal Force at 0.0221-inch deflection

NVAF MFBL Ground Beam

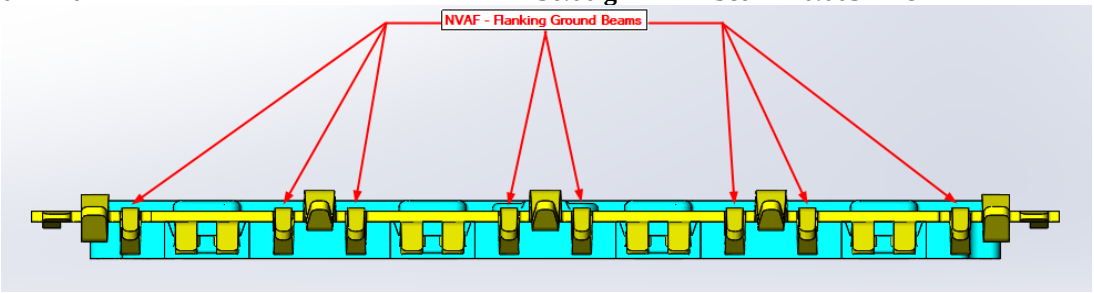
- **Initial**
  - **Min ---------- 106.90 gf Set ----- 0.0031 inch**
  - **Max ---------- 119.80 gf Set ----- 0.0081 inch**
- **Thermal**
  - **Min ----------67.60 gf Set ----- 0.0091 inch**
  - **Max ---------- 105.30 gf Set ----- 0.0137 inch**



Normal Force at 0.0134-inch deflection

NVAF Flanking Ground Beam

- **Initial**
  - **Min ----------51.00 gf Set ----- 0.0004 inch**
  - **Max ----------60.70 gf Set ----- 0.0006 inch**
- **Thermal**
  - **Min ----------36.30 gf Set ----- 0.0004 inch**
  - **Max ----------56.00 gf Set ----- 0.0034 inch**

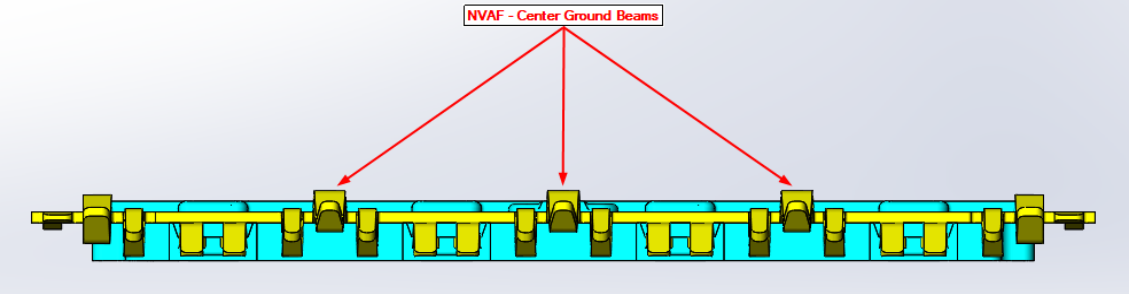


RESULTS Continued

Normal Force at 0.0145-inch deflection

NVAF Center Ground Beam

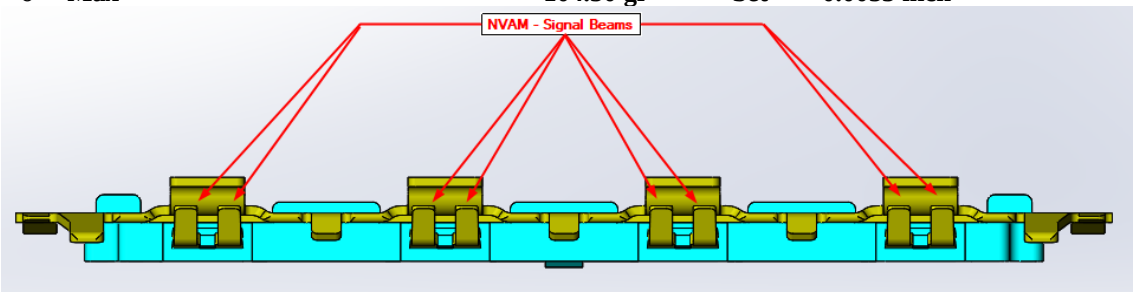
- **Initial**
  - **Min ---------- 140.20 gf Set ----- 0.0006 inch**
  - **Max ---------- 155.50 gf Set ----- 0.0015 inch**
- **Thermal**
  - **Min ----------87.80 gf Set ----- 0.0047 inch**
  - **Max ---------- 116.50 gf Set ----- 0.0063 inch**



Normal Force at 0.0185-inch deflection

NVAM Signal pin

- **Initial**
  - **Min ---------- 100.60 gf Set ----- 0.0021 inch**
  - **Max ---------- 109.00 gf Set ----- 0.0031 inch**
- **Thermal**
  - **Min ----------99.00 gf Set ----- 0.0026 inch**
  - **Max ---------- 104.30 gf Set ----- 0.0033 inch**



RESULTS Continued

Insulation Resistance minimums, IR

Pin to Pin

- **Initial**
  - **Mated ---------- 45000 Meg Ω ---------- Passed**
  - **Unmated ---------- 45000 Meg Ω ---------- Passed**
- **Thermal Shock**
  - **Mated ---------- 45000 Meg Ω ---------- Passed**
  - **Unmated ---------- 45000 Meg Ω ---------- Passed**
- **Humidity**
  - **Mated ---------- 45000 Meg Ω ---------- Passed**
  - **Unmated ---------- 34000 Meg Ω ---------- Passed**

Row to Row

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

Pin to Ground

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

Dielectric Withstanding Voltage minimums, DWV

- **Minimums**
  - **Breakdown Voltage ---------- 804 VAC**
  - **Test Voltage ---------- 500 VAC**
  - **Working Voltage ---------- 200 VAC**

Pin to Pin

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

Row to Row

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

Pin to Ground

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

RESULTS Continued

LLCR Gas Tight (128 signal and 64 ground LLCR test points)

Signal Pin

- **Initial ---------- 21.83 mOhms Max**
- **Gas-Tight**
  - **<= +5.0 mOhms ---------- 128 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 +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**

Ground Pin

- **Initial ----------0.16 mOhms Max**
- **Thermal Aging**
  - **<= +5.0 mOhms ----------64 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 +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**

LLCR Thermal Aging (128 signal and 64 ground LLCR test points)

Signal Pin

- **Initial ---------- 21.30 mOhms Max**
- **Thermal Aging**
  - **<= +5.0 mOhms ---------- 128 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 +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**

Ground Pin

- **Initial ----------0.16 mOhms Max**
- **Thermal Aging**
  - **<= +5.0 mOhms ----------64 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 +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**

RESULTS Continued

LLCR Durability (128 signal and 64 ground LLCR test points)

Signal Pin

- **Initial ---------- 22.08 mOhms Max**
- **Durability, 100 Cycles**
  - **<= +5.0 mOhms ---------- 128 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 +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**
- **Thermal**
  - **<= +5.0 mOhms ---------- 128 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 +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**
- **Humidity**
  - **<= +5.0 mOhms ---------- 128 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 +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**

Ground Pin

- **Initial ----------0.17 mOhms Max**
- **Durability, 100 Cycles**
  - **<= +5.0 mOhms ----------64 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 +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**
- **Thermal**
  - **<= +5.0 mOhms ----------64 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 +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**
- **Humidity**
  - **<= +5.0 mOhms ----------64 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 +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**

RESULTS Continued

LLCR Shock & Vibration (128 signal and 64 ground LLCR test points)

Signal Pin

- **Initial ---------- 21.83 mOhms Max**
- **Shock &Vibration**
  - **<= +5.0 mOhms ---------- 128 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 +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**

Ground Pin

- **Initial ----------0.16 mOhms Max**
- **Shock &Vibration**
  - **<= +5.0 mOhms ----------64 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 +2000 mOhms----------0 Points ---------- Unstable**
  - **>+2000 mOhms----------0 Points ---------- Open Failure**

Mechanical Shock & Random Vibration:

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

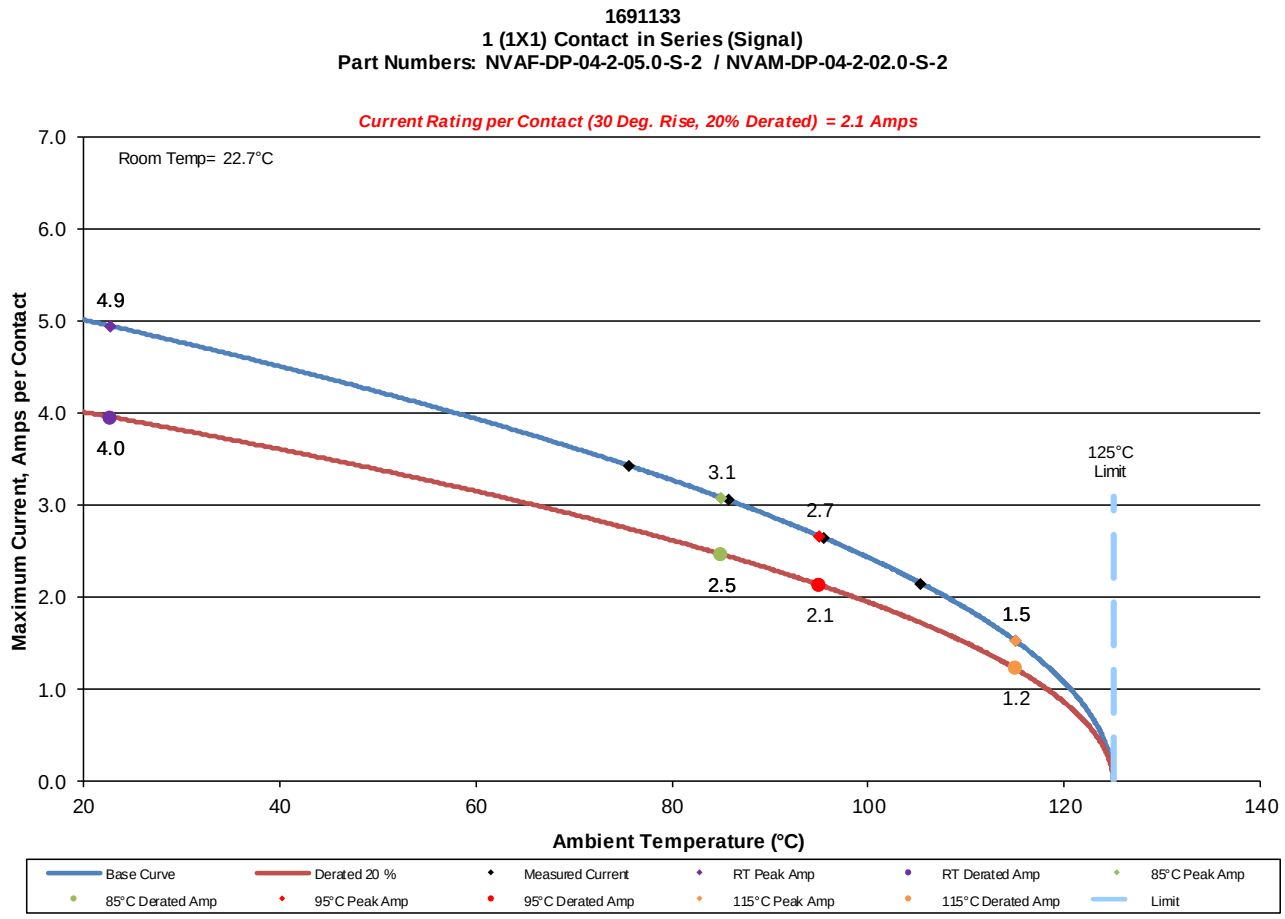
DATA SUMMARIES

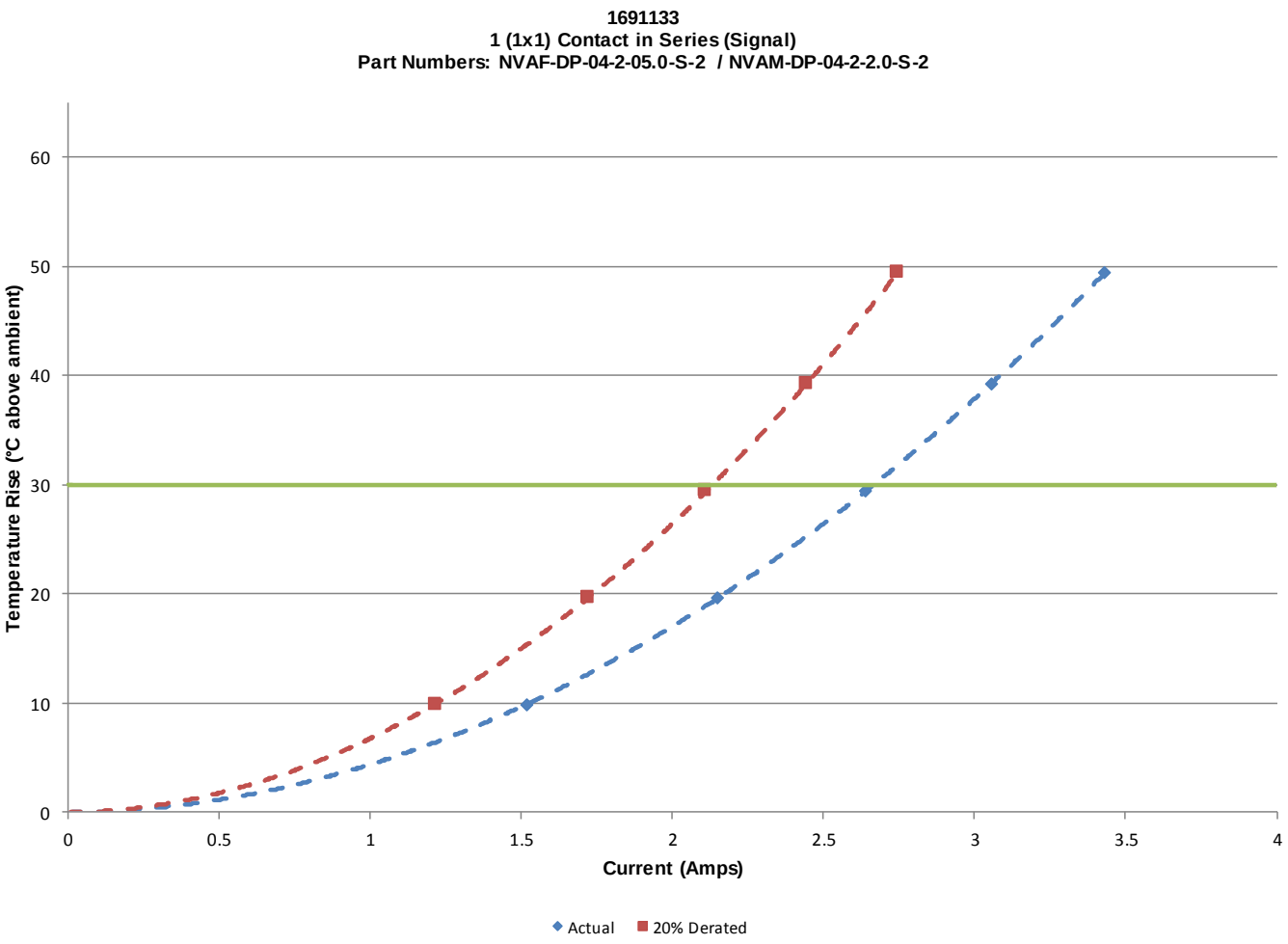
TEMPERATURE RISE (Current Carrying Capacity, CCC):

