DECEMBER 31, 2001

TEST REPORT #201558

SUPPLEMENTAL TESTING
LSH/LTH CONNECTOR

SAMTEC,INC.
TC0141-0544

APPROVED BY: THOMAS PEEL
VICE PRESIDENT AND
DIRECTOR OF TEST PROGRAM DEVELOPMENT
CONTECH RESEARCH, INC.

1478 - 01
ACCREDITED
1478 - 02

Contech Research

REVISION HISTORY

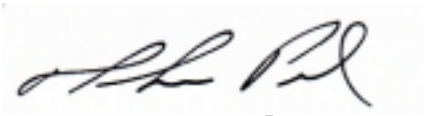
DATE	REV. NO.	DESCRIPTION	ENG.
12/31/2001	1.0	Initial Issue	TP

CERTIFICATION

This is to certify that the evaluation described herein was designed and executed by personnel of Contech Research, Inc. It was performed with the concurrence of Samtec, Inc., of New Albany, IN who was the test sponsor.

All equipment and measuring instruments used during testing were calibrated and traceable to NIST according to ISO 10012-1 and ANSI/NCSL Z540-1, as applicable.

All data, raw and summarized, analysis and conclusions presented herein are the property of the test sponsor. No copy of this report, except in full, shall be forwarded to any agency, customer, etc., without the written approval of the test sponsor and Contech Research.



Thomas Peel
Vice President And
Director Of Test Program Development
Contech Research, Inc.

TP:jsgb

SCOPE

To perform supplemental testing on the LSH/LTH connector series as manufactured and submitted by the test sponsor Samtec, Inc.

APPLICABLE DOCUMENTS

1. Unless otherwise specified, the following documents of issue in effect at the time of testing performed form a part of this report to the extent as specified herein. The requirements of sub-tier specifications and/or standards apply only when specifically referenced in this report.

2. Product Specifications: Samtec TC0141-0544 Flowchart

3. Standards: EIA Publication 364

TEST SAMPLES AND PREPARATION

1. The following test samples were submitted by the test sponsor, Samtec, Inc., for the evaluation to be performed by Contech Research, Inc.

   Description

   a) LSH connectors mounted to test boards
   b) LTH connectors mounted to test boards

2. Test samples were supplied assembled and terminated to test boards by the test sponsor.

3. Figure #1 illustrates the test board layout used for mounting test samples.

4. The test samples were tested in their ‘as received’ condition.

5. Unless otherwise specified in the test procedures used, no further preparation was used.

TEST SELECTION

1. See Test Plan Flow Diagram, Figure #2, for test sequences used.

TEST SELECTION - Continued

2. Test set ups and/or procedures which are standard or common are not detailed or documented herein provided they are certified as being performed in accordance with the applicable (industry or military) test methods, standards and/or drawings as specified in the detail specification.

SAMPLE CODING

1. All samples were coded. Mated test samples remained with each other throughout the test group/sequences for which they were designated. Coding was performed in a manner which remained legible for the test duration.

2. The test samples were coded in the following manner:

Sequence 1

Group 1 : S1-1-1,S1-1-2,S1-1-3,S1-1-4
Group 2 : S1-2-1,S1-2-2
Group 3a : S1-3-1 (Initial Normal Force)
Group 3b : S1-3-2 (Thermal Aging/Final Normal Force)

Sequence 2

Group 1 : S2-1-1,S2-2-1
Group 2a : S2-2a-1,S2-2a-2
Group 2b : S2-2b-1*,S2-2b-2,S2-2b-3
Group 2c : S2-2c-1*,S2-2c-2,S2-2b-3

* These samples were used to determine the breakdown voltage after thermal aging and moisture resistance.

