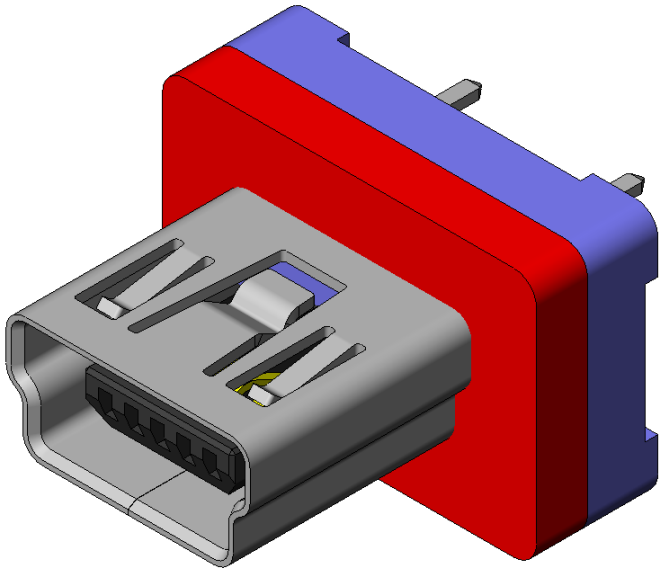
Project Number: Design Verification Test	Tracking Code: TC0909—2284_Report Rev 3		
Requested by: Brandon Harpenau	Date: 7/14/2009	Product Rev: 2	
Part #: MUSBS-05-S-B-TH	Lot #: 1	Tech: Rodney Riley Gary Lomax Troy Cook	Eng: Eric Mings Mark Shireman
Part description: Mini USB		Qty to test: 35	
Test Start: 02/26/2009	Test Completed: 6/24/2009		



Design Verification Test Report

PART DESCRIPTION

MUSBS-05-S-B-TH

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 verification test. 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 and DWV/IR testing were cleaned according to TLWI-0001.
4) Either an automated cleaning procedure or an ultrasonic cleaning procedure may be used.
5) The automated procedure is used with aqueous compatible soldering materials.
6) Parts not intended for testing LLCR and DWV/IR are visually inspected and cleaned if necessary.
7) Any additional preparation will be noted in the individual test sequences.
8) Solder Information: Lead Free Wave Solder
9) Samtec Test PCBs used: PCB-101471-TST-XX / PCB-101472-TST-XX

FLOWCHARTS

Current Carrying Capacity

3 Mated Assemblies Each

TEST STEP	GROUP A 3 Mated Assembies 1 CONTACTS POWERED	GROUP B 3 Mated Assembies 2 CONTACTS POWERED	GROUP C 3 Mated Assembies 3 CONTACTS POWERED	GROUP E 3 Mated Assembies ALL CONTACTS POWERED
01	CCC	CCC	CCC	CCC

(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 105° C
CCC, Temp rise = EIA-364-70

Gas Tight

TEST STEP	GROUP A 40 Points 8 Connectors
01	LLCR-1
02	Gas Tight
03	LLCR-2

Gas Tight = EIA-364-36A
LLCR = EIA-364-23, LLCR
use Keithley 580 in the dry circuit mode, 10 mA Max

Mating/Unmating/Gaps/Normal Force/Deflection Force

TEST STEP	GROUP A 10 Boards	GROUP B1 Individual Contacts (30) min	GROUP B2 Individual Contacts (30) min
01	Contact Gaps	**Setup Approve**	**Setup Approve**
02	Mating / Unmating	Normal Force	Thermal Aging (Mated)
03	Data Review	Data Review	Normal Force
04	1000 Cycles		
05	Mating / Unmating		
06	1000 Cycles		
07	Mating / Unmating		
08	1000 Cycles		
09	Mating / Unmating		
10	1000 Cycles		
11	Mating / Unmating		
12	1000 Cycles		
13	Mating / Unmating		
14	Contact Gaps		
15	Data Review		
16	Thermal Aging (Mated)		
17	Mating / Unmating		
18	Contact Gaps		
19	Data Review		
20	Humidity (Mated)		
21	Contact Gaps		
22	Mating / Unmating		

Thermal Aging = EIA-364-17, Test Condition 4, 105 deg C;
Time Condition 'B' (250 hours)
Humidity =EIA-364-31, Test Condition B (240 Hours)
and Method III (+25 ° C to +65 ° C @ 90%RH to 98% RH)
ambient pre-condition and delete steps 7a and 7b
Mating/Un-Mating Forces = EIA-364-13 (Cycle by Hand 200 Cycles per Hour)
Normal Force = EIA-364-04
(Perpendicular) displacement Force = 12.7 mm/min +/- 6 mm/min
Spec is 50 N @ 1 mm displacement
Contact Gaps/Height - No standard method. Usually measured optically

IR & DWV

TEST STEP	GROUP A1 2 Mated Sets Break Down - Pin to Pin	GROUP A2 2 Unmated of Part # Being Tested Break Down - Pin to Pin	GROUP A3 2 Unmated of Mating Part # Break Down - Pin to Pin	GROUP B 2 Mated Sets Pin to Pin
01	DWV/Break Down Voltage	DWV/Break Down Voltage	DWV/Break Down Voltage	IR & DWV at test voltage (on both mated sets and on each connector unmated)
02				Thermal Aging (both sets unmated)
03				IR & DWV at test voltage (on both mated sets and on each connector unmated)
04				Cyclic Humidity (both sets unmated)
05				IR & DWV at test voltage (on both mated sets and on each connector unmated)

*** - DWV on group B to be performed at Test Voltage**

DWV test voltage is equal to 75% of the lowest break down voltage from group A1, A2 or A3

Thermal Aging = EIA-364-17, Test Condition 4 (105 °C)

Time Condition 'B' (250 hours)

Humidity = EIA-364-31, Test Condition B (240 Hours)

and Method III (+25° C to +65° C @ 90%RH to 98% RH)

ambient pre-condition and delete steps 7a and 7b

ambient pre-condition and delete steps 7a and 7b

IR = EIA-364-21

DWV = EIA-364-20

Durability/Thermal Age/Cyclic Humidity

TEST STEP	GROUP A1 32 Points 5000 Cycles
01	Mating Force
02	Data Review
03	*LLCR-1
04	Data Review
05	5000 Cycles
06	Un-Mating Force
07	*LLCR-2
08	Data Review
09	Thermal Age
10	*LLCR-3
11	Data Review

***LLCR to be measured on signal pins. Signal is comprised of 28AWG twisted pair and 22AWG power lines (resistance values will differ).**

Thermal Aging = EIA-364-17, Test Condition 4, 105 deg C;
Time Condition 'B' (250 hours)
LLCR = EIA-364-23, LLCR
use Keithley 580 in the dry circuit mode, 10 mA Max

IP67 & IP66 Testing w/o Mate

	5 Connectors	5 Connectors	5 Connectors
TEST STEP	GROUP A1 MUSBS Part Number	GROUP A2 MUSBS Part Number	GROUP A3 MUSBS Part Number
01	Dust Test - IP67	Submersion Water Test - IP67	Stream of Water Test - IP66
02	Check for Dust	Check for Water	Check for Water

Dust/Water Testing = Per CEI/IEC 60529 Code IP66 & IP67

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 4 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.

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.

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 three temperature points are reported:
    a. Ambient
    b. 80^{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.