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:

Signal pin

a. Linear configuration with 1 adjacent conductors/contacts powered

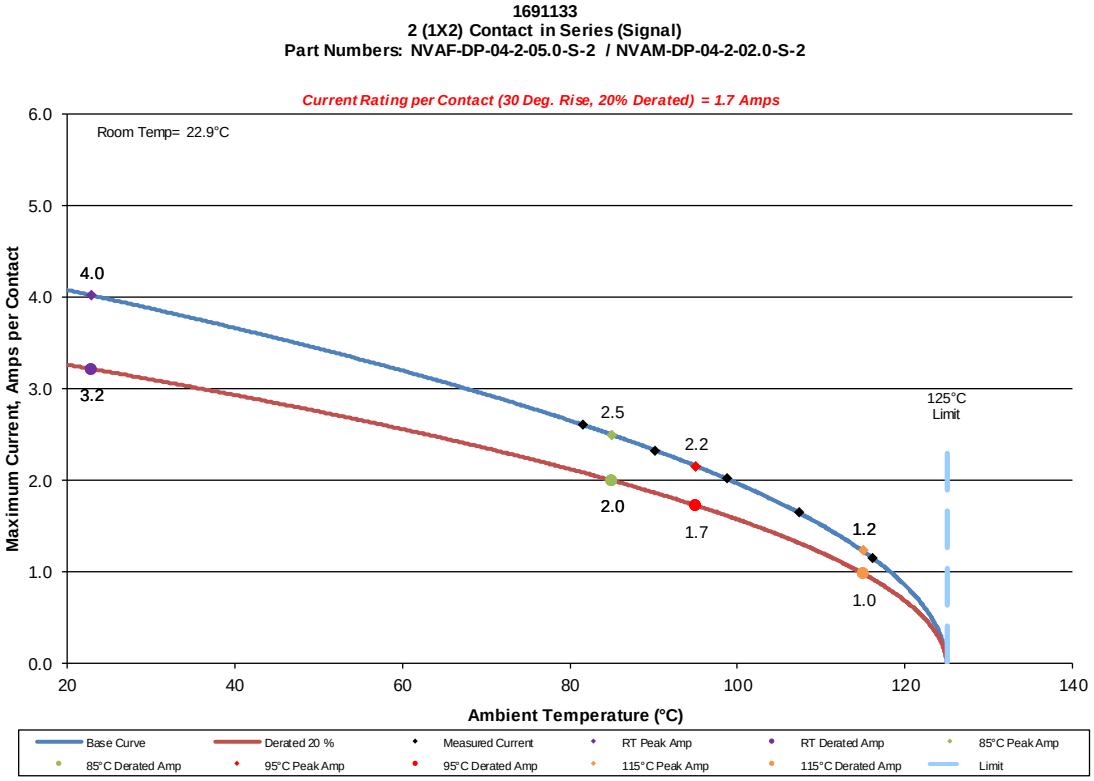


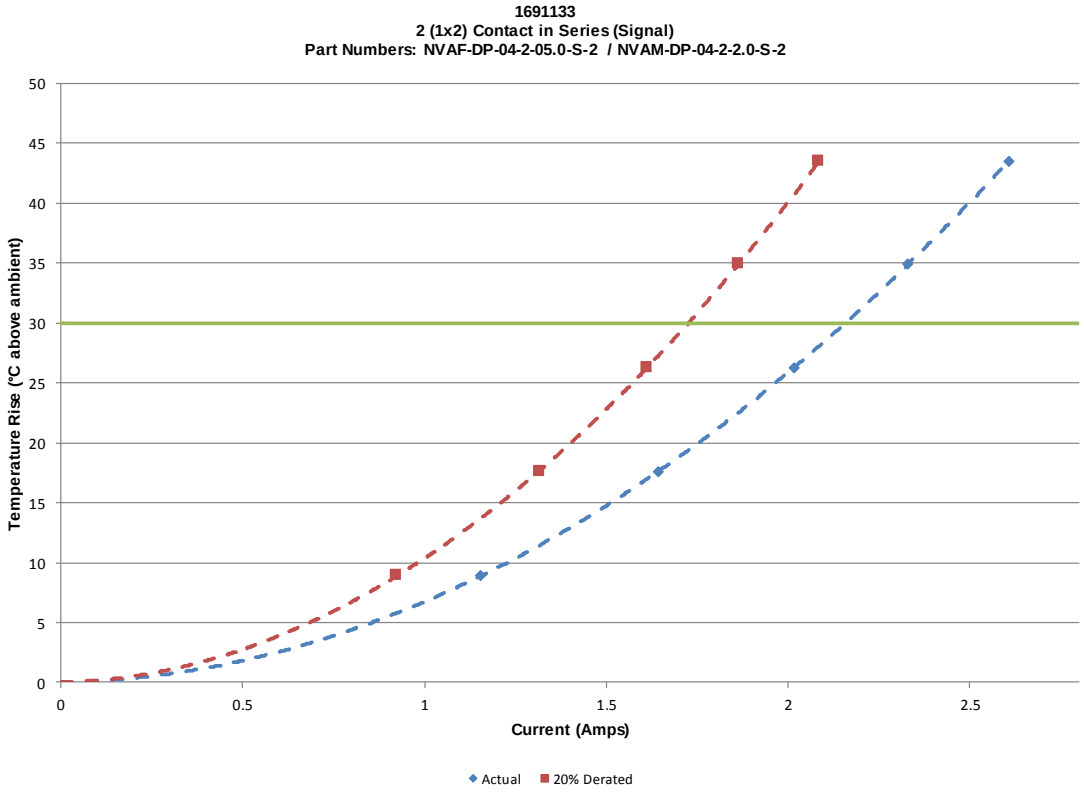

1691133
1 (1x1) Contact in Series (Signal)
Part Numbers: NVAF-DP-04-2-05.0-S-2 / NVAM-DP-04-2-2.0-S-2
Temperature Rise (°C above ambient)
60
50
40
30
20
10
0
0
0.5
1
1.5
2
2.5
3
3.5
4
Current (Amps)
Actual
20% Derated