FIGURE #1

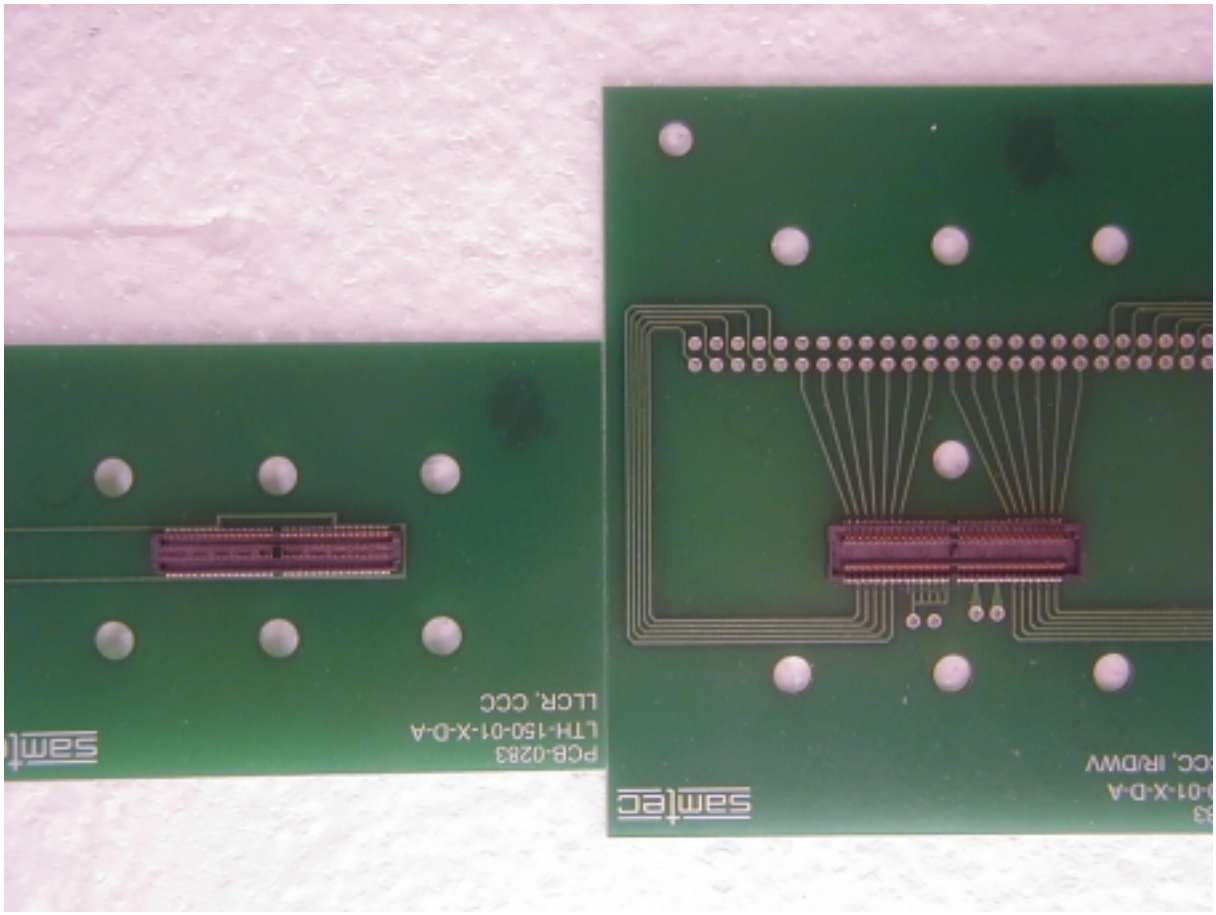
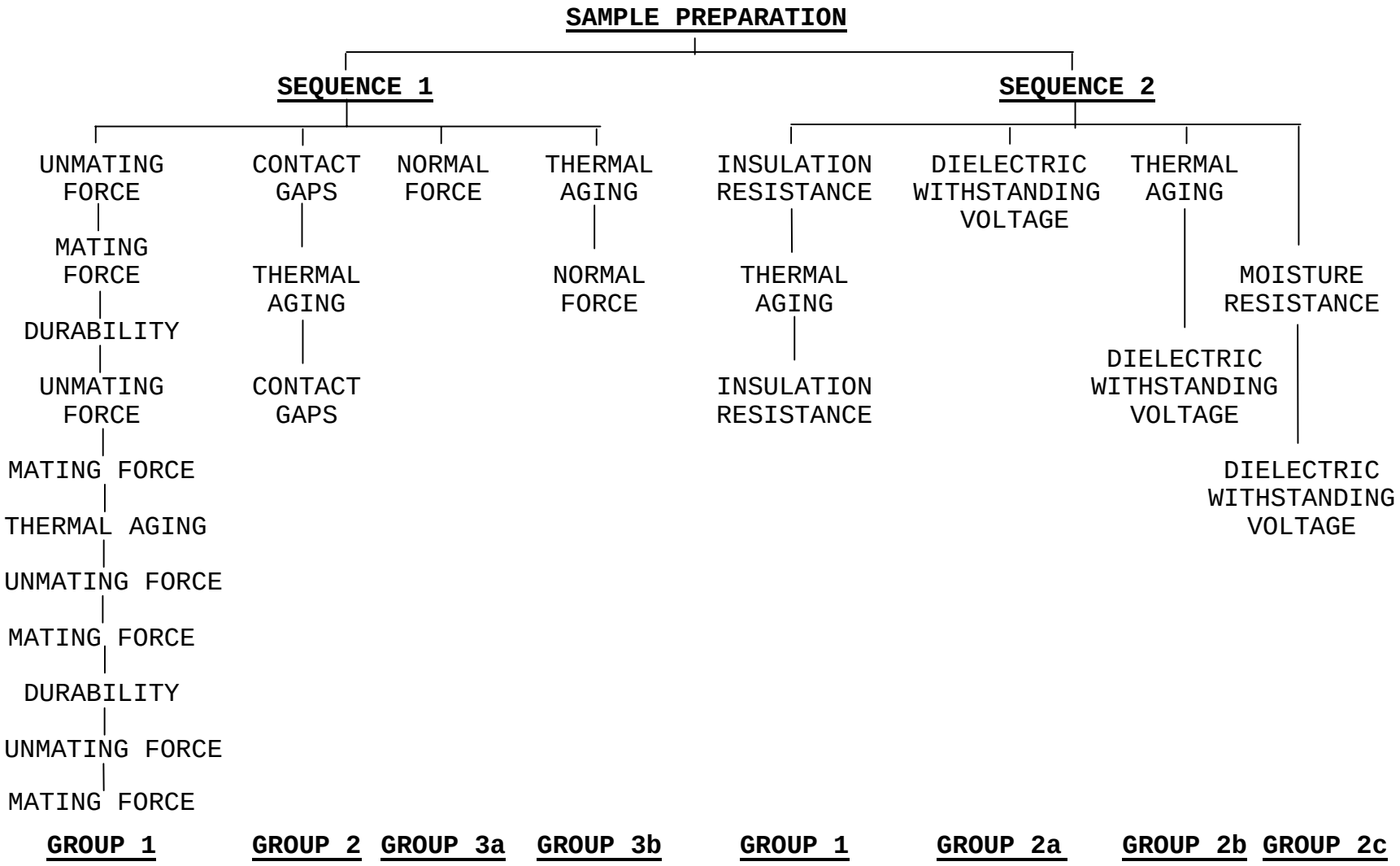


FIGURE #2


SAMPLE PREPARATION
SEQUENCE 1
SEQUENCE 2
UNMATING FORCE
CONTACT GAPS
NORMAL FORCE
THERMAL AGING
INSULATION RESISTANCE
DIELECTRIC WITHSTANDING VOLTAGE
THERMAL AGING
MATING FORCE
THERMAL AGING
NORMAL FORCE
THERMAL AGING
MOISTURE RESISTANCE
DURABILITY
CONTACT GAPS
INSULATION RESISTANCE
DIELECTRIC WITHSTANDING VOLTAGE
UNMATING FORCE
MATING FORCE
DIELECTRIC WITHSTANDING VOLTAGE
THERMAL AGING
UNMATING FORCE
MATING FORCE
DURABILITY
UNMATING FORCE
MATING FORCE
GROUP 1
GROUP 2
GROUP 3a
GROUP 3b
GROUP 1
GROUP 2a
GROUP 2b
GROUP 2c

DATA SUMMARY

TEST	REQUIREMENT	RESULTS
SEQUENCE 1		
GROUP 1		
UNMATING FORCE	RECORD	8.7 LBS.MAX.
MATING FORCE	RECORD	9.8 LBS.MAX.
DURABILITY (10X)	NO DAMAGE	PASSED
UNMATING FORCE	RECORD	6.8 LBS.MAX.
MATING FORCE	RECORD	9.5 LBS.MAX.
THERMAL AGING	NO DAMAGE	PASSED
UNMATING FORCE	RECORD	4.4 LBS.MAX.
MATING FORCE	RECORD	8.4 LBS.MAX.
DURABILITY (10X)	NO DAMAGE	PASSED
UNMATING FORCE	RECORD	4.0 LBS.MAX.
MATING FORCE	RECORD	8.1 LBS.MAX.
GROUP 2		
CONTACT GAPS	RECORD	0.0433 INCHES MAX.
THERMAL AGING	NO DAMAGE	PASSED
CONTACT GAPS	RECORD	0.0444 INCHES MAX.
GROUP 3a		
NORMAL FORCE (LSH)	PLOT FORCE VS DEFL.	SEE RESULTS
GROUP 3b		
THERMAL AGING	NO DAMAGE	PASSED
NORMAL FORCE (LSH)	PLOT FORCE VS DEFL.	SEE RESULTS
SEQUENCE 2		
GROUP 1		
INSULATION RESISTANCE	1000 MEGOHMS MIN.	>50000 MEGOHMS
THERMAL AGING	NO DAMAGE	PASSED
INSULATION RESISTANCE	1000 MEGOHMS MIN.	>50000 MEGOHMS
MOISTURE RESISTANCE	NO DAMAGE	PASSED
INSULATION RESISTANCE	1000 MEGOHMS MIN.	>6000 MEGOHMS

DATA SUMMARY- Continued

TEST	REQUIREMENT	RESULTS
SEQUENCE 2 - Continued		
GROUP 2a		
DWV	BREAKDOWN VOLTAGE @ TEST VOLTAGE 690 VAC	920 VAC. PASSED
GROUP 2b		
THERMAL AGING	NO DAMAGE	PASSED
DWV	BREAKDOWN VOLTAGE @ TEST VOLTAGE 690 VAC	920 VAC. PASSED
GROUP 2c		
MOISTURE RESISTANCE	NO DAMAGE	PASSED
DWV	BREAKDOWN VOLTAGE @ TEST VOLTAGE 645 VAC	860 VAC. PASSED

