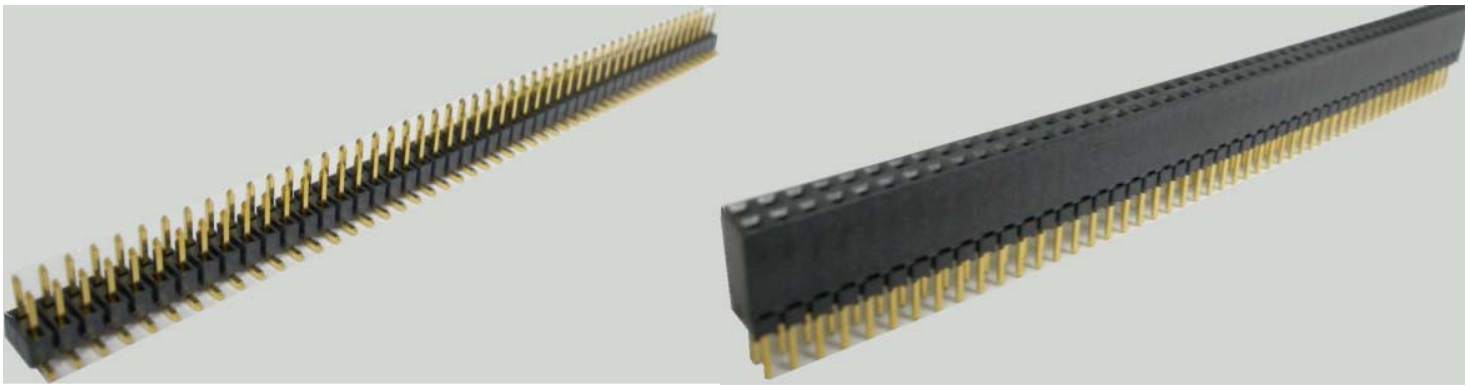
Project Number:	Tracking Code: TC0838-ESQT-1974_ReportRev2		
Requested by: Bryon Saylor	Date: 3/4/2009	Product Rev: BA	
Part #: ESQT-150-02-G-D-.310/TMMH-150-01-G-DV	Lot #: 8/25/2008	Tech: Tony Wagoner	Eng: Dave Scopelliti
Part description: ESQT/TMMH			Qty to test: 25
Test Start: 01/2/2009	Test Completed: 2/20/2009		

SAMTEC POWER CHARACTERIZATION



PART DESCRIPTION

ESQT-150-02-G-D-.310

Mated with

TMMH-150-01-G-DV

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

1. Temperature Rise/Current Carrying Capacity
   - 1.1. To determine the amount of current the device under test (DUT) can safely carry over the operating temperature range of the DUT.
   - 1.2. Contact loading will also be addressed in this document which will determine how much current can be carried as the number of energized contacts is varied.

2. Current Cycling
   - 2.1. To determine the performance of the device under test (DUT) when subjected to the power-on/power-off cycling that heats and cools the DUT in normal everyday use.
   - 2.2. Contact loading will set to 100% throughout the test.

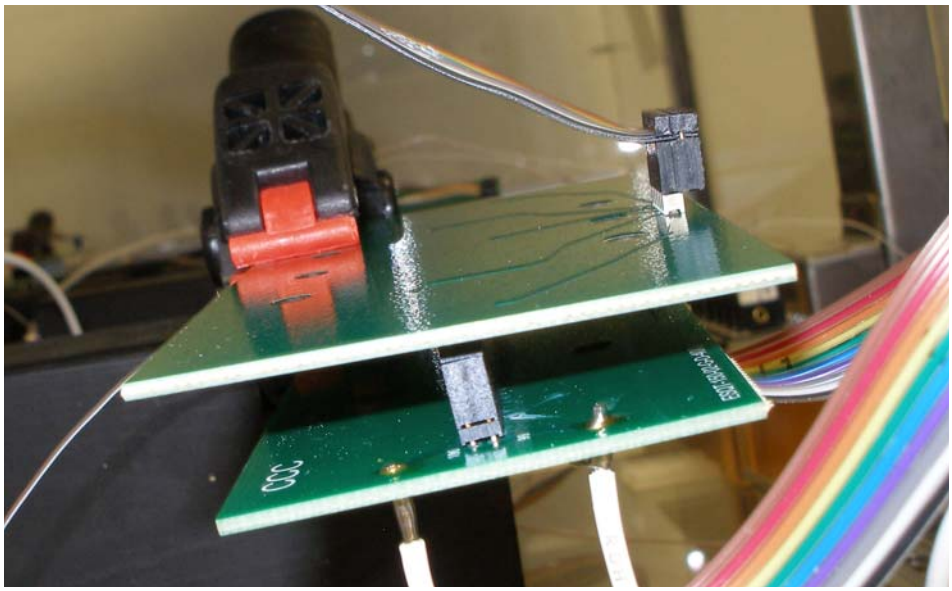
APPLICABLE DOCUMENTS

Standards: EIA Publication 364-70 Temperature Rise
EIA Publication 364-06 Contact Resistance
EIA Publication 364-55 Current Cycling
TLPM-032 Current Carrying Capacity
TLPM-084 Current Cycling
IEC 512-3 Electromechanical Components for Electronic Equipment: Basic Testing Procedures and Measuring Methods, Part 3: Current Carrying Capacity Tests

TEST SAMPLES AND PREPARATION

1) All materials shall be manufactured in accordance with the applicable product specification.
2) All test samples shall be identified and encoded to maintain traceability throughout the test sequences.
3) After soldering, the parts to be used shall be cleaned according to TLWI-0001.
4) All samples shall be visually inspected and cleaned as necessary.
5) Any additional preparation shall be noted in the individual test sequences.
6) Solder Information: Lead Free
7) Re-Flow Time/Temp: See accompanying profile.
8) All products designed to operate mounted on a printed circuits board shall be tested mounted to test boards in accordance with EIA-364-70.

PREPARED TEST SAMPLE



9) The following loading configurations shall be tested for Temperature Rise/Current Carrying Capacity testing of single row connector systems:
   a. One contact energized only
   b. Two contacts energized adjacent to each other
   c. Three contacts energized adjacent to each other
   d. Four contacts energized adjacent to each other
   e. All contacts energized

✧ Indicates energized contacts

✦ Indicates thermocouple monitored, energized contacts

Test Condition as in 9.1 above

✦			

10) The following loading configurations shall be tested for Temperature Rise/Current Carrying Capacity testing of two row connector systems:
   a. Two by One contact energized
   b. Two by Two contacts energized adjacent to each other
   c. Two by Three contacts energized adjacent to each other
   d. Two by Four contacts energized adjacent to each other
   e. All contacts energized