DATA SUMMARIES Continued

Signal pin

b. Linear configuration with 2 adjacent conductors/contacts powered

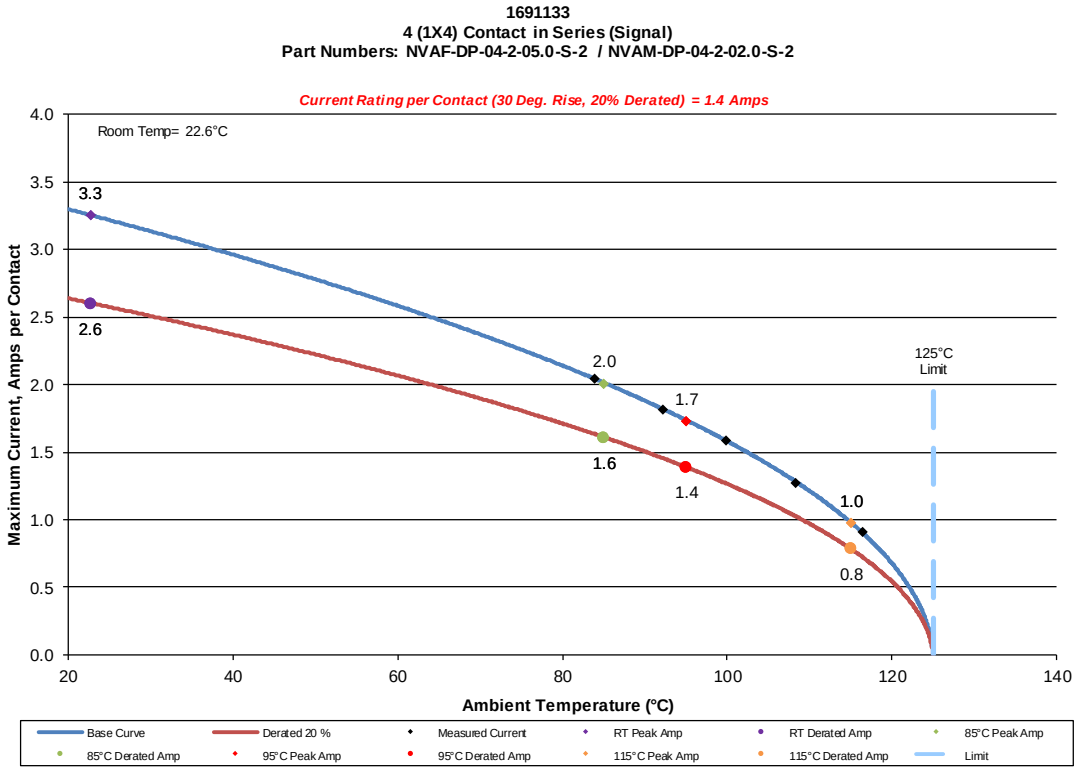


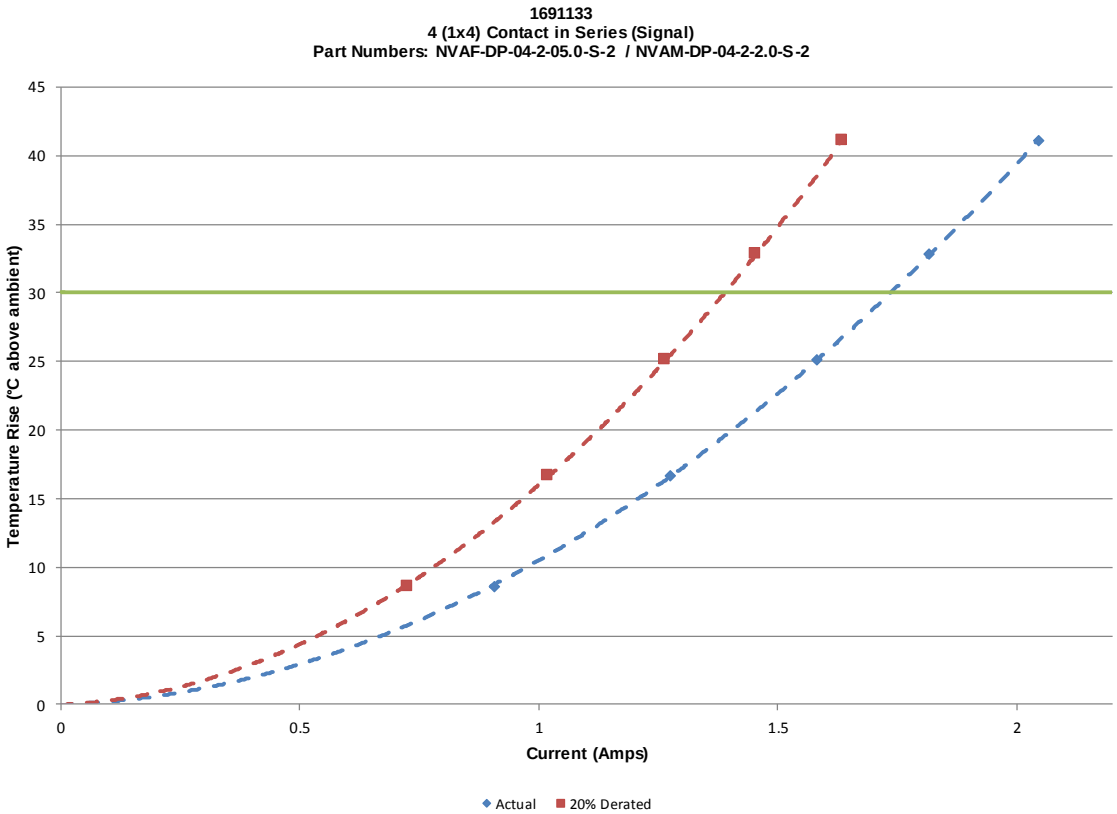


DATA SUMMARIES Continued

Signal pin

c. Linear configuration with 4 adjacent conductors/contacts powered

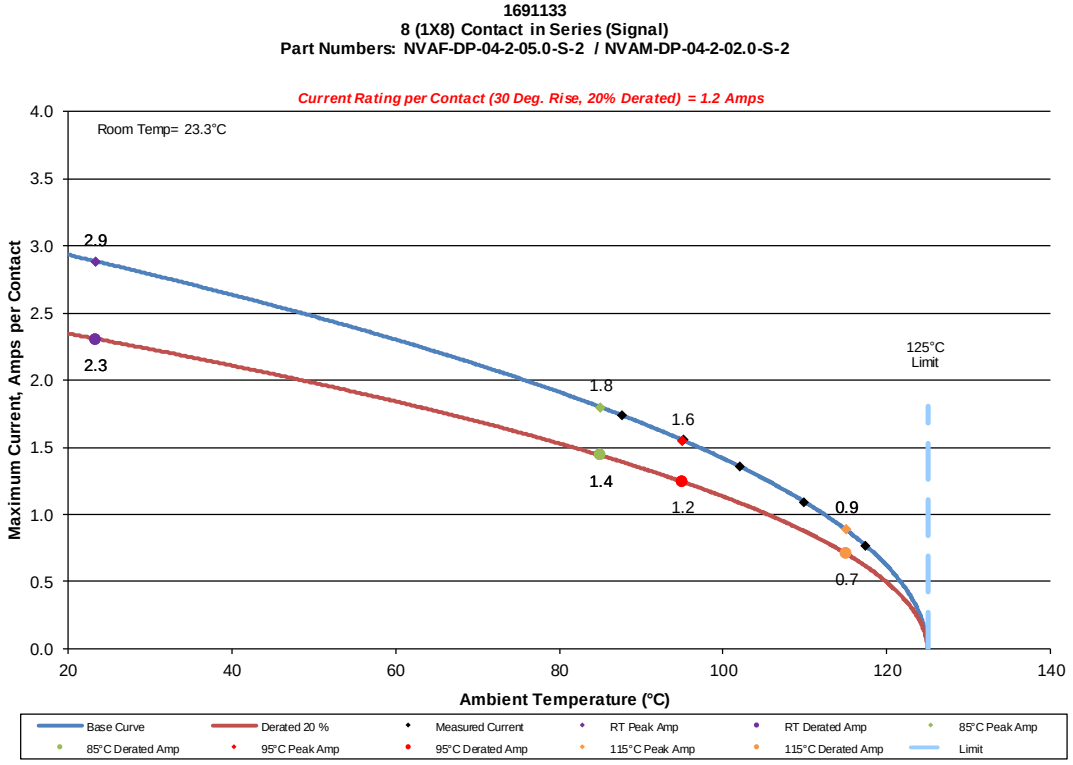


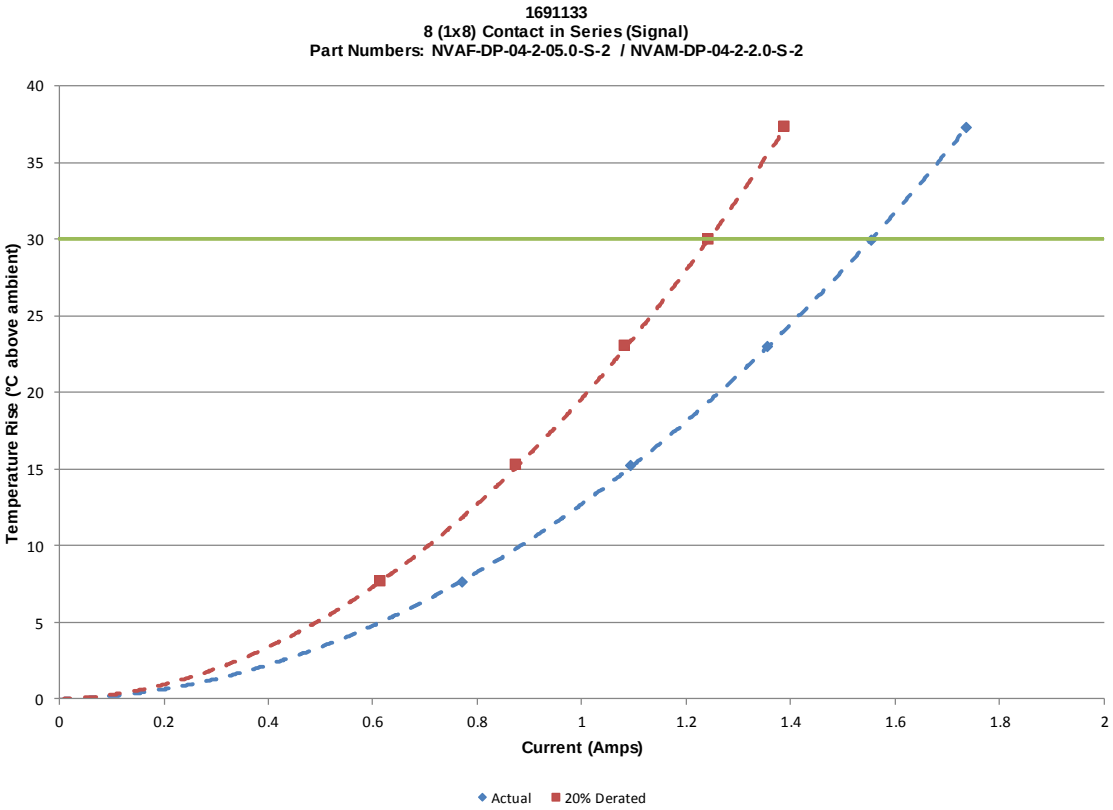


DATA SUMMARIES Continued

Signal pin

d. Linear configuration with 8 adjacent conductors/contacts powered

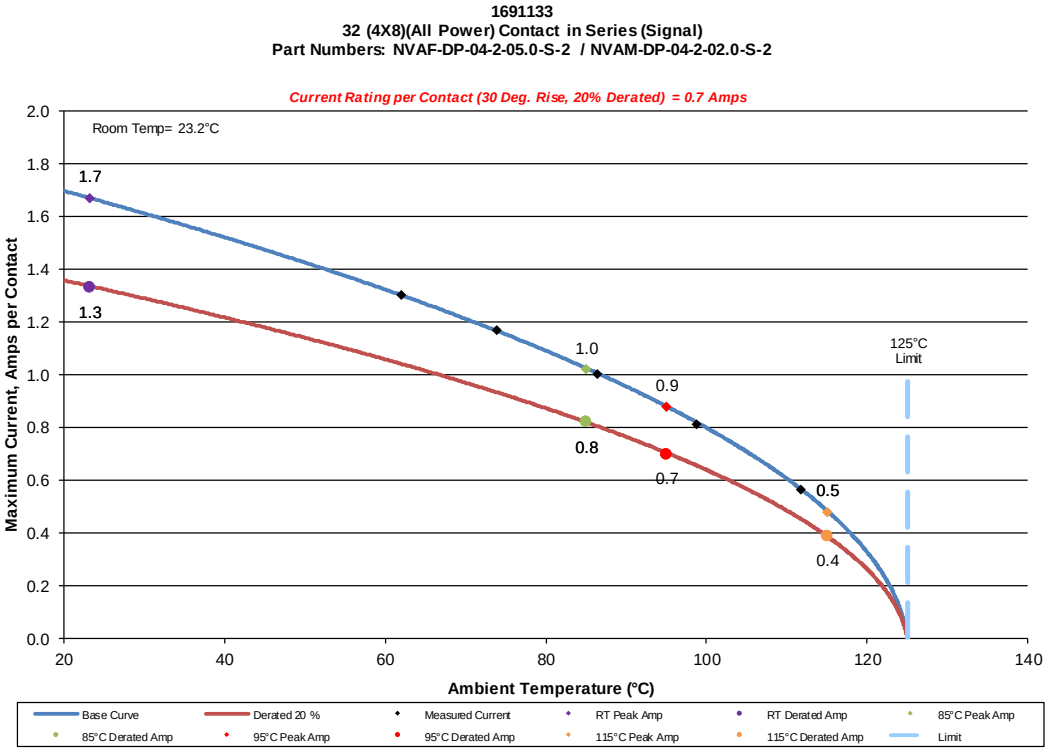


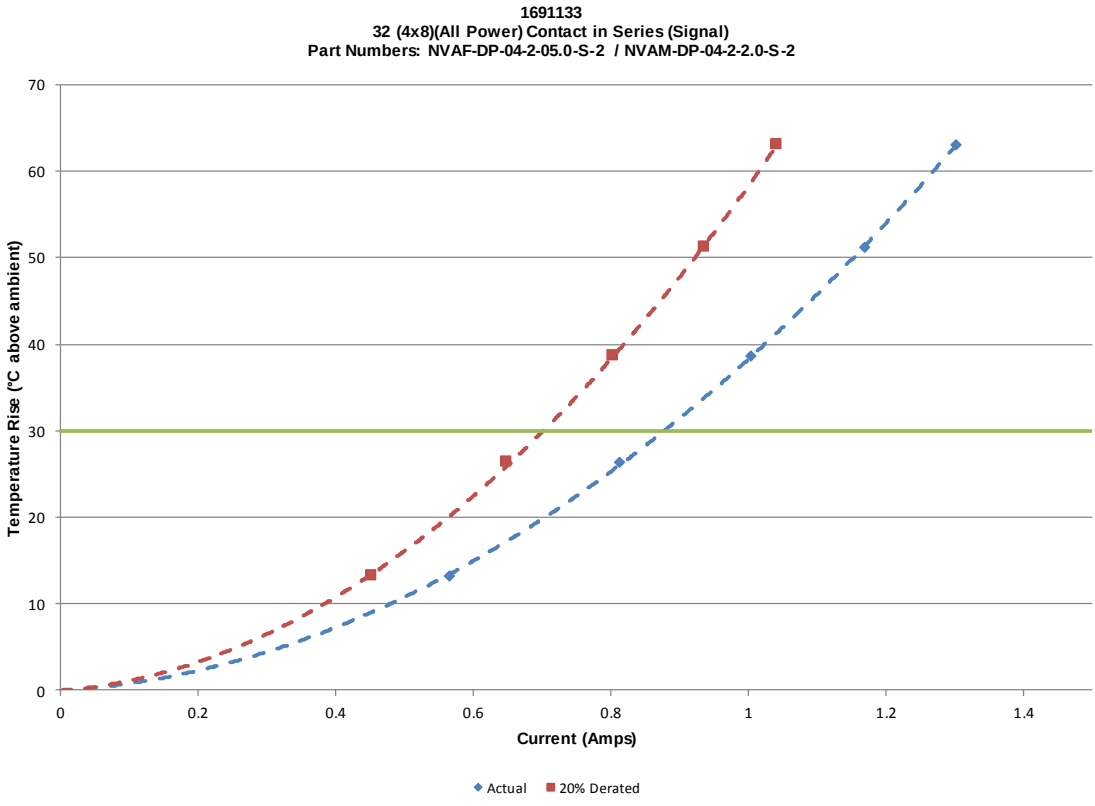


DATA SUMMARIES Continued

Signal pin

e. Linear configuration with 32 adjacent conductors/contacts powered

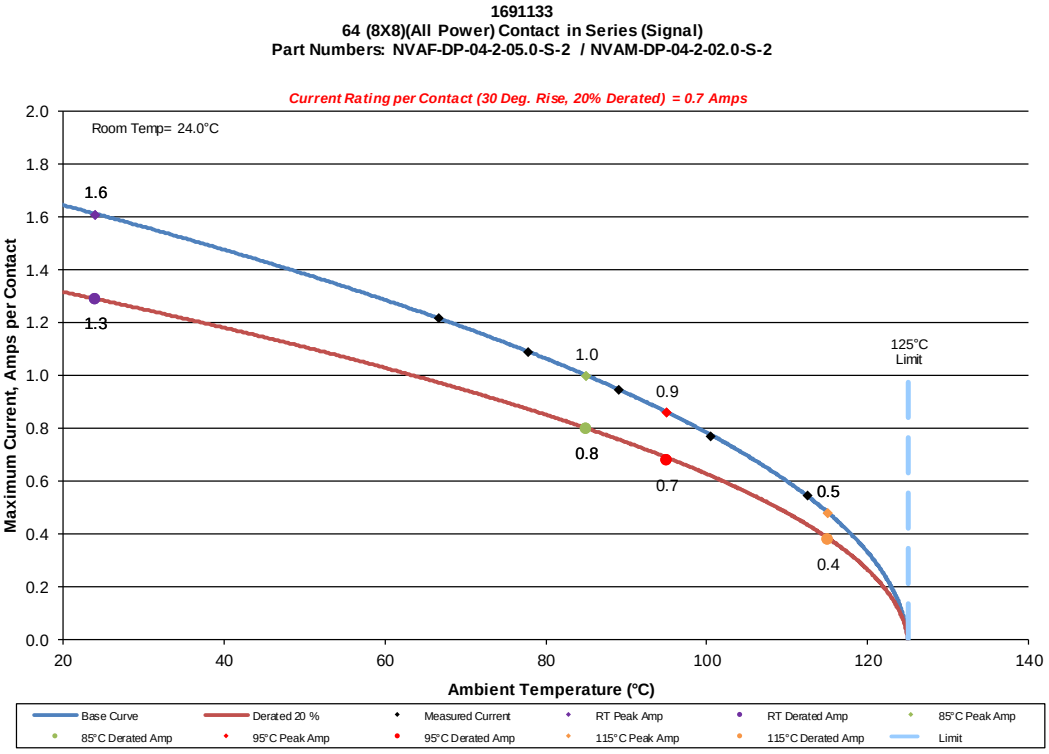


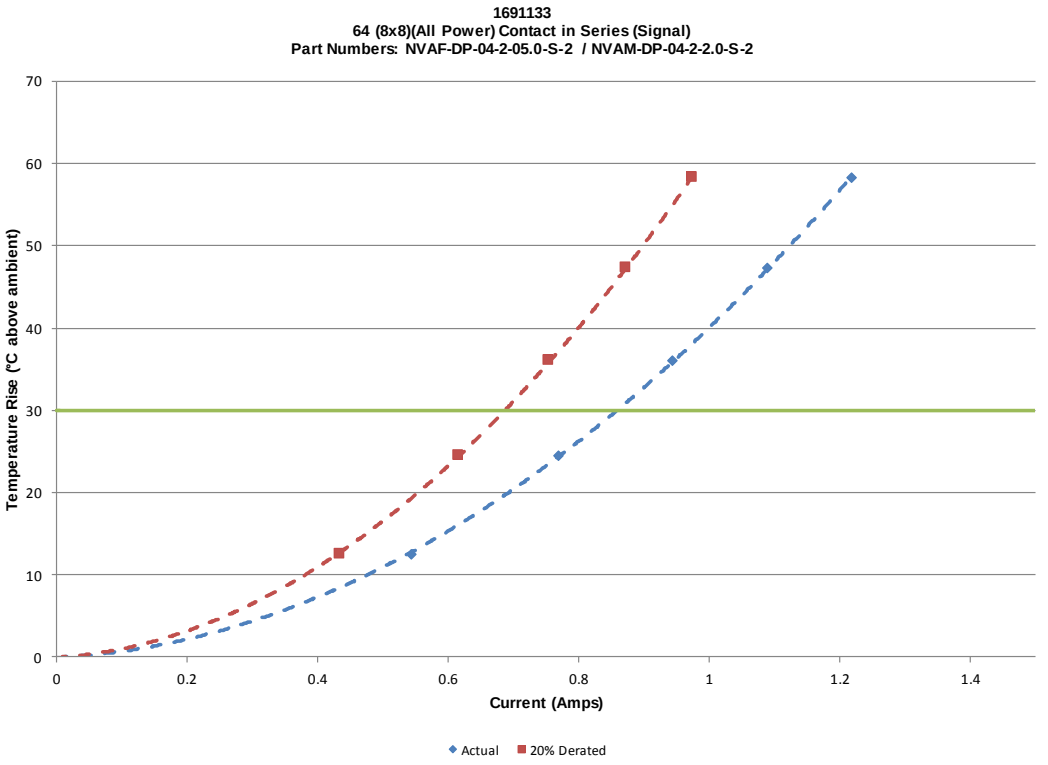


DATA SUMMARIES Continued

Signal Pin

f. Linear configuration with 64 adjacent conductors/contacts powered

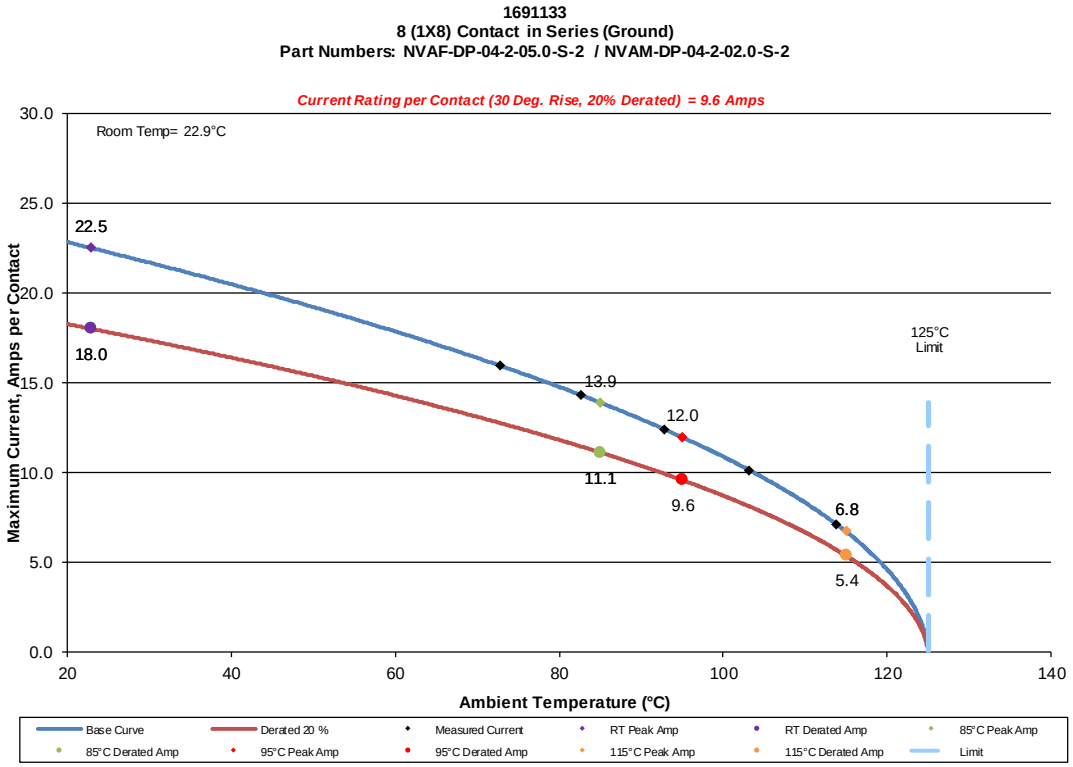


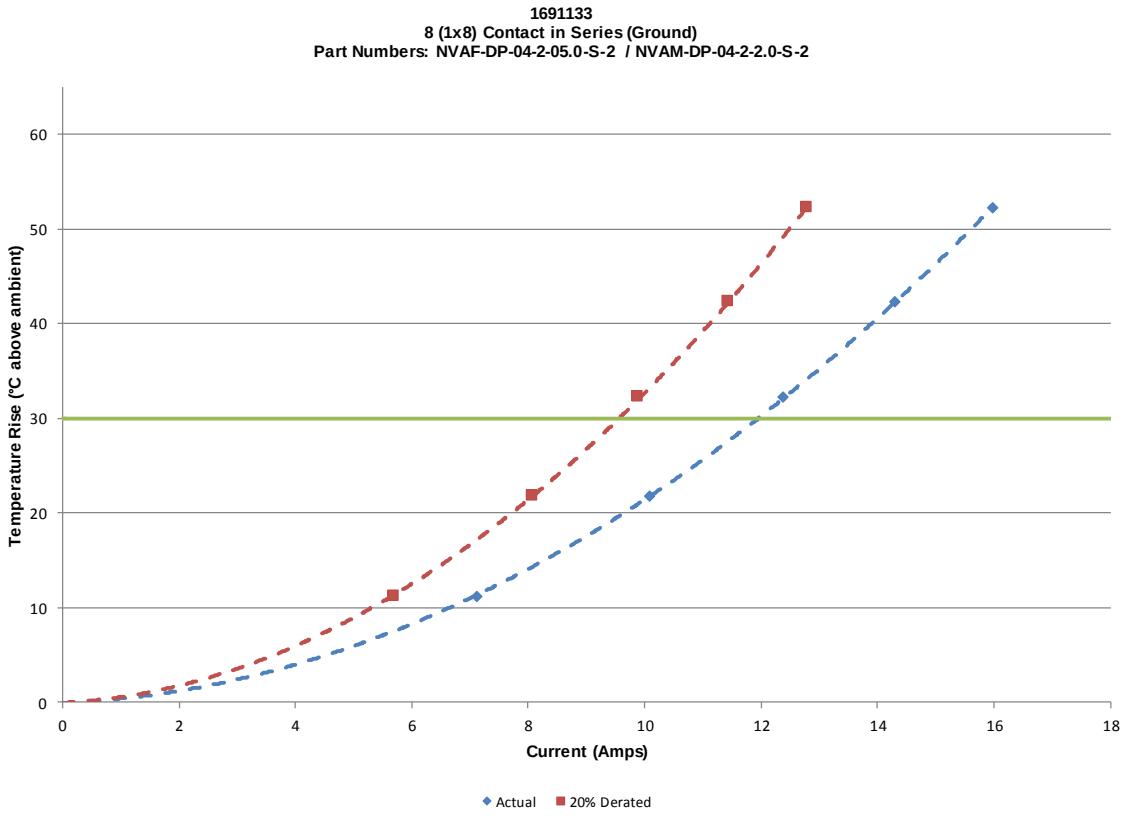


DATA SUMMARIES Continued

Ground Pin

g. Linear configuration with 8 adjacent conductors/contacts powered

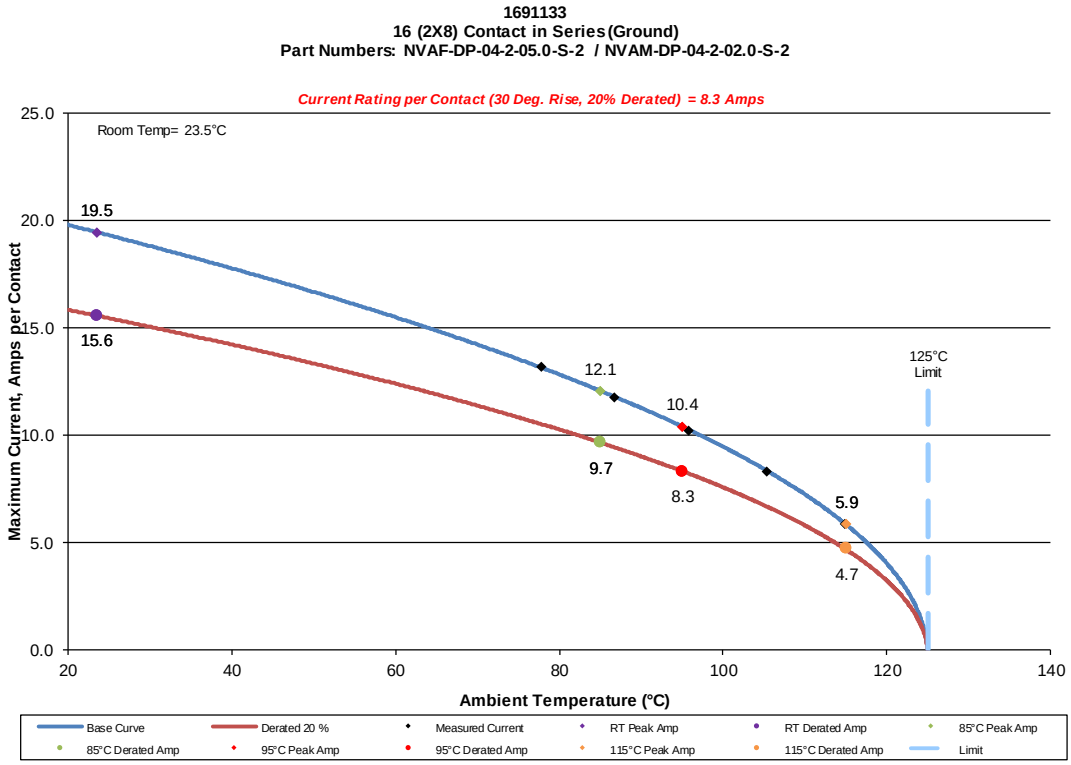


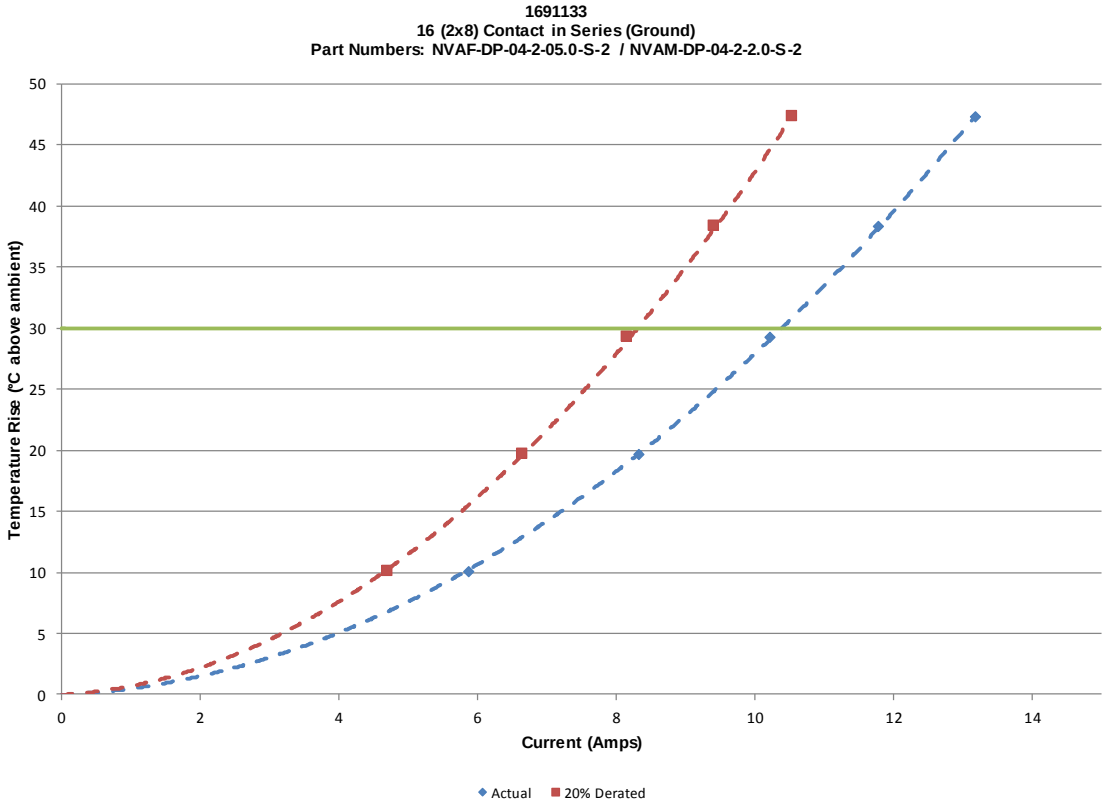


DATA SUMMARIES Continued

Ground Pin