EQUIPMENT LIST

ID#	Next Cal	Last Cal	Equipment Name	Manufacturer	Model #	Serial #	Accuracy	Freq.Cal
27	5/9/02	5/9/01	Temp. Humid. Chamber	Blue M Co.	FR-256PC-1	F2-249	See Cal Cert	12 mon.
53	12/29/01	6/29/01	Load Cell 10 Pound	Daytronic	152A-10	182	See Cal Cert	6 mon.
92			NF Fixture	BK Tool & MFG	N/A	N/A	±.0005"	N/A
93			6 Volt Power Supply	Contech Research	N/A	N/A	N/A	N/A
99	5/1/02	5/1/01	Toolmakers Microscope	Mitutoyo Corp.	TM111	30046	See Cal Cert	12 mon.
321	1/23/02	1/23/01	AC-DC Hipot/Megometer	Hipotronics Co.	H300B	DS16-201	See Cal Cert	12 mon.
421	3/30/02	3/30/01	Megohmeter	Hipotronics Co.	HM3A	031423-00	See Cal Cert	12 mon.
455	8/30/02	8/30/01	Digital Multi Meter Unit	Keithley Co.	199	392203	See Cal Cert	12 mon.
487			Computer	Twilight Co.	386-40	N/A	N/A	N/A
631	12/29/01	6/29/01	LVDT Condt.Amp.	Daytronics Corp.	3230	S04888	See Cal Cert	6 mon.
633	11/6/02	11/6/01	Digital Thermometer	Omega Eng.	DP116-KC2	7130181	±1.1DegC	12mon
683			Plotter	Hewlett Packard	7470A	2308A85161	N/A	N/A
1139	11/15/02	11/15/01	Micrometer Barrel	Mitutuyo	152-391	01	±.0001in	12 mon.
1236			Floor Oven	Blue M.	DC166F	DC-2242	See Manual	N/A

TEST RESULTS

SEQUENCE 1

GROUP 1

PROJECT NO.: 201558 SPECIFICATION: TC0141-0544

PART NO.: NR-LTH-050-01-G-D-A PART DESCRIPTION: LSH/LTH
NR-LSH-050-01-G-D-A Conn.

SAMPLE SIZE: ID#S1-1-1,S1-1-2, TECHNICIAN: LL
S1-1-3,S1-1-4

START DATE: 11/16/01 COMPLETE DATE: 11/16/01

ROOM AMBIENT: 24°C RELATIVE HUMIDITY: 34%

EQUIPMENT ID#: 53, 92, 631

MATING AND UNMATING FORCE

PURPOSE:

To determine the mechanical forces required to mate and unmate the LSH and LTH connectors.

PROCEDURE:

1. The test was performed in accordance with Samtec's TC0141-0544 Flowchart and EIA 364, Test Procedure 13.
2. All test samples were tested in a terminated state soldered.
3. The test samples were fixtured to the base plate of the test stand and applicable force gauge.
4. The fixturing was accomplished in a manner to prevent "bowing" of the test samples during the performance of the test.
5. The fixturing was accomplished to assure axial alignment and allowed self centering movement to exist.
6. Care was taken to assure that the mating faces did not contact each other to assure proper forces were measured.
7. The test rate was 0.5 inches per minute.

REQUIREMENTS: See next page.

REQUIREMENTS:

The force required to mate and unmate the test samples shall be measured and recorded.

RESULTS:

The following is a summary of the observed data:

Sample ID#	MATING FORCE (Pounds)	UNMATING FORCE (Pounds)
S1-1-1	9.0	8.7
S1-1-2	9.1	7.5
S1-1-3	9.8	7.7
S1-1-4	8.3	7.7

PROJECT NO.: 201558	SPECIFICATION: TC0141-0544
PART NO.: NR-LTH-050-01-G-D-A NR-LSH-050-01-G-D-A	PART DESCRIPTION: LSH/LTH Conn.
SAMPLE SIZE: ID#S1-1-1,S1-1-2, S1-1-3,S1-1-4	TECHNICIAN: LL
START DATE: 11/16/01	COMPLETE DATE: 11/16/01
ROOM AMBIENT: 24°C	RELATIVE HUMIDITY: 34%
EQUIPMENT ID#: 53, 92, 631	

DURABILITY

PURPOSE:

1. This is a preconditioning sequence which is used to induce the type of wear on the contacting surfaces which may occur under normal service conditions. The connectors are mated and unmated a predetermined number of cycles. Upon completion, the units being evaluated are exposed to the environments as specified to assess any impact on mechanical stability resulting from wear or other wear dependent phenomenon.

2. This type or preconditioning sequence is also used to mechanically stress the connector system as would normally occur in actual service. This sequence in conjunction with other tests is used to determine if a significant loss of contact pressure occurs from said stresses which in turn, may result in an unstable mechanical condition to exist.

PROCEDURE:

1. The test was performed in accordance with Samtec's TC0141-0544 Flowchart and EIA 364, Test Procedure 09.

2. Test Conditions:

   a) No. of Cycles : 10
   b) Rate : 500 cycles per hour

3. The test samples were fixtured to the base plate of the test stand and applicable force gauge.

PROCEDURE: Continued

4. The test samples were axially aligned to accomplish the mating and unmating function allowing for self-centering movement.

5. Care was taken to prevent the mating faces of the test samples from contacting each other.

6. All subsequent variable testing was performed in accordance with the procedures previously indicated.

REQUIREMENTS:

1. There shall be no evidence of physical damage to the test samples so tested.

2. The force required to mate and unmate the test samples after 10 cycles of durability shall be measured and recorded.

RESULTS:

1. There was no evidence of physical damage to the test samples as tested.

2. The following is a summary of the observed mating/unmating force data:

Sample ID#	MATING FORCE (Pounds)	UNMATING FORCE (Pounds)
S1-1-1	8.2	6.1
S1-1-2	8.6	5.2
S1-1-3	9.5	6.8
S1-1-4	8.2	6.3

PROJECT NO.: 201558	SPECIFICATION: TC0141-0544
PART NO.: NR-LTH-050-01-G-D-A NR-LSH-050-01-G-D-A	PART DESCRIPTION: LSH/LTH Conn.
SAMPLE SIZE: ID#S1-1-1,S1-1-2, S1-1-3,S1-1-4	TECHNICIAN: LL
START DATE: 11/16/01	COMPLETE DATE: 11/27/01
ROOM AMBIENT: 24°C	RELATIVE HUMIDITY: 34%
EQUIPMENT ID#: 53, 92, 631, 633, 1236	

THERMAL AGING

PURPOSE:

To evaluate the impact on electrical stability of the contact system when exposed to a thermal environment. Said environment may generate temperature dependent failure mechanisms such as:

Reduced normal (contact) force due to stress relaxation as a result of a thermal environment.

