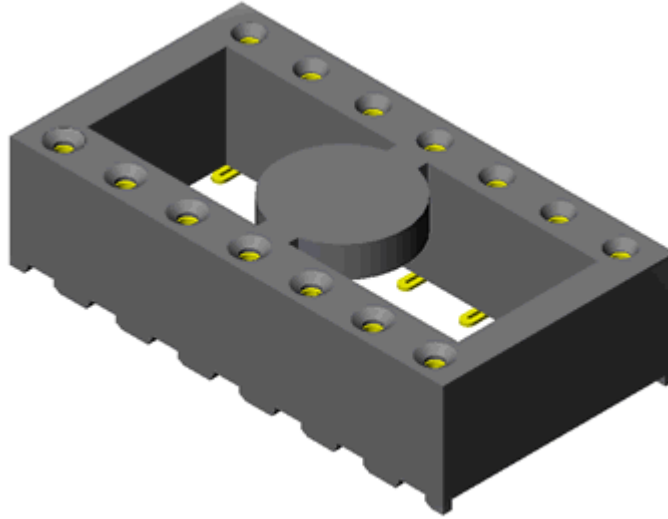




Project Number: N/A		Tracking Code: TC0327-N/A-0227	
Requested by: Phil Eckert		Date: 6/30/2003	Product Rev: N/A
Part #: ICF-316-T-O		Lot #: N/A	Tech: Troy Cook Eng: John Tozier
Part description: ICF			Qty to test: 10
Test Start: 07/18/2003	Test Completed: 8/21/2003		



Satin-Tin contact comparison, soldered with and without a Nitrogen blanket

PART DESCRIPTION

**ICF-316-T-O
Mated with
TopLine .300/16 IC**

CERTIFICATION

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

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SCOPE

To evaluate Satin-Tin contact system integrity after exposure to typical Pb-free soldering processes. The evaluation will occur on systems soldered with and without the Nitrogen blanket.

APPLICABLE DOCUMENTS

Standards: EIA Publication 364

TEST SAMPLES AND PREPARATION

The two mating components (if applicable) were soldered using AIM TSC-4 lead free alloy using Sn with 3.8%-4% Ag, and 0.5% - 0.7% Cu solder paste using the oven profile. Along with the Satin-Tin plating, the TopLine IC had lead-free tin finish.

- 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 were cleaned with the Aqueous Inline Cleaning System (Aqueous Millennium Technologies)

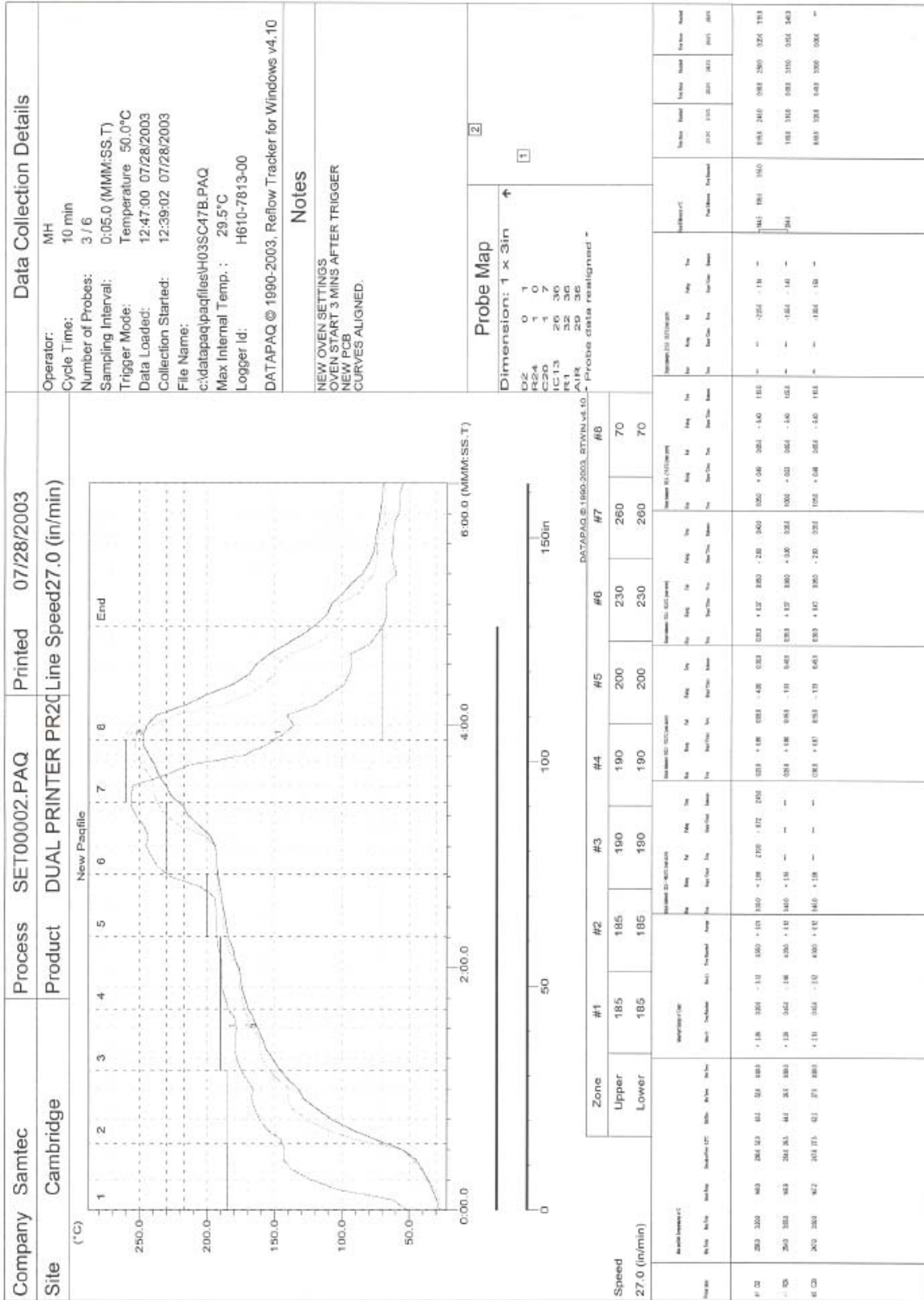
FLOWCHART

TEST STEP	GROUP A 112 Points 480 hour Test Processed in AIR	GROUP B 112 Points 480 hour Test Processed in Nitrogen
01	LLCR-1	LLCR-1
02	Data Review	Data Review
03	Cyclic Humidity, 240 Hours	Cyclic Humidity, 240 Hours
04	LLCR-2	LLCR-2
05	Data Review	Data Review
06	Cyclic Humidity, 240 Hours	Cyclic Humidity, 240 Hours
07	LLCR-3	LLCR-3

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

**LLCR = EIA-364-23, LLCR
use Keithley 580 in the dry circuit mode, 10 mA Max**

OVEN PROFILE



ATTRIBUTE DEFINITION

Following is a brief, simplified description of attributes.

CYCLIC HUMIDITY:

- 1) Reference document: EIA-364-31, *Humidity Test Procedure for Electrical Connectors*.
 - a) Test Condition B, 240 Hours.
 - b) Method III, +25° C to + 65° C, 90% to 98% Relative Humidity excluding sub-cycles 7a and 7b.
- 2) Connectors are mated.
- 3) Test Condition B run twice for a total of 480 hours.
 - a) Intermediate results taken at 240 hours.

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) $\leq +5.0$ 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

RESULTS**LLCR (112 LLCR test points)**

- **Initial**
 - Air Processed -----7.6 mOhms Max
 - Nitrogen Processed-----6.7 mOhms Max
- **Stressed 240 Hours**
 - <= +5.0 mOhms
 - Air Processed-----112 Points ----- Stable
 - Nitrogen Processed-----112 Points ----- Stable
 - +5.1 to +10.0 mOhms
 - Air Processed-----0 Points ----- Minor
 - Nitrogen Processed-----0 Points ----- Minor
 - +10.1 to +15.0 mOhms
 - Air Processed-----0 Points ----- Acceptable
 - Nitrogen Processed-----0 Points ----- Acceptable
 - +15.1 to +50.0 mOhms
 - Air Processed-----0 Points ----- Marginal
 - Nitrogen Processed-----0 Points ----- Marginal
 - +50.1 to +2000 mOhms
 - Air Processed-----0 Points ----- Unstable
 - Nitrogen Processed-----0 Points ----- Unstable
 - >+2000 mOhms
 - Air Processed-----0 Points ----- Open Failure
 - Nitrogen Processed-----0 Points ----- Open Failure
- **Stressed 480 Hours**
 - <= +5.0 mOhms
 - Air Processed-----112 Points ----- Stable
 - Nitrogen Processed-----112 Points ----- Stable
 - +5.1 to +10.0 mOhms
 - Air Processed-----0 Points ----- Minor
 - Nitrogen Processed-----0 Points ----- Minor
 - +10.1 to +15.0 mOhms
 - Air Processed-----0 Points ----- Acceptable
 - Nitrogen Processed-----0 Points ----- Acceptable
 - +15.1 to +50.0 mOhms
 - Air Processed-----0 Points ----- Marginal
 - Nitrogen Processed-----0 Points ----- Marginal
 - +50.1 to +2000 mOhms
 - Air Processed-----0 Points ----- Unstable
 - Nitrogen Processed-----0 Points ----- Unstable
 - >+2000 mOhms
 - Air Processed-----0 Points ----- Open Failure
 - Nitrogen Processed-----0 Points ----- Open Failure