✧ Indicates energized contacts

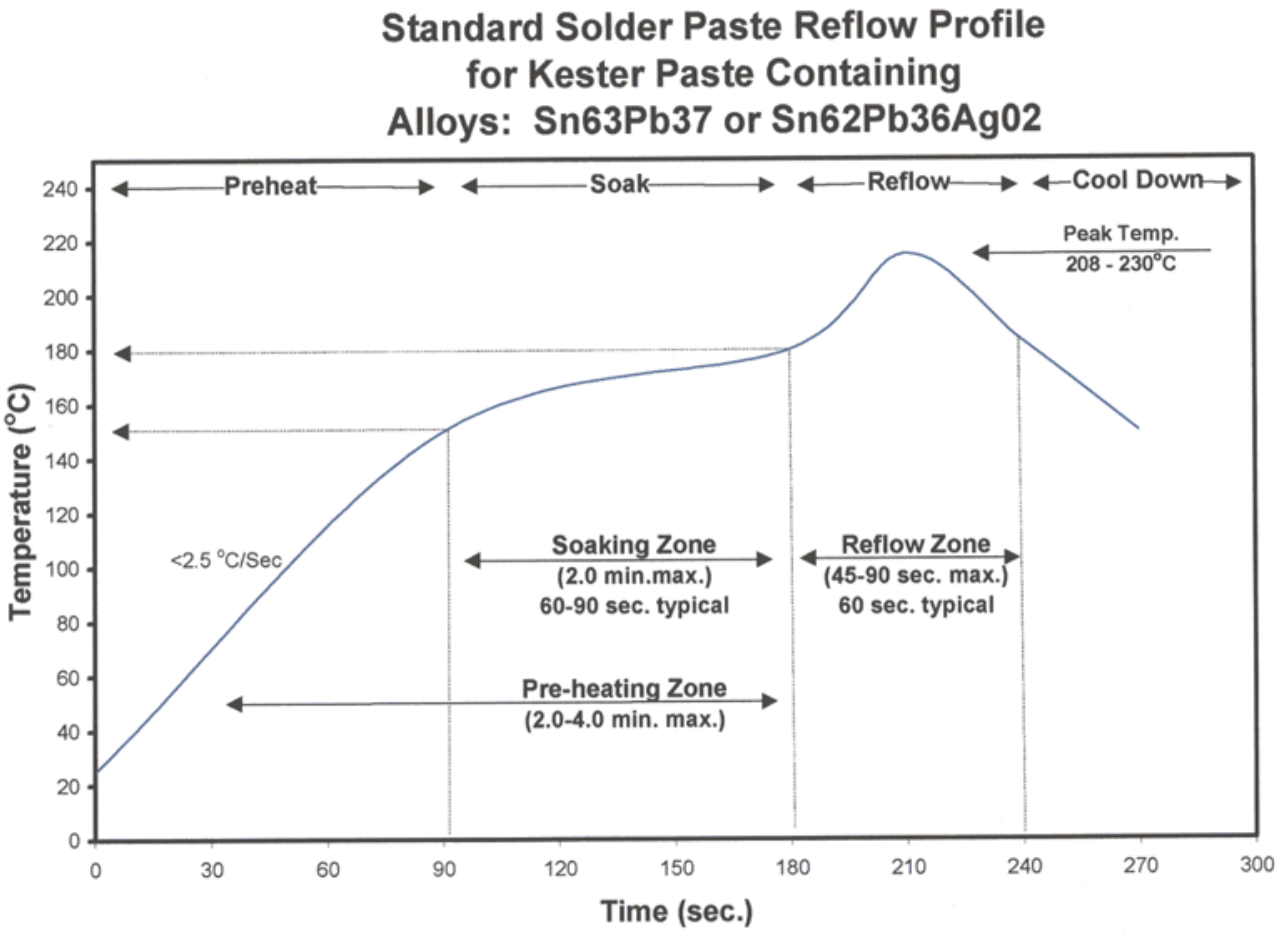
✦ Indicates thermocouple monitored, energized contacts

Test Condition as in 10.1 above

✧			
✦			

11) For Current Cycling, only 100 % loading will be tested.

OVEN PROFILE (Soldering Parts to Test Boards)



FLOWCHARTS

Current Carrying Capacity **3 Mated Assemblies Each**

TEST STEP	GROUP A 3 Mated Assembies 2 CONTACT POWERED	GROUP B 3 Mated Assembies 4 CONTACTS POWERED	GROUP C 3 Mated Assembies 6 CONTACTS POWERED	GROUP D 3 Mated Assembies 8 CONTACTS POWERED	GROUP E 3 Mated Assembies ALL CONTACTS POWERED
01	CCC	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 125° C
CCC, Temp rise = EIA-364-70

Current Cycling

TEST STEP	GROUP A 8 Mated Assembies ALL CONTACTS POWERED
01	Current Cycle, 500 cycles at 125% of Rated current

Current Cycle = EIA 364-55, Condition "B", Method #4
Test at Current 125% of Rated Current
Measure at 45 minutes into ON time of cycle
Measure Voltage Drop on 5 random contacts

TEST PROCEDURES

Part No.	ESQT-150-02-G-Q-400	Mating Part No.	TMMH-150-01-L-DV
Sample Size	15	Technician	Tony Wagoner
Start Date	01/27/2009	Complete Date	01/29/2009
Room Ambient	22.9°C	Relative Humidity	24%
Equipment ID#: MO-04, PS-07, TC111307-(001 - 017)			

TEMPERATURE RISE (Current Carrying Capacity, CCC):

1) Thermocouples shall be calibrated in accordance with Samtec documents; TLWI 0003, Thermocouple Welding Procedure and TLWI 0005, Thermocouple Calibration
2) The thermocouples shall be placed at a location to sense the maximum temperature generated during testing.
3) Temperature stability shall be defined as the temperature at which three successive readings, 5 minutes apart, differ not more than 1° C (computer controlled data acquisition). This is the Temperature Rise that the Current Carrying Capacity and De-rating curves are based on.
4) The following loading configurations shall be tested (double for two row systems):
   a. One contact energized only
   b. Two contacts energized adjacent to each other
   c. Three contacts energized adjacent to each other
   d. Four contacts energized adjacent to each other
   e. All contacts energized
5) The following loading configurations shall be tested for Temperature Rise/Current Carrying Capacity testing of two row connector systems:
   a. Two by One contact energized
   b. Two by Two contacts energized adjacent to each other
   c. Two by Three contacts energized adjacent to each other
   d. Two by Four contacts energized adjacent to each other
   e. All contacts energized
6) Three samples shall be tested for each of the above configurations for a total of eighteen assemblies.
7) Temperature Rise measurements shall be made at 5 different current levels yielding temperature rises in the 10 to 70°C range.
8) The base curve for the Current Rating chart will be derived from the average (maximum) value of three test specimens in accordance with IEC 512-3, Test 5b.

Part No.	**ESQT-150-02-G-Q-400**	**Mating Part No.**	**TMMH-150-01-L-DV**
Sample Size	**8**	**Technician**	**Tony Wagoner**
Start Date	**01/30/2009**	**Complete Date**	**02/20/2009**
Room Ambient	**24.7°C**	**Relative Humidity**	**24%**
Equipment ID#: PS-04, MO-09, TC010908-(060 - 077)			

CURRENT CYCLING

1. Samples shall be prepared and tested as above (paragraph 14.5).
2. Current Cycling shall be performed in accordance with EIA-364-55, Test Condition
3. Testing shall be as follows:
    - 3.1. Test Current: **1.9**(125% of 30°C Rating)
    - 3.2. "ON" Time: 45 Minutes
    - 3.3. "OFF" Time: 15 Minutes
    - 3.4. Number of Cycles: 500
    - 3.5. Measurements: 40 minutes into ON cycle
        - 3.5.1. Temperature
        - 3.5.2. Voltage Drop/Contact Resistance
4. Temperature vs. Number of Cycles and Voltage Drop vs. Number of Cycles shall be measured and recorded.