PROCEDURE:

1. The test samples were placed in the test chamber after it had reached equilibrium at the specified temperature level. The test exposure was performed in accordance with Samtec's TC0141-0544 Flowchart and EIA 364, Test Procedure 17, with the following conditions:

2. Test Condition:

   a) Temperature : 105°C ± 2°C
   b) Duration : 250 hours
   c) Mated Condition : Mated
   d) Mounting Condition : Mounted

3. Prior to performing variable measurements, the test samples were allowed to recover to room ambient conditions.

4. All subsequent variable testing was performed in accordance with the procedures previously indicated.

REQUIREMENTS: See next page.

REQUIREMENTS:

1. There shall be no evidence of physical damage or deterioration of the test samples so exposed.

2. The force required to mate and unmate the test samples shall be measured and recorded.

RESULTS:

1. There was no evidence of visual or physical damage to the test samples as tested.

2. The following is a summary of the observed mating/unmating force data:

Sample ID#	MATING FORCE (Pounds)	UNMATING FORCE (Pounds)
S1-1-1	8.4	4.4
S1-1-2	6.7	3.9
S1-1-3	8.2	4.2
S1-1-4	6.3	4.2

PROJECT NO.: 201558	SPECIFICATION: TC0141-0544
PART NO.: NR-LTH-050-01-G-D-A NR-LSH-050-01-G-D-A	PART DESCRIPTION: LSH/LTH Conn.
SAMPLE SIZE: ID#S1-1-1,S1-1-2, S1-1-3,S1-1-4	TECHNICIAN: LL
START DATE: 11/27/01	COMPLETE DATE: 11/27/01
ROOM AMBIENT: 23°C	RELATIVE HUMIDITY: 34%
EQUIPMENT ID#: 53, 92, 631	

DURABILITY

PURPOSE:

1. This is a preconditioning sequence which is used to induce the type of wear on the contacting surfaces which may occur under normal service conditions. The connectors are mated and unmated a predetermined number of cycles. Upon completion, the units being evaluated are exposed to the environments as specified to assess any impact on electrical stability resulting from wear or other wear dependent phenomenon.

2. This type or preconditioning sequence is also used to mechanically stress the connector system as would normally occur in actual service. This sequence in conjunction with other tests is used to determine if a significant loss of contact pressure occurs from said stresses which in turn, may result in an unstable electrical condition to exist.

PROCEDURE:

1. The test was performed in accordance with Samtec's TC0141-0544 Flowchart and EIA 364, Test Procedure 09.

2. Test Conditions:

   a) No. of Cycles : 10
   b) Rate : 500 cycles per hour

3. The test samples were fixtured to the base plate of the test stand and applicable force gauge.

PROCEDURE: Continued

4. The test samples were axially aligned to accomplish the mating and unmating function allowing for self-centering movement.

5. Care was taken to prevent the mating faces of the test samples from contacting each other.

6. All subsequent variable testing was performed in accordance with the procedures previously indicated.

REQUIREMENTS:

1. There shall be no evidence of physical damage to the test samples so tested.

2. The force required to mate and unmate the test samples after 10 cycles of durability shall be measured and recorded.

RESULTS:

1. There was no evidence of physical damage to the test samples as tested.

2. The following is a summary of the observed mating/unmating force data:

Sample ID#	MATING FORCE (Pounds)	UNMATING FORCE (Pounds)
S1-1-1	8.1	3.4
S1-1-2	6.3	3.8
S1-1-3	8.0	4.0
S1-1-4	6.0	3.5

TEST RESULTS

SEQUENCE 1

GROUP 2

PROJECT NO.: 201558 SPECIFICATION: TC0141-0544

PART NO.: NR-LSH-050-01-G-D-A PART DESCRIPTION: LSH Conn.

SAMPLE SIZE: ID# S1-2-1,S1-2-2, TECHNICIAN: LL

START DATE: 11/13/01 COMPLETE DATE: 11/13/01

ROOM AMBIENT: 20°C RELATIVE HUMIDITY: 23%

EQUIPMENT ID#: 99

CONTACT GAPS

PURPOSE:

To determine the dimensional distance between the contacts and back wall of the LSH connector.

PROCEDURE:

1. The test samples were fixtured to the baseplate of the test stand.

2. The dimensional distance between the contacts and the “back wall” of the LSH connector were measured.

3. Test Conditions:

    a) Mating Conditions : Unmated
    b) Mounting Conditions : Unmounted
    c) Number of Positions Tested : 15 per test sample

REQUIREMENTS:

The dimensional distance between the contacts and the “back wall” of the LSH connector shall be measured and recorded.

RESULTS: See next page.

RESULTS:

1. The following is a summary of the observed data:

Sample ID#	CONTACT GAP (Inches) Avg.	Max.	Min.
S1-2-1	0.0428	0.0431	0.0423
S1-2-2	0.0430	0.0433	0.0424

2. See data file 201558BGAP1 for individual data points.

PROJECT NO.: 201558	SPECIFICATION: TC0141-0544
PART NO.: NR-LTH-050-01-G-D-A NR-LSH-050-01-G-D-A	PART DESCRIPTION: LSH/LTH Conn.
SAMPLE SIZE: ID#S1-2-1,S1-2-2,	TECHNICIAN: LL
START DATE: 11/16/01	COMPLETE DATE: 11/27/01
ROOM AMBIENT: 24°C	RELATIVE HUMIDITY: 34%
EQUIPMENT ID#: 99, 633, 1236	

THERMAL AGING

PURPOSE:

To evaluate the impact on electrical stability of the contact system when exposed to a thermal environment. Said environment may generate temperature dependent failure mechanisms such as:

Reduced normal (contact) force due to stress relaxation as a result of a thermal environment.

PROCEDURE:

1. The test samples were placed in the test chamber after it had reached equilibrium at the specified temperature level. The test exposure was performed in accordance with Samtec's TC0141-0544 Flowchart and EIA 364, Test Procedure 17, with the following conditions:

2. Test Condition:

   a) Temperature : 105°C ± 2°C
   b) Duration : 250 hours
   c) Mated Condition : Mated
   d) Mounting Condition : Mounted

3. Prior to performing variable measurements, the test samples were allowed to recover to room ambient conditions.

4. All subsequent variable testing was performed in accordance with the procedures previously indicated.

REQUIREMENTS: See next page.

REQUIREMENTS:

1. There shall be no evidence of physical damage or deterioration of the test samples so exposed.

2. The dimensional distance between the contacts and the “back wall” of the LSH connector shall be measured and recorded.

