JULY 2,1992

TEST REPORT #92199

SHEAR AND PULL FORCE TESTING ON SURFACE MOUNTED CONNECTORS AND HEADERS

SAMTEC CORPORATION

APPROVED BY: THOMAS PEEL
TEST PROGRAM MANAGER
CONTECH RESEARCH, INC.

Contech Research

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 Corporation who was the test sponsor.

All equipment and measuring instruments used during testing were calibrated and traceable to NIST according to MIL-STD-45662, as applicable.

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

Thomas Peel
Test Program Manager

TP/gb

SCOPE

To perform Shear and Pull Force testing on surface mount headers and connectors as manufactured and submitted by the test sponsor Samtec Corp.

TEST SAMPLES AND PREPARATION

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

   Part Number

   a) TMT-125-01-TD-SM
   b) TSM-125-01-S-D-V-LC
   c) TSM-125-01-S-D-H-LC
   d) TSM-125-01-S-D-V
   e) TSM-125-01-S-D-H
   f) TMM-125-01-S-D-SM
   g) SFM-125-02-S-D-LC
   h) SMM-125-02-S-D-LC
   i) SMM-125-02-S-D
   j) TFM-125-02-S-D-LC
   k) TFM-125-02-S-D
   l) SFM-125-02-S-D

2. All test samples were coded and identified to maintain continuity throughout the test sequences.

3. Test boards were obtained by Contech Research, Inc..

4. The soldering process is described within the test result section of this report.

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

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:

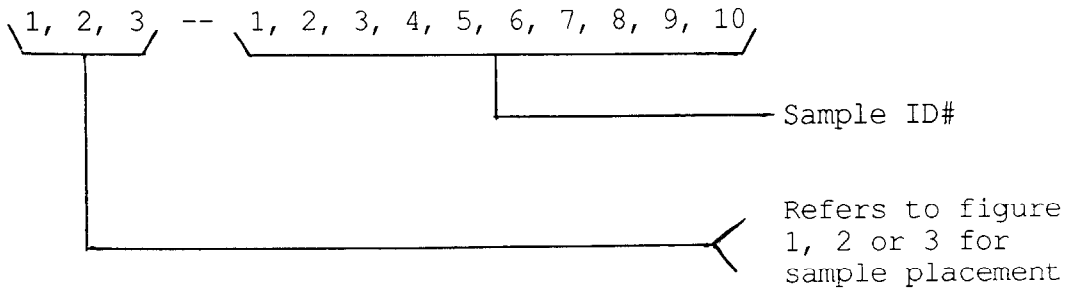

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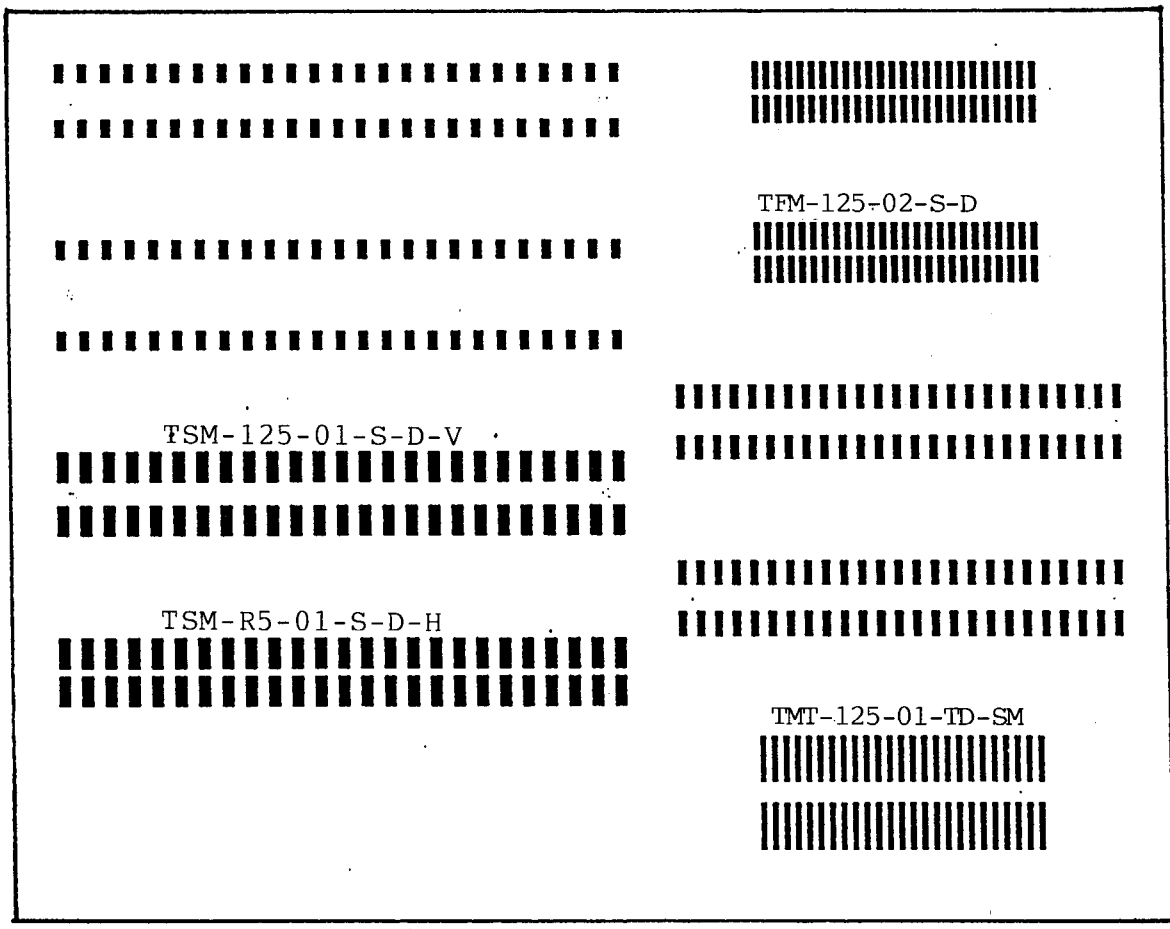
FIGURE #1