TEST RESULTS

CURRENT CARRYING CAPACITY (CCC) RESULTS

- **There was no evidence of physical damage to the test samples as tested.**
- **The following is a summary of the observed data:**

Temperature Rise, CCC at a 20% de-rating

- **CCC for a 30°C Temperature Rise ----------4.5A per contact with 2 contacts (2 x 1) powered**
- **CCC for a 30°C Temperature Rise ----------3.5A per contact with 4 contacts (2 x 2) powered**
- **CCC for a 30°C Temperature Rise ----------2.9A per contact with 6 contacts (2 x 3) powered**
- **CCC for a 30°C Temperature Rise ----------2.6A per contact with 8 contacts (2 x 4) powered**
- **CCC for a 30°C Temperature Rise ----------1.5A per contact with 100 contacts (2 x 50) powered**

CURRENT CYCLING RESULTS

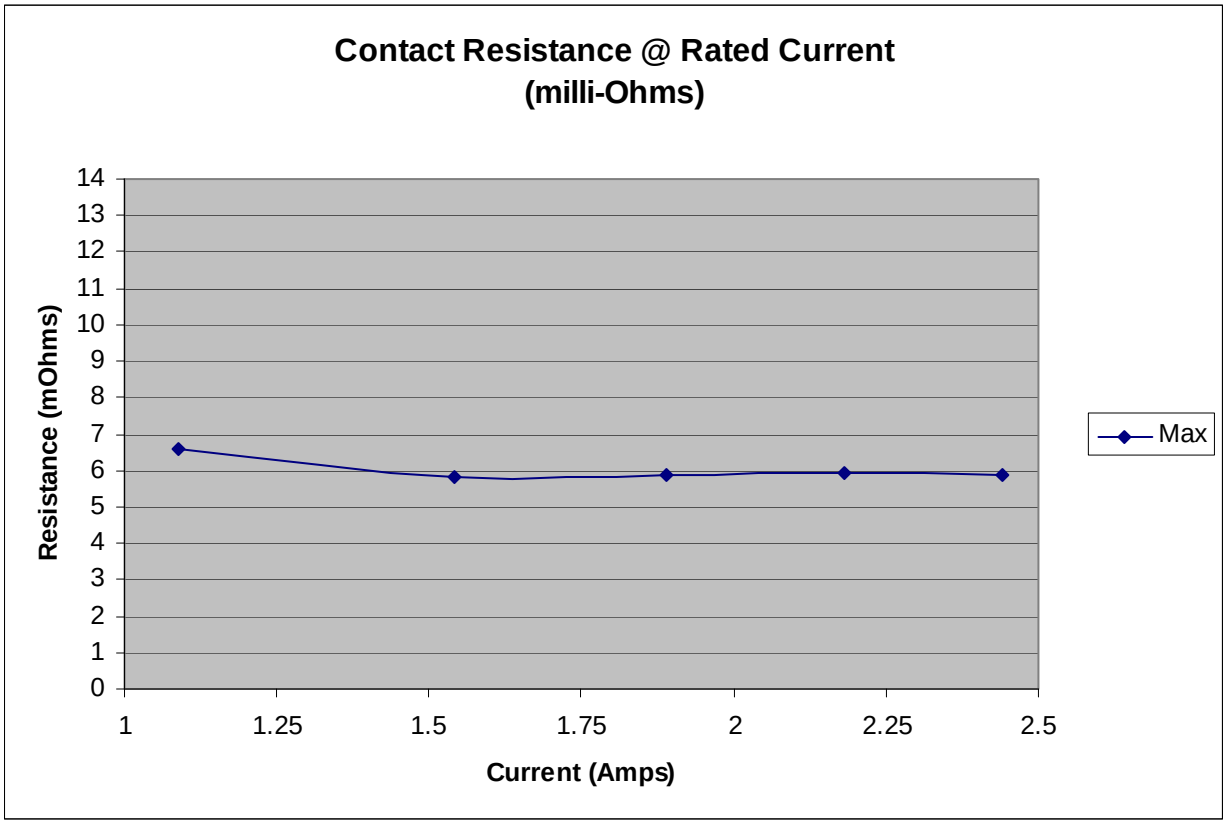
Test Condition: 500 Cycles, 45 minutes ON and 15 minutes OFF

- **Test Current ---------- 1.9 Amps**
- **Contact Resistances, Measured 40 minutes into the FIRST and LAST ON cycle**
  - **Initial**
    - **Min ---------- 4.65 mOhms**
    - **Max---------- 6.26 mOhms**
  - **Final**
    - **Min ---------- 4.57 mOhms**
    - **Max---------- 5.34 mOhms**
- **Temperature Change, Measured 40 minutes into the FIRST and LAST ON cycle**
  - **Initial Temperature Change ----------31.0°C**
  - **Final Temperature Change ----------29.5°C**

TEST DATA

CONTACT RESISTANCE @ RATED CURRENT

The following data represents the Voltage drop and Contact Resistance at Rated Current for the 100% energized samples:

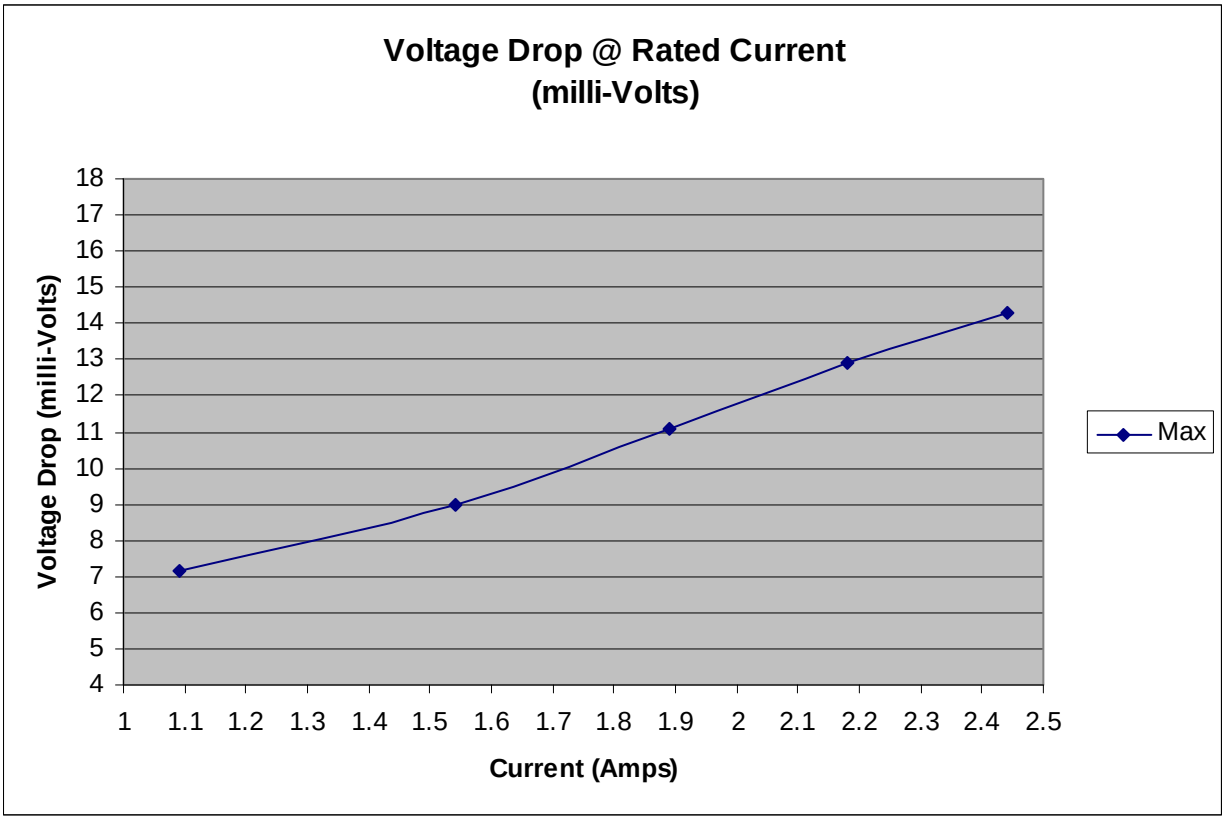


CONTACT RESISTANCE DATA ALL CONTACTS ENERGIZED (mΩ)					
TEST CURRENT AMPS	1.09	1.54	1.89	2.18	2.44
Min	5.2	4.62	4.65	4.67	4.65
Max	6.58	5.84	5.87	5.92	5.87
Avg	5.9	5.12	5.15	5.18	5.15