RESULTS:

1. There was no evidence of visual or physical damage to the test samples as tested.

2. The following is a summary of the observed contact gap data following thermal aging:

	CONTACT GAP (Inches)		
Sample ID#	Avg.	Max.	Min.
S1-2-1	0.0439	0.0444	0.0432
S1-2-2	0.0439	0.0444	0.0435

3. See data file 201558BGAP1 for individual data points.

GAP MEASUREMENTS

PROJECT	**201558**	TEST :	Contact Gap Measurements	REQ. :	Record
CUSTOMER:	**SAMTEC**	SPEC :		PAR. :	TECH : LL
START :	11/13/2001	SAMPLE I.D. # :	S1-1-1 & S1-1-2		
FINISH :	11/28/2001	TEMP :ºC 20	R.H. % 23	UNITS :	inches
EQUIPMENT I.D. #:	99	SEQUENCE 1 Group 2		FILE :	201558BGAP1

S1-2-1					S1-2-2			
POS.	**INITIAL**	**FINAL**			POS.	**INITIAL**	**FINAL**	
1	0.0424	0.0438			1	0.0424	0.0435	
2	0.0424	0.0437			2	0.0428	0.0440	
3	0.0429	0.0440			3	0.0431	0.0444	
4	0.0427	0.0436			4	0.0429	0.0435	
5	0.0429	0.0437			5	0.0431	0.0438	
6	0.0430	0.0444			6	0.0432	0.0444	
7	0.0430	0.0442			7	0.0429	0.0437	
8	0.0431	0.0444			8	0.0430	0.0438	
9	0.0428	0.0437			9	0.0430	0.0437	
10	0.0431	0.0440			10	0.0432	0.0442	
11	0.0430	0.0444			11	0.0432	0.0440	
12	0.0431	0.0440			12	0.0433	0.0444	
13	0.0428	0.0436			13	0.0433	0.0444	
14	0.0429	0.0436			14	0.0427	0.0439	
15	0.0423	0.0432			15	0.0428	0.0435	
MAX:	0.0431	0.0444			MAX:	0.0433	0.0444	
MIN:	0.0423	0.0432			MIN:	0.0424	0.0435	
AVG:	0.0428	0.0439			AVG:	0.0430	0.0439	
STD	0.0003	0.0004			STD	0.0002	0.0003	
TECH	LL	LL			TECH	LL	LL	
EQUIP	99	99			EQUIP	99	99	

TEST RESULTS

SEQUENCE 1

GROUP 3a

PROJECT NO.: 201558	SPECIFICATION: TC0141-0544
PART NO.: NR-LSH-050-01-G-D-A	PART DESCRIPTION: LSH Conn.
SAMPLE SIZE: ID#S1-3-1	TECHNICIAN: LL
START DATE: 11/28/01	COMPLETE DATE: 11/28/01
ROOM AMBIENT: 24°C	RELATIVE HUMIDITY: 37%
EQUIPMENT ID#: 53, 92, 93, 455, 487, 631, 683, 1139	

NORMAL FORCE

PURPOSE:

1. To determine the magnitude of normal force generated at any given deflection level within the normal operating levels of the contact system. To determine the magnitude of permanent set, if any, and its impact on loss of normal force. This data and its relationship to contact interface is then evaluated in proper perspective when reviewed with other attributes.

2. Normal force is one of the basic attributes of a contact system. It is a direct indication of contact pressure as well as contact integrity. The magnitude of said force can establish the gas tight condition between contacting surfaces. A gas tight interface prevents harsh environments and oxide or film growth from penetrating between surfaces which may cause degradation of electrical stability. It will also influence fretting motion and wear.

PROCEDURE:

1. The test was performed in accordance with Samtec's TC0141-0544 Flowchart and EIA 364, Test Procedure 4.

2. Applicable portions of the plastic housing (LSH connector only) were removed to expose the contacts to be tested.

3. The preparation was accomplished so as not to disturb the contact locking system or location within the plastic housing.

PROCEDURE: Continued

4. The prepared sample was placed in a special holding fixture on a X-Y moveable table.

5. The sample was positioned in such a manner so as to allow a special probe attached to a force transducer to deflect the contact element to a given distance as specified.

6. The probe/force traducer is interconnected with a linear transducer, amplifier, data acquisition/computer system and plotter.

7. As the contact element is deflected to the level desired, the normal force characteristic is plotted directly and simultaneously.

8. This test is a destructive procedure.

9. The test was performed with the contact in its plastic housing.

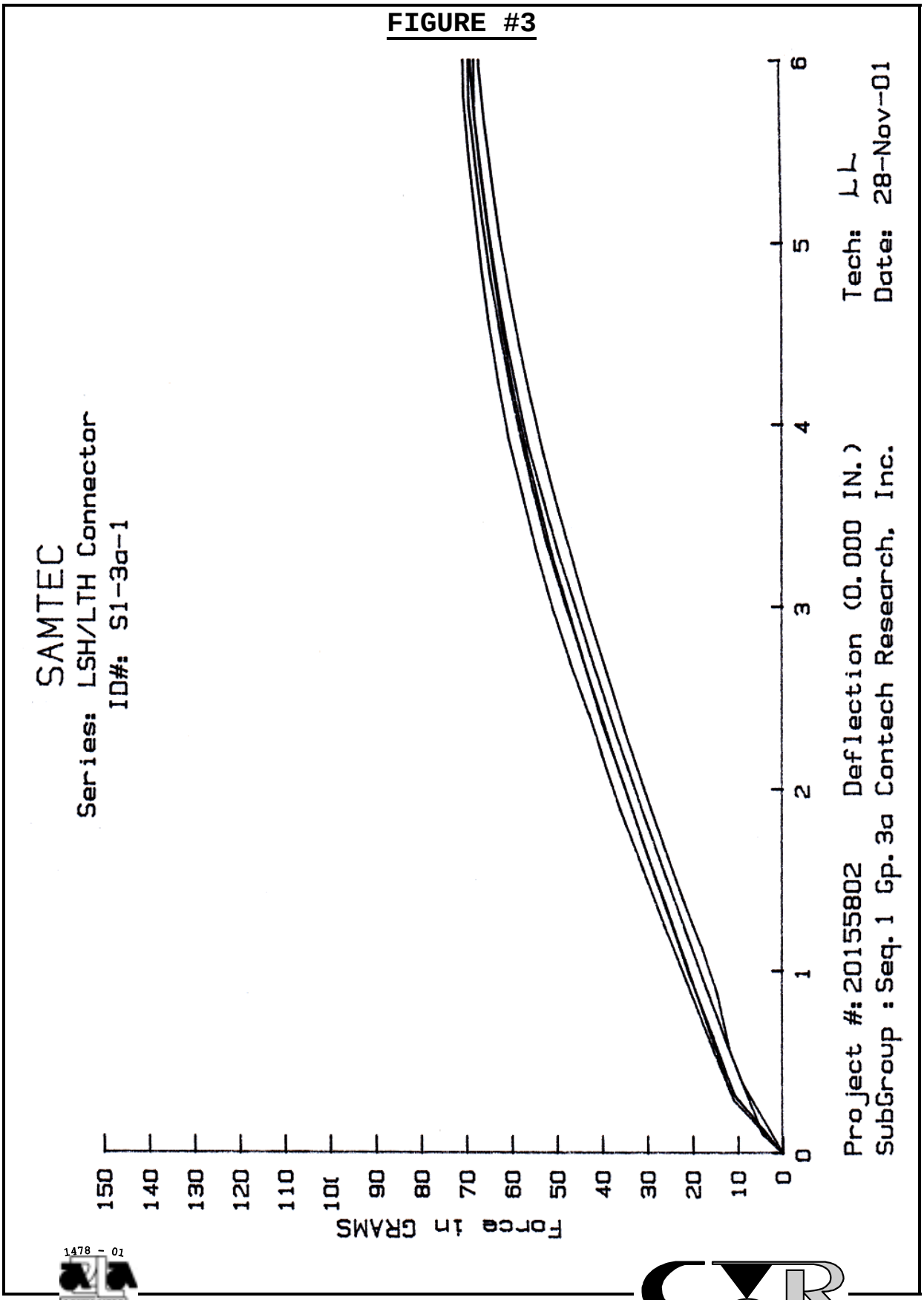
REQUIREMENTS:

The force/deflection characteristic shall be plotted.

