SlimSeal SSL Connector

1. INTRODUCTION

1.1 Purpose

Testing was performed on the TE Connectivity SlimSeal SSL Connector to determine its conformance to the requirements of Product Specification 108-2391, Rev. A.

1.2 Scope

This report covers the electrical, mechanical, and environmental performance of the TE SlimSeal SSL Connector. Testing was performed at the Harrisburg Electrical Components Test Laboratory (HECTL) between 4-February-2011 and 27-September-2011. This documentation is on file and available under EA20101109T.

1.3 Conclusion

All part numbers listed in paragraph 1.4 conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-2391, Rev. A.

1.4 Product Description

SlimSeal SSL Connectors and contacts are for printed circuit (pc) board and free-hanging applications. The connectors consist of vertical and right-angle pin headers available in 2 through 4 contact positions and receptacle and plug housing available in 1 through 4 contact positions. Connector contact cavities are marked with numbers to provide circuit identification.

1.5 Test Specimens

The test specimens were representative of normal production lots, and the following part numbers were used for test:

Table 1- Specimen Identification

Test Groups	Test Sets	Qty	Part Number	Description
1	1	10	2106135-2 Rev 4	2 pos Housing SlimSeal SSL connector
		20	2106123-1 Rev 10	Contacts on 18 AWG wire Socket
		10	2106111-2 Rev 3	2 pos RA Pin Header Housing SlimSeal SSL TH
		10	60-1042782-1 Rev A	PC Board TH
	2	10	2106135-4 Rev 4	4 pos Housing SlimSeal SSL connector
		40	2106123-1 Rev 10	Contacts on 18 AWG wire Socket
		10	2106111-6 Rev 3	4 pos RA Pin Header Housing SlimSeal SSL TH
		10	60-1042782-1 Rev A	PC Board TH
	3	10	2106135-4 Rev 4	4 pos Housing SlimSeal SSL connector
		40	2106123-1 Rev 10	Contacts on 18 AWG wire Socket
		10	2106053-6 Rev 3	4 pos V Pin Header Housing SlimSeal SSL SMT
		10	60-1042601-1 Rev A	PC Board SMT
	4	10	2106135-2 Rev 4	2 pos Housing SlimSeal SSL connector
		20	2106123-1 Rev 10	Contacts on 18 AWG wire Socket
		10	2106116-2 Rev 4	2 pos V Pin Header Housing SlimSeal SSL SMT
		10	60-1042783-1 Rev A	PC Board SMT
	5	10	2106135-4 Rev 4	4 pos Housing SlimSeal SSL connector
		40	2106123-1 Rev 10	Contacts on 18 AWG wire Socket
		10	2106116-8 Rev 4	4 pos V Pin Header Housing SlimSeal SSL SMT
		10	60-1042783-1 Rev A	PC Board SMT