TEST DATA

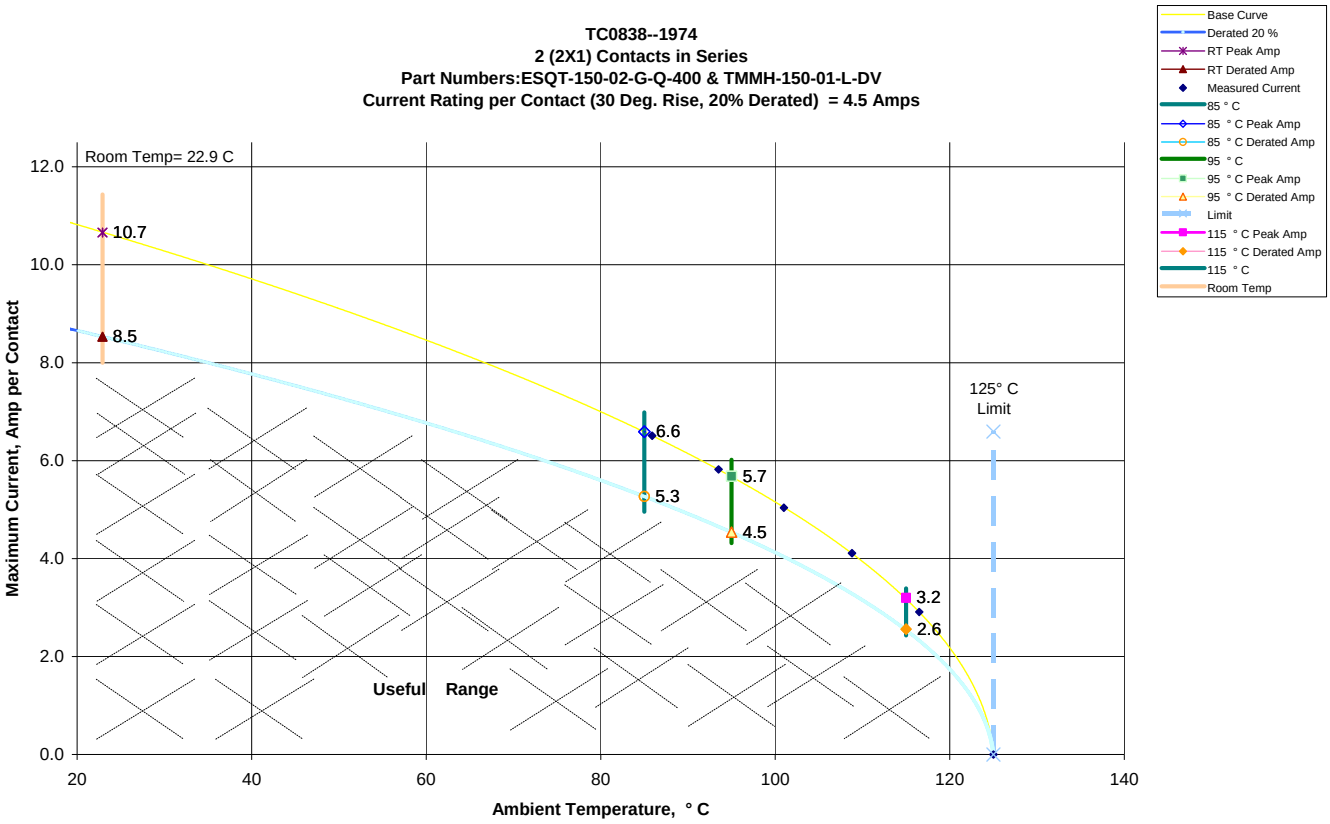
VOLTAGE DROP @ RATED CURRENT

The following data represents the Voltage drop at Rated Current for the 100% energized samples:



VOLTAGE DROP DATA ALL CONTACTS ENERGIZED (mV)					
TEST CURRENT AMPS	1.09	1.54	1.89	2.18	2.44
Min	5.67	7.11	8.78	10.19	11.34
Max	7.17	8.99	11.1	12.9	14.32
Avg	6.54	8.04	9.94	11.54	12.84

CURRENT CARRYING CAPACITY DATA



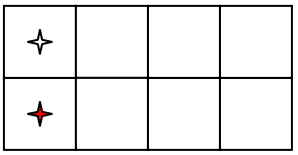
TEMPERATURE RISE DATA
TWO CONTACT ENERGIZED
(Degrees Celsius above ambient)

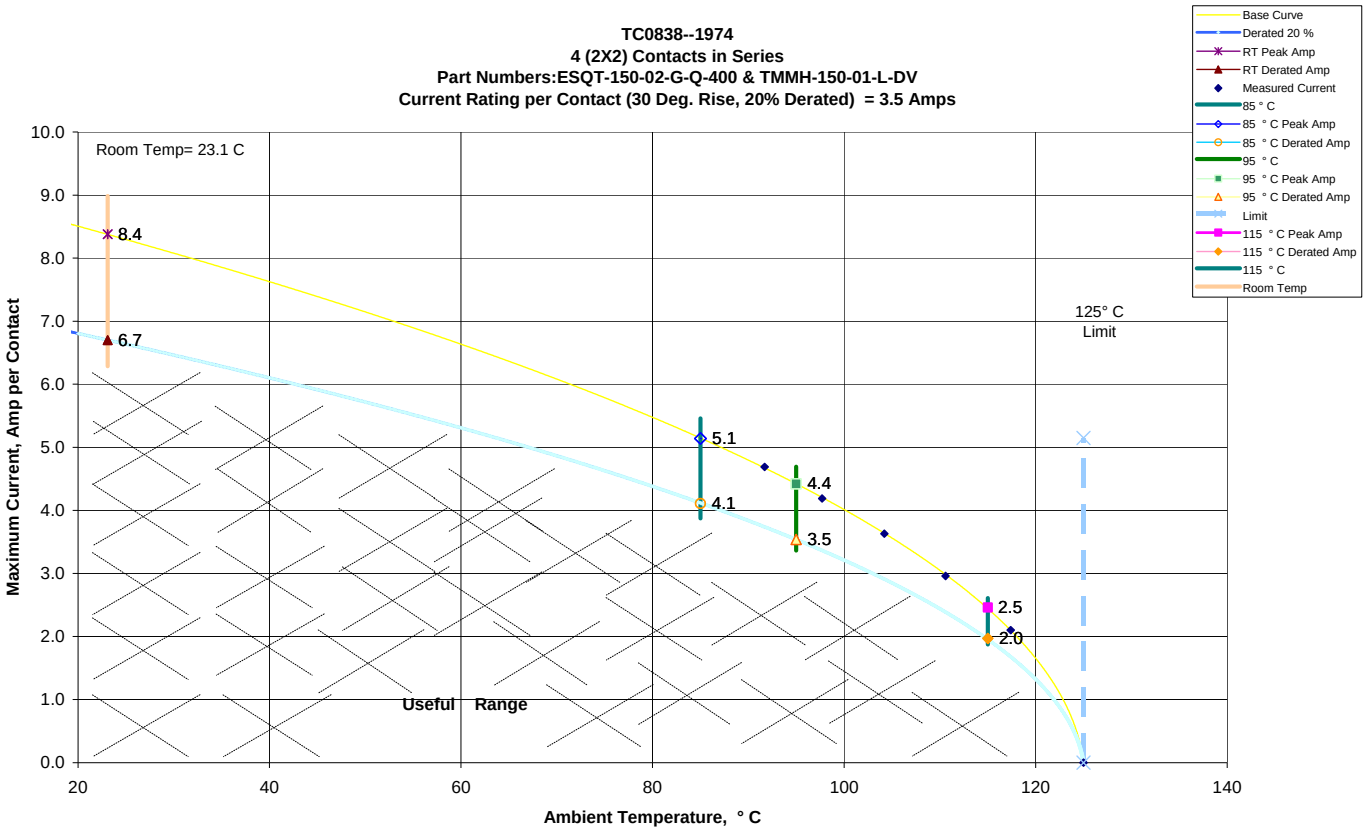
TEST CURRENT AMPS	2.91	4.11	5.04	5.82	6.51
Sample 1	8.5	16.4	24.2	31.7	39.2
Sample 2	8.4	16.1	23.8	31.3	38.7
Sample 3	8.5	16.2	24	31.6	39.3
Min	8.4	16.1	23.8	31.3	38.7
Max	8.5	16.4	24.2	31.7	39.3
Avg	8.47	16.23	24	31.53	39.07