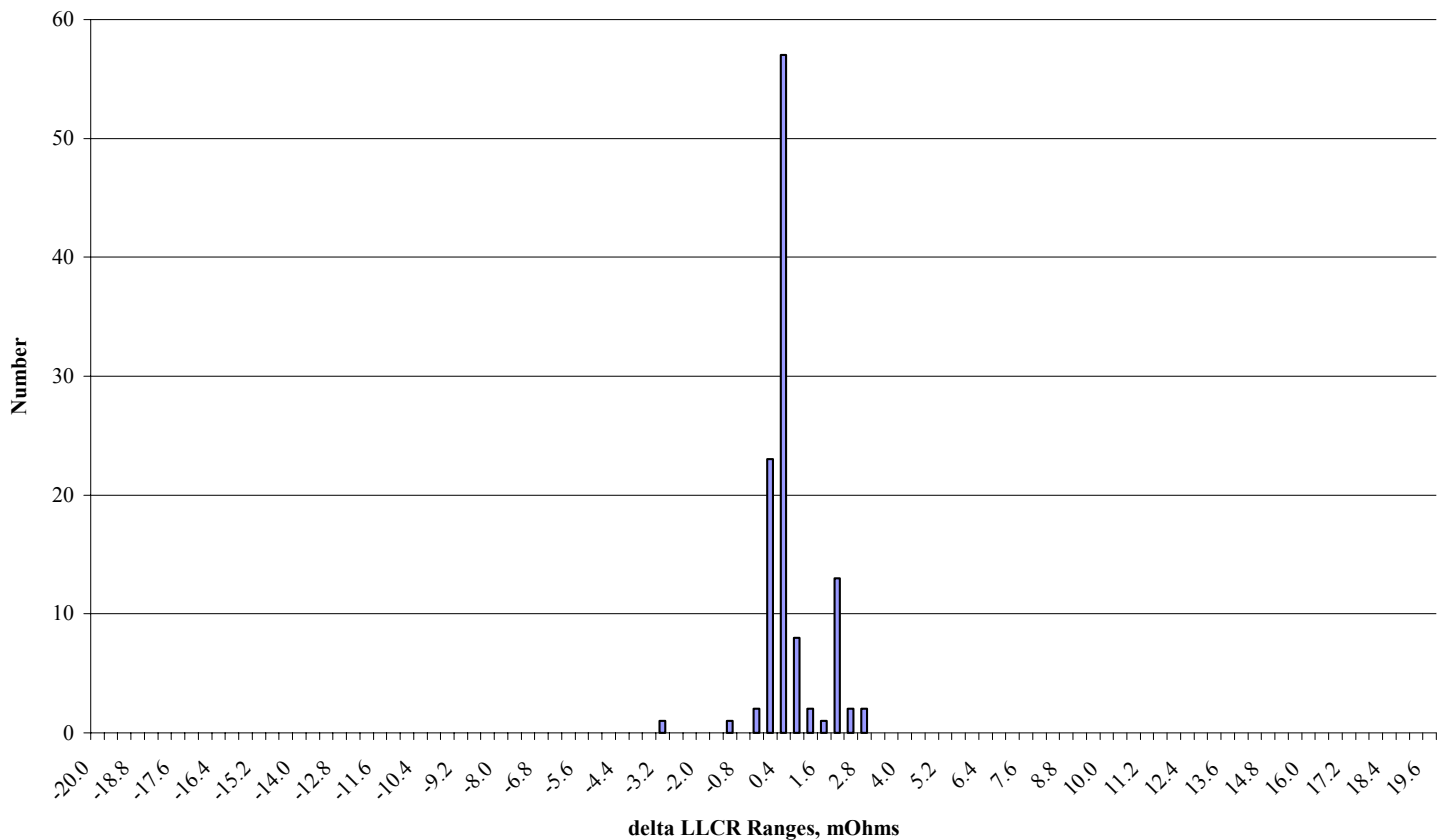
After soldering, neither the parts soldered in the ‘open air process’ or parts soldered in the ‘nitrogen blanket process’ showed discoloration.

DATA SUMMARIES**LLCR:**

- 1) A total of 112 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) $\leq +5.0$ 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

mOhm values	Air Processed		
	Actual Initial	Delta Humidity-240 Hours	Delta Humidity-480 Hours
Average	4.2	0.2	0.3
St. Dev.	1.2	0.5	0.8
Min	2.6	-1.3	-3.6
Max	7.6	2.0	2.5
Count	112	112	112

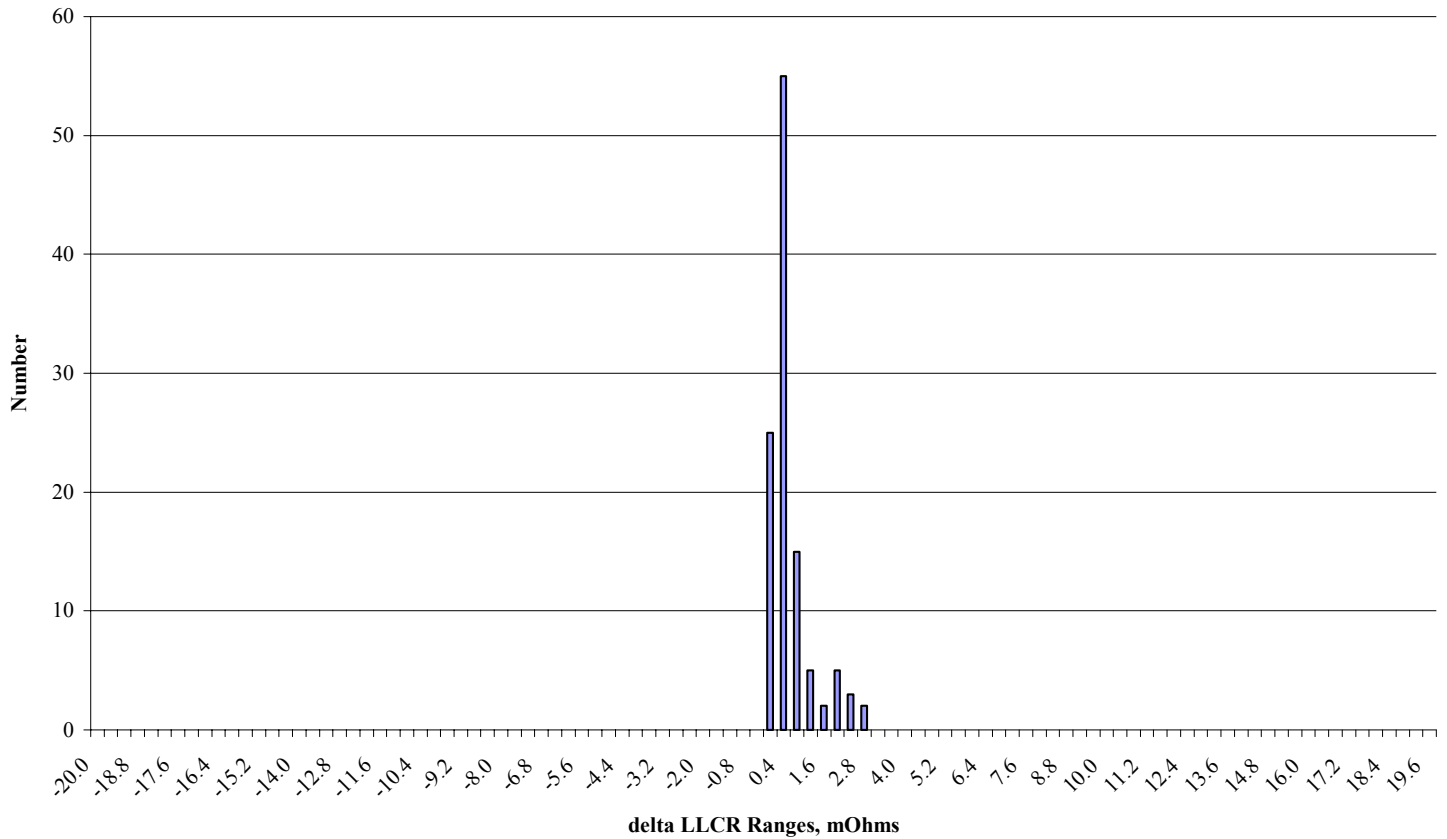
**Air Processed
After 480 Hours**



DATA SUMMARIES Continued

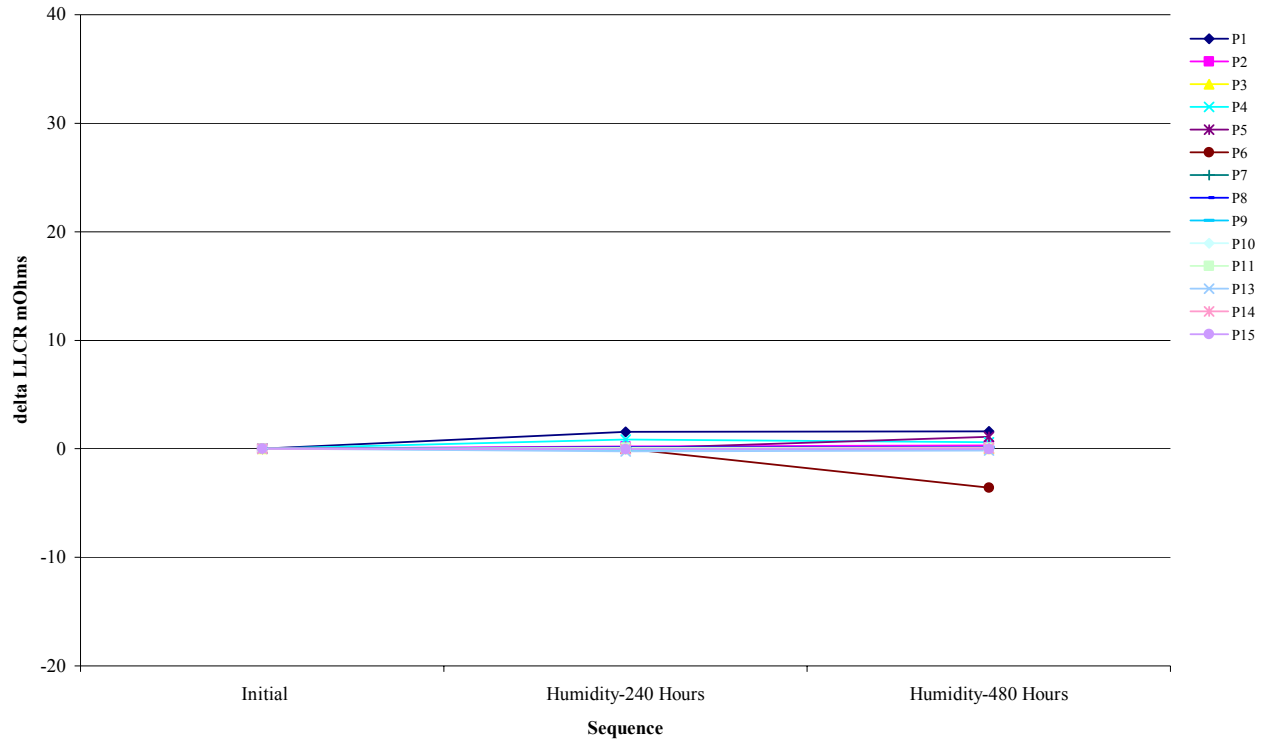
mOhm values	Nitrogen Processed		
	Actual Initial	Delta Humidity-240 Hours	Delta Humidity-480 Hours
Average	3.4	0.2	0.4
St. Dev.	1.0	0.5	0.6
Min	2.6	-0.4	-0.3
Max	6.7	2.0	2.6
Count	112	112	112