h. Linear configuration with 16 adjacent conductors/contacts powered

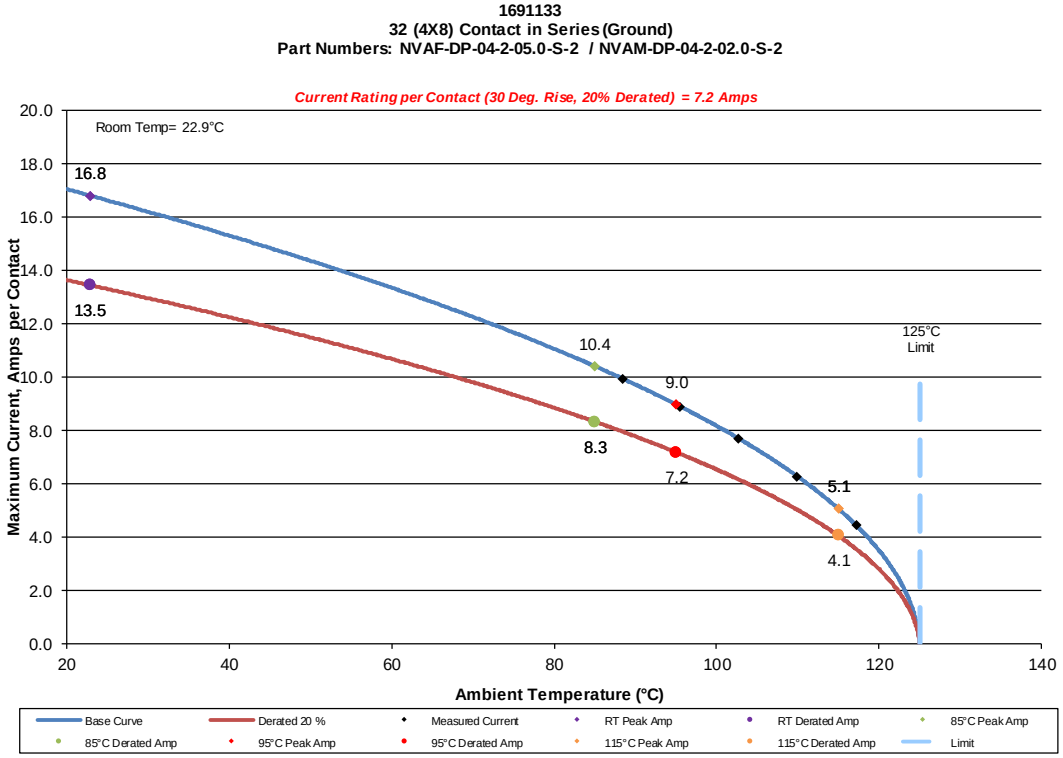


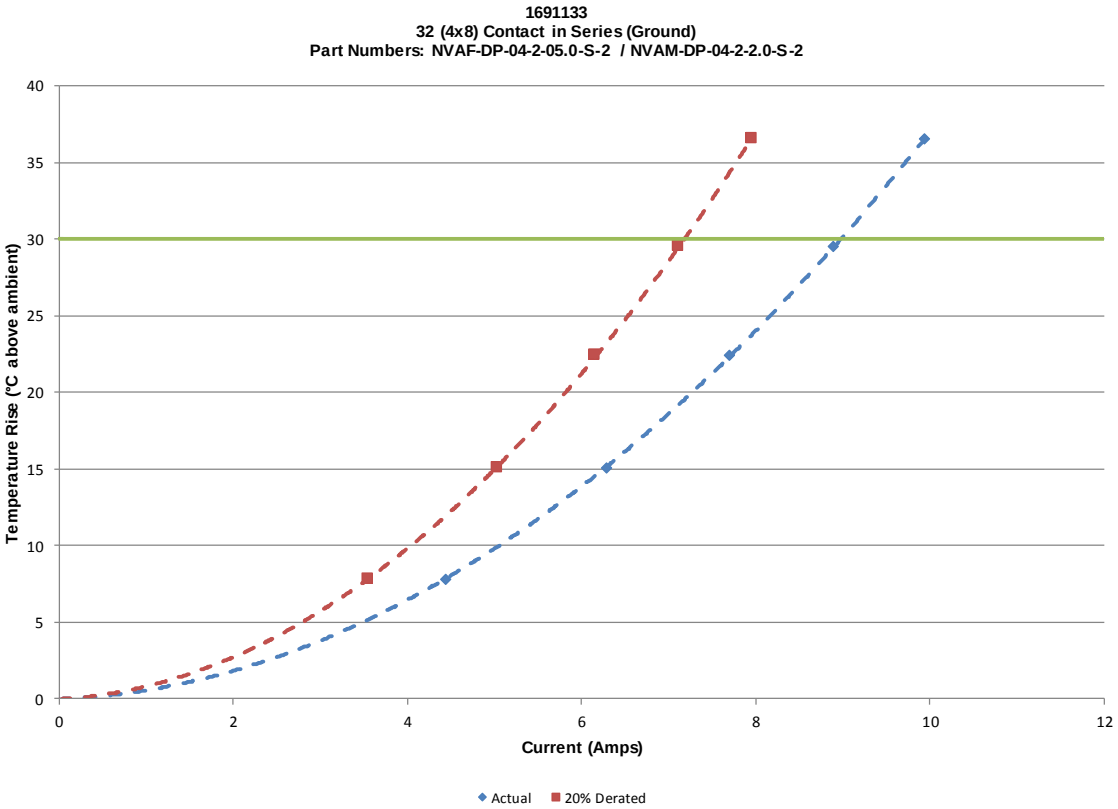


DATA SUMMARIES Continued

Ground Pin

i. Linear configuration with 32 adjacent conductors/contacts powered

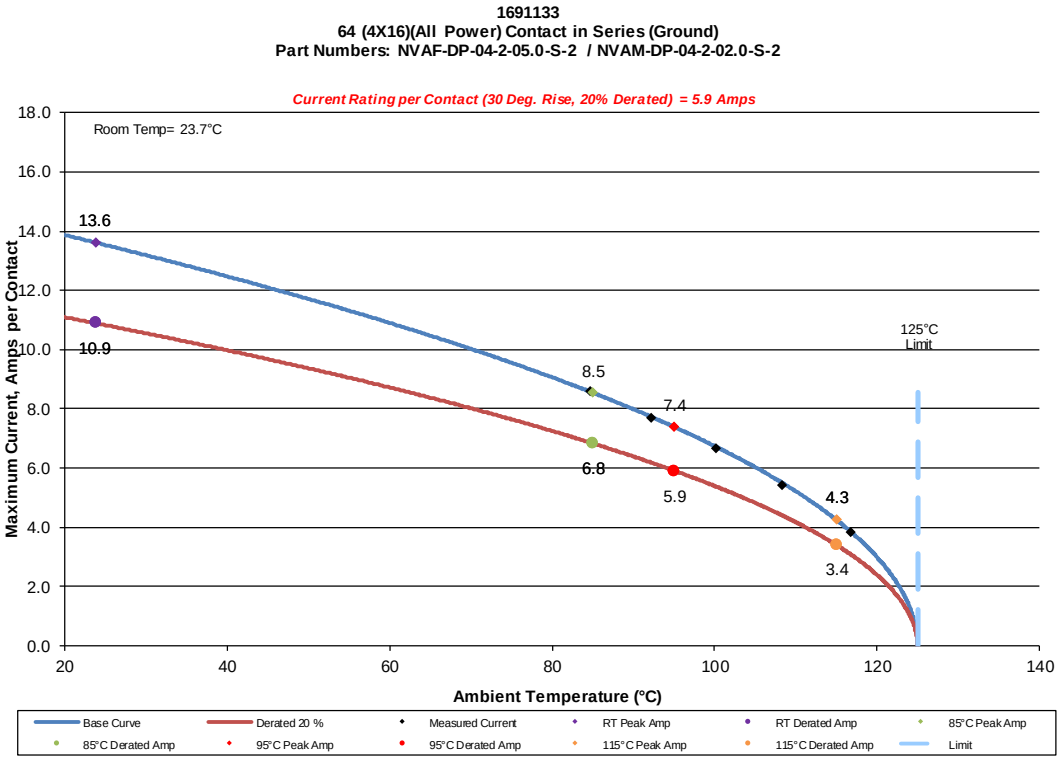


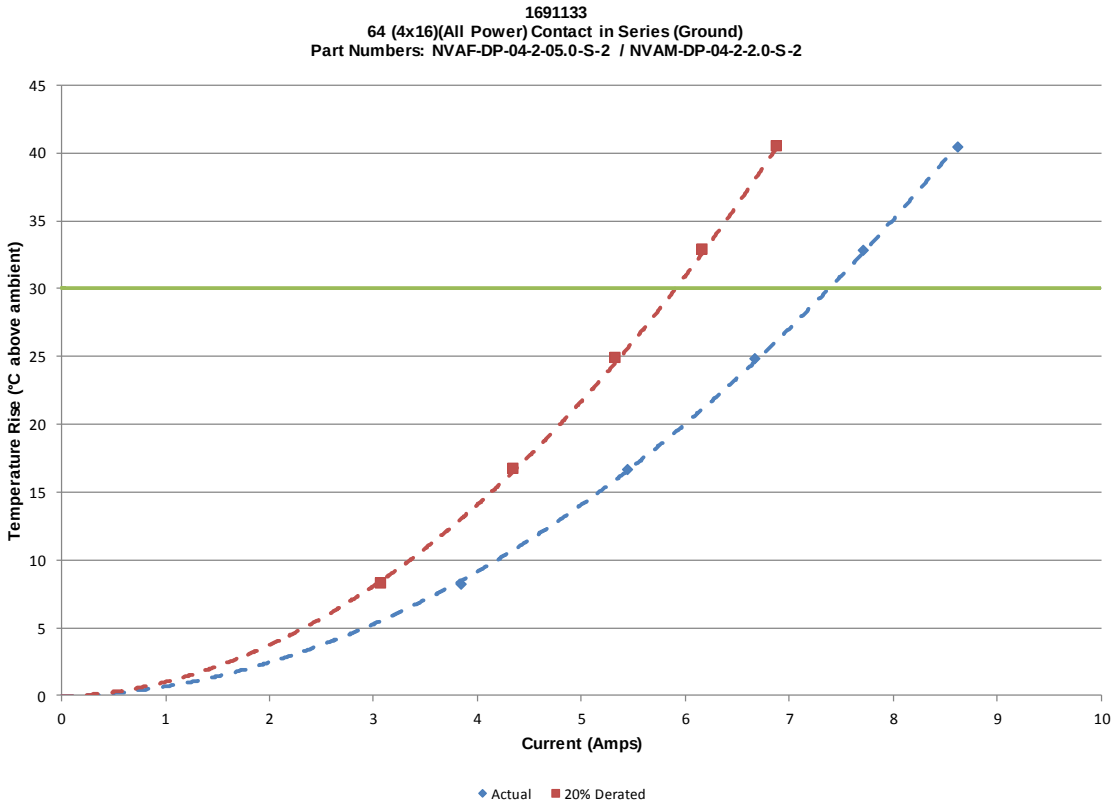


DATA SUMMARIES Continued

Ground Pin

j. Linear configuration with 64 adjacent conductors/contacts powered

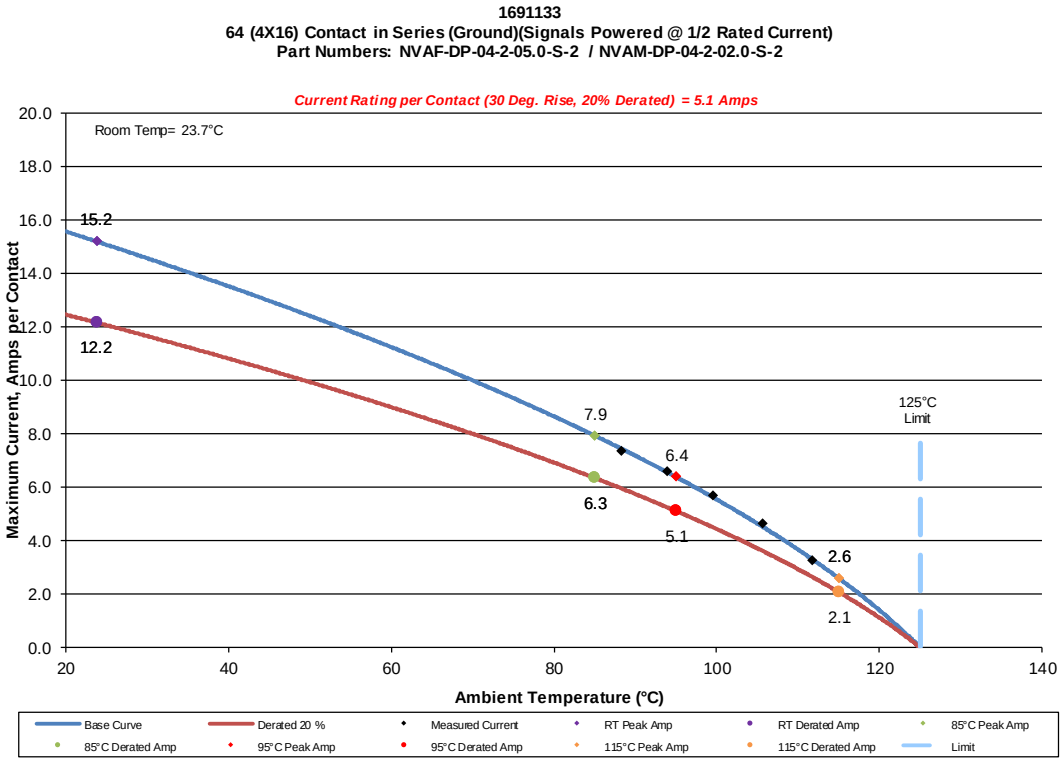


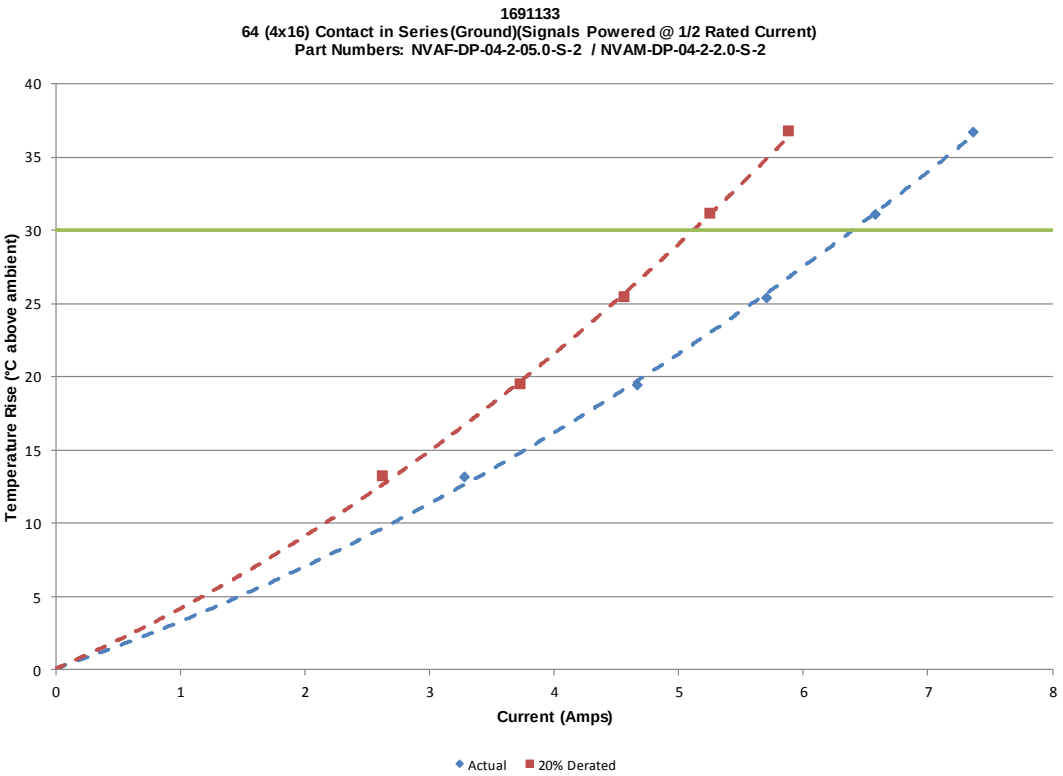


DATA SUMMARIES Continued

Signal & Ground Pin

k. Linear configuration with 64 adjacent conductors contact in Series (Ground)(Signals Powered @ 1/2 Rated Current /contacts powered





DATA SUMMARIES Continued

MATING/UNMATING:

Thermal Aging Group

	Initial				After Thermals			
	Mating		**Unmating**		**Mating**		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	55.40	12.45	46.12	10.37	38.29	8.61	31.29	7.04
Maximum	60.95	13.70	54.32	12.21	52.94	11.90	35.07	7.88
Average	58.79	**13.22**	51.06	**11.48**	45.24	**10.17**	32.60	**7.33**
St Dev	2.04	0.46	3.04	0.68	4.87	1.09	1.55	0.35
Count	8	8	8	8	8	8	8	8

Mating/Unmating Durability Group

	Initial				25 Cycles			