Double Row Configuration

✧ Indicates energized contacts

✦ Indicates thermocouple monitored, energized contacts



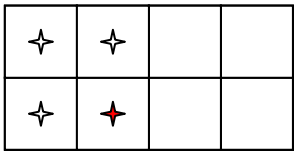


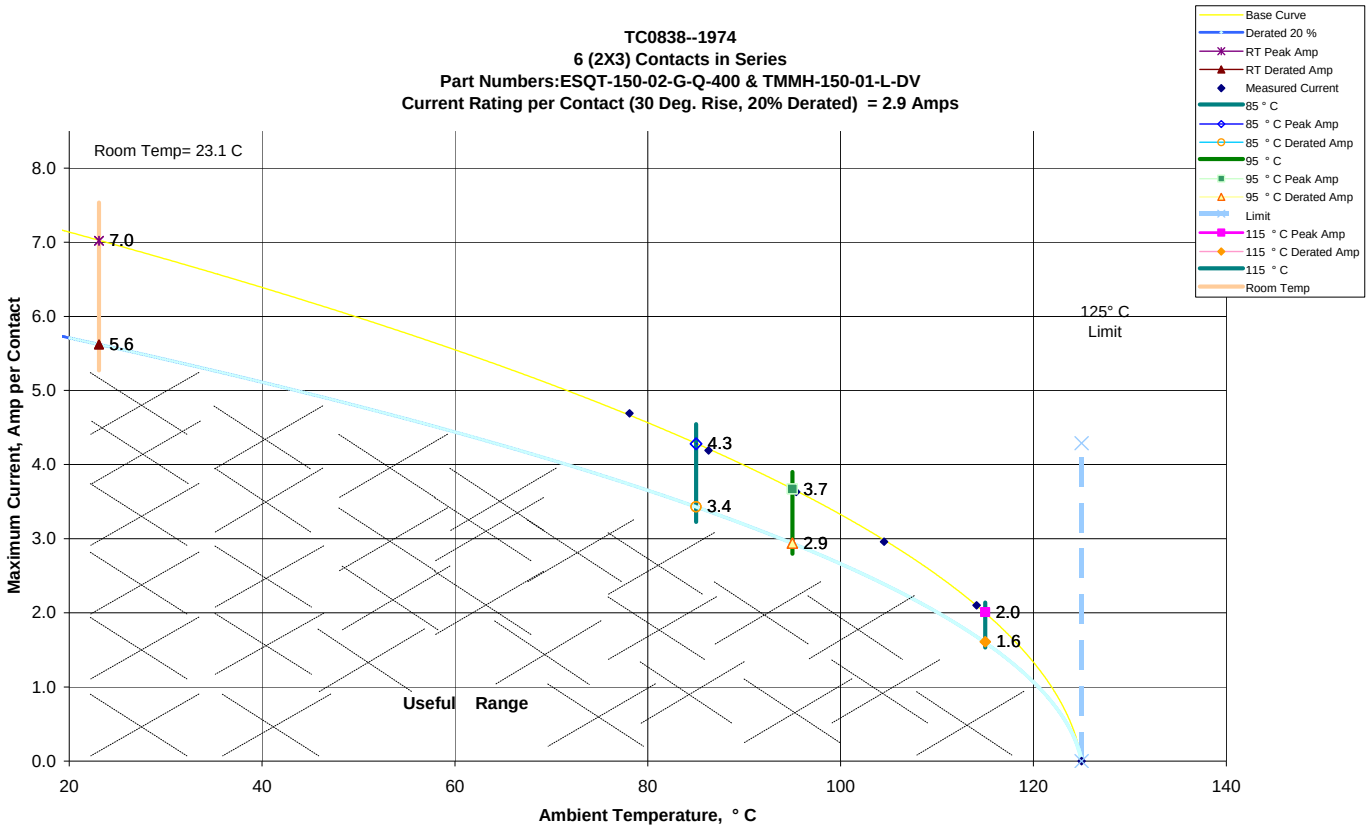
TEMPERATURE RISE DATA
FOUR CONTACTS ENERGIZED
(Degrees Celsius above ambient)

TEST CURRENT AMPS	2.1	2.96	3.63	4.19	4.69
Sample 4	7.1	13.5	19.7	25.8	31.6
Sample 5	7.8	14.8	21.4	28.2	34.1
Sample 6	7.8	14.8	21.3	27.9	34.1
Min	7.1	13.5	19.7	25.8	31.6
Max	7.8	14.8	21.4	28.2	34.1
Avg	7.57	14.37	20.8	27.3	33.27

✧ Indicates energized contacts

✦ Indicates thermocouple monitored, energized contacts



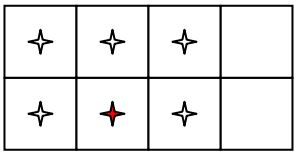


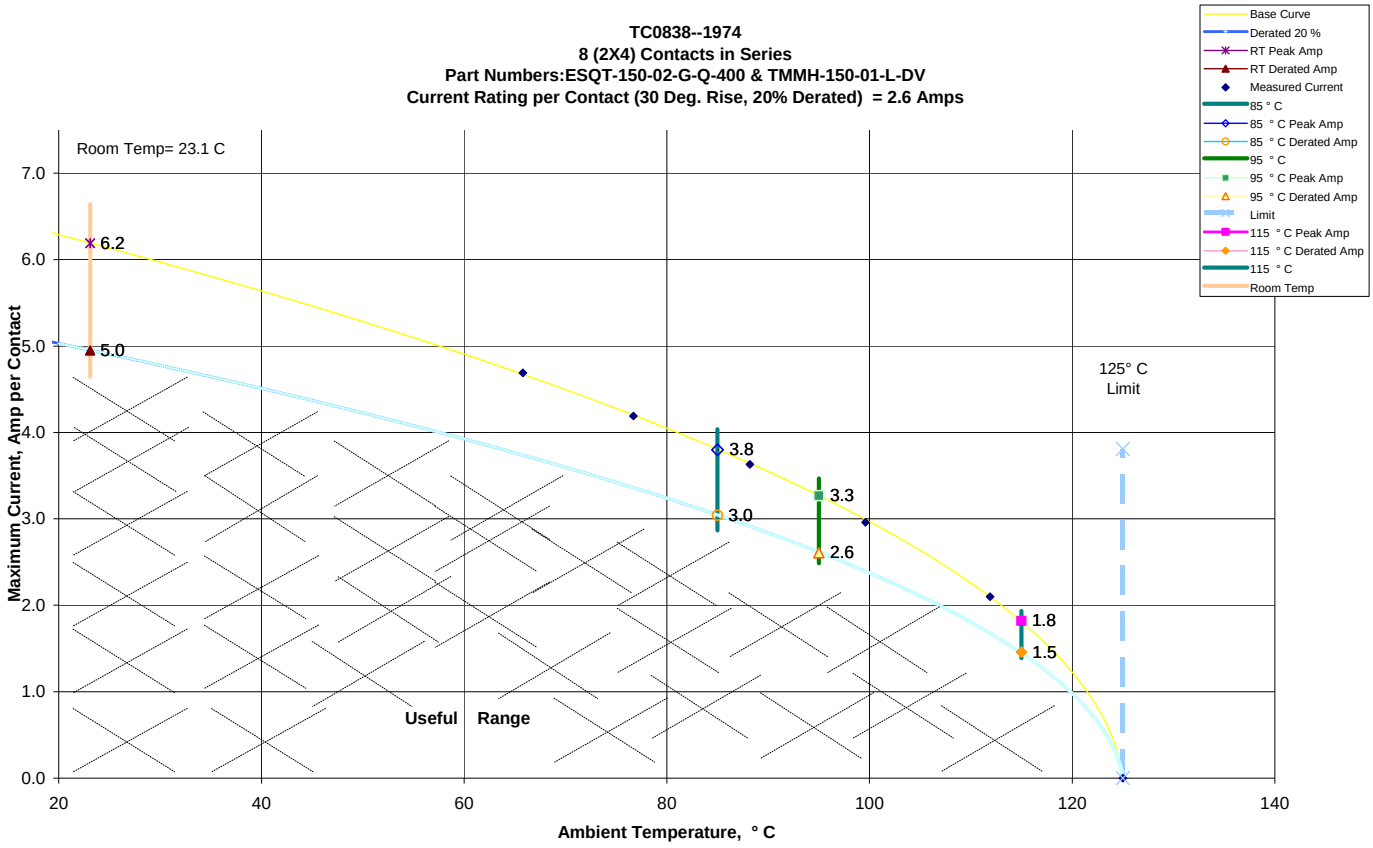
TEMPERATURE RISE DATA
SIX CONTACTS ENERGIZED
(Degrees Celsius above ambient)