**Nitrogen Processed
After 480 Hours**

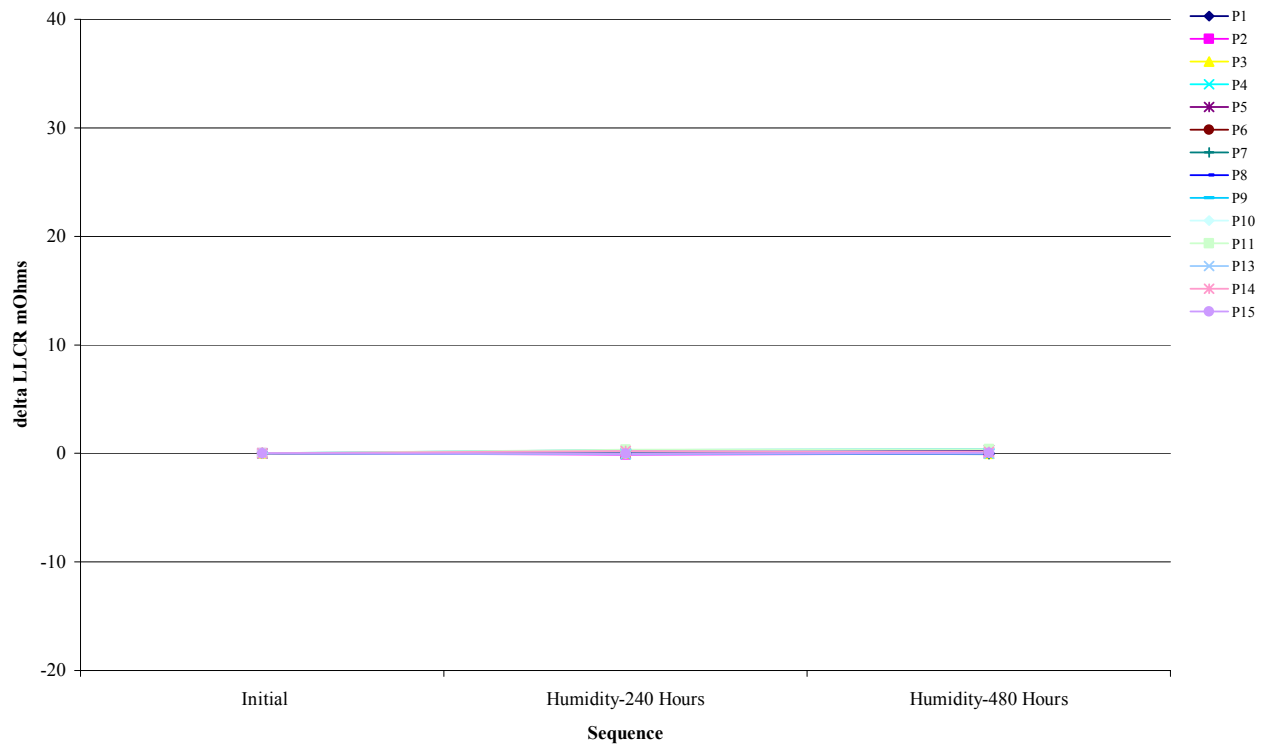


DATA SUMMARIES Continued

Air Processed
Board #1

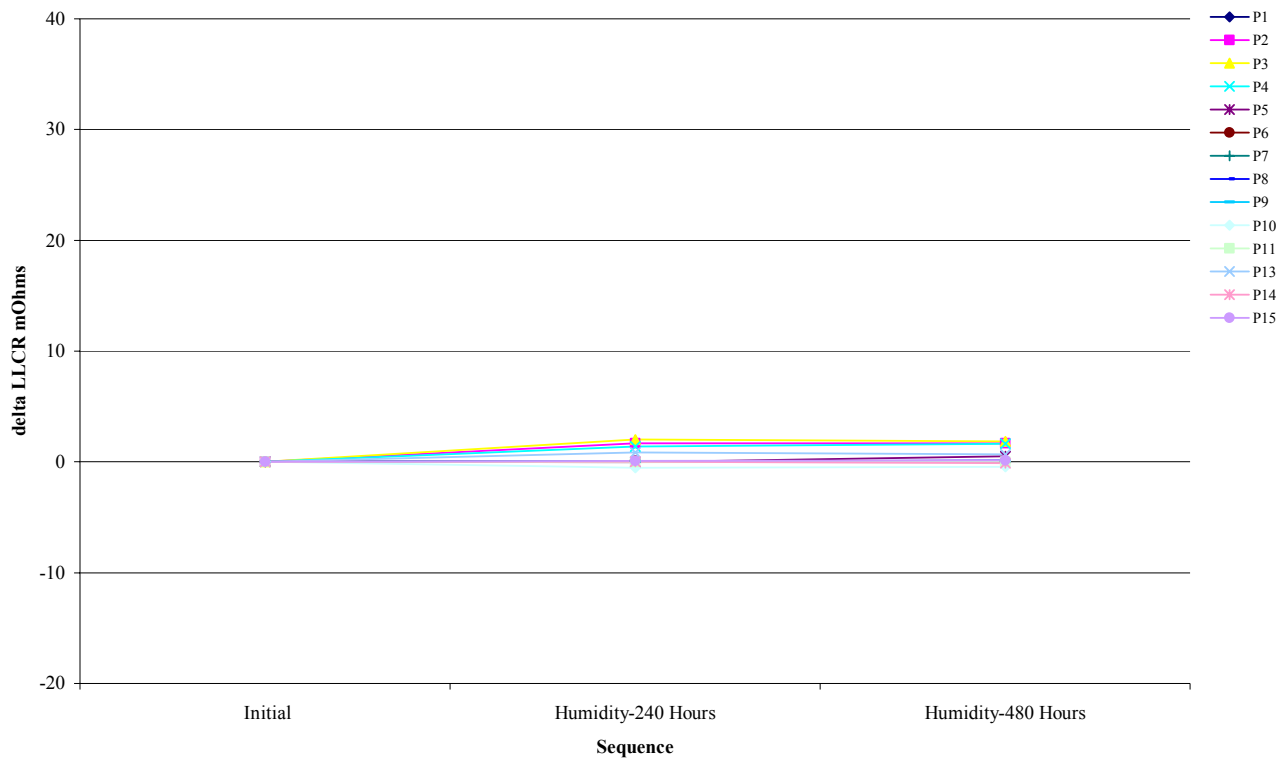


Air Processed
Board #2

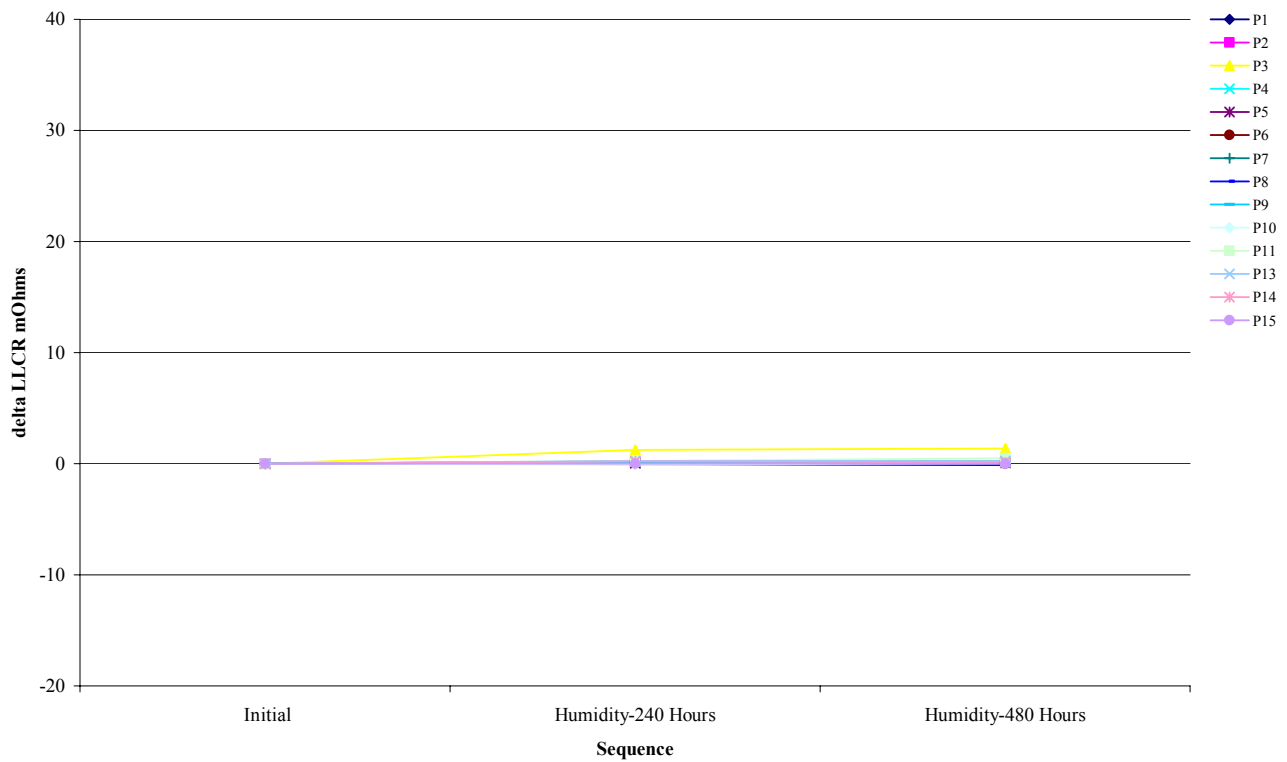


DATA SUMMARIES Continued

Air Processed
Board #3

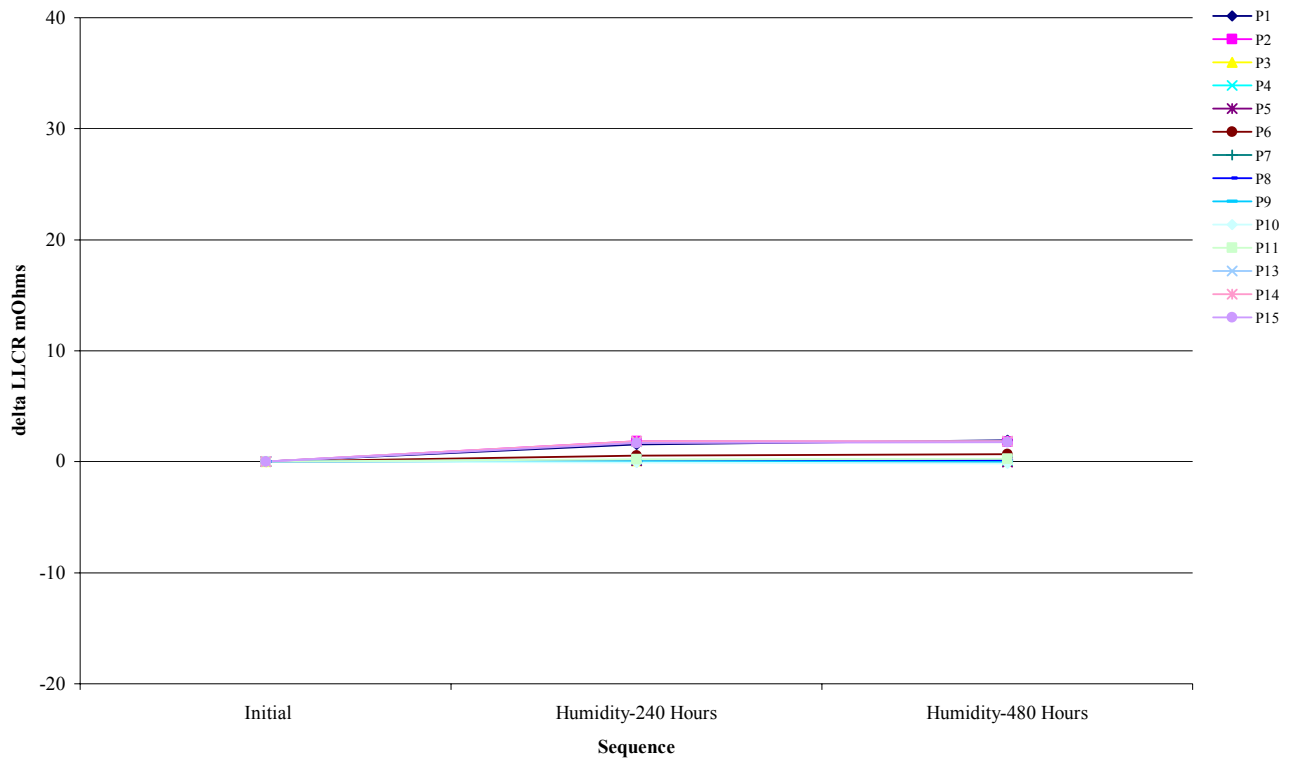


Air Processed
Board #4

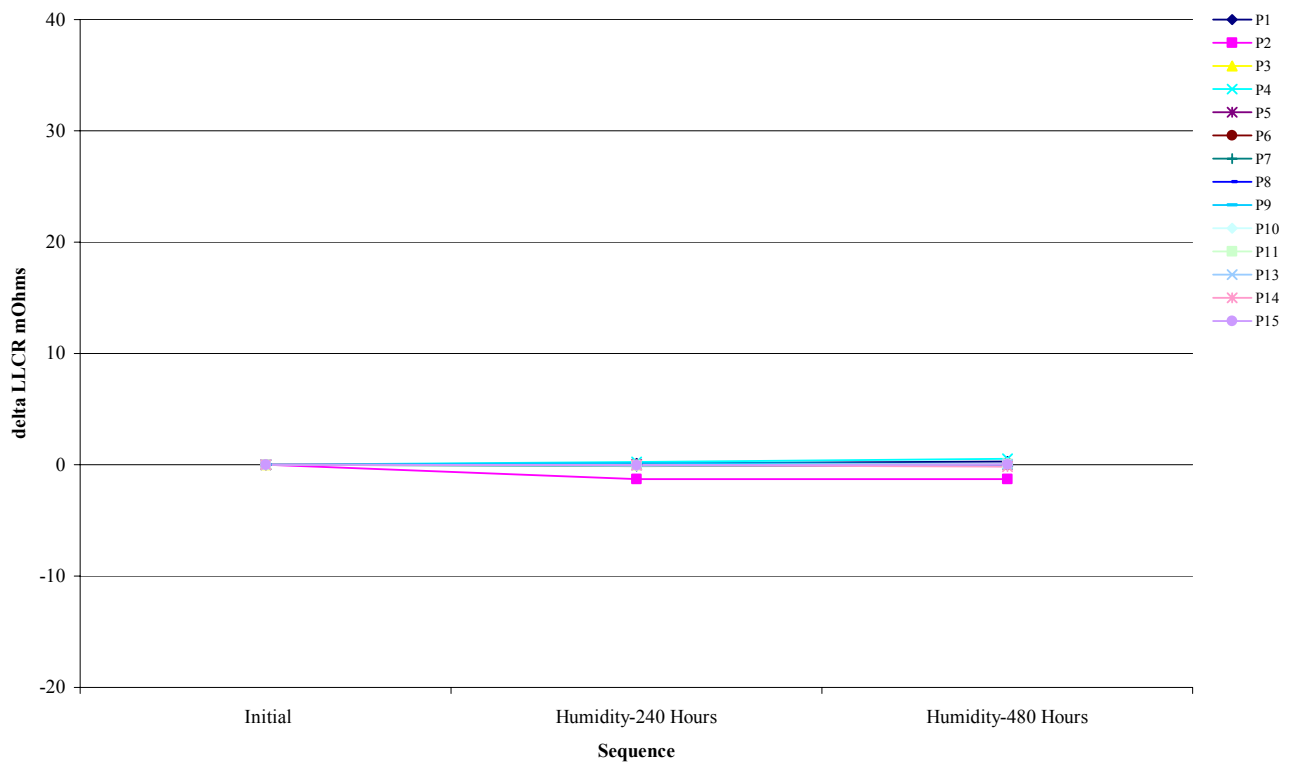


DATA SUMMARIES Continued

Air Processed