Sample ID Location



SAMTEC 92191
LAYER 1 - COMPONENT SIDE

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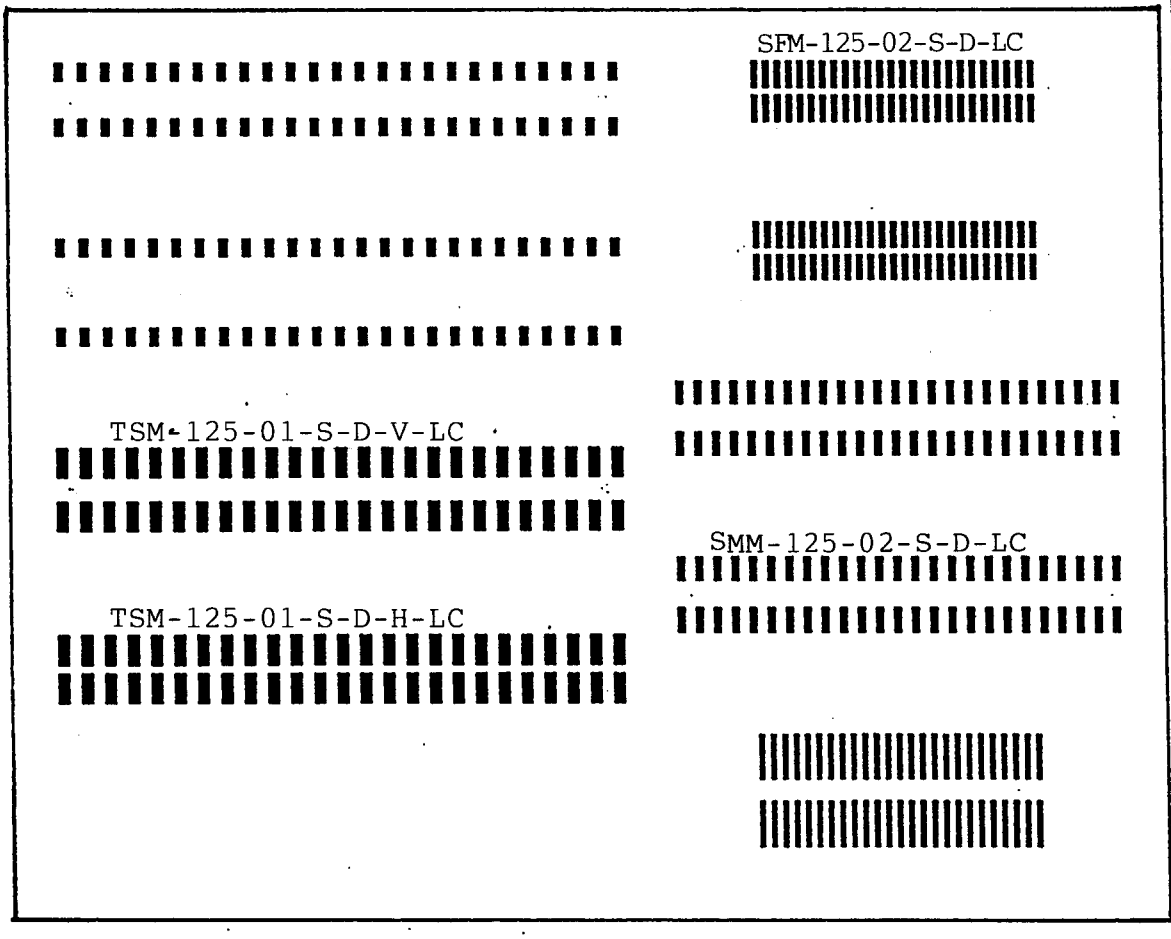
FIGURE #2