CONTACT GAPS:

1) Gaps above the surrounding plastic surface were measured before and after stressing the contacts (e.g. thermal aging, mechanical cycling, etc.).
2) Typically, all contacts on the connector are measured.

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.

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.

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).

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.

SUPPLEMENTAL TESTS

WATER TESTING:

1) Reference document: CEI/IEC 60529 Code IP66 and IP67
2) Torque requirements for testing:
    a. Machine Screw Torque to Fixture: 15.0 Inch/LB Min.
3) Gasket on connector compressed approximately 50% of thickness

DUST TESTING:

1) Reference document: CEI/IEC 60529 Code IP67
2) Torque requirements for testing:
    a. Machine Screw Torque to Fixture: 15.0 Inch/LB Min.
3) Gasket on connector compressed approximately 50% of thickness

RESULTS

Temperature Rise, CCC at a 20% de-rating

- CCC for a 30°C Temperature Rise ----------3.1A per contact with 1 contact powered
- CCC for a 30°C Temperature Rise ----------2.3A per contact with 2 adjacent contacts powered
- CCC for a 30°C Temperature Rise ----------2.0A per contact with 3 adjacent contacts powered
- CCC for a 30°C Temperature Rise ----------1.9A per contact with all adjacent contacts powered

- CCC for a 30°C Temperature Rise ----------2.7A per wire with all adjacent contacts powered

Contact Gaps

- Initial
  - Min ---------- 0.3420 mm
  - Max ---------- 0.4080 mm
- After 5,000 Cycles
  - Min ---------- 0.1880 mm
  - Max ---------- 0.3780 mm
- Thermal
  - Min ---------- 0.1720 mm
  - Max ---------- 0.3840 mm
- Humidity
  - Min ---------- 0.1700 mm
  - Max ---------- 0.3680 mm

Mating – Unmating Forces

- Initial
  - Mating
    - Min ---------- 1.19 Lbs
    - Max---------- 2.10 Lbs
  - Unmating
    - Min ---------- 0.96 Lbs
    - Max---------- 2.20 Lbs
- After 1000 Cycles
  - Mating
    - Min ---------- 0.66 Lbs
    - Max---------- 1.10 Lbs
  - Unmating
    - Min ---------- 0.66 Lbs
    - Max---------- 1.30 Lbs
- After 2000 Cycles
  - Mating
    - Min ---------- 0.38 Lbs
    - Max---------- 1.10 Lbs
  - Unmating
    - Min ---------- 0.43 Lbs
    - Max---------- 1.80 Lbs
- After 3000 Cycles
  - Mating
    - Min ---------- 0.42 Lbs
    - Max---------- 1.40 Lbs
  - Unmating
    - Min ---------- 0.34 Lbs
    - Max---------- 1.70 Lbs
- After 4000 Cycles
  - Mating
    - Min ---------- 0.32 Lbs
    - Max---------- 1.60 Lbs
  - Unmating
    - Min ---------- 0.29 Lbs
    - Max---------- 1.40 Lbs
- After 5000 Cycles
  - Mating
    - Min ---------- 0.35 Lbs
    - Max---------- 0.60 Lbs
  - Unmating
    - Min ---------- 0.31 Lbs
    - Max---------- 0.50 Lbs
- Thermal
  - Mating
    - Min ---------- 0.28 Lbs
    - Max---------- 0.60 Lbs
  - Unmating
    - Min ---------- 0.28 Lbs
    - Max---------- 0.70 Lbs
- Humidity
  - Mating
    - Min ---------- 0.29 Lbs
    - Max---------- 0.50 Lbs
  - Unmating
    - Min ---------- 0.18 Lbs
    - Max---------- 0.40 Lbs

Normal Force at 0.012” Deflection

- Initial
  - Min ----------73.60 g Set-----0.0000”
  - Max----------82.10 g Set-----0.0003”
- Thermal
  - Min ----------66.30 g
  - Max----------72.00 g

Insulation Resistance minimums, IR

- Initial
  - Mated---------- 50,000 Meg Ω----------Pass
  - Unmated ---------- 50,000 Meg Ω ----------Pass
- Thermal
  - Mated---------- 100,000 Meg Ω----------Pass
  - Unmated ---------- 100,000 Meg Ω----------Pass
- Humidity
  - Mated---------- 50,000 Meg Ω----------Pass
  - Unmated ---------- 50,000 Meg Ω ----------Pass

Dielectric Withstanding Voltage minimums, DWV

- Minimums
  - Breakdown Voltage ----------1000 VAC
  - Test Voltage---------- 750 VAC
  - Working Voltage ---------- 250 VAC
- Initial DWV ----------Passed
- Thermal DWV ----------Passed
- Humidity DWV----------Passed

LLCR Durability (36 LLCR test points)

- Initial ----------35.8 mOhms Max
- Durability, 5000 Cycles
  - <= +5.0 mOhms ----------36 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 ----------35 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 +2000 mOhms---------- 0 Points ----------Unstable
  - >+2000 mOhms---------- 0 Points ----------Open Failure

LLCR Gas Tight (32 LLCR test points)

- Initial ----------38.2 mOhms Max
- Gas-Tight
  - <= +5.0 mOhms ----------31 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 +2000 mOhms---------- 0 Points ----------Unstable
  - >+2000 mOhms---------- 0 Points ----------Open Failure

SUPPLEMENTAL TESTING

IP66 & IP67 Testing w/o Mate (Water & Dust)

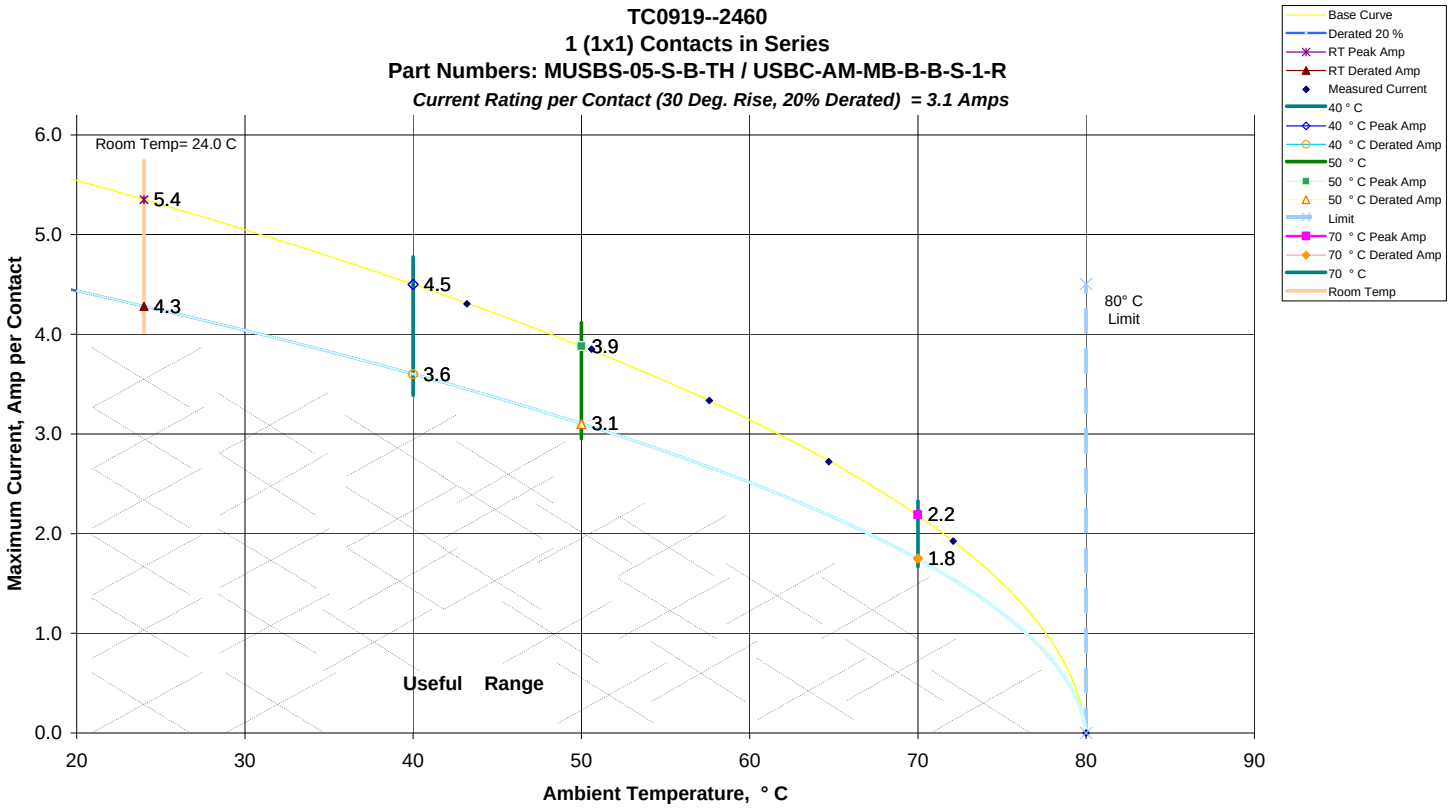
	Initial (Before Exposure)	After Exposure
Water	No Water Present	No Water Present
Dust	No Dust Present	No Dust Present