TEST CURRENT AMPS	2.1	2.96	3.63	4.19	4.69
Sample 7	10.8	20.3	29.3	38.4	46.7
Sample 8	10.9	20.5	29.6	38.8	47.1
Sample 9	11	20.7	29.8	38.8	47
Min	10.8	20.3	29.3	38.4	46.7
Max	11	20.7	29.8	38.8	47.1
Avg	10.9	20.5	29.57	38.67	46.93

Indicates energized contacts

Indicates thermocouple monitored, energized contacts



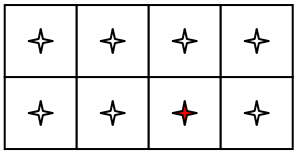


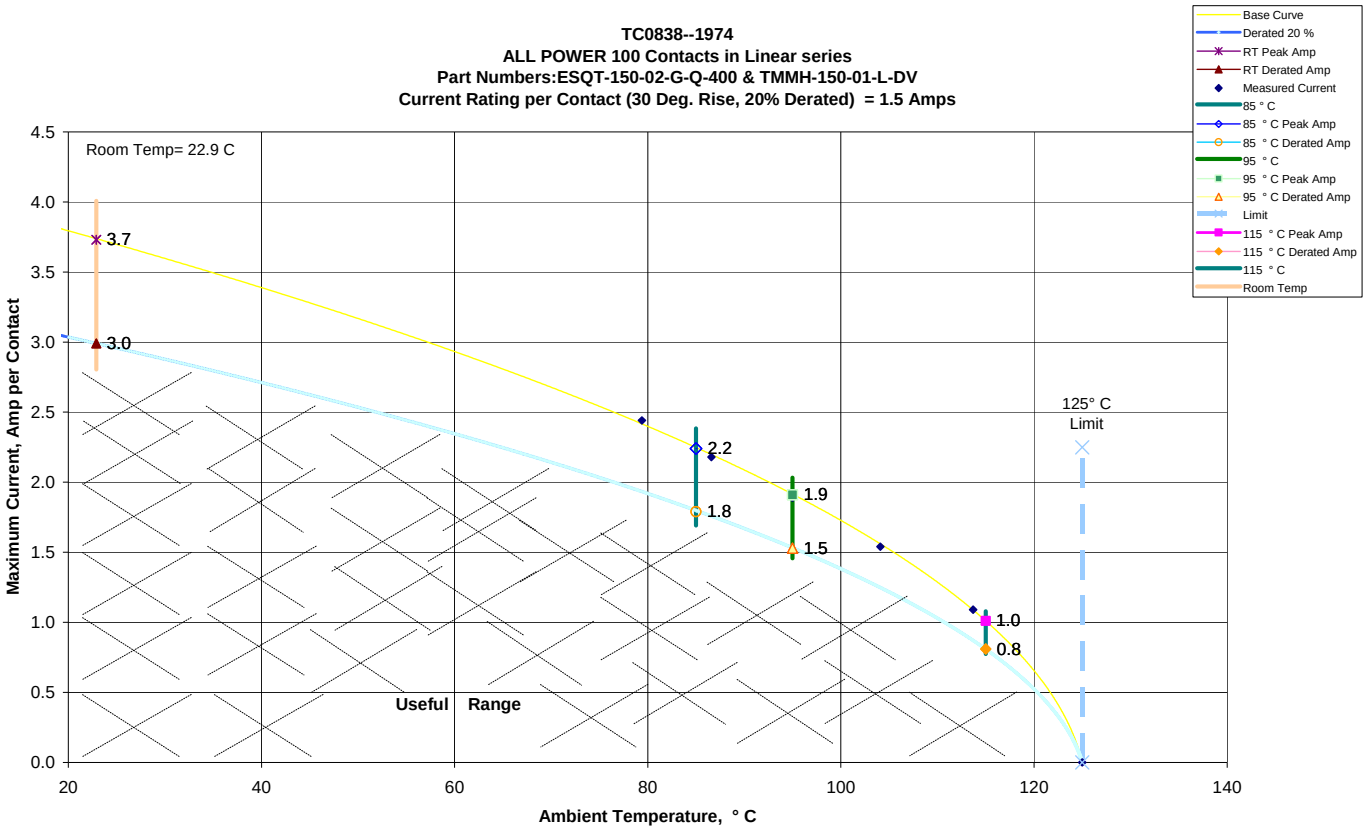
TEMPERATURE RISE DATA
EIGHT CONTACTS ENERGIZED
(Degrees Celsius above ambient)

TEST CURRENT AMPS	2.1	2.96	3.63	4.19	4.69
Sample 10	13.2	25.4	36.5	47.7	58.7
Sample 11	12.6	24.8	36.3	47.8	58.7
Sample 12	13.4	26.1	37.6	49.3	60.3
Min	12.6	24.8	36.3	47.7	58.7
Max	13.4	26.1	37.6	49.3	60.3
Avg	13.07	25.43	36.8	48.27	59.23