Sample ID Location



SAMTEC 92191
LAYER 1 - COMPONENT SIDE

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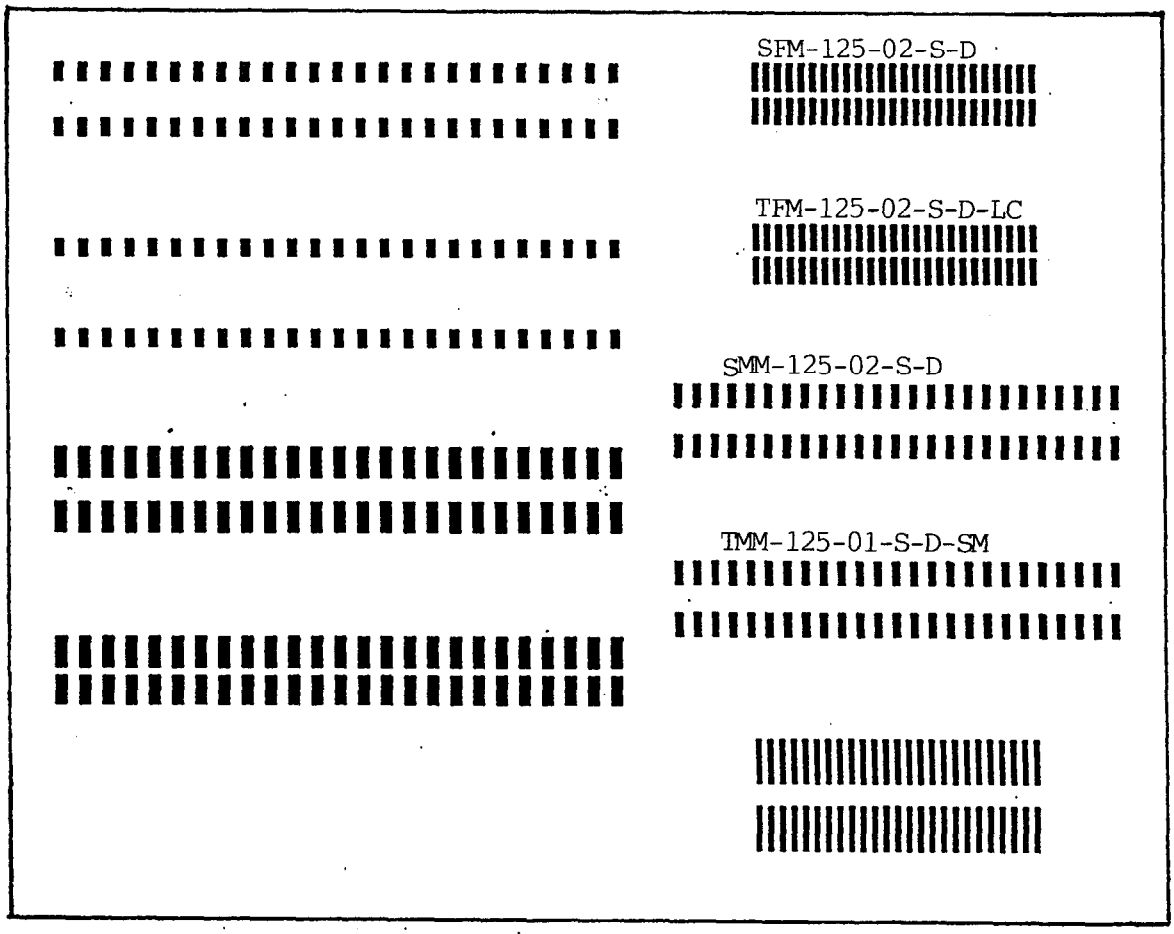
FIGURE #3

Sample ID Location



SAMTEC 92191
LAYER 1 - COMPONENT SIDE

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Equipment List

ID#	Last Cal	Next Cal	Equipment Name	Manufacturer	Accuracy	Model #	Serial #	Freq Cal
12	6/18/92	12/18/92	Force Gage - 110#	Chatillon	0.5% of full scale	DPP-100	514	6 months
38			Universal Test Stand	Chatillon	N/A	UTSM-SS	1030	N/A
349			Vapor Degreaser	Phillips Company	N/A	2CRU1012	13333	N/A
394			Vapor Phase Unit	BTU Engineering Co.	N/A	VPR 12/16 Ne	VPR 12/16-00	N/A
398	2/4/92	8/4/92	500 Pound Force Gage	Commercial Scale Co.	±.15 % f.s.	DFI-500	11792	6 months

TEST RESULTS

PROJECT NO.:	92199	SPECIFICATION:	N/A
PART NO.:	See Page 3	PART DESCRIPTION:	Surface Mount Headers and Connectors
SAMPLE SIZE:	20 Per Part Number	TECHNICIAN:	SR
START DATE:	5/27/92	COMPLETE DATE:	6/16/92
ROOM AMBIENT:	20°C	RELATIVE HUMIDITY:	42%
EQUIPMENT ID#:	349, 394		

SAMPLE PREPARATION -- VAPOR PHASE SOLDERING

PROCEDURE:

1. Solder paste was applied to all the pads on the test boards.

2. Solder paste thickness was 0.008 inches.

3. The connectors and headers were assembled to the test board manually.

4. All samples were exposed to the vapor phase soldering process as follows:

   a) The vapor phase unit used was manufactured by BTV Engineering.
   b) The primary vapor was Galden LS/230, manufactured by Ausimont USA. The vapor was maintained at a temperature of 419°F (215°C).
   c) The secondary vapor was Freon TF which was maintained at a temperature of approximately 117°F (47°C).
   d) The samples were lowered through the secondary vapor into the primary vapor and allowed to dwell for 60 seconds.
   e) During the removal cycle, the samples were allowed to dwell for 30 seconds in Freon vapor and then removed totally.
   f) The samples were allowed to dwell for 30 seconds in the entrance area of the chamber.
   g) After removal, the samples were cleaned in hot vapors for 30 seconds (trichloroethane 1-1-1) followed by a 15 second spray.