DATA SUMMARIES

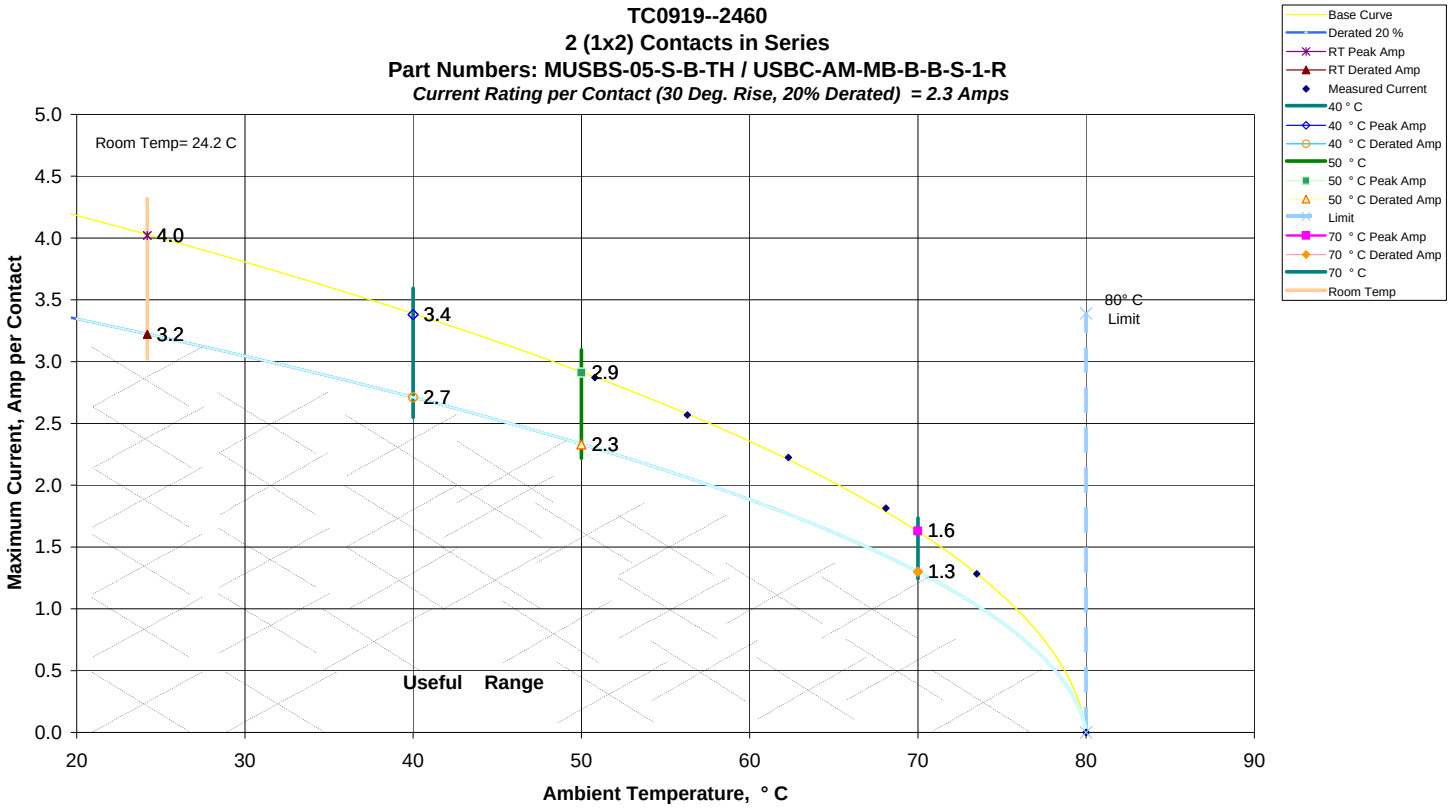
TEMPERATURE RISE (Current Carrying Capacity, CCC):

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:

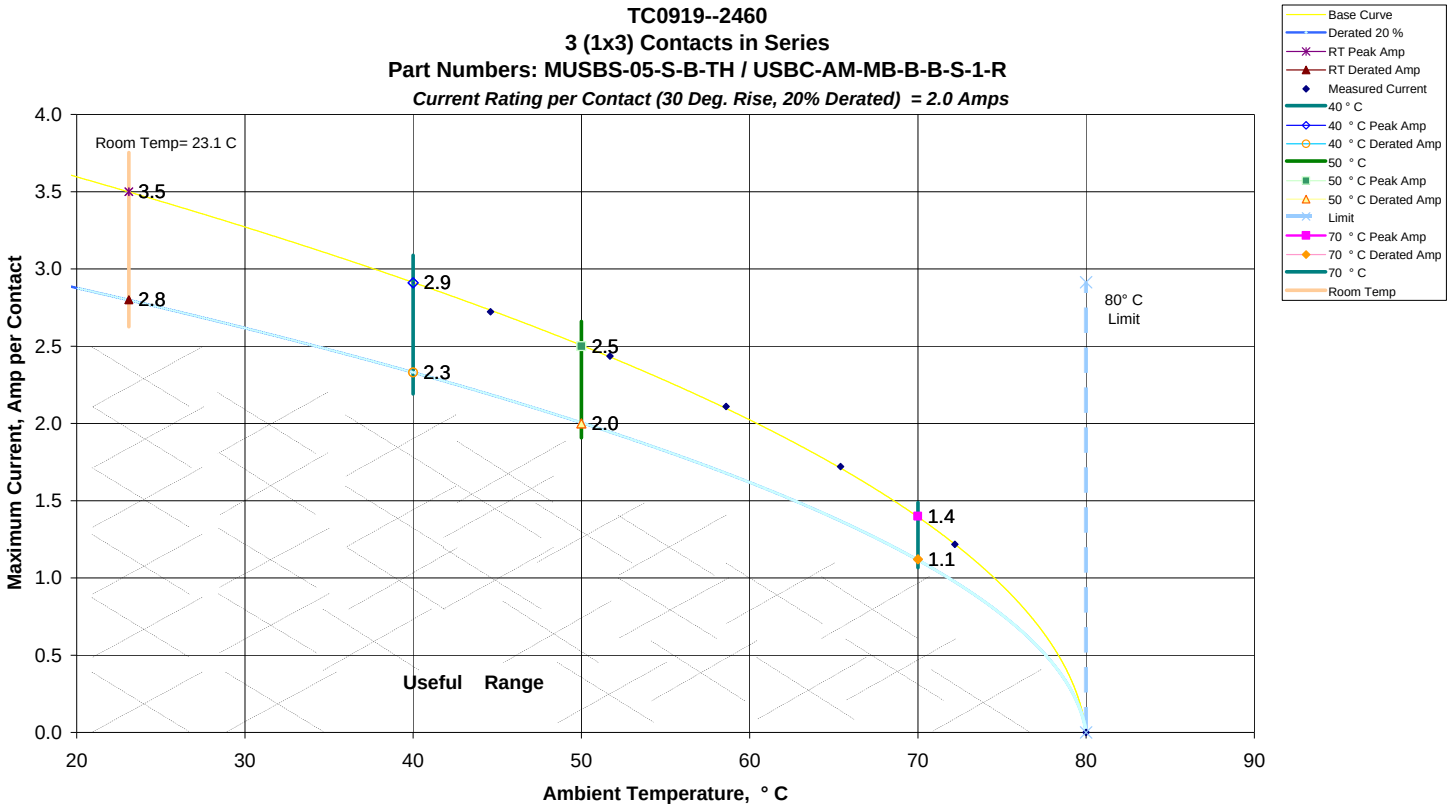
    a. Linear configuration with 1 conductor/contact powered



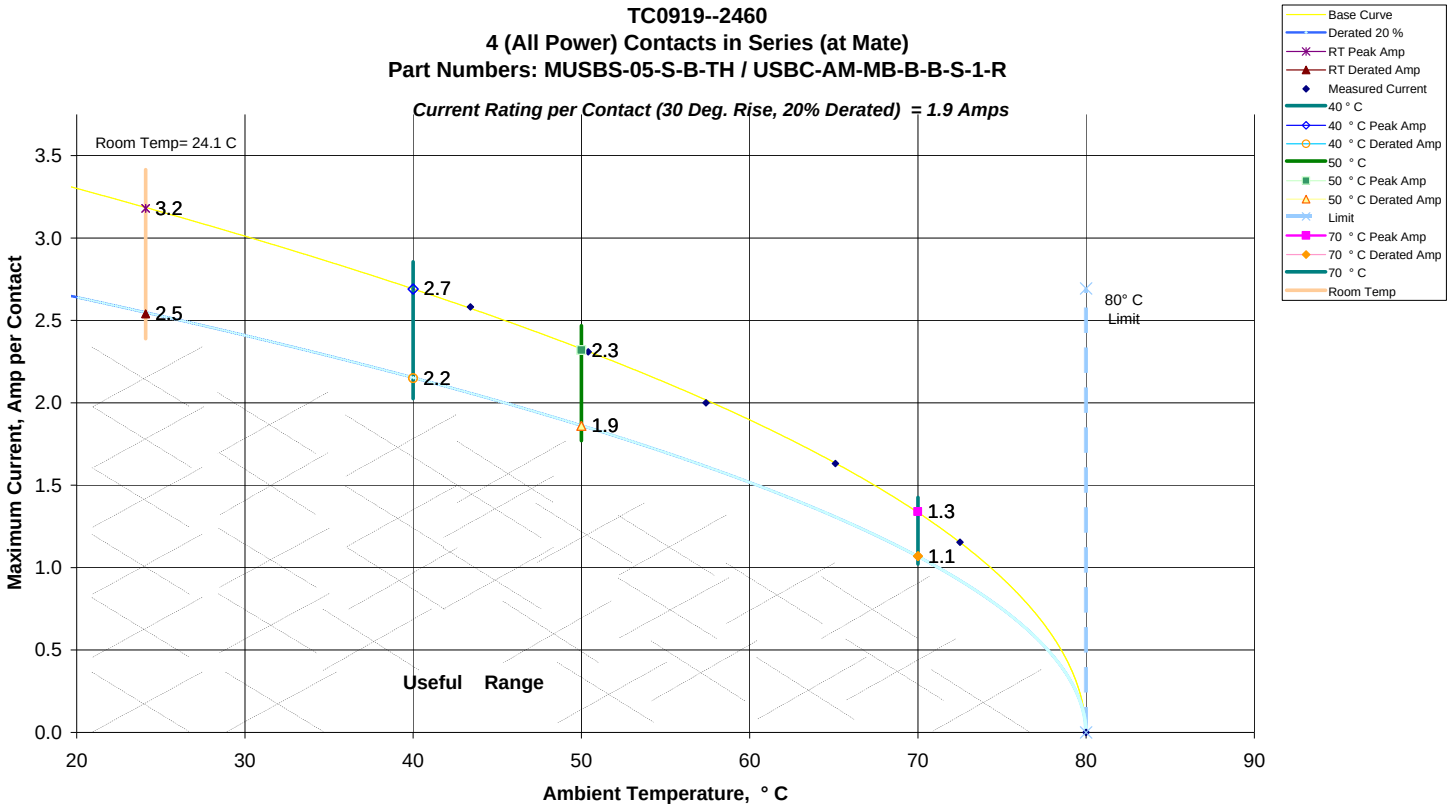
b. Linear configuration with 2 adjacent conductors/contacts powered