Indicates energized contacts

Indicates thermocouple monitored, energized contacts



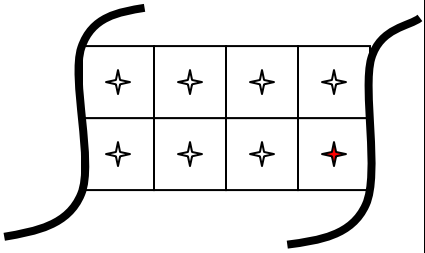


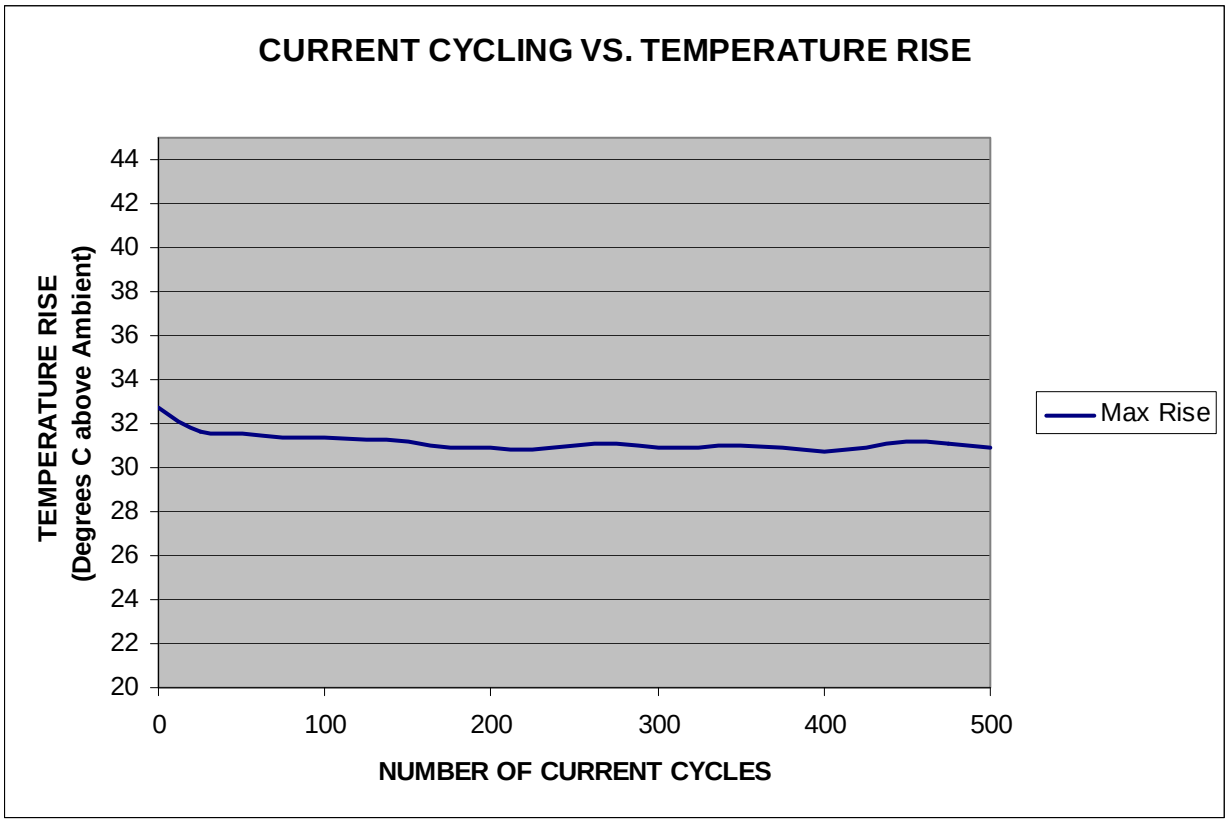
TEMPERATURE RISE DATA
ALL CONTACTS ENERGIZED
(Degrees Celsius above ambient)

TEST CURRENT AMPS	1.09	1.54	1.89	2.18	2.44
Sample 13	13.1	19.4	27.8	35.6	42.3
Sample 14	13.7	21	30.2	38.6	46
Sample 15	14.4	22.3	32	40.9	48.6
Min	13.1	19.4	27.8	35.6	42.3
Max	14.4	22.3	32	40.9	48.6
Avg	13.73	20.9	30	38.37	45.63

Indicates energized contacts

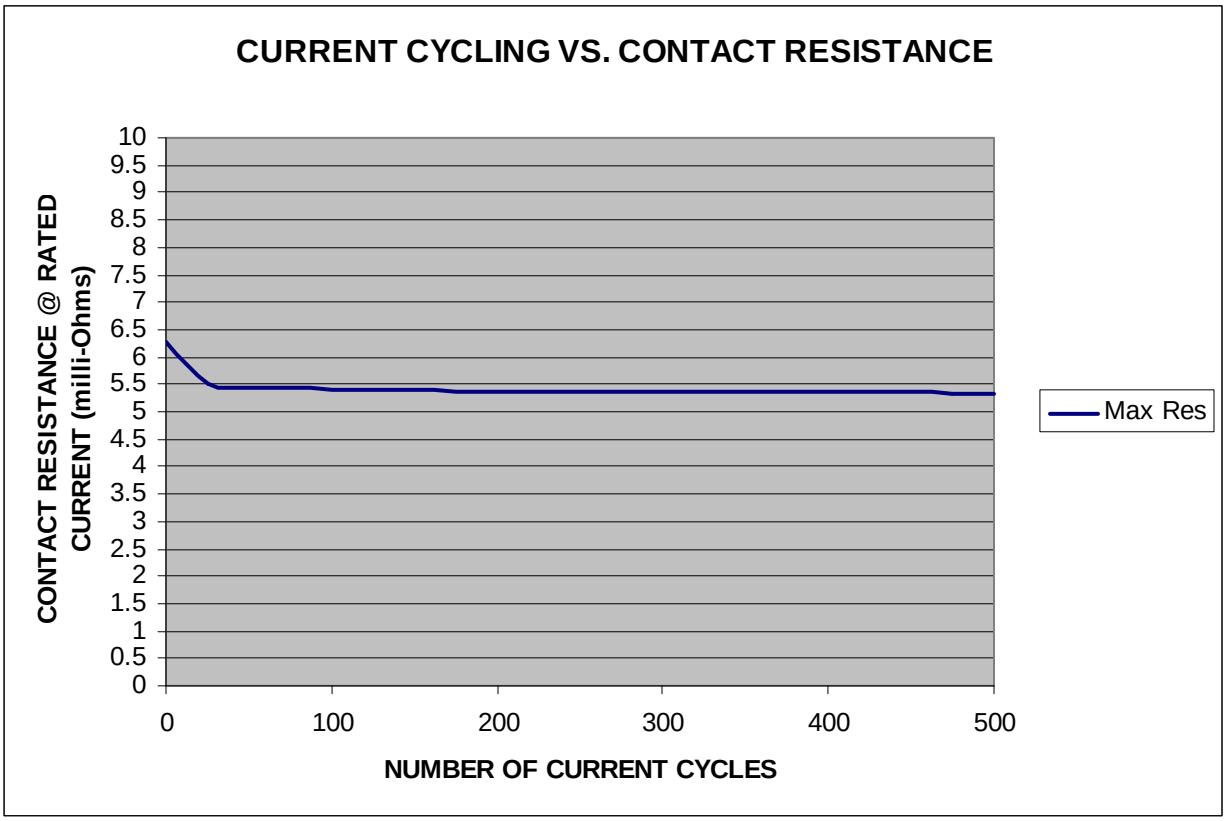
Indicates thermocouple monitored, energized contacts





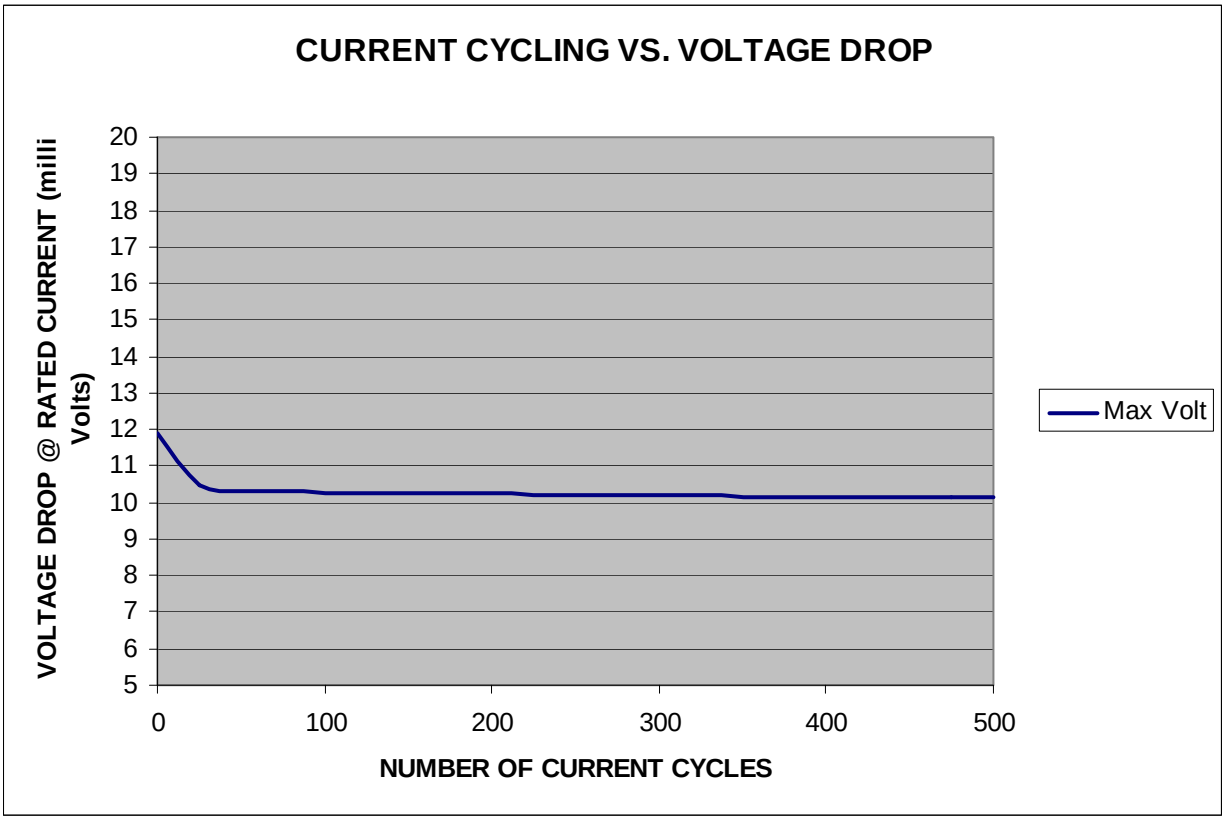
TEMPERATURE RISE DATA
ALL CONTACTS ENERGIZED
(Degrees Celsius above ambient)