Test Groups	Test Sets	Qty	Part Number	Description
1	6	10	2106135-4 Rev 4	4 pos Housing SlimSeal SSL connector
		40	2106123-1 Rev 10	Contacts on 18 AWG wire Socket
		10	2106112-2 Rev B	4 pos V Pin Header Housing SlimSeal SSL SMT
		10	60-1042845-1 Rev A	PC Board SMT
	7	10	2106135-2 Rev 4	2 pos Housing SlimSeal SSL connector Socket
		20	2106123-1 Rev 10	Contacts on 18 AWG wire Socket
		10	2106136-2 Rev 3	2 pos Housing SlimSeal SSL connector Pin
		20	2106124-2 Rev 8	Contacts on 18 AWG wire Pin
	8	10	2106135-2 Rev 4	2 pos Housing SlimSeal SSL connector Socket
		20	1-2106123-1 Rev 10	Contacts on 24 AWG wire Socket
		10	2106136-2 Rev 3	2 pos Housing SlimSeal SSL connector Pin
		20	2-2106124-2 Rev 8	Contacts on 24 AWG wire Pin
	9	10	2106135-4 Rev 4	4 pos Housing SlimSeal SSL connector Socket
		40	2106123-1 Rev 10	Contacts on 18 AWG wire Socket
		10	2106136-2 Rev 3	4 pos Housing SlimSeal SSL connector Pin
		40	2106124-2 Rev 8	Contacts on 18 AWG wire Pin
	10	10	2106135-2 Rev 4	4 pos Housing SlimSeal SSL connector Socket
		40	1-2106123-1 Rev 10	Contacts on 24 AWG wire Socket
		10	2106136-2 Rev 3	4 pos Housing SlimSeal SSL connector Pin
		40	2-2106124-2 Rev 8	Contacts on 24 AWG wire Pin
2	11	10	2106135-2 Rev 4	4 pos Housing SlimSeal SSL connector Socket
		40	1-2106123-1 Rev 10	Contacts on 20 AWG wire Socket
		10	2106136-2 Rev 3	4 pos Housing SlimSeal SSL connector Pin
		40	2-2106124-2 Rev 8	Contacts on 20 AWG wire Pin
	12	10	2106135-2 Rev 4	4 pos Housing SlimSeal SSL connector Socket
		40	1-2106123-1 Rev 10	Contacts on 24 AWG wire Socket
		10	2106136-2 Rev 3	4 pos Housing SlimSeal SSL connector Pin
		40	2-2106124-2 Rev 8	Contacts on 24 AWG wire Pin
	13	10	2106135-4 Rev 4	4 pos Housing SlimSeal SSL connector
		40	2106123-1 Rev 10	Contacts on 20 AWG wire Socket
		10	2106056-8 Rev 3	4 pos RA Pin Header Housing SlimSeal SSL SMT
		10	60-1042783-1 Rev A	PC Board SMT
	14	10	2106135-4 Rev 4	4 pos Housing SlimSeal SSL connector
		40	1-2106123-1 Rev 10	Contacts on 24 AWG wire Socket
		10	2106056-8 Rev 3	4 pos RA Pin Header Housing SlimSeal SSL SMT
		10	60-1042783-1 Rev A	PC Board SMT
3	15	15	2106135-4 Rev 4	4 pos Housing SlimSeal SSL connector
		60	2106123-1 Rev 10	Contacts on 18 AWG wire Socket
		15	2106117-8 Rev 3	4 pos V Pin Header Housing SlimSeal SSL TH
	16	15	2106135-4 Rev 4	4 pos Housing SlimSeal SSL connector
		60	2106123-1 Rev 10	Contacts on 18 AWG wire Socket
		15	2106053-6 Rev 3	4 pos V Pin Header Housing SlimSeal SSL SMT
	17	15	2106135-4 Rev 4	4 pos Housing SlimSeal SSL connector Socket
		60	2106123-1 Rev 10	Contacts on 18 AWG wire Socket
		15	2106136-2 Rev 3	4 pos Housing SlimSeal SSL connector Pin
		60	2106124-2 Rev 8	Contacts on 18 AWG wire Pin
4	18	30	2106123-1 Rev 10	Contacts on 18 AWG wire Socket Hand Crimped
	19	30	2106124-2 Rev 8	Contacts on 18 AWG wire Pin Hand Crimped
	20	30	2106123-1 Rev 10	Contacts on 18 AWG wire Socket Applicator
	21	30	2106124-2 Rev 8	Contacts on 18 AWG wire Pin Applicator