RESULTS:

The force/deflection characteristic is shown in Figure #3.

FIGURE #3


SAMTEC
Series: LSH/LTH Connector
ID#: S1-3a-1
Force in GRAMS
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
0
1
2
3
4
5
6
Project #: 20155802 Deflection (0.000 IN.)
SubGroup : Seq. 1 Gp. 3a Contech Research, Inc.
Tech: LL
Date: 28-Nov-01

TEST RESULTS

SEQUENCE 1

GROUP 3b

PROJECT NO.: 201558	SPECIFICATION: TC0141-0544
PART NO.: NR-LTH-050-01-G-D-A NR-LSH-050-01-G-D-A	PART DESCRIPTION: LSH/LTH Conn.
SAMPLE SIZE: ID#S1-3b-1	TECHNICIAN: LL
START DATE: 11/29/01	COMPLETE DATE: 12/10/01
ROOM AMBIENT: 23°C	RELATIVE HUMIDITY: 30%
EQUIPMENT ID#: 633, 1236	

THERMAL AGING

PURPOSE:

To evaluate the impact on electrical stability of the contact system when exposed to a thermal environment. Said environment may generate temperature dependent failure mechanisms such as:

Reduced normal (contact) force due to stress relaxation as a result of a thermal environment.

PROCEDURE:

1. The test samples were placed in the test chamber after it had reached equilibrium at the specified temperature level. The test exposure was performed in accordance with Samtec's TC0141-0544 Flowchart and EIA 364, Test Procedure 17, with the following conditions:

2. Test Condition:

   a) Temperature : 105°C ± 2°C
   b) Duration : 250 hours
   c) Mated Condition : Mated
   d) Mounting Condition : Mounted

REQUIREMENTS: See next page.

REQUIREMENTS:

There shall be no evidence of physical damage or deterioration of the test samples so exposed.

RESULTS:

There was no evidence of visual or physical damage to the test samples as tested.

PROJECT NO.: 201558	SPECIFICATION: TC0141-0544
PART NO.: NR-LTH-050-01-G-D-A NR-LSH-050-01-G-D-A	PART DESCRIPTION: LSH Conn.
SAMPLE SIZE: ID#S1-3b-1	TECHNICIAN: LL
START DATE: 12/10/01	COMPLETE DATE: 12/10/01
ROOM AMBIENT: 23°C	RELATIVE HUMIDITY: 25%
EQUIPMENT ID#: 53, 92, 93, 455, 487, 631, 683, 1139	

NORMAL FORCE

PURPOSE:

1. To determine the magnitude of normal force generated at any given deflection level within the normal operating levels of the contact system. To determine the magnitude of permanent set, if any, and its impact on loss of normal force. This data and its relationship to contact interface is then evaluated in proper perspective when reviewed with other attributes.

2. Normal force is one of the basic attributes of a contact system. It is a direct indication of contact pressure as well as contact integrity. The magnitude of said force can establish the gas tight condition between contacting surfaces. A gas tight interface prevents harsh environments and oxide or film growth from penetrating between surfaces which may cause degradation of electrical stability. It will also influence fretting motion and wear.

PROCEDURE:

1. The test was performed in accordance with Samtec's TC0141-0544 Flowchart and EIA 364, Test Procedure 4.

2. Applicable portions of the plastic housing (LSH connector only) were removed to expose the contacts to be tested.

3. The preparation was accomplished so as not to disturb the contact locking system or location within the plastic housing.

PROCEDURE: Continued

4. The prepared sample was placed in a special holding fixture on a X-Y moveable table.

5. The sample was positioned in such a manner so as to allow a special probe attached to a force transducer to deflect the contact element to a given distance as specified.

6. The probe/force traducer is interconnected with a linear transducer, amplifier, data acquisition/computer system and plotter.

7. As the contact element is deflected to the level desired, the normal force characteristic is plotted directly and simultaneously.

8. This test is a destructive procedure.

9. The test was performed with the contact in its plastic housing.

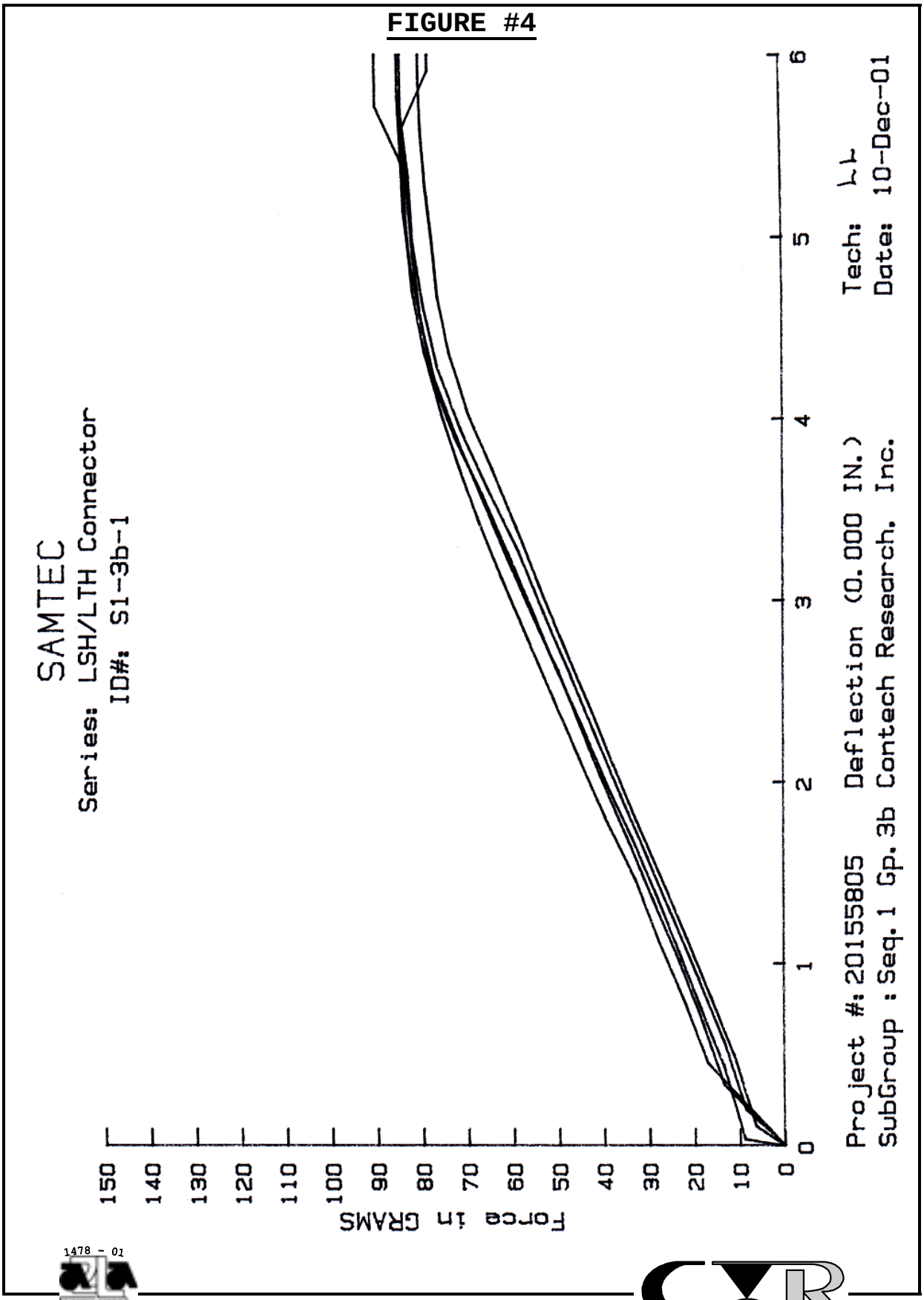
REQUIREMENTS:

The force/deflection characteristic shall be plotted.

RESULTS:

The force/deflection characteristic is shown in Figure #4.

FIGURE #4


SAMTEC
Series: LSH/LTH Connector
ID#: S1-3b-1
Force in GRAMS
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
0
1
2
3
4
5
6
Project #: 20155805 Deflection (0.000 IN.)
SubGroup : Seq. 1 Gp. 3b Contech Research, Inc.
Tech: LL
Date: 10-Dec-01

TEST RESULTS

SEQUENCE 2

GROUP 1

PROJECT NO.: 201558	SPECIFICATION: TC0141-0544
PART NO.: NR-LTH-050-01-G-D-A NR-LSH-050-01-G-D-A	PART DESCRIPTION: LSH/LTH Conn.
SAMPLE SIZE: ID#S2-1-1,S2-1-2	TECHNICIAN: LL
START DATE: 11/14/01	COMPLETE DATE: 11/14/01
ROOM AMBIENT: 22°C	RELATIVE HUMIDITY: 26%
EQUIPMENT ID#: 421	

INSULATION RESISTANCE(IR)

PURPOSE:

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.

PROCEDURE:

1. The test was performed in accordance with Samtec's TC0141-0544 Flowchart and EIA 364, Test Procedure 21.

2. Test Conditions:

a) Between Adjacent Contacts	:	Yes
b) Between Rows	:	Yes
c) Mated Condition	:	Mated
d) Mounting Condition	:	Mounted
e) Electrification Time	:	2.0 Minutes
f) Test Voltage	:	500 VDC

REQUIREMENTS:

When the specified test voltage is applied, the insulation resistance shall not be less than 1000 megohms.

RESULTS:

The insulation resistance exceeded 50,000 megohms.

PROJECT NO.: 201558	SPECIFICATION: TC0141-0544
PART NO.: NR-LTH-050-01-G-D-A NR-LSH-050-01-G-D-A	PART DESCRIPTION: LSH/LTH Conn.
SAMPLE SIZE: ID#S2-1-1,S2-1-2	TECHNICIAN: LL
START DATE: 11/16/01	COMPLETE DATE: 11/27/01
ROOM AMBIENT: 24°C	RELATIVE HUMIDITY: 34%
EQUIPMENT ID#: 421, 633, 1236	

THERMAL AGING

PURPOSE:

To determine the effects of high temperature on the physical properties of the connector housing.

PROCEDURE:

1. The test samples were placed in the test chamber after it had reached equilibrium at the specified temperature level. The test exposure was performed in accordance with Samtec's TC0141-0544 Flowchart and EIA 364, Test Procedure 17, with the following conditions:

2. Test Condition:

    a) Temperature : 105°C ± 2°C
    b) Duration : 250 hours
    c) Mated Condition : Mated
    d) Mounting Condition : Mounted

3. Prior to performing variable measurements, the test samples were allowed to recover to room ambient conditions.

4. All subsequent variable testing was performed in accordance with the procedures previously indicated.

REQUIREMENTS: See next page.

REQUIREMENTS:

1. There shall be no evidence of physical damage or deterioration of the test samples so exposed.

2. When the specified test voltage is applied, the insulation resistance shall not be less than 1000 megohms.

RESULTS:

1. There was no evidence of physical damage or deterioration of the test samples.

2. The following is a summary of the observed insulation resistance following thermal aging:

Sample ID#	INSULATION RESISTANCE (Megohms)
S2-1-1	>50000
S2-1-2	>50000

PROJECT NO.: 201558	SPECIFICATION: TC0141-0544
PART NO.: NR-LTH-050-01-G-D-A NR-LSH-050-01-G-D-A	PART DESCRIPTION: LSH/LTH Conn.
SAMPLE SIZE: ID#S2-1-1,S2-1-2	TECHNICIAN: LL
START DATE: 11/30/01	COMPLETE DATE: 12/10/01
ROOM AMBIENT: 22°C	RELATIVE HUMIDITY: 26%
EQUIPMENT ID#: 27, 421	

MOISTURE RESISTANCE

PURPOSE:

1. The purpose of this test is to permit evaluation of the properties of materials used in connectors as they are influenced or deteriorated by the effects of high humidity and heat conditions. Measurements made under high humidity conditions may reflect the peculiar conditions under which the readings were made, and should be compared only to initial readings when careful analysis indicates that such a comparison is valid and applicable.

2. This test imposes a vapor on the material under test that constitutes the force behind the moisture migration and penetration. Hygroscopic materials are sensitive to moisture and deteriorate rapidly under humidity conditions. Absorption of moisture may result in swelling that would destroy functioning utility, and cause loss of physical strength and changes in other important mechanical properties. Degradation of electrical properties may also occur.

3. This test obtains added effectiveness in employment of temperature cycling that provides a breathing action, inducing corrosion processes, and the introduction of moisture into partially sealed test samples. This condition imposes a vapor pressure on the samples which constitutes the major force behind the moisture migration and penetration.

PROCEDURE: See next page.

PROCEDURE:

1. The test environment was performed in accordance with Samtec's TC0141-0544 and EIA 364, Test Procedure 31 with the following conditions:

2. Test Conditions:

a) Relative Humidity	:	90% to 95%
b) Temperature Conditions	:	25°C to 65°C
c) Cold Cycle	:	No
d) Polarizing Voltage	:	No
e) Mating Conditions	:	Mated
f) Mounting Conditions	:	Mounted
g) Duration	:	240 hours

3. Prior to performing variable measurements, the test samples were allowed to recover to room ambient conditions.

4. All subsequent variable testing was performed in accordance with the procedures previously indicated.

REQUIREMENTS:

1. There shall be no evidence of physical deterioration of the test samples as tested.

2. The final insulation resistance shall not be less than 1000 megohms.

RESULTS:

1. The test samples as tested showed no evidence of physical deterioration.

2. The following is a summary of the observed insulation resistance following moisture resistance:

Sample ID#	INSULATION RESISTANCE (Megohms)
S2-1-1	6000
S2-1-2	7000

TEST RESULTS

SEQUENCE 2

GROUP 2a

PROJECT NO.: 201558 SPECIFICATION: TC0141-0544

PART NO.: NR-LTH-050-01-G-D-A, NR-LSH-050-01-G-D-A PART DESCRIPTION: LSH/LTH Conn.