	INITIAL	50 CYCLES	100 CYCLES	200 CYCLES	500 CYCLES
Min	29.1	28.6	28.7	28.4	28.2
Max	32.7	31.5	31.4	30.9	30.9
Avg	31	30.1	30.1	29.7	29.5



CONTACT RESISTANCE DATA
ALL CONTACTS ENERGIZED
(mΩ)

	INITIAL	50 CYCLES	100 CYCLES	200 CYCLES	500 CYCLES
Min	4.65	4.61	4.62	4.6	4.57
Max	6.26	5.43	5.4	5.38	5.34
Avg	5.14	4.97	4.93	4.9	4.86



VOLTAGE DROP DATA
ALL CONTACTS ENERGIZED
(MV)

	INITIAL	50 CYCLES	100 CYCLES	200 CYCLES	500 CYCLES
Min	8.83	8.75	8.77	8.74	8.68
Max	11.9	10.31	10.26	10.23	10.15
Avg	9.77	9.44	9.37	9.32	9.24

EQUIPMENT AND CALIBRATION SCHEDULES

Equipment #: PS-01
Description: System Power Supply
Manufacturer: Hewlett Packard
Model: HP 6033A
Serial #: (HP) 3329A-07330
Accuracy: See Manual
… Last Cal: 06/16/2008, Next Cal: 06/17/2009

Equipment #: PS-02
Description: System Power Supply, 0 - 20V/ 0 - 30 amp, 200 Watts
Manufacturer: Hewlett Packard
Model: 6033A
Serial #: (HP) 2847A-04167
Accuracy: See Manual
… Last Cal: 04/07/2008, Next Cal: 04/07/2009

Equipment #: PS-03
Description: Power Supply, 50 amp
Manufacturer: HP/Agilent
Model: 0-60V / 0 - 50 amps / 1000 Watts
Serial #: 2723A-02144
Accuracy: See Manual
… Last Cal: 06/16/2008, Next Cal: 06/16/2009

Equipment #: PS-04
Description: 60 V, 50 A DC Power Supply - AutoRanging SO
Manufacturer: Hewlett Packard / Agilent
Model: AT-6032A
Serial #: MY41001186
Accuracy: See Manual Current Cycle Chamber 2 - Lower Shelf
… Last Cal: 06/16/2008, Next Cal: 06/16/2009

Equipment #: PS-05
Description: 60 V, 50 A DC Power Supply - AutoRanging SO
Manufacturer: Hewlett Packard / Agilent
Model: AT-6032A
Serial #: MY41001158
Accuracy: See Manual Current Cycle Chamber 2 - Lower Shelf
… Last Cal: 06/16/2008, Next Cal: 06/16/2009

Equipment #: PS-06
Description: 60 V, 50 A DC Power Supply - AutoRanging SO
Manufacturer: Hewlett Packard / Agilent
Model: AT-6032A
Serial #: US35420827
Accuracy: See Manual Current Cycle Chamber 3 (This chamber only has 1 shelf)
… Last Cal: 06/16/2008, Next Cal: 06/16/2009

Equipment #: PS-07
Description: 20 V, 120 A DC Power Supply - AutoRanging SO/HPIB
Manufacturer: Hewlett Packard / Agilent
Model: AT-6031A
Serial #: 2721A00648
Accuracy: See Manual See Manual
… Last Cal: 06/16/2008, Next Cal: 06/16/2009

Equipment #: PS-09
Description: 60 V, 50 A DC Power Supply - AutoRanging SO
Manufacturer: Hewlett Packard / Agilent
Model: AT-6032A
Serial #: US38322853
Accuracy: See Manual Current Cycle Chamber 3 (This chamber only has 1 shelf)
… Last Cal: 10/21/2008, Next Cal: 10/21/2009

Equipment #: PS-10
Description: 60 V, 50 A DC Power Supply - AutoRanging SO
Manufacturer: Hewlett Packard / Agilent
Model: AT-6031A
Serial #: 3440A10457
Accuracy: See Manual See Manual
… Last Cal: 10/21/2008, Next Cal: 10/21/2009

Equipment #: MO-02
Description: Multimeter /Data Acquisition System
Manufacturer: Keithley
Model: 2700
Serial #: 0780546
Accuracy: See Manual
… Last Cal: 07/08/2008, Next Cal: 07/08/2009

Equipment #: MO-08
Description: Model 2750 Multimeter/Switch System (Integra Series)
Manufacturer: Keithley
Model: 2750
Serial #: WDC-875194
Accuracy: See Manual
… Last Cal: 11/24/2008, Next Cal: 11/24/2009

Equipment #: MO-09
Description: Model 2750 Multimeter/Switch System (Integra Series)
Manufacturer: Keithley
Model: 2750
Serial #: WDC-874817
Accuracy: See Manual
… Last Cal: 11/24/2008, Next Cal: 11/24/2009

Equipment #: TC111307-(001 - 017)
Description: CCC Chamber Thermocouples
Manufacturer: Samtec
Model:
Serial #: TC111307-(001 - 017)
Accuracy: +/- 1 Deg.
… Last Cal: 11/03/2008, Next Cal: 11/03/2009

Equipment #: TC111307-(041 - 059)
Description: Current Cycling Chamber #1 Thermcouples
Manufacturer: Samtec
Model:
Serial #: TC111307-(041 - 059)
Accuracy: +/- 1 Deg.
… Last Cal: 11/03/2008, Next Cal: 11/03/2009

Equipment #: TC010908-(060 - 077)
Description: Current Cycling Chamber # 2 Thermcouples
Manufacturer: Samtec
Model:
Serial #: TC010908-(060-077)
Accuracy: +/- 1 Deg.
… Last Cal: 11/03/2008, Next Cal: 11/03/2009

Equipment #: TC111307-(118 - 136)
Description: Current Cycling Chamber # 3 Thermcouples
Manufacturer: Samtec
Model:
Serial #: TC111307-(118 - 136)
Accuracy: +/- 1 Deg.
… Last Cal: 11/03/2008, Next Cal: 11/03/2009

Equipment #: TC120607-(101C - 109C), 110807-140
Description: Current Cycling Chamber # 4 Thermcouples
Manufacturer: Samtec
Model:
Serial #: TC120607-(101C - 109C), 110807-140
Accuracy: +/- 1 Deg.
… Last Cal: 12/06/2008 & 11/08/2008, Next Cal: 12/06/2009 & 11/08/2009