Test Groups	Test Sets	Qty	Part number	Description
4	22	30	2106123-1 Rev 10	Contacts on 20 AWG wire Socket Hand Crimped
	23	30	2106124-2 Rev 8	Contacts on 20 AWG wire Pin Hand Crimped
	24	30	2106123-1 Rev 10	Contacts on 20 AWG wire Socket Applicator
	25	30	2106124-2 Rev 8	Contacts on 20 AWG wire Pin Applicator
	26	30	2106123-1 Rev 10	Contacts on 22 AWG wire Socket Hand Crimped
	28	30	2106124-2 Rev 8	Contacts on 22 AWG wire Pin Hand Crimped
	29	30	2106123-1 Rev 10	Contacts on 22 AWG wire Socket Applicator
	30	30	2106124-2 Rev 8	Contacts on 22 AWG wire Pin Applicator
	31	30	2106123-1 Rev 10	Contacts on 24 AWG wire Socket Hand Crimped
	32	30	2106124-2 Rev 8	Contacts on 24 AWG wire Pin Hand Crimped
	33	30	2106123-1 Rev 10	Contacts on 24 AWG wire Socket Applicator
	34	30	2106124-2 Rev 8	Contacts on 24 AWG wire Pin Applicator
5	35	10	2106135-2 Rev 4	2 pos Housing SlimSeal SSL connector Socket
		20	1-2106123-1 Rev 10	Contacts on 24 AWG wire Socket
		10	2106117-8 Rev A2	2 pos V Pin Header Housing SlimSeal SSL TH
		10	60-1042782-1 Rev A	PC Board TH
	36	10	2106135-3 Rev 4	3 pos Housing SlimSeal SSL connector Socket
		30	1-2106123-1 Rev 10	Contacts on 24 AWG wire Socket
		10	2106112-4 Rev A	3 pos V Pin Header Housing SlimSeal SSL TH
		10	60-1042782-1 Rev A	PC Board TH
	37	10	2106135-2 Rev 4	4 pos Housing SlimSeal SSL connector Socket
		40	1-2106123-1 Rev 10	Contacts on 24 AWG wire Socket
		10	2106117-8 Rev A2	4 pos V Pin Header Housing SlimSeal SSL TH
		10	60-1042782-1 Rev A	PC Board TH
	38	10	2106135-2 Rev 4	2 pos Housing SlimSeal SSL connector Socket
		20	1-2106123-1 Rev 10	Contacts on 24 AWG wire Socket
		10	2106136-2 Rev 3	2 pos Housing SlimSeal SSL connector Pin
		20	2-2106124-2 Rev 8	Contacts on 24 AWG wire Pin
	39	10	2106135-3 Rev 4	3 pos Housing SlimSeal SSL connector Socket
		30	1-2106123-1 Rev 10	Contacts on 24 AWG wire Socket
		10	2106136-3 Rev 3	3 pos Housing SlimSeal SSL connector Pin
		30	2-2106124-2 Rev 8	Contacts on 24 AWG wire Pin
	40	10	2106135-2 Rev 4	4 pos Housing SlimSeal SSL connector Socket
		40	1-2106123-1 Rev 10	Contacts on 24 AWG wire Socket
		10	2106136-2 Rev 3	4 pos Housing SlimSeal SSL connector Pin
		40	2-2106124-2 Rev 8	Contacts on 24 AWG wire Pin
	41	10	2106135-2 Rev 4	2 pos Housing SlimSeal SSL connector Socket
		20	2106123-1 Rev 10	Contacts on 18 AWG wire Socket
		10	2106111-2 Rev A	2 pos RA Pin Header Housing SlimSeal SSL TH
		10	60-1042782-1 Rev A	PC Board TH
	42	10	2106135-3 Rev 4	3 pos Housing SlimSeal SSL connector Socket
		30	2106123-1 Rev 10	Contacts on 18 AWG wire Socket
		10	2106111-4 Rev A	3 pos RA Pin Header Housing SlimSeal SSL TH
		10	60-1042782-1 Rev A	PC Board TH
	43	10	2106135-2 Rev 4	4 pos Housing SlimSeal SSL connector Socket
		40	2106123-1 Rev 10	Contacts on 18 AWG wire Socket
		10	2106111-6 Rev A	4 pos RA Pin Header Housing SlimSeal SSL TH
		10	60-1042782-1 Rev A	PC Board TH