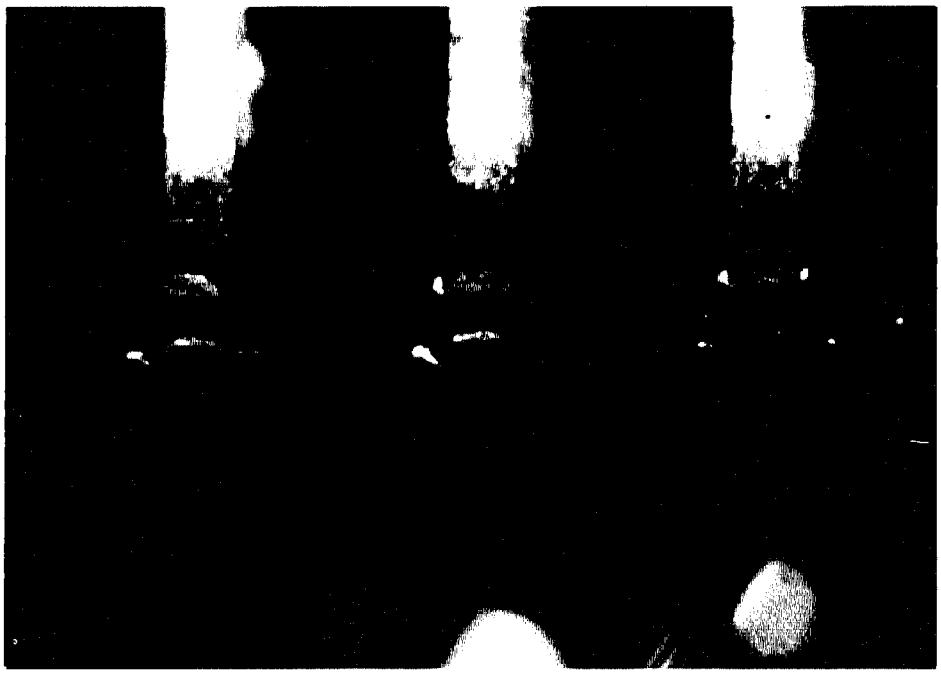
5. Since flux is an integral part of the solder paste, no external flux was applied.

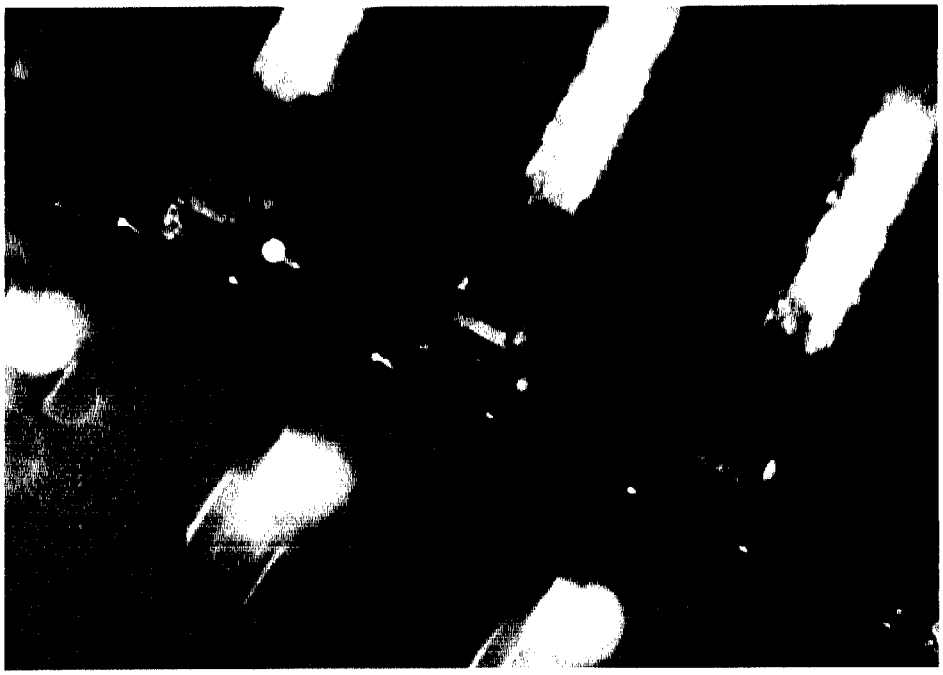
OBSERVATIONS

1. Following the soldering process the outside row of contacts on part number TSM-125-01-S-D-H-LC and TSM-125-01-S-D-H did not solder to the board. See the photographs on pages 6a and 6b.

2. After further examination it appears that the headers do not sit flush to the board upon assembly.

3. The test sponsor was notified and it was decided to place a "shim" under the housing to ensure all contacts were on their appropriate pads.





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PROJECT NO.:	92199	SPECIFICATION:	N/A
PART NO.:	See Page 3	PART DESCRIPTION:	Surface Mount Headers and Connectors
SAMPLE SIZE:	20 Per Part Number	TECHNICIAN:	SR
START DATE:	5/27/92	COMPLETE DATE:	6/16/92
ROOM AMBIENT:	20°C	RELATIVE HUMIDITY:	42%
EQUIPMENT ID#:	12, 38, 398		

SHEAR AND PULL TEST

PROCEDURE:

1. The test board was fixtured to the base plate of the monitored test stand and applicable force gauge.

2. Ten samples of each part number were mounted horizontally for the pull test and vertically for the shear test.

3. Figure #4 and 5 illustrate a typical set-up.

4. The test rate used was 1.0 inch per minute for both the shear and pull test.

REQUIREMENTS:

1. The shear and pull forces shall be measured and recorded.

RESULTS: See next page for test results.

RESULTS:

1. All test samples so tested met the requirements as specified.

Part Number	SHEAR TEST (Pounds) Avg	Max	Min	PULL TEST (Pounds) Avg	Max	Min
TFM-125-02-S-D	77.1	145.0	62.0	56.1	67.1	46.0
TFM-125-02-S-D-LC	72.6	86.0	67.0	41.6	52.0	37.0
TSM-125-01-S-D-V-LC	243.0	267.0	214.0	199.1	245.0	171.0
TSM-125-01-S-D-H-LC	149.9	166.0	134.0	104.1	124.0	88.0
TSM-125-01-S-D-V	266.3	316.0	247.0	235.9	265.0	160.0
TSM-125-01-S-D-H	170.0	178.0	159.0	52.2	60.0	45.0
SFM-125-02-S-D-LC	55.6	66.0	44.0	43.8	50.0	38.0
SFM-125-02-S-D	33.7	38.0	28.0	49.8	64.0	41.0
SMM-125-02-S-D-LC	66.2	78.0	54.0	60.5	77.0	48.0
SMM-125-02-S-D	60.0	92.0	45.0	39.0	48.0	32.0
TMT-125-01-TD-SM	179.8	203.0	167.0	109.5	148.0	98.0
TMM-125-01-S-D-SM	146.7	158.0	135.0	81.3	88.0	76.0

2. Refer to pages 16 through 27 for individual data points.

OBSERVATIONS AND COMMENTS FOR REVIEW AND EVALUATION

1. The force observed during the shear and pull test were a combination of the following:

   - Terminals separated from the solder joints.
   - Terminals remaining soldered to the board, but that have dislodged from the socket or connector housing.
   - Terminals remaining soldered to the board, but have broken at the heel of the terminal.
   - Other: As indicated below.