Board #5

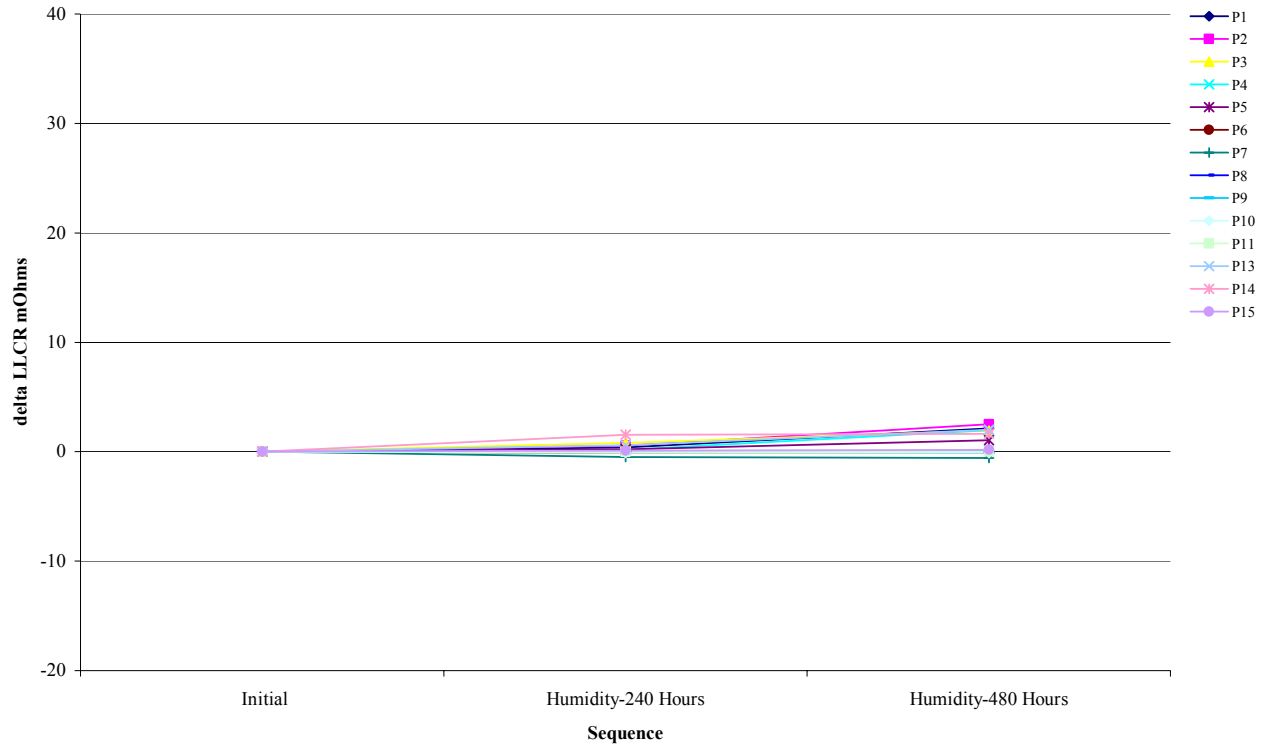


Air Processed
Board #6

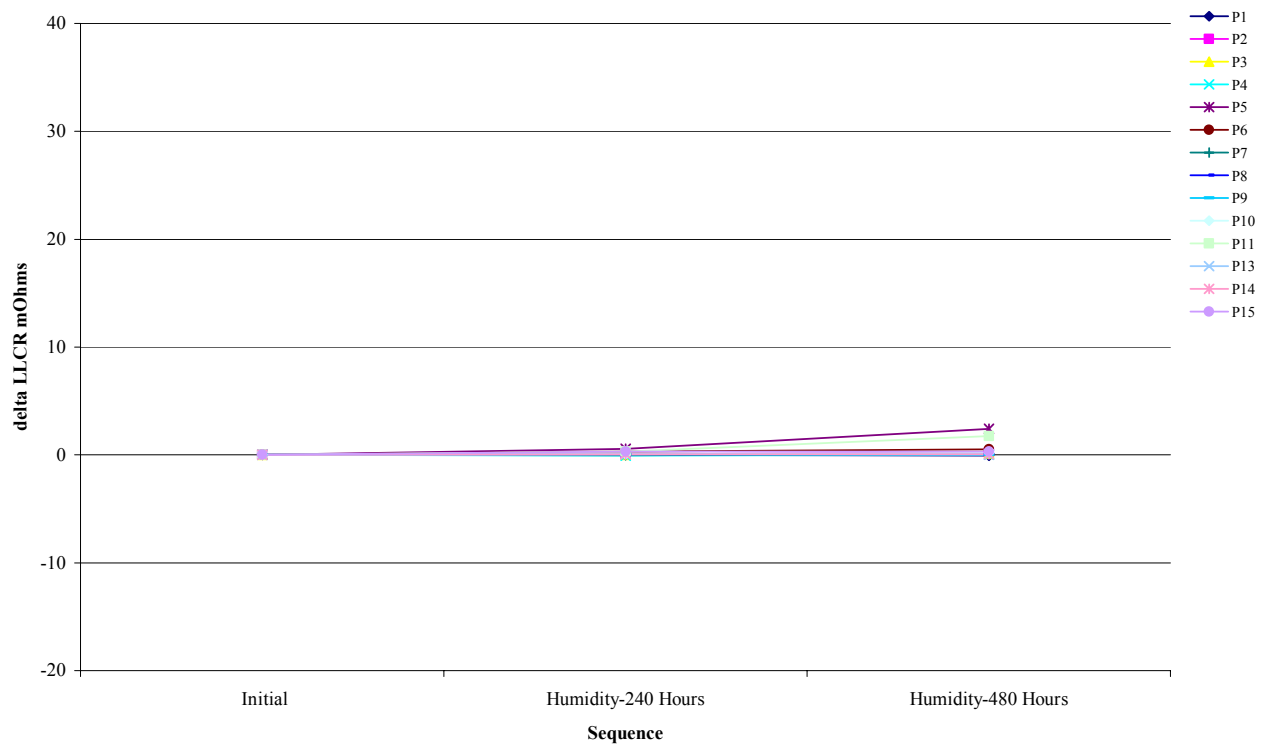


DATA SUMMARIES Continued

Air Processed
Board #7

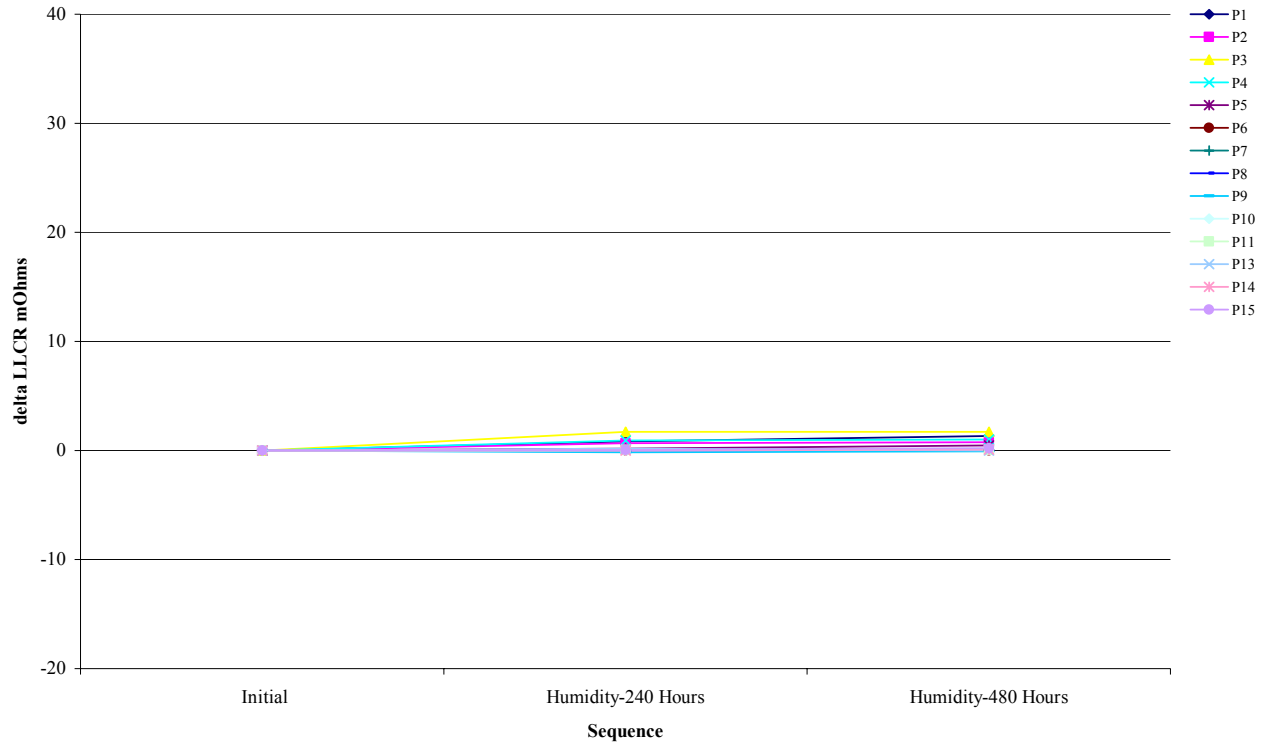


Air Processed
Board #8

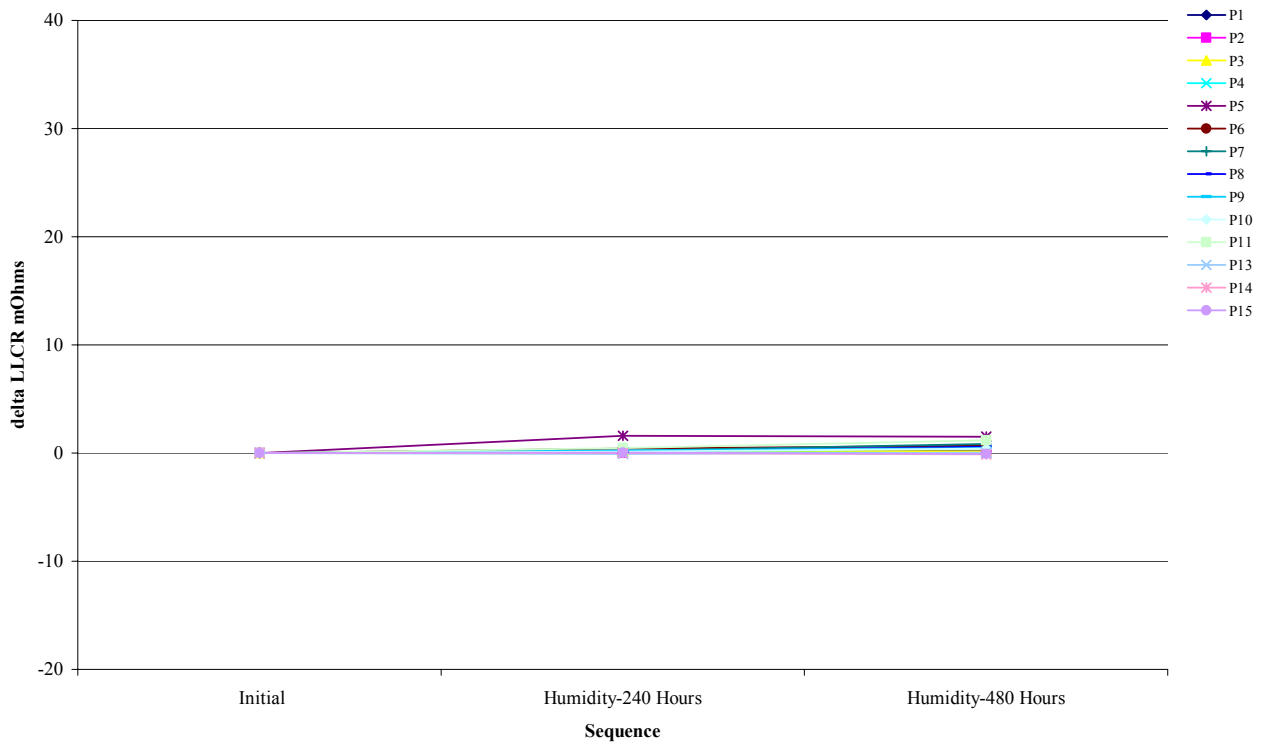


DATA SUMMARIES Continued

Nitrogen Processed Board #1

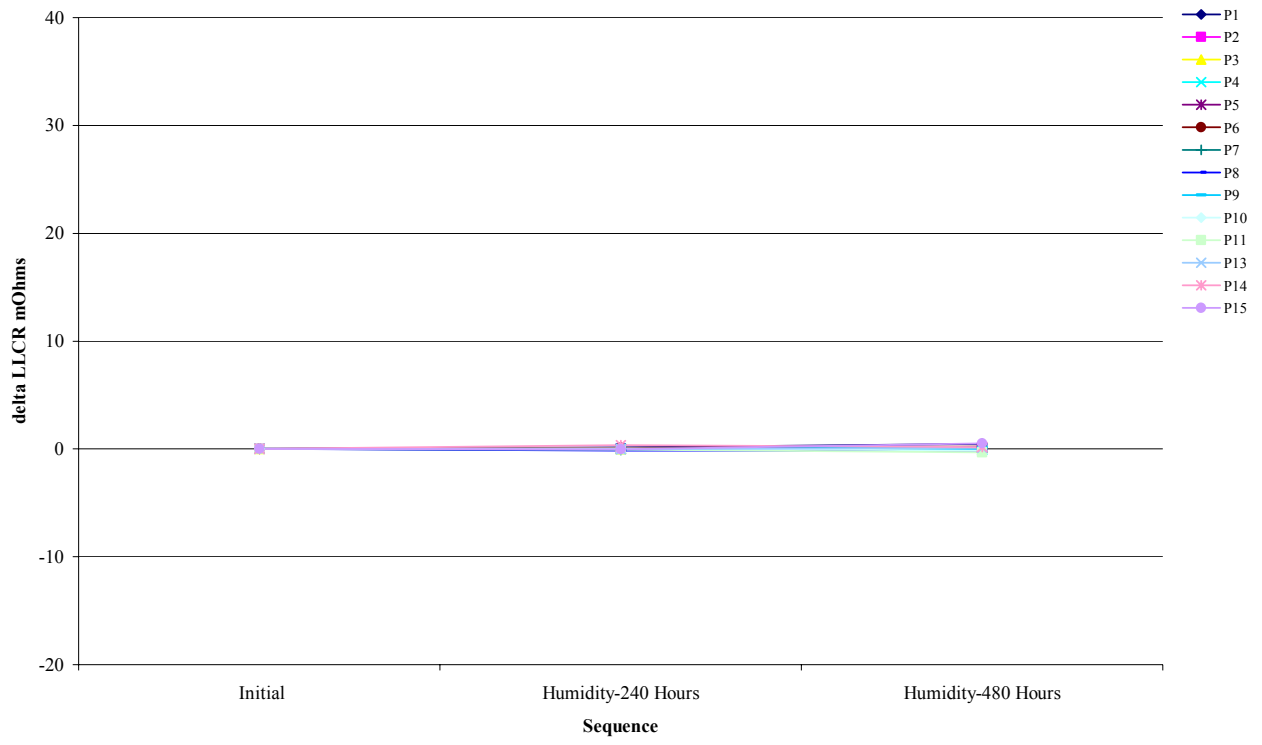


Nitrogen Processed Board #2



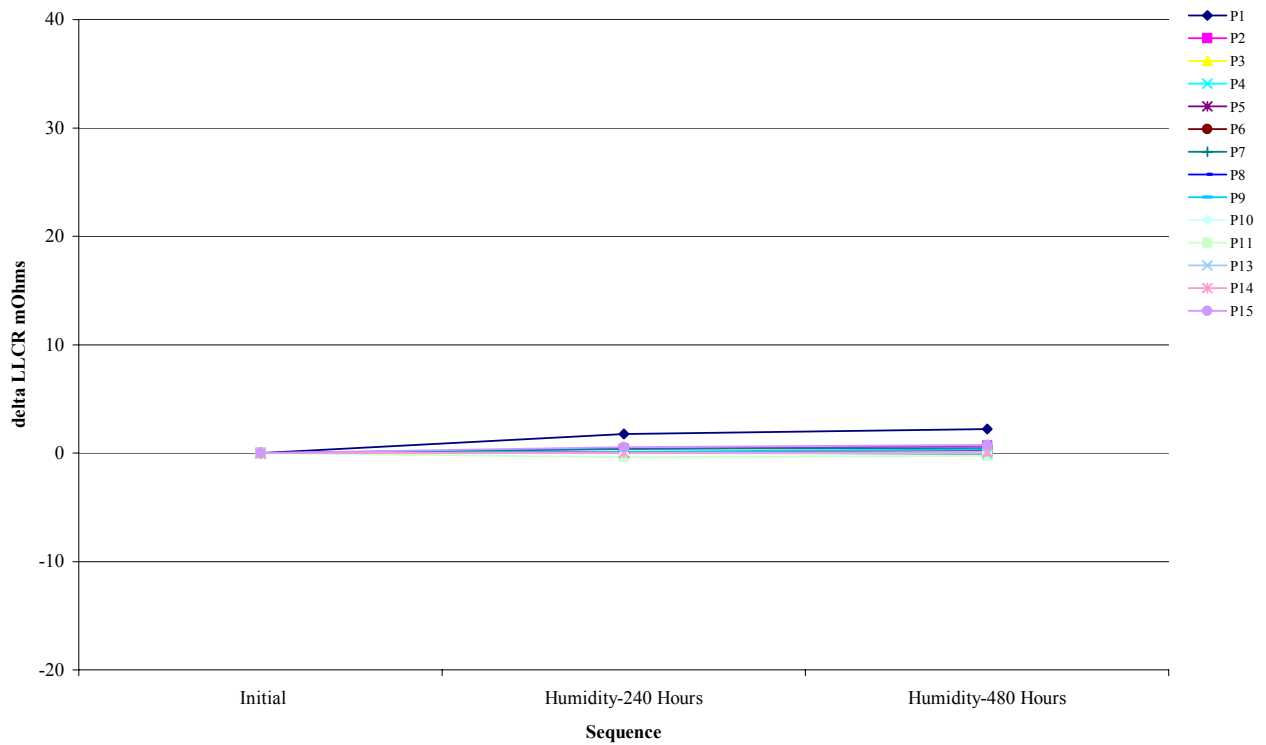