SAMPLE SIZE: ID#S2-2a-1 TECHNICIAN: LL

START DATE: 11/27/01 COMPLETE DATE: 11/27/01

ROOM AMBIENT: 24°C RELATIVE HUMIDITY: 34%

EQUIPMENT ID#: 321

DIELECTRIC WITHSTANDING VOLTAGE (SEA LEVEL)

PURPOSE:

To determine the voltage at which dielectric breakdown occurs.

PROCEDURE:

1. The test was performed in accordance with Samtec's TC0141-0544 Flowchart and EIA 364, Test Procedure 20.

2. Test Conditions:

   a) Between Adjacent Contacts : Yes
   b) Between Rows : Yes
   c) Mated Condition : Mated
   d) Mounting Condition : Mounted
   e) Hold Time : 60 Seconds
   f) Rate of Application : 60 volts/sec.

3. The test voltage was determined by increasing the applied voltage until breakdown occurs. The test voltage is 75% of the breakdown voltage.

REQUIREMENTS:

1. The breakdown voltage shall be measured and recorded.

2. When the specified test voltage is applied (75% of breakdown), there shall be no evidence of breakdown, arcing, etc.

RESULTS: See next page.

RESULTS:

1. The breakdown voltage was 920 VAC. The test voltage was calculated to be 690 VAC.

2. All samples tested at 690 VAC met the requirements as specified.

TEST RESULTS

SEQUENCE 2

GROUP 2b

PROJECT NO.: 201558	SPECIFICATION: TC0141-0544
PART NO.: NR-LTH-050-01-G-D-A NR-LSH-050-01-G-D-A	PART DESCRIPTION: LSH/LTH Conn.
SAMPLE SIZE: ID#S2-2b-1,S2-2b-2 S2-2b-3	TECHNICIAN: LL
START DATE: 11/16/01	COMPLETE DATE: 11/27/01
ROOM AMBIENT: 24°C	RELATIVE HUMIDITY: 34%
EQUIPMENT ID#: 321, 633, 1236	

THERMAL AGING

PURPOSE:

To determine the effects of high temperature on the physical properties of the connector housing.

PROCEDURE:

1. The test samples were placed in the test chamber after it had reached equilibrium at the specified temperature level. The test exposure was performed in accordance with Samtec's TC0141-0544 Flowchart and EIA 364, Test Procedure 17, with the following conditions:

2. Test Condition:

    a) Temperature : 105°C ± 2°C
    b) Duration : 250 hours
    c) Mated Condition : Mated
    d) Mounting Condition : Mounted

3. Following Thermal Aging, Dielectric Withstanding Voltage testing was performed in accordance with Samtec's TC0141-0544Flowchart and EIA 364, Test Procedure 20.

4. Test Conditions:

    a) Between Adjacent Contacts : Yes
    b) Between Rows : Yes
    c) Mated Condition : Mated
    d) Mounting Condition : Mounted
    e) Hold Time : 60 Seconds
    f) Rate of Application : 60 volts/sec.

PROCEDURE: Continued

5. The test voltage was determined by increasing the applied voltage until breakdown occurs. The test voltage is 75% of the breakdown voltage.

6. Prior to performing variable measurements, the test samples were allowed to recover to room ambient conditions.

REQUIREMENTS:

1. There shall be no evidence of physical damage or deterioration of the test samples so exposed.

2. The breakdown voltage shall be measured and recorded.

3. When the specified test voltage is applied (75% of breakdown), there shall be no evidence of breakdown, arcing, etc.

RESULTS:

1. There was no evidence of visual or physical damage to the test samples as tested.

2. The breakdown voltage was 920 VAC. The test voltage was calculated to be 690 VAC.

3. All samples tested at 690 VAC met the requirements as specified.

TEST RESULTS

SEQUENCE 2

GROUP 2c

PROJECT NO.: 201558	SPECIFICATION: TC0141-0544
PART NO.: NR-LTH-050-01-G-D-A NR-LSH-050-01-G-D-A	PART DESCRIPTION: LSH/LTH Conn.
SAMPLE SIZE:ID#S2-2c-1,S2-2c-2, S2-2c-3	TECHNICIAN: LL
START DATE: 11/16/01	COMPLETE DATE: 11/26/01
ROOM AMBIENT: 24°C	RELATIVE HUMIDITY: 34%
EQUIPMENT ID#: 27, 321	

MOISTURE RESISTANCE

PURPOSE:

1. The purpose of this test is to permit evaluation of the properties of materials used in connectors as they are influenced or deteriorated by the effects of high humidity and heat conditions. Measurements made under high humidity conditions may reflect the peculiar conditions under which the readings were made, and should be compared only to initial readings when careful analysis indicates that such a comparison is valid and applicable.

2. This test imposes a vapor on the material under test that constitutes the force behind the moisture migration and penetration. Hygroscopic materials are sensitive to moisture and deteriorate rapidly under humidity conditions. Absorption of moisture may result in swelling that would destroy functioning utility, and cause loss of physical strength and changes in other important mechanical properties. Degradation of electrical properties may also occur.

3. This test obtains added effectiveness in employment of temperature cycling that provides a breathing action, inducing corrosion processes, and the introduction of moisture into partially sealed test samples. This condition imposes a vapor pressure on the samples which constitutes the major force behind the moisture migration and penetration.

PROCEDURE: See next page.

PROCEDURE:

1. The test environment was performed in accordance with Samtec's TC0141-0544 and EIA 364, Test Procedure 31 with the following conditions:

2. Test Conditions:

a) Relative Humidity	:	90% to 95%
b) Temperature Conditions	:	25°C to 65°C
c) Cold Cycle	:	No
d) Polarizing Voltage	:	No
e) Mating Conditions	:	Mated
f) Mounting Conditions	:	Mounted
g) Duration	:	240 hours

3. Following Moisture Resistance, Dielectric Withstanding Voltage was performed in accordance with Samtec's TC0141-0544Flowchart and EIA 364, Test Procedure 20.

4. Test Conditions:

a) Between Adjacent Contacts	:	Yes
b) Between Rows	:	Yes
c) Mated Condition	:	Mated
d) Mounting Condition	:	Mounted
e) Hold Time	:	60 Seconds
f) Rate of Application	:	60 volts/sec.

5. The test voltage was determined by increasing the applied voltage until breakdown occurs. The test voltage is 75% of the breakdown voltage.

6. Prior to performing variable measurements, the test samples were allowed to recover to room ambient conditions.

REQUIREMENTS:

1. There shall be no evidence of physical deterioration of the test samples as tested.

2. The breakdown voltage shall be measured and recorded.

3. When the specified test voltage is applied (75% of breakdown), there shall be no evidence of breakdown, arcing, etc.

RESULTS:

1. The test samples as tested showed no evidence of physical deterioration.

2. The breakdown voltage was 860 VAC. The test voltage was calculated to be 645 VAC.

3. All samples tested at 645 VAC met the requirements as specified.