Test Groups	Test Sets	Qty	Part number	Description
5	44	10	2106135-2 Rev 4	2 pos Housing SlimSeal SSL connector Socket
		20	2106123-1 Rev 10	Contacts on 18 AWG wire Socket
		10	2106136-2 Rev 3	2 pos Housing SlimSeal SSL connector Pin
		20	2106124-2 Rev 8	Contacts on 18 AWG wire Pin
	45	10	2106135-3 Rev 4	3 pos Housing SlimSeal SSL connector Socket
		30	2106123-1 Rev 10	Contacts on 18 AWG wire Socket
		10	2106136-3 Rev 3	3 pos Housing SlimSeal SSL connector Pin
		30	2106124-2 Rev 8	Contacts on 18 AWG wire Pin
	46	10	2106135-2 Rev 4	4 pos Housing SlimSeal SSL connector Socket
		40	2106123-1 Rev 10	Contacts on 18 AWG wire Socket
		10	2106136-2 Rev 3	4 pos Housing SlimSeal SSL connector Pin
		40	2106124-2 Rev 8	Contacts on 18 AWG wire Pin

1.5 Environmental Conditions

Unless otherwise stated, the following environmental conditions prevailed during testing:

Temperature: 15°C to 35°C
Relative Humidity: 25% to 75%

1.6 Qualification Test Sequence

The specimens listed in Table 1 were subjected to the test sequence listed in Table 2.

Table 2 – Test Sequence

Test or Examination	Test Groups				
	1	2	3	4	5
	Test Sequence (a)				
Initial Examination of Product	1	1	1	1	1
Low Level Contact Resistance	3	2, 6			
Insulation Resistance			3,7		
Withstanding Voltage			4,8		
Temperature Rise vs Current		3, 7			
Crimp tensile				2	
Random Vibration,	5				
Mechanical Shock	6				
Durability	4				
Header contact retention			10(b)		
Crimp contact retention			11		
Crimp contact insertion force			2		
Mating Force	2				
Unmating Force	7				
Housing lock strength			9		
Thermal Shock			5		3
Humidity-Temperature Cycling		4(c)	6		
Temperature life		5			
MFG		4(c)			
Ingress protection					4
Use aging					2
Final Examination of Product	8	8	12	3	5

Note: (a) Numbers indicate the sequence in which tests were performed.
(b) Test omitted when testing wire to wire connectors.
(c) The fourth test in this sequence will be either humidity/temperature cycling for tin plated specimens or mixed flowing gas for gold plated specimens.

2. SUMMARY OF TESTING

2.1 Initial Examination of Product – All Test Groups

All samples submitted for testing were representative of normal production lots. A Certificate of Conformance was issued by the Product Assurance Department. Where specified, samples were visually examined and no evidence of physical damage detrimental to product performance was observed.

2.2 Low Level Contact Resistance – Test Groups 1 and 2

All low level contact resistance measurements were less than 20.0 milliohms initially. Table 3 lists Test Group 1 LLCR data summaries.

Table 3 - Low Level Contact Resistance Summary Data

	Test Group 1 milliohms				
	Test Set 1 & 2	**Test Set 3**	**Test Set 4, 5 & 6**	**Test Set 7 & 8**	**Test Set 9 & 10**
	Initial	Initial	Initial	Initial	Initial
Min	3.86	3.44	3.41	4.98	3.92
Max	4.28	3.85	4.16	5.70	14.58
Mean	4.02	3.61	3.86	5.26	8.91
STD	0.10	0.11	0.13	0.15	1.04

Note: **Test Set 1 & 2 = RA thru hole 18 AWG to Board.**
Test Set 3 = Vert thru hole 18 AWG to Board.
Test Set 4, 5 & 6 = Vert SMT 18 AWG to Board.
Test Set 7 & 8 = 18 AWG Wire to Wire.
Test Set 9 & 10 = 24 AWG Wire to Wire.

All low level contact resistance measurements were less than 20 milliohms maximum initially and finally. Table 4 lists Test Group 2 LLCR data summaries.