DATA SUMMARIES Continued

Nitrogen Processed
Board #3



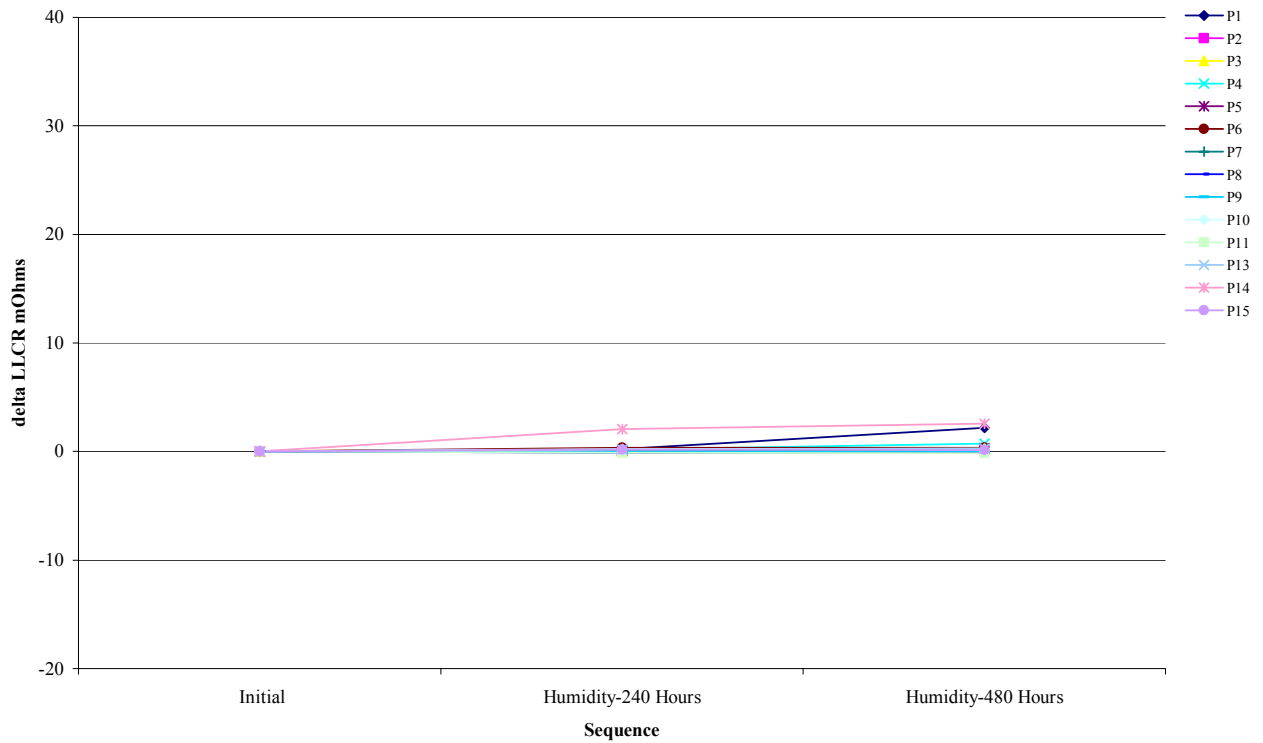
Nitrogen Processed

Board #4



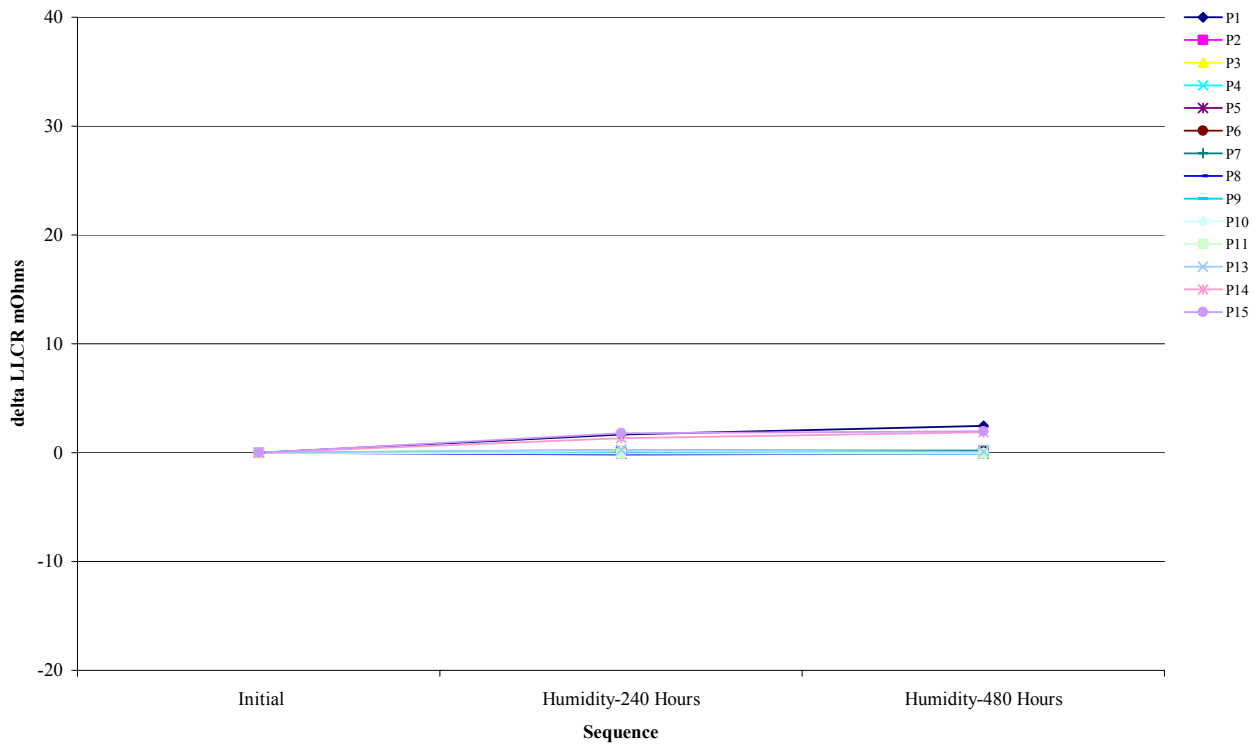
DATA SUMMARIES Continued

Nitrogen Processed
Board #5



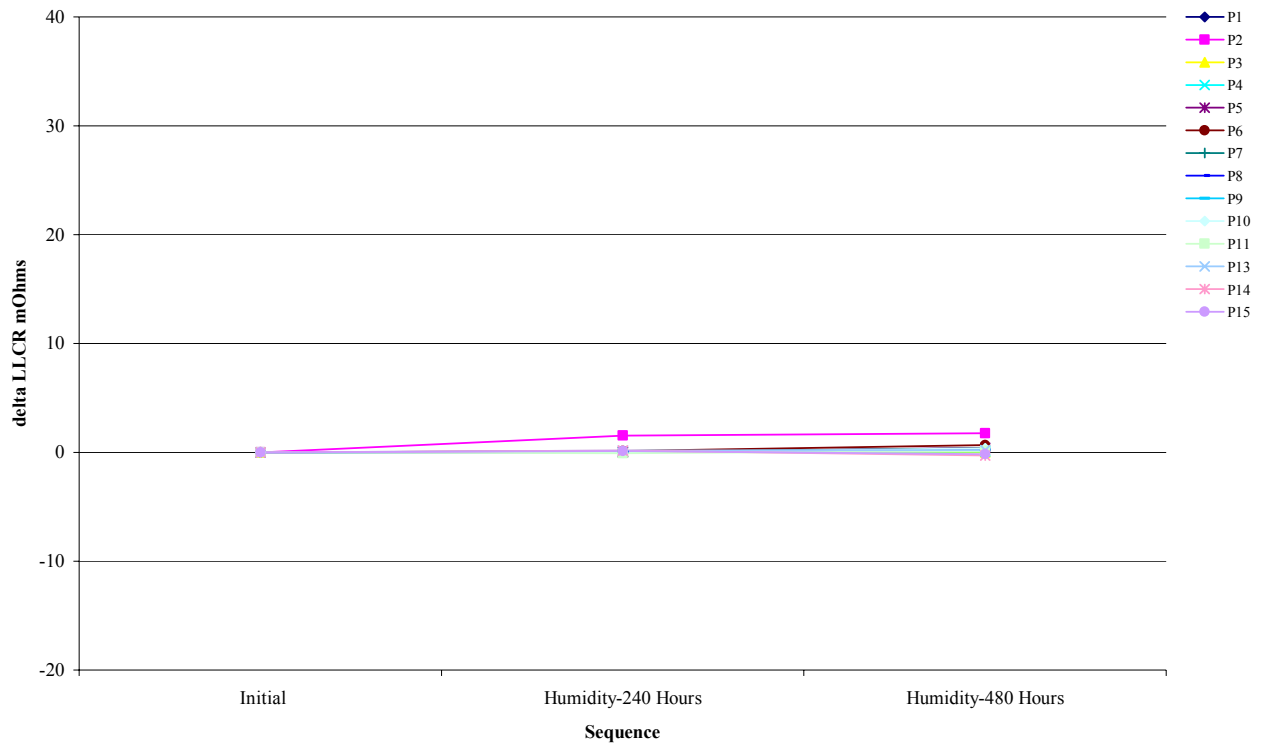
Nitrogen Processed

Board #6



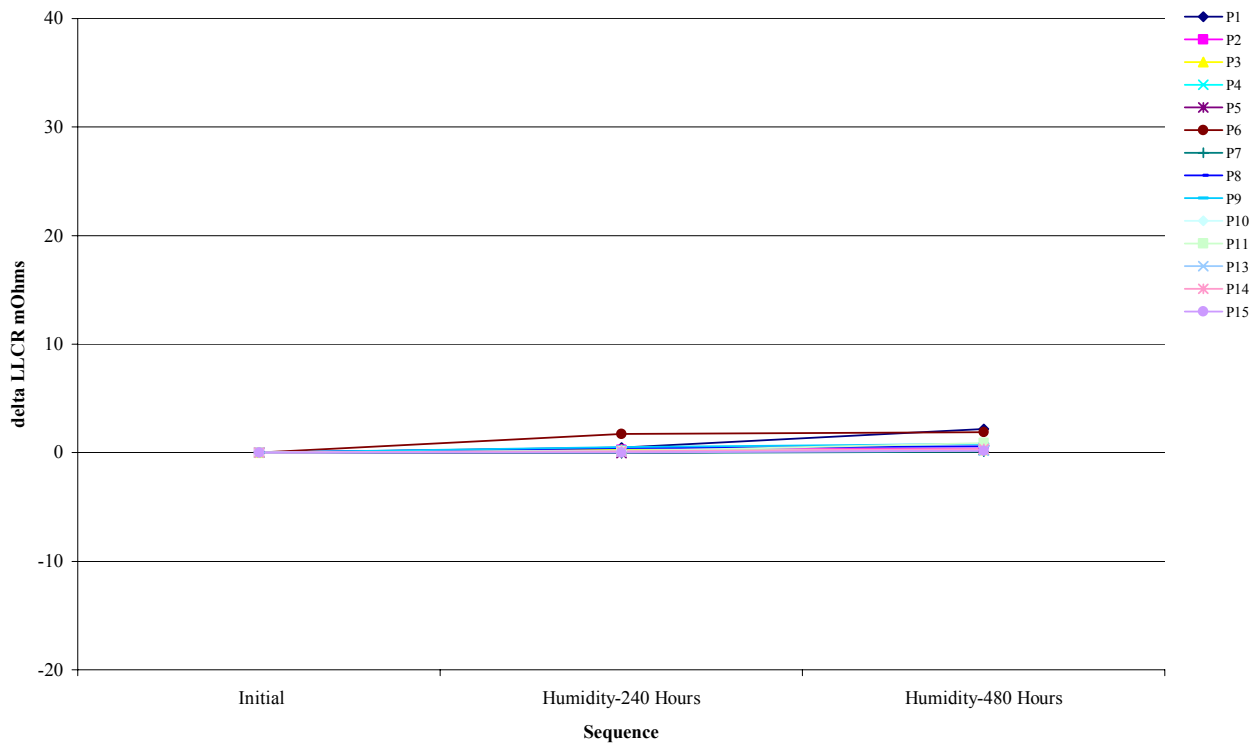
DATA SUMMARIES Continued

Nitrogen Processed
Board #7



Nitrogen Processed

Board #8