2. The following summary indicates the percentage of terminals per part number that exhibit the above conditions.

TFM-125-02-S-D	SHEAR TEST	PULL TEST
- Terminals separated from the solder joints.	22.7%	9.7%
- Terminals remaining soldered to the board, but that have dislodged from the socket or connector housing.	77.3%	90.3%
- Terminals remaining soldered to the board, but have broken at the heel of the terminal.	0.0%	0.0%

TFM-125-02-S-D-LC		
- Terminals separated from the solder joints.	21.1%	15.3%
- Terminals remaining soldered to the board, but that have dislodged from the socket or connector housing.	78.9%	84.7%
- Terminals remaining soldered to the board, but have broken at the heel of the terminal.	0.0%	0.0%

TSM-125-01-S-D-V-LC		
- Terminals separated from the solder joints.	70.9%	57.5%
- Terminals remaining soldered to the board, but that have dislodged from the socket or connector housing.	29.1%	42.5%
- Terminals remaining soldered to the board, but have broken at the heel of the terminal.	0.0%	0.0%

TSM-125-01-S-D-H-LC	SHEAR TEST	PULL TEST
- Terminals separated from the solder joints.	48.8%	46.5%
- Terminals remaining soldered to the board, but that have dislodged from the socket or connector housing.	0.0%	0.0%
- Terminals remaining soldered to the board, but have broken at the heel of the terminal.	0.0%	0.0%
- Pads removed from the board	1.8%	0.0%
- Terminals not reflowed to the board.	49.4%	53.5%
TSM-125-01-S-D-V		
- Terminals separated from the solder joints.	79.5%	35.6%
- Terminals remaining soldered to the board, but that have dislodged from the socket or connector housing.	19.8%	64.4%
- Terminals remaining soldered to the board, but have broken at the heel of the terminal.	0.0%	0.0%
- Pads removed from the board	0.7%	0.0%
TSM-125-01-S-D-H		
- Terminals separated from the solder joints.	57.5%	45.8%
- Terminals remaining soldered to the board, but that have dislodged from the socket or connector housing.	0.0%	8.9%
- Terminals remaining soldered to the board, but have broken at the heel of the terminal.	0.0%	0.0%
- Terminals not reflowed to the board.	42.5%	45.3%
SFM-125-02-S-D-LC		
- Terminals separated from the solder joints.	25.8%	35.7%
- Terminals remaining soldered to the board, but that have dislodged from the socket or connector housing.	0.0%	30.5%
- Terminals remaining soldered to the board, but have broken at the heel of the terminal.	74.2%	33.8%

SFM-125-02-S-D	SHEAR TEST	PULL TEST
- Terminals separated from the solder joints.	18.2%	56.7%
- Terminals remaining soldered to the board, but that have dislodged from the socket or connector housing.	71.8%	43.4%
- Terminals remaining soldered to the board, but have broken at the heel of the terminal.	0.0%	0.0%

SMM-125-02-S-D-LC		
- Terminals separated from the solder joints.	34.2%	9.2%
- Terminals remaining soldered to the board, but that have dislodged from the socket or connector housing.	65.8%	90.8%
- Terminals remaining soldered to the board, but have broken at the heel of the terminal.	0.0%	0.0%

SMM-125-02-S-D		
- Terminals separated from the solder joints.	46.2%	17.1%
- Terminals remaining soldered to the board, but that have dislodged from the socket or connector housing.	53.8%	82.9%
- Terminals remaining soldered to the board, but have broken at the heel of the terminal.	0.0%	0.0%

TMT-125-01-TD-SM		
- Terminals separated from the solder joints.	38.4%	71.4%
- Terminals remaining soldered to the board, but that have dislodged from the socket or connector housing.	61.6%	29.6%
- Terminals remaining soldered to the board, but have broken at the heel of the terminal.	0.0%	0.0%

TMM-125-01-S-D-SM	SHEAR TEST	PULL TEST
- Terminals separated from the solder joints.	50.9%	6.9%
- Terminals remaining soldered to the board, but that have dislodged from the socket or connector housing.	49.1%	93.1%
- Terminals remaining soldered to the board, but have broken at the heel of the terminal.	0.0%	0.0%