Table 4 - Low Level Contact Resistance Summary Data

	Test Group 2 milliohms							
	Test Set 11		**Test Set 12**		**Test Set 13**		**Test Set 14**	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final
Min	5.34	5.69	7.20	8.29	3.75	4.07	2.38	3.26
Max	9.28	16.94	8.66	13.11	8.17	9.43	9.85	10.82
Mean	6.23	8.66	7.92	9.47	5.92	6.43	6.63	7.37
STD	1.23	2.89	0.25	1.10	0.97	1.08	2.16	2.09

Note: **Test Set 11 = 20 AWG Wire to Wire.**
Test Set 12 = 24 AWG Wire to Wire.
Test Set 13 = RA SMT 20 AWG to Board
Test Set 14 = RA SMT 24 AWG to Board

2.3 Insulation Resistance – Test Group 3

All specimens met the requirement of 1000 mega-ohms (1.0 X 10^9 ohms) initially and 100 mega-ohms final.

2.4 Withstanding Voltage – Test Group 3

All specimens met the requirement of no breakdown or flashover for both initial and final readings.

2.5 Temperature Rise vs Current – Test Group 2

All samples had a temperature rise of less than 35°C above ambient when tested using a baseline rated current of 5.0 amperes on 20 AWG and 3.5 amperes on 24 AWG. Table 5 lists Test Group 2 T-Rise data summery.

Table 5 - Temperature Rise Data Summery (Degree C)

	Wire to Wire				Wire to Board			
	Test Set 11 – 20 AWG		**Test Set 12 – 24 AWG**		**Test Set 13 – 20 AWG**		**Test Set 14 – 24 AWG**	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final
Min	12.69	14.59	10.00	11.80	10.50	10.40	7.90	8.70
Max	15.69	33.69	13.30	31.30	14.20	21.20	12.60	11.70
Avg	14.38	24.77	11.87	16.68	12.76	14.04	10.52	10.43
STD	0.75	5.27	0.73	5.23	0.81	2.02	1.19	0.73

2.6 Random Vibration – Test Group 1

No discontinuities were detected during vibration. Following vibration, no cracks, breaks, or loose parts on the connector assemblies were visible.

2.7 Mechanical Shock – Test Group 1

No discontinuities were detected during physical shock. Following physical shock testing, no cracks, breaks, or loose parts on the connector assemblies were visible.

2.8 Durability – Test Group 1

After 30 cycles of durability the specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

2.9 Mating Force – Test Group 1

All specimens met the requirement of 3.74 kg per contact [8.25 lbf] maximum mating force. The data summaries are listed in Table 6.

Table 6 – Mating Force

	Test Group 1	
	kg	**lbf**
Min	0.374	0.825
Max	3.088	6.81
Mean	1.20	2.66
STD	0.670	1.477

2.10 Unmating Force – Test Group 1

All of the specimens met the requirement of 0.0861 kg per contact [0.19 lbf.] minimum unmating force. The data summaries are listed in Table 7.

Table 7 – Unmating Force

	Test Group 1	
	kg	lbs.
Min	0.235	0.52
Max	0.668	1.36
Mean	0.299	0.66
STD	0.0517	0.114

2.11 Thermal Shock – Test Groups 3 and 5

Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

2.12 Humidity-Temperature Cycling – Test Group 3

Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

2.13 Temperature Life – Test Group 2

Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

2.14 Header Contact Retention – Test Group 3

All test specimens in Test Sets 15 and 16 were subjected to Header Contact Retention Force. The contacts were subjected to a 1.4 kg [3.1 lb.] force for six seconds in the opposite direction of the contacts insertion to the header. The contacts were not displaced. All specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

2.15 Crimp Contact Retention – Test Group 3

All test specimens in Test Sets 15, 16 and 17 were subjected to Crimp Contact Retention Force. The contacts were subjected to a 1.81 kg [4 lb.] force for six seconds in the opposite direction of the insertion of the contacts. All specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

2.16 Crimp Contact Insertion Force – Test Group 3

All test specimens in Test Sets 15, 16 and 17 met the requirement of less than 1.814 kg [4 lbs.]. The data summaries are listed in Table 8.