	Mating		**Unmating**		**Mating**		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	49.60	11.15	41.08	9.24	97.46	21.91	60.57	13.62
Maximum	60.59	13.62	51.95	11.68	105.07	23.62	66.79	15.02
Average	55.93	**12.57**	46.56	**10.47**	100.69	**22.64**	64.01	**14.39**
St Dev	4.37	0.98	3.99	0.90	2.57	0.58	1.96	0.44
Count	8	8	8	8	8	8	8	8
	50 Cycles				75 Cycles			
	Mating		**Unmating**		**Mating**		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	93.23	20.96	59.73	13.43	90.38	20.32	60.57	13.62
Maximum	105.12	23.63	66.24	14.89	100.80	22.66	64.38	14.47
Average	99.54	**22.38**	63.25	**14.22**	95.48	**21.47**	62.28	**14.00**
St Dev	3.39	0.76	2.12	0.48	3.40	0.76	1.48	0.33
Count	8	8	8	8	8	8	8	8
	100 Cycles				After Humidity			
	Mating		**Unmating**		**Mating**		**Unmating**	
	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)	Newtons	Force (Lbs)
Minimum	86.99	19.56	60.13	13.52	46.09	10.36	28.28	6.36
Maximum	95.97	21.58	65.10	14.64	55.29	12.43	34.35	7.72
Average	91.21	**20.51**	62.36	**14.02**	48.64	**10.94**	31.82	**7.15**
St Dev	2.92	0.66	1.53	0.34	3.07	0.69	1.92	0.43
Count	8	8	8	8	8	8	8	8

DATA SUMMARIES Continued

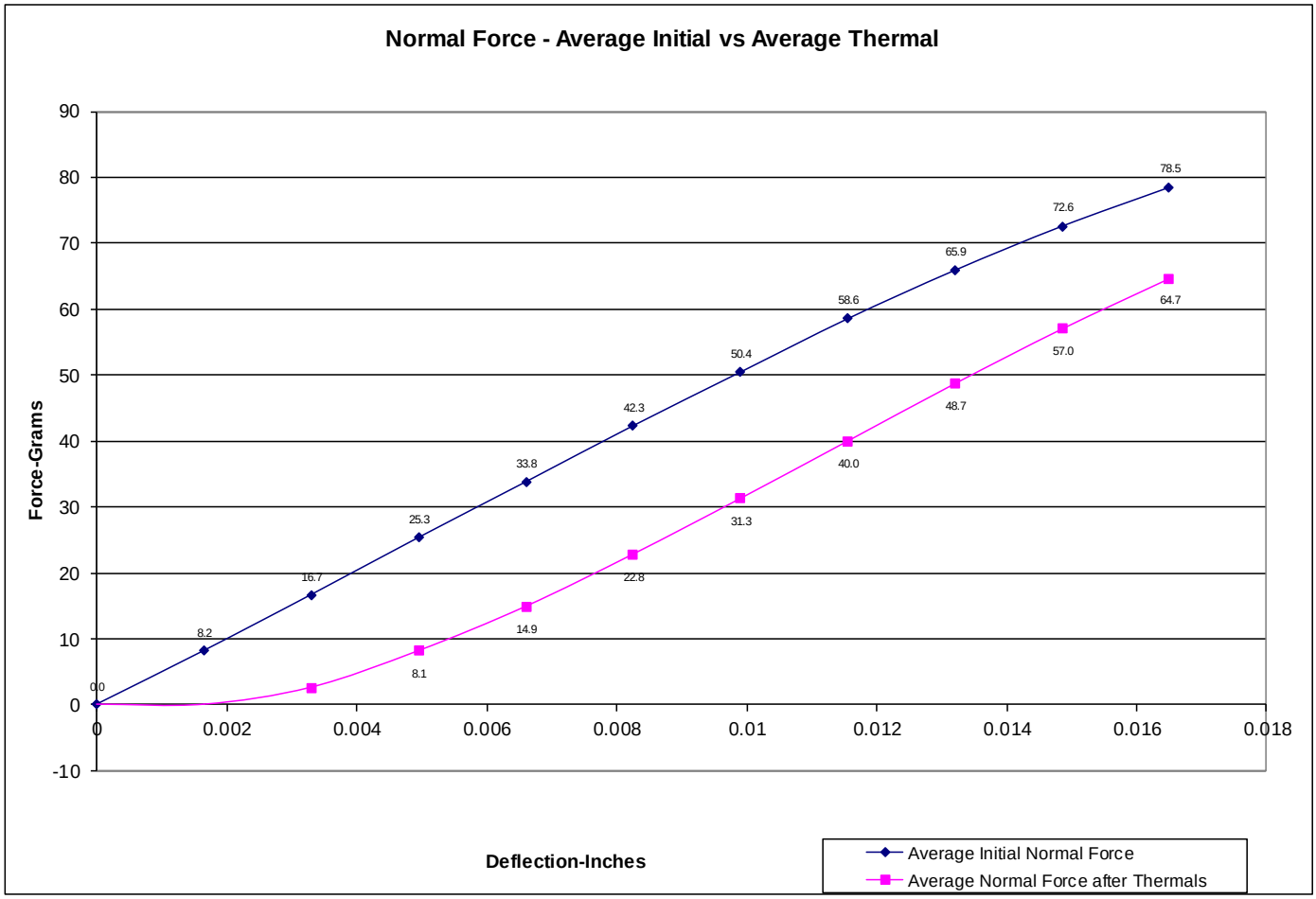
NORMAL FORCE (FOR CONTACTS TESTED IN THE HOUSING):

1) Calibrated force gauges are used along with computer controlled positioning equipment.