DATA**LLCR, Air Processed:**

Date	Jul. 23 2003	Aug. 05 2003	Aug. 20 2003
Room Temp C	20	21	21
RH	47%	51%	54%
Initials	Troy Cook	Troy Cook	Troy Cook

mOhm values		Actual	Delta	Delta
Board	Position	Initial	Humidity- 240 Hours	Humidity- 480 Hours
1	P1	4.5	1.6	1.6
1	P2	3.6	0.2	0.3
1	P3	4.1	0.0	0.0
1	P4	5.7	0.8	0.6
1	P5	3.7	0.0	1.1
1	P6	7.6	0.0	-3.6
1	P7	3.3	0.1	0.1
1	P8	3.2	0.1	0.1
1	P9	3.5	-0.1	0.0
1	P10	3.4	-0.1	0.0
1	P11	3.4	0.1	0.1
1	P13	5.2	-0.2	-0.2
1	P14	4.3	0.0	0.0
1	P15	4.4	0.0	0.0
2	P1	6.1	0.0	0.1
2	P2	6.0	-0.1	0.0
2	P3	6.0	0.0	0.0
2	P4	5.9	-0.1	0.0
2	P5	3.5	0.0	0.3
2	P6	3.3	0.0	0.0
2	P7	3.2	0.0	-0.1
2	P8	3.3	0.0	0.0
2	P9	3.0	0.3	0.4
2	P10	3.3	0.0	0.1
2	P11	3.0	0.3	0.4
2	P13	5.9	0.0	0.0
2	P14	5.7	0.2	0.1
2	P15	5.9	0.0	0.0
3	P1	5.9	0.1	0.1
3	P2	4.1	1.7	1.7
3	P3	4.0	2.0	1.9
3	P4	4.7	1.4	1.6
3	P5	3.6	0.0	0.5
3	P6	3.6	0.1	0.0
3	P7	2.7	0.0	0.1
3	P8	3.1	0.0	0.1
3	P9	3.1	0.1	0.0