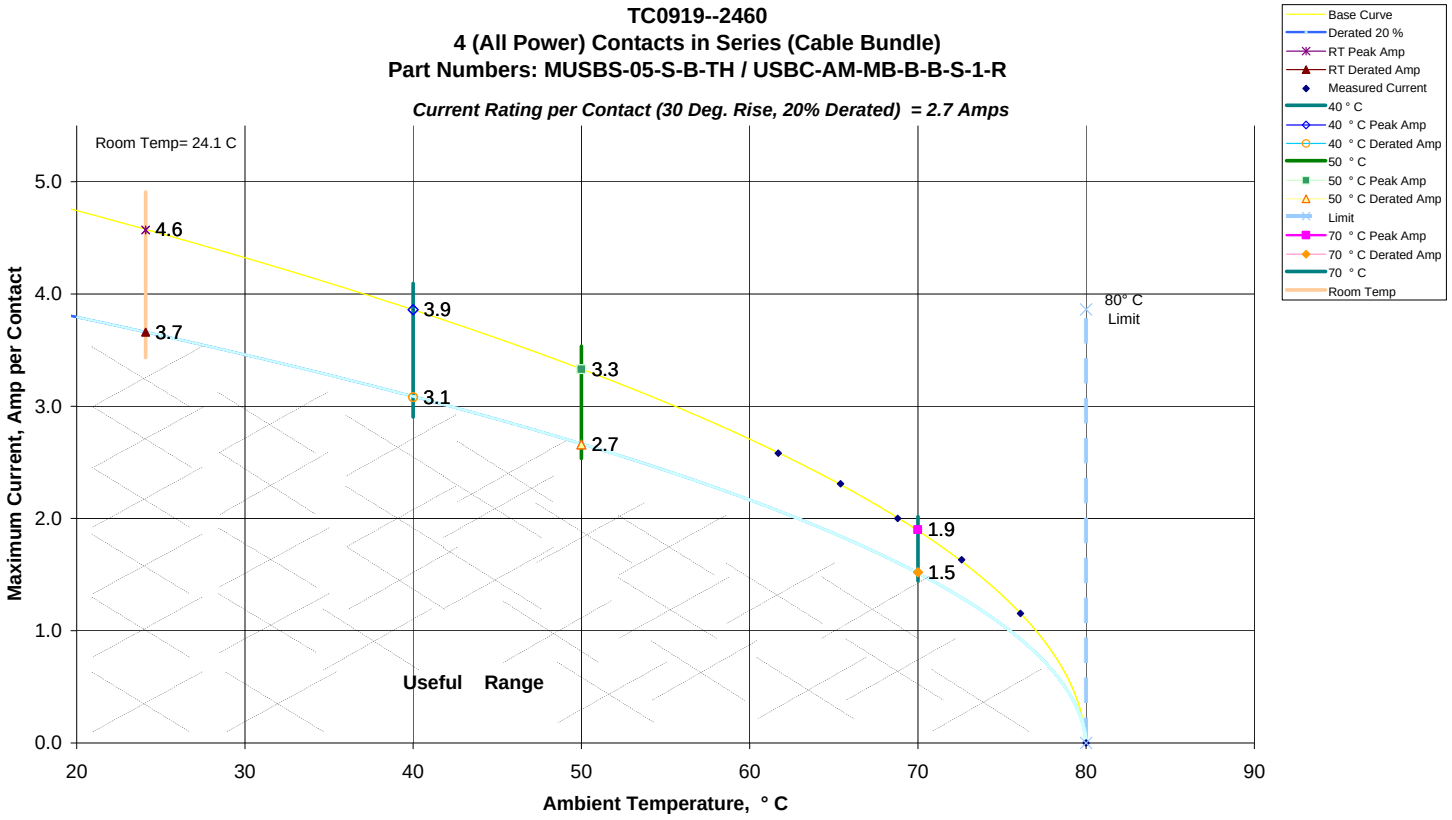
c. Linear configuration with 3 adjacent conductors/contacts powered



d. Linear configuration with all adjacent conductors/contacts powered



e. Linear configuration with all adjacent conductors/contacts powered



CONTACT GAPS:

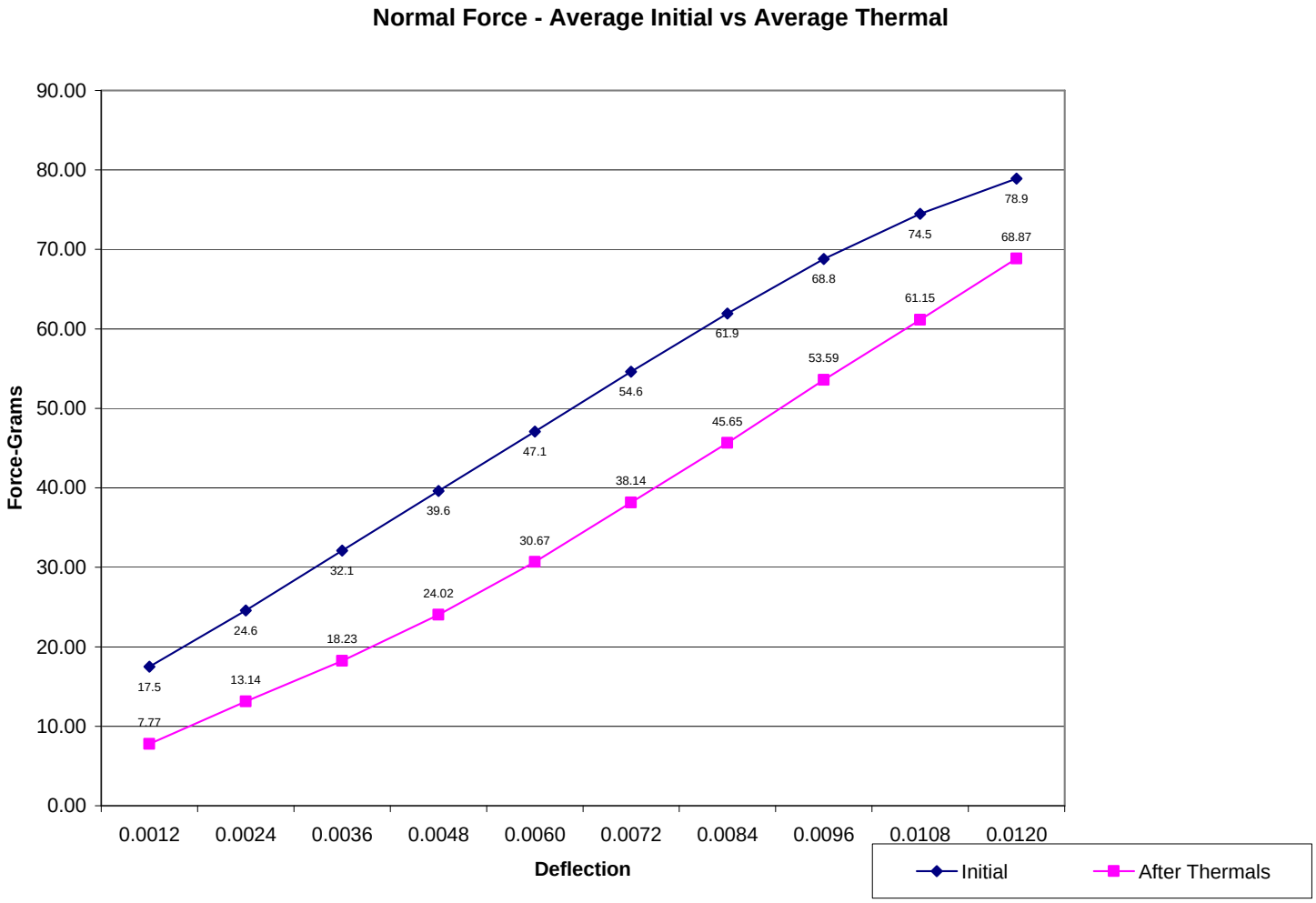
Initial		After 5000 Cycles		Thermal		Humidity	
Measured in mm		Measured in mm		Measured in mm		Measured in mm	
Minimum	0.3420	***Minimum***	0.1880	***Minimum***	0.1720	***Minimum***	0.1700
Maximum	0.4080	***Maximum***	0.3780	***Maximum***	0.3840	***Maximum***	0.3680
Average	0.3761	***Average***	0.3214	***Average***	0.3294	***Average***	0.3070
St. Dev.	0.0147	***St. Dev.***	0.0380	***St. Dev.***	0.0379	***St. Dev.***	0.0445
Count	50	***Count***	50	***Count***	50	***Count***	50

MATING/UNMATING:

	Initial				After 1000 Cycles			
	Mating		**Unmating**		**Mating**		**Unmating**	
	Force (Oz)	Force (Lbs)	Force (Oz)	Force (Lbs)	Force (Oz)	Force (Lbs)	Force (Oz)	Force (Lbs)
Minimum	19.1	1.19	15.4	0.96	10.5	0.66	10.6	0.66
Maximum	34.0	2.1	35.7	2.2	17.8	1.1	20.6	1.3
Average	24.8	**1.5**	23.9	**1.5**	14.1	**0.9**	16.1	**1.0**
	After 2000 Cycles				After 3000 Cycles			
	Mating		**Unmating**		**Mating**		**Unmating**	
	Force (Oz)	Force (Lbs)	Force (Oz)	Force (Lbs)	Force (Oz)	Force (Lbs)	Force (Oz)	Force (Lbs)
Minimum	6.1	0.38	6.9	0.43	6.7	0.42	5.4	0.34
Maximum	17.6	1.1	28.5	1.8	21.6	1.4	26.4	1.7
Average	11.9	**0.7**	14.3	**0.9**	10.6	**0.7**	10.7	**0.7**
	After 4000 Cycles				After 5000 Cycles			
	Mating		**Unmating**		**Mating**		**Unmating**	
	Force (Oz)	Force (Lbs)	Force (Oz)	Force (Lbs)	Force (Oz)	Force (Lbs)	Force (Oz)	Force (Lbs)
Minimum	5.1	0.32	4.6	0.29	5.6	0.35	5.0	0.31
Maximum	25.6	1.6	22.9	1.4	9.4	0.6	8.0	0.5
Average	10.3	**0.6**	9.5	**0.6**	7.1	**0.4**	6.6	**0.4**
	After Thermals				After Humidity			
	Mating		**Unmating**		**Mating**		**Unmating**	
	Force (Oz)	Force (Lbs)	Force (Oz)	Force (Lbs)	Force (Oz)	Force (Lbs)	Force (Oz)	Force (Lbs)
Minimum	4.6	0.28	4.5	0.28	4.6	0.29	2.9	0.18
Maximum	9.8	0.6	10.7	0.7	8.6	0.5	6.7	0.4
Average	7.3	**0.5**	6.1	**0.4**	6.4	**0.4**	5.2	**0.3**

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.



Initial	Deflections in inches Forces in Grams										
	0.0012	**0.0024**	**0.0036**	**0.0048**	**0.0060**	**0.0072**	**0.0084**	**0.0096**	**0.0108**	**0.0120**	***SET***
Averages	**17.51**	**24.58**	**32.10**	**39.62**	**47.08**	**54.63**	**61.93**	**68.80**	**74.48**	**78.91**	**0.0001**
Min	11.40	18.00	24.80	31.80	38.90	46.20	53.60	61.00	68.10	73.60	0.0000
Max	23.00	30.50	38.10	45.50	53.30	60.60	67.80	73.90	78.80	82.10	0.0003
St. Dev	3.545	4.019	4.169	4.255	4.397	4.496	4.489	4.151	3.447	2.517	0.0001
Count	12	12	12	12	12	12	12	12	12	12	12

After Thermals	Deflections in inches Forces in Grams										
	0.0012	**0.0024**	**0.0036**	**0.0048**	**0.0060**	**0.0072**	**0.0084**	**0.0096**	**0.0108**	**0.0120**	***SET***
Averages	**7.77**	**13.14**	**18.23**	**24.02**	**30.67**	**38.14**	**45.65**	**53.59**	**61.15**	**68.87**	**0.0000**
Min	5.80	11.60	15.60	21.80	28.50	35.50	43.00	50.70	58.40	66.30	-0.0001
Max	12.40	18.00	23.10	28.10	34.60	42.00	49.50	57.00	64.70	72.00	0.0002
St. Dev	2.130	1.976	2.220	1.955	1.699	1.713	1.751	1.827	1.922	1.862	0.0001
Count	11	11	11	11	11	11	11	11	11	11	11

INSULATION RESISTANCE (IR):

	Pin to Pin		
	Mated	Unmated	Unmated
Minimum	**MUSBS/Cable**	**MUSBS**	**Cable**
Initial	50000	50000	Not Tested
Thermal	100000	100000	Not Tested
Humidity	50000	50000	Not Tested

	Pin to Ground		
	Mated	Unmated	Unmated
Minimum	**MUSBS/Cable**	**MUSBS**	**Cable**
Initial	100000	100000	Not Tested
Thermal	100000	100000	Not Tested
Humidity	100000	100000	Not Tested

DIELECTRIC WITHSTANDING VOLTAGE (DWV):

Voltage Rating Summary	
Minimum	**MUSBS/Cable**
Break Down Voltage	1000
Test Voltage	750
Working Voltage	250

Pin to Pin	
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

LLCR:

1) A total of 36 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

Date	May 15 2009	May 22 2009	Jun. 08 2009
Room Temp C	24	24	23
RH	37%	36%	47%
Name	RILEY	Eric Mings	Lomax
mOhm values	**Actual Initial**	**Delta 5000 Cycles**	**Delta Thermal**
Average	29.2	-0.3	1.1
St. Dev.	3.3	0.8	1.4
Min	23.0	-2.6	-1.9
Max	35.8	1.2	5.5
Count	36	36	36

GAS TIGHT:

1) A total of 36 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

Date	May 20 2009	May 27 2009
Room Temp C	24	24
RH	34%	38%
Name	Lomax	Lomax
mOhm values	**Actual Initial**	**Delta Gas Tight**
Average	28.8	-0.3
St. Dev.	3.8	1.6
Min	23.8	-5.2
Max	38.2	3.3
Count	32	32

SUPPLEMENTAL TESTS

IP66 & IP67 Testing w/o Mate (Water & Dust)

IP66 Water Jet Nozzle Test

Sample #	Visual Inspection
1	No water ingress through the connector or in the enclosure.
2	No water ingress through the connector or in the enclosure.
3	No water ingress through the connector or in the enclosure.
4	No water ingress through the connector or in the enclosure.
5	No water ingress through the connector or in the enclosure.

IP67 Water Submersion Test

Sample #	Visual Inspection
1	No water ingress through connector or into enclosure.
2	No water ingress through connector or into enclosure.
3	No water ingress through connector or into enclosure.
4	No water ingress through connector or into enclosure.
5	No water ingress through connector or into enclosure.

IP67 Dust Pressure Test

Sample #	Visual Inspection
1	No dust ingress through connector or into enclosure
2	No dust ingress through connector or into enclosure
3	No dust ingress through connector or into enclosure
4	No dust ingress through connector or into enclosure
5	No dust ingress through connector or into enclosure

DATA

CONTACT GAPS:

Initial										
Measured in mm										
Pos.#	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**	**B9**	**B10**
1	0.342	0.392	0.378	0.364	0.358	0.384	0.372	0.386	0.36	0.4
2	0.346	0.384	0.374	0.364	0.362	0.39	0.39	0.392	0.376	0.39
3	0.354	0.388	0.38	0.376	0.378	0.384	0.39	0.376	0.376	0.402
4	0.37	0.366	0.352	0.38	0.384	0.374	0.402	0.37	0.394	0.364
5	0.364	0.362	0.364	0.374	0.372	0.366	0.386	0.362	0.408	0.384
After 5000 Cycles										
Measured in mm										
Pos.#	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**	**B9**	**B10**
1	0.324	0.338	0.326	0.342	0.344	0.346	0.334	0.376	0.368	0.358
2	0.326	0.33	0.286	0.36	0.322	0.32	0.338	0.366	0.352	0.316
3	0.32	0.326	0.316	0.326	0.318	0.348	0.316	0.378	0.368	0.328
4	0.294	0.318	0.244	0.306	0.326	0.334	0.334	0.344	0.348	0.31
5	0.216	0.246	0.26	0.188	0.316	0.348	0.328	0.278	0.314	0.302
After Thermal										
Measured in mm										
Pos.#	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**	**B9**	**B10**
1	0.328	0.356	0.322	0.336	0.348	0.344	0.344	0.38	0.338	0.36
2	0.342	0.36	0.326	0.358	0.334	0.354	0.35	0.384	0.324	0.342
3	0.326	0.346	0.322	0.326	0.334	0.352	0.35	0.378	0.354	0.358
4	0.35	0.322	0.276	0.322	0.338	0.298	0.356	0.354	0.35	0.336
5	0.238	0.28	0.244	0.172	0.312	0.316	0.316	0.264	0.326	0.324
After Humidity										
Measured in mm										
Pos.#	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**	**B9**	**B10**
1	0.278	0.326	0.29	0.32	0.24	0.34	0.332	0.368	0.298	0.35
2	0.292	0.302	0.316	0.334	0.312	0.344	0.334	0.362	0.292	0.354
3	0.32	0.326	0.312	0.322	0.316	0.354	0.364	0.366	0.334	0.344
4	0.276	0.284	0.262	0.3	0.322	0.318	0.354	0.348	0.328	0.336
5	0.21	0.242	0.214	0.17	0.3	0.274	0.316	0.232	0.292	0.232

MATING/UNMATING:

	Initial		After 1000 Cycles		After 2000 Cycles		After 3000 Cycles		After 4000 Cycles		After 5000 Cycles		After Thermals	
Sample#	Mating	Unmating	Mating	Unmating	Mating	Unmating	Mating	Unmating	Mating	Unmating	Mating	Unmating	Mating	Unmating
1	2.13	1.97	0.77	0.66	0.92	0.77	0.67	0.64	0.51	0.39	0.37	0.41	0.28	0.31
2	1.87	2.18	0.66	1.29	0.68	0.53	0.87	1.08	0.49	0.44	0.43	0.32	0.50	0.39
3	2.04	2.23	0.93	1.13	0.83	0.86	0.42	0.34	0.32	0.29	0.45	0.48	0.61	0.67
4	1.44	1.61	1.11	1.12	0.77	1.78	0.48	0.54	0.37	0.34	0.47	0.39	0.51	0.35
5	1.43	1.39	1.00	0.89	0.78	0.66	0.75	0.62	0.65	0.50	0.39	0.50	0.39	0.34
6	1.48	1.20	1.00	1.04	1.10	1.12	1.35	1.65	1.60	1.43	0.52	0.47	0.42	0.39
7	1.37	1.17	0.89	1.05	0.49	0.67	0.48	0.41	0.60	0.65	0.35	0.31	0.38	0.30
8	1.19	1.04	0.99	1.24	0.75	1.40	0.44	0.48	0.55	0.62	0.47	0.46	0.45	0.47
9	1.25	0.96	0.82	0.78	0.71	0.68	0.51	0.40	0.67	0.68	0.59	0.47	0.56	0.33
10	1.28	1.18	0.66	0.88	0.38	0.43	0.63	0.54	0.68	0.58	0.38	0.34	0.43	0.28

NORMAL FORCE (FOR CONTACTS TESTED IN THE HOUSING), Initial:

Initial — **Deflections in inches, Forces in Grams**

Sample #	0.0012	0.0024	0.0036	0.0048	0.0060	0.0072	0.0084	0.0096	0.0108	0.0120	*SET*
1	12.2	18.6	26.2	33.9	41.4	49.1	56.4	64.2	71.4	77.0	0.0000
2	11.4	18.0	24.8	31.8	38.9	46.2	53.6	61.0	68.1	75.2	0.0000
3	20.0	27.6	35.0	42.6	50.0	57.9	65.0	71.6	76.7	80.8	0.0001
4	23.0	30.5	38.1	45.5	53.3	60.6	67.8	73.9	78.8	82.1	0.0002
5	21.0	28.4	36.0	43.5	51.1	58.5	65.8	72.2	77.1	80.4	0.0003
6	17.7	24.9	33.0	40.6	48.1	55.4	63.1	70.6	76.4	79.6	0.0001
7	17.5	24.9	32.3	39.8	47.9	55.8	63.0	70.0	75.2	78.8	0.0001
8	19.6	27.4	35.1	42.6	49.6	57.7	65.1	71.9	77.1	81.3	0.0001
9	20.6	27.7	35.1	42.6	50.0	57.2	64.4	70.7	75.5	78.9	0.0002
10	15.5	20.5	27.7	34.8	41.7	48.6	55.7	62.4	68.5	73.6	0.0001
11	16.2	24.2	32.1	40.2	47.9	55.8	63.2	69.8	75.5	80.3	0.0002
12	15.4	22.3	29.8	37.5	45.1	52.7	60.0	67.3	73.4	78.9	0.0001

NORMAL FORCE (FOR CONTACTS TESTED IN THE HOUSING), After Thermals:

After Thermals — **Deflections in inches, Forces in Grams**

Sample #	0.0012	0.0024	0.0036	0.0048	0.0060	0.0072	0.0084	0.0096	0.0108	0.0120	*SET*
1	7.1	11.9	17.6	23.8	30.3	37.7	46.0	53.5	60.2	67.1	0.0000
2	10.9	15.4	20.9	26.5	32.4	39.0	46.7	54.8	62.9	70.9	0.0000
3	6.2	11.6	17.0	23.4	30.1	36.9	43.8	51.6	59.0	67.5	0.0000
4	7.1	13.0	18.6	24.7	31.4	38.8	46.7	54.9	62.8	70.9	0.0001
5	6.3	12.4	16.7	22.4	28.5	35.5	43.0	50.7	58.4	66.3	0.0002
6	5.8	11.6	15.6	21.8	28.8	36.5	44.4	52.2	59.9	68.5	0.0000
7	9.2	13.7	19.8	25.1	31.0	39.2	46.4	55.4	62.9	70.4	0.0000
8	6.8	12.1	16.8	22.6	29.9	38.3	45.7	53.6	60.8	68.4	0.0000
9											
10	7.0	13.1	17.7	23.7	30.4	38.3	45.2	53.1	60.6	67.7	0.0001
11	6.7	11.7	16.7	22.1	30.0	37.3	44.8	52.7	60.5	67.9	-0.0001
12	12.4	18.0	23.1	28.1	34.6	42.0	49.5	57.0	64.7	72.0	0.0000

***** Sample 9 data deleted due to bad setup*****

INSULATION RESISTANCE (IR):

Initial Insulation Resistance
Measured In Meg Ohms

	Pin to Pin		
	Mated	Unmated	
	X	X	
Sample#	MUSBS/Cable	MUSBS	Cable
1	100,000	100,000	
2	50,000	50,000	

	Pin to Ground		
	Mated	Unmated	
	X	X	
Sample#	MUSBS/Cable	MUSBS	Cable
1	100,000	100,000	
2	100,000	100,000	

Thermal Insulation Resistance
Measured In Meg Ohms

	Pin to Pin		
	Mated	Unmated	
	X	X	
Sample#	MUSBS/Cable	MUSBS	Cable
1	100,000	100,000	
2	100,000	100,000	

	Pin to Ground		
	Mated	Unmated	
	X	X	
Sample#	MUSBS/Cable	MUSBS	Cable
1	100,000	100,000	
2	100,000	100,000	