2) For Normal force 8-10 measurements are taken and the averages reported.

NVAF Signal Pin

Initial	Deflections in inches Forces in Grams										
	0.0017	**0.0033**	**0.0050**	**0.0066**	**0.0083**	**0.0099**	**0.0116**	**0.0132**	**0.0149**	**0.0165**	***SET***
Averages	**8.16**	**16.65**	**25.33**	**33.78**	**42.29**	**50.43**	**58.55**	**65.93**	**72.63**	**78.54**	**0.0013**
Min	7.60	15.30	23.50	31.90	40.80	48.70	55.90	62.80	69.00	74.30	0.0011
Max	8.80	17.80	26.80	35.00	43.70	52.60	60.70	68.40	75.30	81.60	0.0014
St. Dev	0.323	0.614	0.982	0.966	1.051	1.418	1.590	1.782	1.927	2.246	0.0001
Count	12	12	12	12	12	12	12	12	12	12	12

After Thermal	Deflections in inches Forces in Grams										
	0.0017	**0.0033**	**0.0050**	**0.0066**	**0.0083**	**0.0099**	**0.0116**	**0.0132**	**0.0149**	**0.0165**	***SET***
Averages	**0.00**	**2.59**	**8.14**	**14.88**	**22.80**	**31.26**	**39.98**	**48.71**	**57.03**	**64.69**	**0.0029**
Min	0.00	0.50	6.50	11.80	18.70	26.70	34.80	43.20	50.80	58.70	0.0024
Max	0.00	4.60	10.20	17.70	26.10	35.10	43.50	54.40	63.30	69.60	0.0033
St. Dev	0.000	1.347	1.308	1.882	2.136	2.339	2.547	2.891	3.140	2.889	0.0003
Count	12	12	12	12	12	12	12	12	12	12	12