3. The test samples were returned to the test sponsor for further evaluation.

FIGURE #4

Typical Set-Up
Shear Force

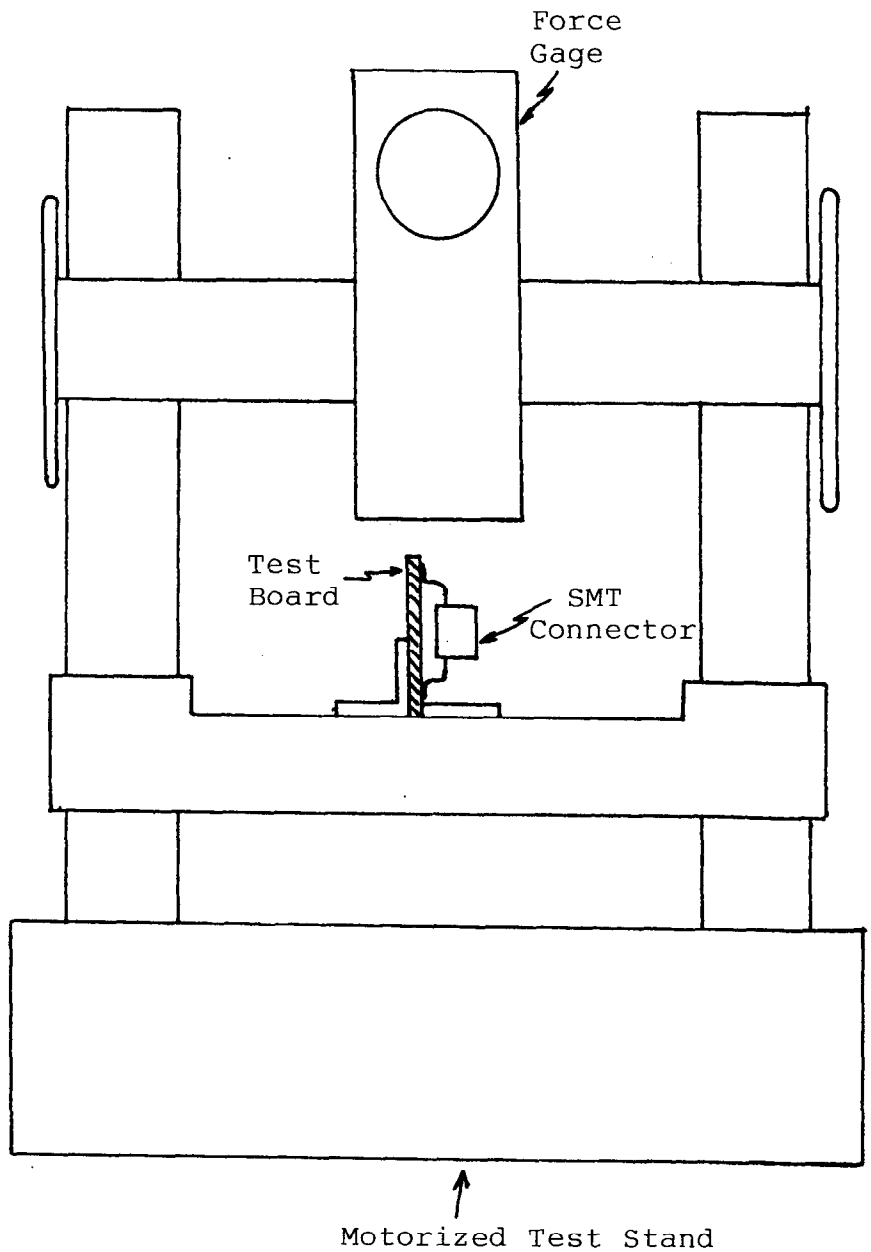

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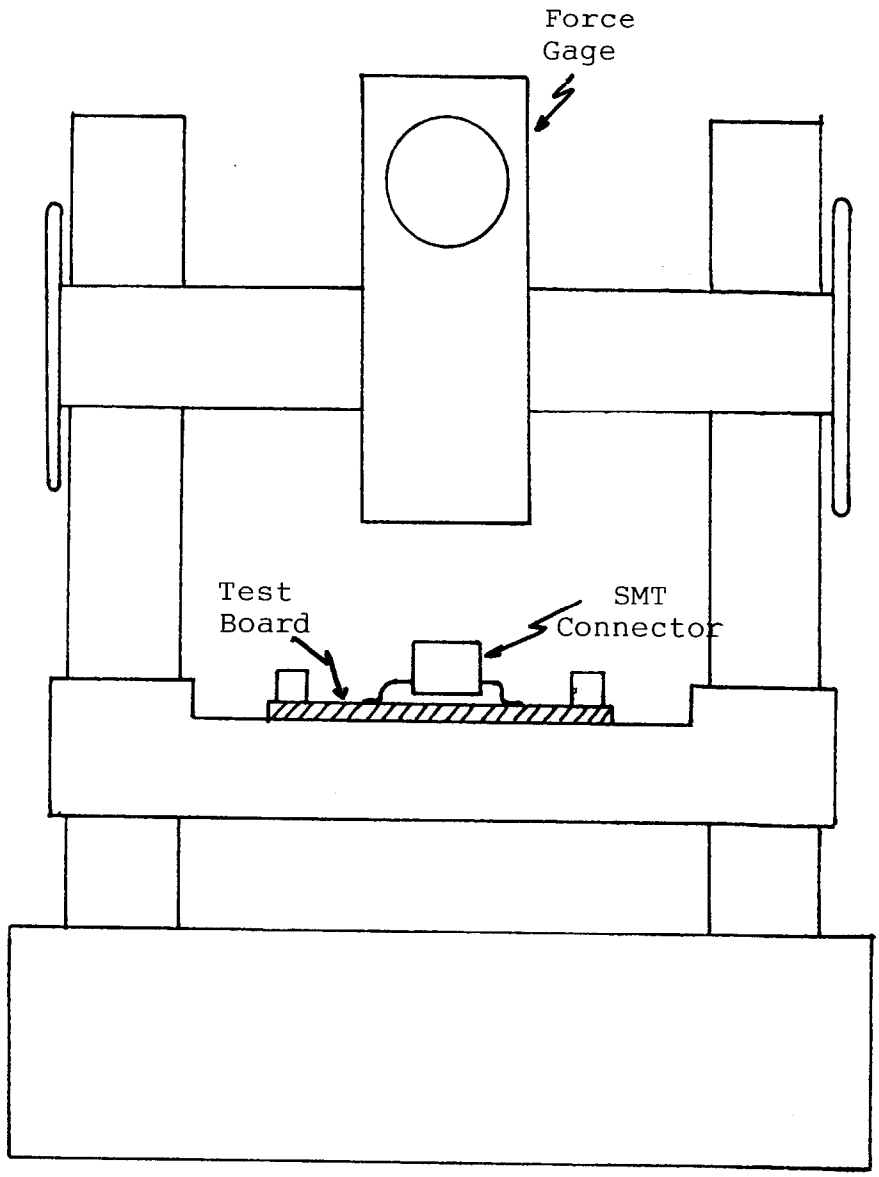
FIGURE #5