Part description: ICF

3	P10	3.4	-0.5	-0.5
3	P11	3.1	0.0	0.0
3	P13	5.0	0.9	0.7
3	P14	6.4	0.0	-0.1
3	P15	6.3	0.1	0.1
4	P1	5.3	0.2	0.3
4	P2	5.5	0.1	0.1
4	P3	4.5	1.3	1.4
4	P4	5.8	0.2	0.2
4	P5	3.4	0.0	0.1
4	P6	3.3	0.1	0.0
4	P7	3.4	0.0	0.0
4	P8	3.4	0.0	-0.1
4	P9	2.9	0.1	0.1
4	P10	2.8	-0.1	0.0
4	P11	3.1	0.2	0.5
4	P13	5.7	0.3	0.3
4	P14	5.9	0.2	0.1
4	P15	6.0	0.0	0.0
5	P1	4.0	1.6	1.9
5	P2	4.2	1.8	1.8
5	P3	6.0	0.1	0.1
5	P4	6.2	0.2	0.0
5	P5	3.5	0.1	0.0
5	P6	2.8	0.6	0.7
5	P7	3.1	0.0	0.2
5	P8	3.0	0.0	0.1
5	P9	3.1	0.0	0.0
5	P10	3.2	-0.1	-0.1
5	P11	3.2	0.2	0.3
5	P13	4.4	1.8	1.9
5	P14	4.5	1.9	1.9
5	P15	5.0	1.7	1.8
6	P1	3.4	0.1	0.3
6	P2	4.2	-1.3	-1.3
6	P3	2.8	0.0	0.0
6	P4	3.0	0.3	0.5
6	P5	3.6	0.0	0.0
6	P6	3.0	-0.1	0.0
6	P7	3.1	-0.1	0.0
6	P8	2.9	0.0	-0.1
6	P9	2.9	0.2	0.1
6	P10	2.6	-0.1	0.1
6	P11	3.7	0.0	0.1
6	P13	2.9	0.0	0.0
6	P14	2.9	-0.1	-0.2
6	P15	3.0	0.0	0.0
7	P1	3.5	0.4	2.1
7	P2	3.3	0.6	2.5
7	P3	3.9	0.8	1.9

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Part #: ICF-316-T-O

Part description: ICF

7	P4	3.8	0.2	2.0
7	P5	3.8	0.2	1.0
7	P6	3.8	-0.1	-0.1
7	P7	3.9	-0.5	-0.6
7	P8	3.5	0.0	-0.1
7	P9	3.5	0.0	0.1
7	P10	3.7	-0.1	-0.1
7	P11	3.7	0.0	0.0
7	P13	3.7	0.6	2.0
7	P14	4.2	1.5	1.6
7	P15	6.1	0.1	0.2
8	P1	6.2	0.0	-0.1
8	P2	5.8	0.1	0.2
8	P3	6.1	0.0	0.1
8	P4	6.4	-0.1	0.0
8	P5	3.3	0.6	2.4
8	P6	3.3	0.3	0.5
8	P7	3.9	0.0	0.1
8	P8	3.5	0.1	0.1
8	P9	3.7	0.0	0.0
8	P10	3.5	0.1	0.2
8	P11	3.5	0.3	1.7
8	P13	6.4	0.1	0.1
8	P14	6.5	0.0	0.0
8	P15	6.6	0.3	0.3

DATA Continued**LLCR, Nitrogen Processed:**

Date	Jul. 23 2003	Aug. 05 2003	Aug. 20 2003
Room Temp C	22	21	20
RH	52%	47%	49%
Initials	Troy Cook	Troy Cook	Troy Cook

mOhm values		Actual	Delta	Delta
Board	Position	Initial	Humidity- 240 Hours	Humidity- 480 Hours
1	P1	4.2	0.9	1.3
1	P2	4.9	0.7	0.7
1	P3	3.9	1.7	1.7
1	P4	4.8	0.9	1.0
1	P5	3.4	0.2	0.5
1	P6	3.0	0.0	0.0
1	P7	2.8	0.1	0.1
1	P8	2.8	-0.1	0.0
1	P9	2.7	-0.2	-0.1
1	P10	2.6	0.0	0.1
1	P11	2.8	0.0	0.1
1	P13	5.8	0.1	0.0
1	P14	6.0	0.0	0.1
1	P15	6.1	0.1	0.2
2	P1	2.7	0.1	0.2
2	P2	2.6	0.0	0.0
2	P3	2.6	0.2	0.2
2	P4	2.8	0.1	0.0
2	P5	4.7	1.6	1.5
2	P6	3.1	0.4	0.7
2	P7	3.1	0.2	0.8
2	P8	3.1	0.1	0.6
2	P9	3.0	0.2	0.4
2	P10	3.2	0.1	0.4
2	P11	3.1	0.5	1.2
2	P13	2.9	-0.1	0.0
2	P14	3.0	0.0	-0.1
2	P15	3.1	0.0	-0.1
3	P1	2.9	0.1	0.5
3	P2	2.8	0.1	0.1
3	P3	2.9	0.0	0.1
3	P4	3.0	0.0	-0.1
3	P5	3.1	0.0	0.1
3	P6	3.0	0.1	0.2
3	P7	3.0	-0.1	0.1
3	P8	2.9	-0.2	-0.2

Part description: ICF

3	P9	2.7	0.0	0.1
3	P10	2.9	0.1	-0.1
3	P11	2.9	-0.1	-0.3
3	P13	2.9	0.0	0.1
3	P14	2.8	0.3	0.2
3	P15	2.9	0.0	0.5
4	P1	3.6	1.7	2.2
4	P2	2.9	0.4	0.7
4	P3	2.8	0.0	0.0
4	P4	2.8	0.1	0.0
4	P5	3.0	0.1	0.2
4	P6	3.3	0.0	0.0
4	P7	3.0	0.4	0.5
4	P8	2.9	0.0	0.0
4	P9	3.0	0.1	0.3
4	P10	2.9	-0.1	0.0
4	P11	3.1	-0.4	-0.3
4	P13	3.2	0.0	0.0
4	P14	3.0	0.0	0.1
4	P15	3.1	0.5	0.7
5	P1	3.3	0.2	2.2
5	P2	3.1	0.0	0.1
5	P3	3.2	0.0	0.1
5	P4	3.3	0.2	0.7
5	P5	3.0	0.1	0.3
5	P6	3.1	0.3	0.3
5	P7	3.2	0.1	0.0
5	P8	3.1	-0.1	-0.1
5	P9	3.1	0.0	0.0
5	P10	3.1	0.2	0.3
5	P11	3.1	-0.1	-0.1
5	P13	3.1	0.2	0.3
5	P14	3.6	2.0	2.6
5	P15	6.1	0.2	0.1
6	P1	2.9	1.7	2.5
6	P2	2.7	0.1	0.2
6	P3	2.6	0.2	0.2
6	P4	2.6	0.3	0.2
6	P5	3.0	-0.1	-0.1
6	P6	2.8	0.1	0.1
6	P7	2.7	0.1	0.2
6	P8	3.0	-0.2	-0.1
6	P9	3.0	0.0	-0.1
6	P10	2.9	0.2	0.0
6	P11	2.9	-0.1	-0.1
6	P13	2.7	0.2	0.1
6	P14	3.0	1.3	1.9
6	P15	4.1	1.8	2.0
7	P1	5.9	0.1	0.2
7	P2	4.6	1.5	1.8

Tracking Code: TC0327-N/A-0227

Part #: ICF-316-T-O

Part description: ICF

7	P3	6.1	0.0	0.0
7	P4	6.2	0.0	0.1
7	P5	3.1	0.0	0.4
7	P6	3.2	0.1	0.7
7	P7	3.3	0.1	0.4
7	P8	3.3	0.0	0.3
7	P9	3.5	0.1	0.2
7	P10	3.5	0.0	0.4
7	P11	3.5	-0.1	0.1
7	P13	6.3	0.2	0.2
7	P14	6.5	0.2	-0.3
7	P15	6.7	0.1	-0.2
8	P1	3.6	0.5	2.2
8	P2	3.1	0.3	0.4
8	P3	3.0	0.3	0.3
8	P4	3.0	0.2	0.2
8	P5	2.9	0.0	0.3
8	P6	3.4	1.7	1.9
8	P7	2.9	0.0	0.1
8	P8	3.2	0.5	0.6
8	P9	3.1	0.5	0.8
8	P10	2.9	0.2	0.3
8	P11	3.0	0.1	0.9
8	P13	3.1	0.1	0.2
8	P14	3.1	0.1	0.3
8	P15	3.2	0.0	0.2

EQUIPMENT AND CALIBRATION SCHEDULES**Equipment #:** THL-01**Description:** Temperature/Humidity Chart Recorder**Manufacturer:** Dickson**Model:** THDX**Serial #:** 9316255**Accuracy:** Temp: +/- 1C; Humidity: +/-2% RH (0 - 60%) +/- 3% RH (61 - 95%).

... Last Cal: 7/15/02, Next Cal: 7/15/03

Equipment #: MO-01**Description:** Micro-Ohmmeter**Manufacturer:** Keithley**Model:** 580**Serial #:** 0772740**Accuracy:** See Manual

... Last Cal: 6/12/03, Next Cal: 6/12/04

Equipment #: MO-03**Description:** Multimeter /Data Acquisition System**Manufacturer:** Keithley**Model:** 2700**Serial #:** 0791975**Accuracy:** See Manual

... Last Cal: 6/12/03, Next Cal: 6/12/04

Equipment #: THC-01**Description:** Temperature/Humidity Chamber**Manufacturer:** Thermotron**Model:** SM-8-7800**Serial #:** 30676**Accuracy:** See Manual

... Last Cal: 5/28/2003, Next Cal: 5/28/2004

Equipment #: OV-5**Description:** Nitrogen Purge IR Reflow**Manufacturer:** Vitronics Soltec**Model:** XPM-730**Serial #:** XN 70328**Accuracy:** +/- 5 deg. C