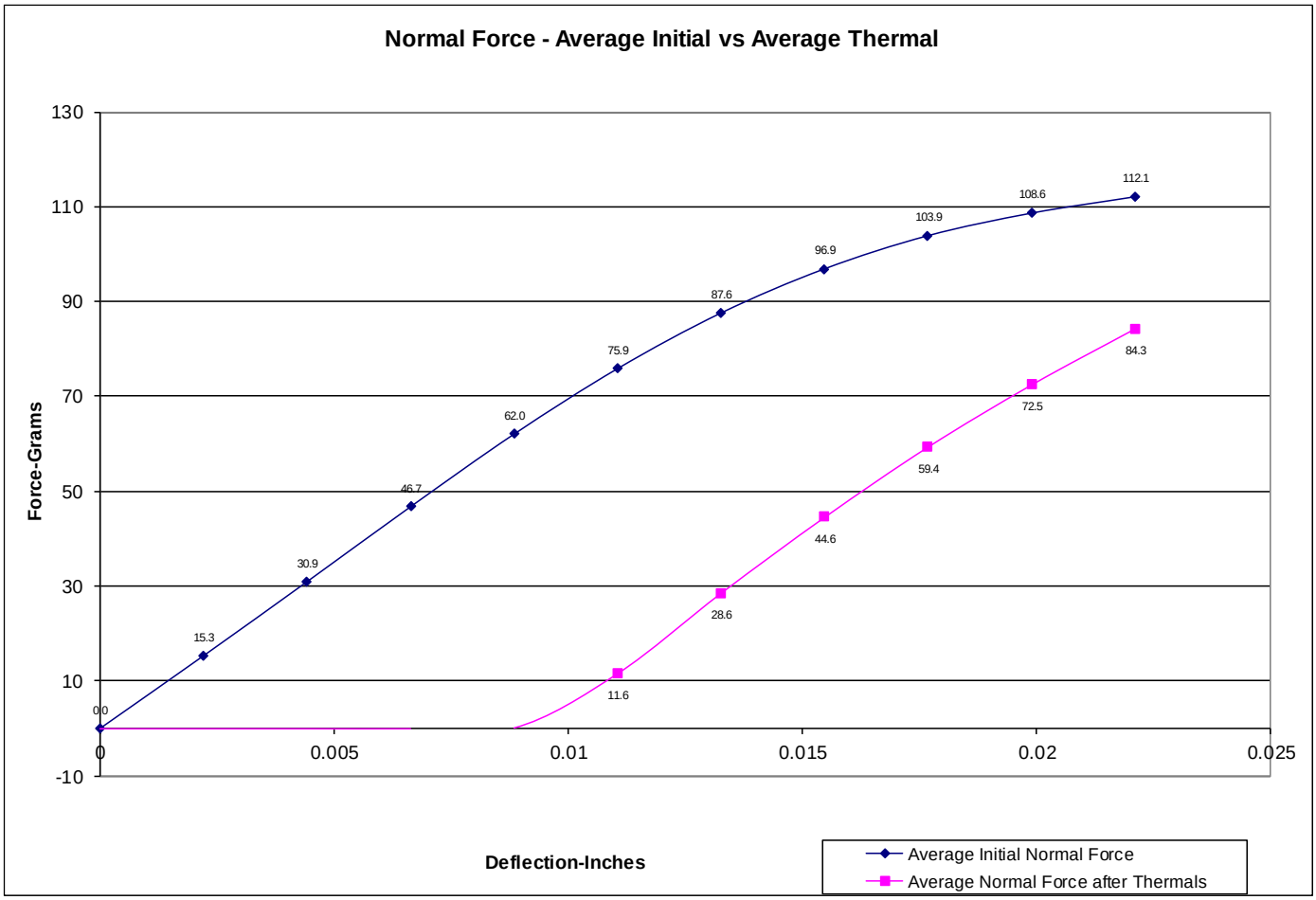


DATA SUMMARIES Continued

NVAF MFBL Ground Beam

Initial	Deflections in inches Forces in Grams										
	0.0022	**0.0044**	**0.0066**	**0.0088**	**0.0111**	**0.0133**	**0.0155**	**0.0177**	**0.0199**	**0.0221**	***SET***
Averages	**15.33**	**30.94**	**46.74**	**62.05**	**75.85**	**87.58**	**96.89**	**103.88**	**108.63**	**112.08**	**0.0061**
Min	11.20	22.20	33.50	47.50	62.10	76.00	87.60	96.60	103.50	106.90	0.0031
Max	19.90	39.00	57.50	75.40	89.20	98.00	104.20	108.60	115.10	119.80	0.0081
St. Dev	3.421	6.194	8.265	9.417	9.363	7.788	5.435	4.047	3.499	3.575	0.0016
Count	11	11	11	11	11	11	11	11	11	11	11

After Thermal	Deflections in inches Forces in Grams										
	0.0022	**0.0044**	**0.0066**	**0.0088**	**0.0111**	**0.0133**	**0.0155**	**0.0177**	**0.0199**	**0.0221**	***SET***
Averages	**0.00**	**0.00**	**0.00**	**0.18**	**11.63**	**28.57**	**44.58**	**59.40**	**72.51**	**84.33**	**0.0111**
Min	0.00	0.00	0.00	0.00	1.10	20.60	37.60	50.40	60.20	67.60	0.0091
Max	0.00	0.00	0.00	1.50	18.70	37.30	53.20	70.30	87.30	105.30	0.0137
St. Dev	0.000	0.000	0.000	0.427	5.593	5.221	4.813	5.306	7.265	10.038	0.0012
Count	12	12	12	12	12	12	12	12	12	12	12

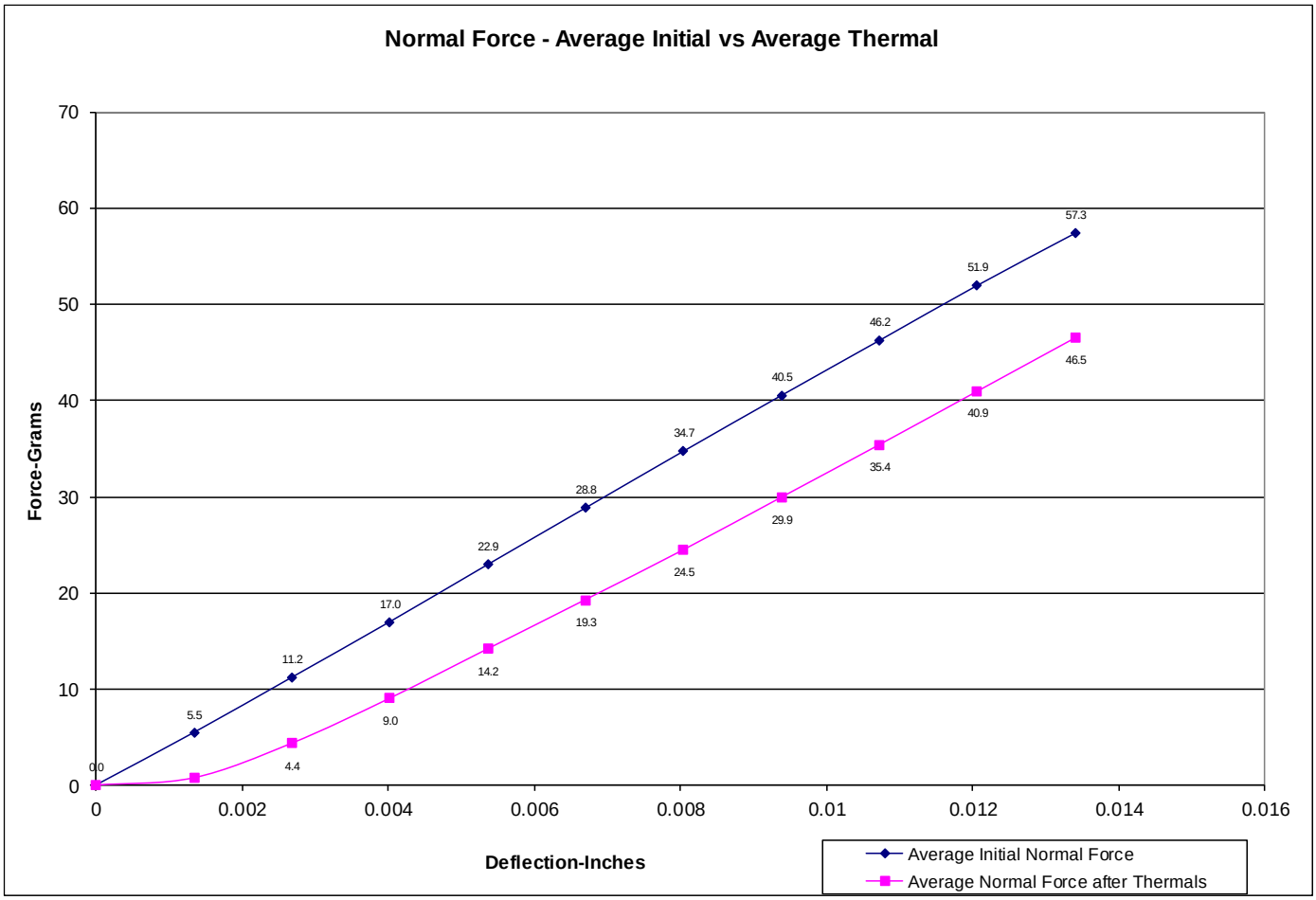


DATA SUMMARIES Continued

NVAF Flanking Ground Beam

Initial	Deflections in inches Forces in Grams										
	0.0013	**0.0027**	**0.0040**	**0.0054**	**0.0067**	**0.0080**	**0.0094**	**0.0107**	**0.0121**	**0.0134**	***SET***
Averages	**5.46**	**11.19**	**16.96**	**22.91**	**28.80**	**34.69**	**40.48**	**46.19**	**51.92**	**57.34**	**0.0005**
Min	4.60	9.30	14.10	19.20	24.70	30.30	35.90	41.20	46.20	51.00	0.0004
Max	6.00	12.20	17.90	24.10	30.40	36.70	43.50	49.90	55.60	60.70	0.0006
St. Dev	0.370	0.735	1.107	1.412	1.644	1.850	2.125	2.385	2.706	2.879	0.0001
Count	12	12	12	12	12	12	12	12	12	12	12

After Thermal	Deflections in inches Forces in Grams										
	0.0013	**0.0027**	**0.0040**	**0.0054**	**0.0067**	**0.0080**	**0.0094**	**0.0107**	**0.0121**	**0.0134**	***SET***
Averages	**0.76**	**4.35**	**9.03**	**14.16**	**19.28**	**24.47**	**29.93**	**35.38**	**40.94**	**46.49**	**0.0018**
Min	0.00	0.00	2.60	7.10	11.50	15.80	20.70	25.60	30.90	36.30	0.0004
Max	4.80	10.30	15.80	21.20	26.60	32.40	38.30	44.30	50.30	56.00	0.0034
St. Dev	1.460	3.061	3.896	4.104	4.370	4.700	4.927	5.191	5.382	5.559	0.0009
Count	12	12	12	12	12	12	12	12	12	12	12

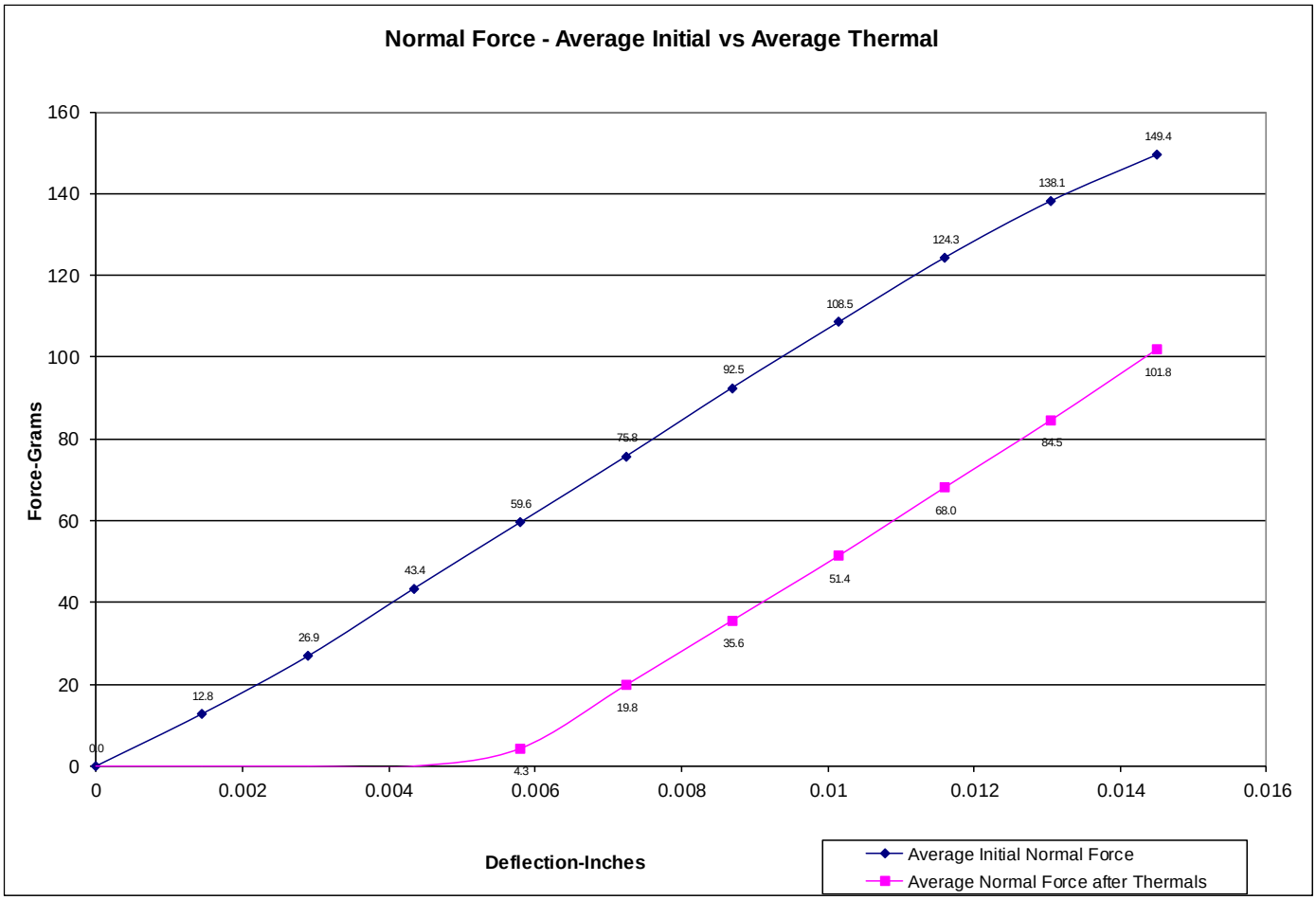


DATA SUMMARIES Continued

NVAF Center Ground Beam

Initial	Deflections in inches Forces in Grams										
	0.0015	**0.0029**	**0.0044**	**0.0058**	**0.0073**	**0.0087**	**0.0102**	**0.0116**	**0.0131**	**0.0145**	***SET***
Averages	**12.78**	**26.91**	**43.43**	**59.58**	**75.78**	**92.52**	**108.51**	**124.27**	**138.11**	**149.43**	**0.0011**
Min	8.20	16.50	33.20	48.80	64.90	80.90	95.90	111.10	125.90	140.20	0.0006
Max	18.10	34.30	52.00	68.50	85.60	104.60	120.90	135.80	147.30	155.50	0.0015
St. Dev	4.518	7.139	7.146	7.205	7.607	8.097	8.209	7.613	6.499	4.888	0.0004
Count	12	12	12	12	12	12	12	12	12	12	12

After Thermal	Deflections in inches Forces in Grams										
	0.0015	**0.0029**	**0.0044**	**0.0058**	**0.0073**	**0.0087**	**0.0102**	**0.0116**	**0.0131**	**0.0145**	***SET***
Averages	**0.00**	**0.00**	**0.00**	**4.31**	**19.84**	**35.60**	**51.35**	**68.03**	**84.46**	**101.78**	**0.0055**
Min	0.00	0.00	0.00	0.00	11.50	27.10	42.20	57.80	71.70	87.80	0.0047
Max	0.00	0.00	0.00	12.60	30.00	48.30	64.30	82.20	98.70	116.50	0.0063
St. Dev	0.000	0.000	0.000	4.012	5.009	5.598	5.974	7.124	8.076	9.325	0.0004
Count	12	12	12	12	12	12	12	12	12	12	12