Typical Set-Up
Pull Test



Motorized Test Stand

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DATA SHEET

PROJECT: 92199 TEST: PULL - SHEAR REQ: —
SPEC: — PARAGRAPH: — T.P. — TECH: S - R
STARTED: 23 JUN 92 SAMPLE I.D. #: P/N TFM-125-02-S-D
COMPLETED: 24JUN92 TEMP: 22 °C R.H. 50 % UNITS: POUND
EQUIPMENT I.D. #: 38-12-398 FIGURE # 1

		PULL		SHEAR					
1		56		76					
2		48		73					
3		46		64					
4		56		66					
5		66		71					
6		47		75					
7		61		62					
8		48		64					
9		67		75					
10		66		145					
11									
12									
13									
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34									
35									
36									
37									
38									
39									
40									
AVG:		56.1		77.1					
MAX:		67.0		145.0					
MIN:		46.0		62.0					

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DATA SHEET

PROJECT: 92199 TEST: Pull-SHEAR REQ: —
SPEC: — PARAGRAPH: — T.P. — TECH: S-R
STARTED: 17 JUN 92 SAMPLE I.D. #: P/N TFM-125-02-S-D-LC
COMPLETED: 22 JUN 92 TEMP: 22 °C R.H. 52 % UNITS: POUND
EQUIPMENT I.D. #: 38-12 FIBURE #3

		PULL		SHEAR					
1		40		74					
2		39		69					
3		45		71					
4		37		67					
5		41		73					
6		46		74					
7		36		71					
8		42		69					
9		38		72					
10		52		86					
11									
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34									
35									
36									
37									
38									
39									
40									
AVG:		41.6		72.6					
MAX:		52.0		86.0					
MIN:		37.0		67.0					

Contech Research, Inc.

DATA SHEET

PROJECT: 92199 TEST: PULL - SHEAR REQ: _____
SPEC: — PARAGRAPH: — T.P. — TECH: S - R
STARTED: 18 JUN 92 SAMPLE I.D. #: P/N TSM-125-01-S-D-MEC
COMPLETED: 23 JUN 92 TEMP: 22 °C R.H. 54 % UNITS: POUND
EQUIPMENT I.D. #: 38-398-12 FIGURE #2

		PULL		SHEAR					
1		104		148					
2		124		143					
3		118		155					
4		98		134					
5		90		163					
6		115		147					
7		88		166					
8		92		157					
9		108		136					
10		~~60~~	CRACKED TIP	~~87~~					
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
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35									
36									
37									
38									
39									
40									
AVG:		104.1	~~110.5~~		~~153.6~~	149.9				
MAX:		124.0	~~108.0~~		~~207.0~~	166.0				
MIN:			88.0		134.0					

DATA SHEET

PROJECT: 92199 TEST: PULL-SHEAR REQ: _____
SPEC: - PARAGRAPH: - T.P. - TECH: S-R / TFP
STARTED: 19 JUN 92 SAMPLE I.D. #: TSM-125-01-S-D-V-LC
COMPLETED: 23 JUN 92 TEMP: 22 °C R.H. 56 % UNITS: POUND
EQUIPMENT I.D. #: 38 - 398

			PULL		SHEAR					
1			185		228					
2			171		237					
3			198		214					
4			174		244					
5			204		257					
6			213		238					
7			182		267					
8			220		257					
9			245		245					
10			~~39~~	TFP	~~127~~					
11										
12										
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34										
35										
36										
37										
38										
39										
40										
AVG:			194.1		243.0					
MAX:			245.0		267.0					
MIN:			171.0		214.0					

NOTE: ~~SUBSEQUENT~~
THE DATA FROM SAMPLE #10 HAS BEEN DELETED
DUE TO A MALFUNCTION OF THE TEST EQUIP.
TFP

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DATA SHEET

PROJECT: 92199 TEST: PULL - SHEAR REQ: _____
SPEC: — PARAGRAPH: — T.P. — TECH: S - R
STARTED: 24 JUN 92 SAMPLE I.D. #: TSM-125-01-5-D-V
COMPLETED: 25 JUN 92 TEMP: 21 °C R.H. 52 % UNITS: POUND
EQUIPMENT I.D. #: 38-398 FIGURE # 1

		PULL		SHEAR					
1		228		258					
2		253		273					
3		238		262					
4		265		278					
5		259		264					
6		246		247					
7		232		253					
8		237		248					
9		241		264					
10		160		316					
11									
12									
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31									
32									
33									
34									
35									
36									
37									
38									
39									
40									
AVG:		225.9		266.3					
MAX:		265.0		316.0					
MIN:		160.0		247.0					

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DATA SHEET

PROJECT: 92199 TEST: PULL-SHEAR REQ: _____

SPEC: — PARAGRAPH: — T.P. — TECH: S-R

STARTED: 24 JUN 92 SAMPLE I.D. #: P/N TSM-125-01-S-D-H

COMPLETED: 25 JUN 92 TEMP: 21 °C R.H. 52 % UNITS: POUND

EQUIPMENT I.D. #: 38-12-398 FIGURE #1

			PULL		SHEAR					
1			57		176					
2			60		169					
3			49		172					
4			52		178					
5			45		166					
6			51		170					
7			55		159					
8			47		167					
9			54		173					
10			42	*	158	*				
11										
12										
13										
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33										
34										
35										
36										
37										
38										
39										
40										
AVG:			52.2		170.0					
MAX:			60.0		178.0					
MIN:			45.0		159.0					

Contech Research, Inc.