Humidity Insulation Resistance
Measured In Meg Ohms

	Pin to Pin		
	Mated	Unmated	
	X	X	
Sample#	MUSBS/Cable	MUSBS	Cable
1	50,000	50,000	
2	100,000	100,000	

	Pin to Ground		
	Mated	Unmated	
	X	X	
Sample#	MUSBS/Cable	MUSBS	Cable
1	100,000	100,000	
2	100,000	100,000	

DIELECTRIC WITHSTANDING VOLTAGE (DWV):

Initial DWV
Test Voltage= 750

	Pin to Pin		
	Mated	Unmated	
Sample#	MUSBS/Cable	MUSBS	Cable
1	750	750	
2	750	750	

	Pin to Ground		
	Mated	Unmated	
Sample#	MUSBS/Cable	MUSBS	Cable
1	750	750	
2	750	750	

Thermal Test Voltage
Test Voltage= 750

	Pin to Pin		
	Mated	Unmated	
Sample#	MUSBS/Cable	MUSBS	Cable
1	750	750	
2	750	750	

	Pin to Ground		
	Mated	Unmated	
Sample#	MUSBS/Cable	MUSBS	Cable
1	750	750	
2	750	750	

Humidity Test Voltage
Test Voltage= 750

	Pin to Pin		
	Mated	Unmated	
Sample#	MUSBS/Cable	MUSBS	Cable
1	750	750	
2	750	750	

	Pin to Ground		
	Mated	Unmated	
Sample#	MUSBS/Cable	MUSBS	Cable
1	750	750	
2	750	750	

LLCR:

mOhm values		Actual	Delta	Delta
Board	Position	Initial	5000 Cycles	Thermal
1	P1	26.3	-0.1	0.3
1	P2	32.0	-0.6	0.8
1	P3	31.3	0.0	1.5
1	P5	27.1	-0.8	0.8
2	P1	28.2	-2.6	-0.3
2	P2	33.1	-1.4	1.1
2	P3	30.7	-1.0	0.7
2	P5	26.8	0.0	4.5
3	P1	28.1	0.6	0.7
3	P2	34.7	0.0	0.4
3	P3	32.5	0.8	1.7
3	P5	28.5	-0.4	0.1
4	P1	26.3	-0.6	-0.4
4	P2	33.5	1.2	1.8
4	P3	31.7	0.2	2.0
4	P5	27.1	-1.2	0.3
5	P1	27.4	-0.4	0.0
5	P2	35.8	-2.4	-1.9
5	P3	33.3	-0.7	-0.3
5	P5	28.0	-1.1	0.4
6	P1	25.1	0.7	2.5
6	P2	32.0	-0.3	0.5
6	P3	30.3	-0.2	0.1
6	P5	25.6	0.2	1.2
7	P1	26.0	-0.4	3.1
7	P2	32.7	-0.7	1.8
7	P3	31.9	-0.1	5.5
7	P5	27.2	-0.8	0.5
8	P1	26.2	-0.4	2.9
8	P2	32.7	-0.2	0.9
8	P3	31.7	-0.3	0.7
8	P5	25.7	-0.2	1.8
9	P1	23.4	-0.2	0.6
9	P2	28.0	0.4	0.3
9	P3	27.8	0.3	1.6
9	P5	23.0	0.8	0.3

GAS TIGHT:

mOhm values		Actual	Delta
Board	Position	Initial	Gas Tight
1	P1	29.1	0.1
1	P2	38.2	-2.8
1	P3	33.3	-3.4
1	P5	30.8	-5.2
2	P1	24.8	0.2
2	P2	30.2	0.6
2	P3	28.6	0.4
2	P5	24.9	0.5
3	P1	28.0	-0.4
3	P2	34.1	0.1
3	P3	32.8	0.1
3	P5	28.0	-0.2
4	P1	32.3	-4.6
4	P2	34.6	-0.4
4	P3	33.6	-0.1
4	P5	27.8	0.1
5	P1	24.0	-0.5
5	P2	29.7	0.1
5	P3	28.4	0.3
5	P5	23.8	0.4
6	P1	24.1	0.3
6	P2	29.9	3.3
6	P3	29.4	1.2
6	P5	24.0	0.1
7	P1	23.8	0.2
7	P2	30.4	-0.9
7	P3	28.5	0.2
7	P5	24.4	-0.3
8	P1	25.0	-0.3
8	P2	30.1	0.1
8	P3	29.6	-0.4
8	P5	24.9	0.3

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: 5/7/2009, Next Cal: 5/7/2010

Equipment #: TCT-05
Description: TCT-225 Frame with TLC Console
Manufacturer: Chatillon
Model: TCD-225-0200
Serial #: TC 0071
Accuracy: See Manual See Manual
… Last Cal: 7/14/2008, Next Cal: 7/14/2009

Equipment #: THC-01
Description: Temperature/Humidity Chamber
Manufacturer: Thermotron
Model: SM-8-7800
Serial #: 30676
Accuracy: See Manual
… Last Cal: 04/07/2009, Next Cal: 04/07/2010

Equipment #: THC-04
Description: Temperature/Humidity Chamber
Manufacturer: Thermotron
Model: SM-8-3800
Serial #: 37782
Accuracy: See Manual
… Last Cal: 04/07/2009, Next Cal: 04/07/2010

Equipment #: MO-06
Description: Micro-Ohmeter
Manufacturer: Keithley
Model: 580
Serial #: 1110525
Accuracy: See Manual
… Last Cal: 06/16/2009, Next Cal: 06/16/2010

Equipment #: MO-07
Description: Multimeter / Data Acquistion System
Manufacturer: Keithley
Model: 2700
Serial #: 1116559
Accuracy: See Manual
… Last Cal: 6/16/2009, Next Cal: 6/16/2010

Equipment #: MO-01
Description: Micro-Ohmeter
Manufacturer: Keithley
Model: 580
Serial #: 0772740
Accuracy: See Manual See Manual
… Last Cal: 06/16/2009, Next Cal: 06/16/2010

Equipment #: MO-03
Description: Multimeter /Data Acquisition System
Manufacturer: Keithley
Model: 2700
Serial #: 0791975
Accuracy: See Manual
… Last Cal: 06/16/2009, Next Cal: 06/16/2010

Equipment #: MO-04
Description: Multimeter /Data Acquisition System
Manufacturer: Keithley
Model: 2700
Serial #: 0798688
Accuracy: See Manual
… Last Cal: 04/06/2009, Next Cal: 04/06/2010

Equipment #: OV-5
Description: Nitrongen Purge IR Reflow
Manufacturer: Vitronics Soltec
Model: XPM-730
Serial #: XN 70328
Accuracy: +/- 5 deg. C
… Last Cal: 02/19/2009, Next Cal: 02/19/2010

Equipment #: HPM-01
Description: Hipot Megommeter
Manufacturer: Hipotronics
Model: H306B-A
Serial #: 04-1041-04
Accuracy: 2 % Full Scale Accuracy
… Last Cal: 11/24/2008, Next Cal: 11/24/2009

Equipment #: MV-05
Description: 6" x 6" Video Measuring Machine
Manufacturer: Micro-Vu
Model: M3010838
Serial #: V9344
Accuracy: See Manual
… Last Cal: 02/10/2009, Next Cal: 02/10/2010

Equipment #: MV-08
Description: 6" x 6" Video Measuring Machine
Manufacturer: Micro-Vu
Model: M3010898
Serial #: V9472
Accuracy: See Manual
… Last Cal: 02/10/2009, Next Cal: 02/10/2010