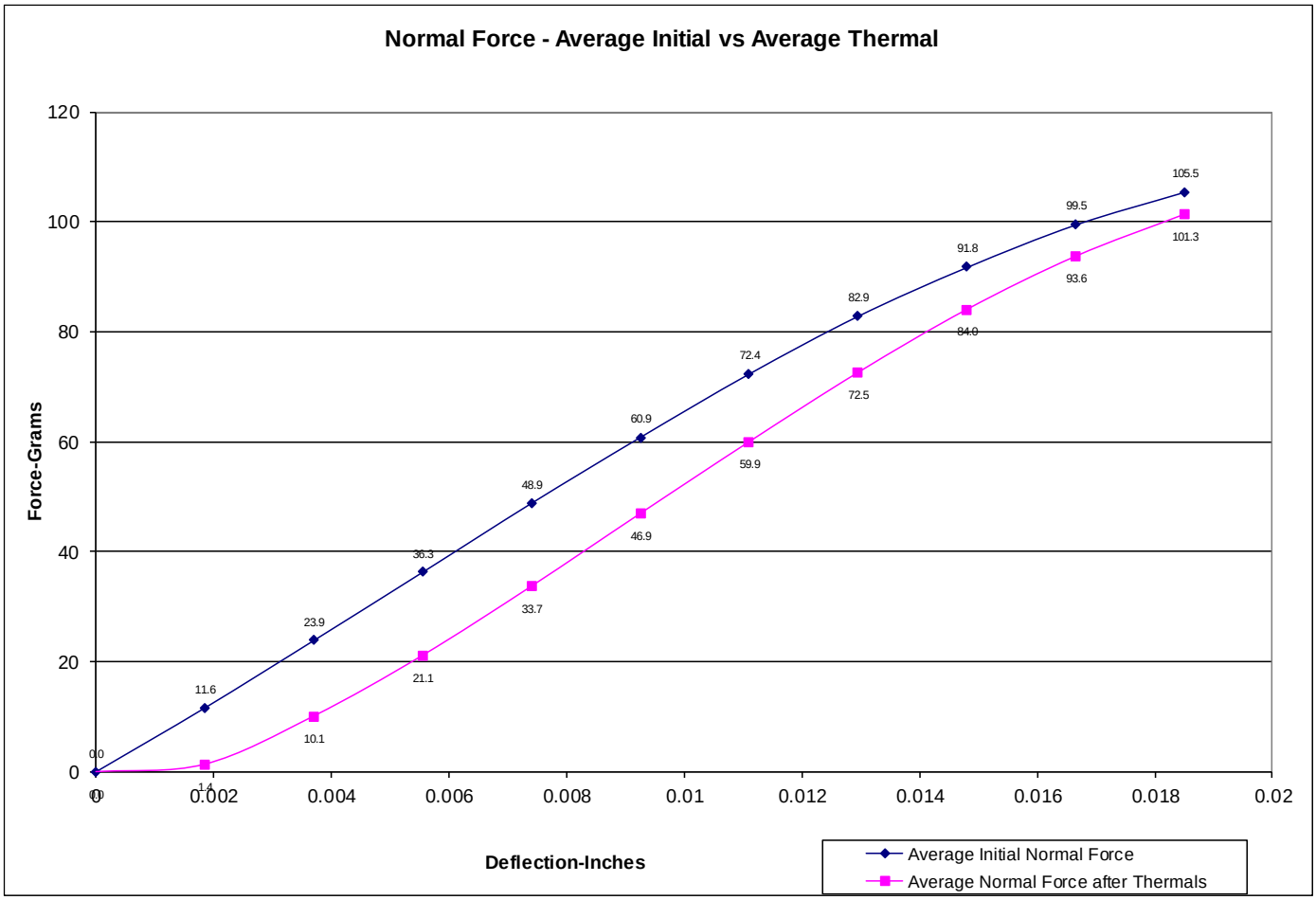


DATA SUMMARIES Continued

NVAM Signal pin

Initial	Deflections in inches Forces in Grams										
	0.0019	**0.0037**	**0.0056**	**0.0074**	**0.0093**	**0.0111**	**0.0130**	**0.0148**	**0.0167**	**0.0185**	***SET***
Averages	**11.63**	**23.88**	**36.31**	**48.86**	**60.85**	**72.38**	**82.88**	**91.77**	**99.52**	**105.47**	**0.0024**
Min	11.00	22.80	34.90	47.10	59.20	70.40	79.90	88.40	95.20	100.60	0.0021
Max	13.10	26.00	39.50	52.50	64.80	75.70	85.10	93.60	101.50	109.00	0.0031
St. Dev	0.624	0.953	1.287	1.366	1.532	1.417	1.538	1.520	1.924	2.470	0.0003
Count	12	12	12	12	12	12	12	12	12	12	12

After Thermal	Deflections in inches Forces in Grams										
	0.0019	**0.0037**	**0.0056**	**0.0074**	**0.0093**	**0.0111**	**0.0130**	**0.0148**	**0.0167**	**0.0185**	***SET***
Averages	**1.37**	**10.10**	**21.13**	**33.68**	**46.89**	**59.93**	**72.51**	**83.97**	**93.63**	**101.27**	**0.0029**
Min	0.90	9.00	18.10	29.50	42.50	55.00	68.60	80.60	91.50	99.00	0.0026
Max	1.80	11.60	24.20	37.90	51.20	63.80	76.20	86.30	96.50	104.30	0.0033
St. Dev	0.284	0.741	1.539	2.138	2.234	2.344	2.183	1.867	1.601	1.627	0.0002
Count	12	12	12	12	12	12	12	12	12	12	12



DATA SUMMARIES Continued

INSULATION RESISTANCE (IR):

	Pin to Pin		
	Mated	Unmated	Unmated
Minimum	**NVAF/NVAM**	**NVAF**	**NVAM**
Initial	45000	45000	45000
Thermal	45000	45000	45000
Humidity	45000	45000	45000

	Row to Row		
	Mated	Unmated	Unmated
Minimum	**NVAF/NVAM**	**NVAF**	**NVAM**
Initial	45000	45000	45000
Thermal	45000	45000	45000
Humidity	45000	45000	45000

	Pin to Ground		
	Mated	Unmated	Unmated
Minimum	**NVAF/NVAM**	**NVAF**	**NVAM**
Initial	45000	45000	45000
Thermal	45000	45000	45000
Humidity	45000	45000	45000

DIELECTRIC WITHSTANDING VOLTAGE (DWV):

Voltage Rating Summary	
Minimum	**NVAF/NVAM**
Break Down Voltage	804
Test Voltage	605
Working Voltage	200

Pin to Pin	
Initial Test Voltage	Passed
After Thermal Test Voltage	Passed
After Humidity Test Voltage	Passed

Row to Row	
Initial Test Voltage	Passed
After Thermal Test Voltage	Passed
After Humidity Test Voltage	Passed

Pin to Ground	
Initial Test Voltage	Passed
After Thermal Test Voltage	Passed
After Humidity Test Voltage	Passed

DATA SUMMARIES Continued

LLCR Durability:

1) A total of 128 signal and 64 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 +2000 mOhms----------Unstable
   f. >+2000 mOhms:----------Open Failure

LLCR Measurement Summaries by Pin Type				
Date	9/17/2018	9/20/2018	9/24/2018	10/5/2018
Room Temp (Deg C)	23	23	23	23
Rel Humidity (%)	50	49	49	50
Technician	Tony Wagoner	Tony Wagoner	Tony Wagoner	Tony Wagoner
mOhm values	**Actual Initial**	**Delta 100 Cycles**	**Delta Therm Shck**	**Delta Humidity**
	Pin Type 1: Signal			
Average	20.36	0.36	0.48	0.44
St. Dev.	0.45	0.26	0.35	0.29
Min	19.11	0.00	0.01	0.00
Max	22.08	1.39	2.05	1.45
Summary Count	128	128	128	128
Total Count	128	128	128	128
	Pin Type 2: Ground			
Average	0.14	0.02	0.02	0.03
St. Dev.	0.01	0.01	0.01	0.02
Min	0.11	0.00	0.00	0.00
Max	0.17	0.05	0.05	0.08
Summary Count	64	64	64	64
Total Count	64	64	64	64

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	**192**	**0**	**0**	**0**	**0**	**0**

DATA SUMMARIES Continued

LLCR Thermal Aging:

1) A total of 128 signal and 64 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 +2000 mOhms: ----------Unstable
   f. >+2000 mOhms:----------Open Failure

LLCR Measurement Summaries by Pin Type				
Date	9/23/2018	10/4/2018		
Room Temp (Deg C)	22	23		
Rel Humidity (%)	46	48		
Technician	Tony Wagoner	Tony Wagoner		
mOhm values	**Actual Initial**	**Delta Thermal**	**Delta**	**Delta**
	Pin Type 1: Signal			
Average	20.14	0.40		
St. Dev.	0.61	0.46		
Min	18.19	0.00		
Max	21.30	2.12		
Summary Count	128	128		
Total Count	128	128		
	Pin Type 2: Ground			
Average	0.13	0.02		
St. Dev.	0.01	0.02		
Min	0.11	0.00		
Max	0.16	0.06		
Summary Count	64	64		
Total Count	64	64		

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
Thermal	**192**	**0**	**0**	**0**	**0**	**0**

DATA SUMMARIES Continued

LLCR Gas Tight:

1) A total of 128 signal and 64 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 +2000 mOhms: ----------Unstable
   f. >+2000 mOhms:----------Open Failure

LLCR Measurement Summaries by Pin Type				
Date	9/6/2018	9/7/2018		
Room Temp (Deg C)	23	23		
Rel Humidity (%)	46	47		
Technician	Tony Wagoner	Tony Wagoner		
mOhm values	**Actual Initial**	**Delta Acid Vapor**	**Delta**	**Delta**
	Pin Type 1: Signal			
Average	20.40	0.45		
St. Dev.	0.51	0.44		
Min	18.82	0.01		
Max	21.83	3.18		
Summary Count	128	128		
Total Count	128	128		
	Pin Type 2: Ground			
Average	0.13	0.02		
St. Dev.	0.02	0.01		
Min	0.10	0.00		
Max	0.16	0.06		
Summary Count	64	64		
Total Count	64	64		

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
Acid Vapor	**192**	**0**	**0**	**0**	**0**	**0**

DATA SUMMARIES Continued

LLCR Shock &Vibration:

1). A total of 128 signal and 64 ground 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 +2000 mOhms ----------Unstable
   f. >+2000 mOhms: ----------Open Failure

LLCR Measurement Summaries by Pin Type				
Date	9/25/2018	10/3/2018		
Room Temp (Deg C)	23	23		
Rel Humidity (%)	50	52		
Technician	Tony Wagoner	Tony Wagoner		
mOhm values	**Actual Initial**	**Delta Shock-Vib**	**Delta**	**Delta**
	Pin Type 1: Signal			
Average	20.55	0.26		
St. Dev.	0.55	0.17		
Min	18.99	0.01		
Max	21.83	0.96		
Summary Count	128	128		
Total Count	128	128		
	Pin Type 2: Ground			
Average	0.13	0.03		
St. Dev.	0.01	0.02		
Min	0.11	0.00		
Max	0.16	0.07		
Summary Count	64	64		
Total Count	64	64		

LLCR Delta Count by Category						
	Stable	**Minor**	**Acceptable**	**Marginal**	**Unstable**	**Open**
mOhms	**<=5**	**>5 & <=10**	**>10 & <=15**	**>15 & <=50**	**>50 & <=1000**	**>1000**
Shock-Vib	**192**	**0**	**0**	**0**	**0**	**0**

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 #: 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: 05/29/2018, Next Cal: 05/29/2019

Equipment #: MO-11
Description: Switch/Multimeter
Manufacturer: Keithley
Model: 3706
Serial #: 120169
Accuracy: See Manual
… Last Cal: 09/11/2018, Next Cal: 09/11/2019

Equipment #: THC-05
Description: Temperature/Humidity Chamber (Chamber Room)
Manufacturer: Thermotron
Model: SM-8-3800
Serial #: 05 23 00 02
Accuracy: See Manual
… Last Cal: 11/14/2017, Next Cal: 11/14/2018

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: 06/30/2018, Next Cal: 06/30/2019

Equipment #: HPT-01
Description: Hipot Safety Tester
Manufacturer: Vitrek
Model: V73
Serial #: 019808
Accuracy:
… Last Cal: 05/15/2018, Next Cal: 05/15/2019

Equipment #: PS-02
Description: Power Supply
Manufacturer: Hewlett-Packer
Model: 6033A
Serial #: N/A
Accuracy: See Manual
… Last Cal: NOT CALIBRATED

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: 04/22/2018, Next Cal: 04/22/2019

Equipment #: ACLM-01
Description: Accelerometer
Manufacturer: PCB Piezotronics
Model: 352C03
Serial #: 115819
Accuracy: See Manual
… Last Cal: 07/18/2018, Next Cal: 07/18/2019

Equipment #: ED-03
Description: Event Detector
Manufacturer: Analysis Tech
Model: 32EHD
Serial #: 1100604
Accuracy: See Manual
… Last Cal: 10/31/2018, Next Cal: 10/31/2019

Equipment #: MO-04
Description: Multimeter /Data Acquisition System
Manufacturer: Keithley
Model: 2700
Serial #: 0798688
Accuracy: See Manual
… Last Cal: 09/11/2018, Next Cal: 09/11/2019