DATA SHEET

PROJECT: 92199 TEST: PULL - SHEAR REQ: —
SPEC: — PARAGRAPH: — T.P. — TECH: S-R
STARTED: 18 JUN 92 SAMPLE I.D. #: P/N SFM-125-02-S-D-LC
COMPLETED: 23 JUN 92 TEMP: 22 °C R.H. 54 % UNITS: POUND
EQUIPMENT I.D. #: 38-398-12 FIGURE # 2

		PULL		SHEAR					
1		44		57					
2		42		66					
3		50		55					
4		45		52					
5		48		60					
6		46		56					
7		38		53					
8		41		44					
9		39		48					
10		45		65					
11									
12									
13									
14									
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29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									
AVG:		43.8		55.6					
MAX:		50.0		66.0					
MIN:		38.0		44.0					

Contech Research, Inc.

DATA SHEET

PROJECT: 92199 TEST: PULL - SHEAR REQ: —
SPEC: — PARAGRAPH: — T.P. — TECH: S-R
STARTED: 17 JUN 92 SAMPLE I.D. #: P/N SFM-125-02-S-D
COMPLETED: 22 JUN 92 TEMP: 22 °C R.H. 52 % UNITS: POUND
EQUIPMENT I.D. #: 38-12 FIGURE # 3

		PULL		SHEAR					
1		33		48					
2		36		51					
3		29		47					
4		32		54					
5		38		47					
6		31		41					
7		28		55					
8		35		48					
9		37		43					
10		38		64					
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AVG:		33.7		49.8					
MAX:		38.0		64.0					
MIN:		28.0		41.0					

Contech Research, Inc.

DATA SHEET

PROJECT: 92199 TEST: PULL - SHEAR REQ: —

SPEC: — PARAGRAPH: — T.P. — TECH: S - Q

STARTED: 18 JUN 92 SAMPLE I.D. #: P/N SMM-125-02-S-D-LC

COMPLETED: 23 JUN 92 TEMP: 22 °C R.H. 54 % UNITS: POUND

EQUIPMENT I.D. #: 38-398-12 FIGURE # 2

			PULL		SHEAR					
1			72		54					
2			64		61					
3			57		68					
4			77		58					
5			52		60					
6			56		74					
7			61		78					
8			65		63					
9			53		72					
10			48		74					
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AVG:			60.5		66.2					
MAX:			77.0		78.0					
MIN:			48.0		54.0					

Contech Research, Inc.

DATA SHEET

PROJECT: 92199 TEST: PULL - SHEAR REQ:
SPEC: — PARAGRAPH: — T.P. — TECH: S-R
STARTED: 17 JUN 92 SAMPLE I.D. #: SMM-125-02-S-D
COMPLETED: 22 JUN 92 TEMP: 22 °C R.H. 52 % UNITS: POUND
EQUIPMENT I.D. #: 12 - 38 FIGURE #3

		PULL		SHEAR					
1		36		53					
2		34		45					
3		38		63					
4		41		61					
5		48		48					
6		32		64					
7		46		57					
8		40		51					
9		43		66					
10		32		92					
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40									
AVG:		39.0		60.0					
MAX:		48.0		92.0					
MIN:		32.0		45.0					

Contech Research, Inc.

DATA SHEET

PROJECT: 92199 TEST: PULL - SHEAR REQ: —
SPEC: — PARAGRAPH: — T.P. — TECH: S - R
STARTED: 23 JUN 92 SAMPLE I.D. #: P/N TMT-125-01-TD-SM
COMPLETED: 24 JUN 92 TEMP: 22 °C R.H. 50 % UNITS: POUND
EQUIPMENT I.D. #: 38 - 398 FIGURE # 1

		PULL		SHEAR					
1		105		182					
2		98		167					
3		112		169					
4		104		172					
5		108		203					
6		99		190					
7		102		175					
8		110		177					
9		109		184					
10		148		179					
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AVG:		109.5		179.8					
MAX:		148.0		203.0					
MIN:		98.0		167.0					

Contech Research, Inc.

DATA SHEET

PROJECT: 92199 TEST: PULL - SHEAR REQ: _____

SPEC: — PARAGRAPH: — T.P. — TECH: S-R

STARTED: 17 JUN 92 SAMPLE I.D. #: PIN TMM-125-01-S-D-SM

COMPLETED: 22 JUN 92 TEMP: 22 °C R.H. 52 % UNITS: POUND

EQUIPMENT I.D. #: 38-12-398 FIGURE # 3

		PULL		SHEAR					
1		85		145					
2		78		138					
3		76		142					
4		82		135					
5		80		149					
6		78		155					
7		88		147					
8		81		151					
9		84		158					
10		~~124~~		~~244~~	TFP GRADED DATA				
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AVG:		81.3				146.7			
MAX:		88.0	~~124.0~~		~~244.0~~	158.0			
MIN:		76.0				135.0			

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