Table 8 - Contact Insertion Force

kg [lbs.]	Test Group 3	
	Pin	Socket
Min	1.00 [2.22]	0.979 [2.16]
Max	1.542 [3.4]	1.50 [3.31]
Mean	1.197 [2.64	1.197 [2.64]
STD	0.127 [0.28]	0.0952 [0.21]

2.17 Housing Lock Strength – Test Group 3

All test specimens in Test Sets 15, 16 and 17 were subjected to Housing Lock Strength. The connectors were unmated with the housing latch engaged. All forces were greater than 2.7 kg [6.0 lbs.] force. The data summaries are listed in Table 9.

Table 9 - Housing Lock Strength

4 Position Housing Kg [lbs.]	Test group 3		
	Wire to Board Vertical Thru Hole	Wire to Board SMT	Wire to Wire
Min	3.188 [7.03]	3.878 [8.55]	2.898 [6.39]
Max	6.685 [14.74]	8.25 [18.19]	5.728 [12.63]
Mean	5.13 [11.31]	6.636 [14.63]	4.327 [9.54]
STD	1.29 [2.85]	1.30 [2.87]	0.929 [2.05]

2.18 Crimp Tensile – Test Group 4

All test specimens in Test Sets 18 thru 34 were subjected to Crimp Tensile. All forces were greater than 3.7 kg [8.0 lb.] force for the 20, 22 and 24 AWG contacts, and 9.1 kg [20 lb.] for the 18 AWG contacts. The data summaries are listed in Tables 10 and 11.

Table 10 - Crimp Tensile by Applicator

kg [lbs.]	Test Group 4							
	18 AWG		20 AWG		22 AWG		24 AWG	
	Pin	Socket	Pin	Socket	Pin	Socket	Pin	Socket
Min	10.37 [22.86]	15.07 [33.24]	9.43 [20.80]	10.56 [23.29]	6.28 [13.85]	6.78 [14.95]	5.64 [12.45]	5.52 [12.17]
Max	15.91 [35.08]	17.64 [38.89]	12.04 [26.56]	12.08 [26.65]	7.97 [17.59]	8.41 [18.56]	6.40 [14.11]	6.42 [14.17]
Mean	14.32 [31.57]	16.02 [35.33]	11.24 [24.77]	11.50 [25.36]	7.39 [16.30]	7.78 [17.17]	6.18 [13.64]	6.26 [13.80]
STD	1.156 [2.55]	0.653 [1.44]	0.689 [1.52]	0.335 [0.74]	0.317 [0.70]	0.304 [0.67]	0.163 [0.36]	0.204 [0.45]

Table 11 - Crimp Tensile by Hand

kg [lbs.]	Test Group 4							
	18 AWG		20 AWG		22 AWG		24 AWG	
	Pin	Socket	Pin	Socket	Pin	Socket	Pin	Socket
Min	10.01 [22.07]	11.36 [25.06]	4.27 [9.43#]	9.44 [20.83]	5.28 [11.64]	7.35 [16.20]	4.78 [10.55]	5.19 [11.45]
Max	14.80 [32.64]	16.27 [35.87]	13.34 [29.42]	13.39 [29.52]	8.29 [18.27]	8.48 [18.70]	5.97 [13.17]	6.028 [13.29]
Mean	12.51 [27.58]	14.08 [31.05]	11.30 [24.93]	11.38 [25.10]	7.37 [16.25]	8.078 [17.81]	5.59 [12.32]	5.75 [12.68]
STD	1.183 [2.61]	1.29 [2.85]	2.00 [4.42]	0.975 [2.15]	0.68 [1.50]	0.367 [0.81]	0.29 [0.64]	0.267 [0.59]

 # Contact Broke

2.19 Ingress Protection – Test Group 5

All test specimens passed Ingress Protection Test, IPX7.

2.20 Use Aging – Test Group 5

No evidence of physical damage detrimental to product performance was observed.

2.21 Final Examination of Product – All Test Groups

Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

3. TEST METHODS

3.1. Initial Examination of Product

A Certificate of Conformance was issued stating that all specimens in this test package were produced, inspected, and accepted as conforming to product drawing requirements, and were manufactured using the same core manufacturing processes and technologies as production parts. Specimens were visually examined with the unaided eye. Testing was conducted in accordance with EIA-364-18.

3.2 Low-level Contact Resistance

Contact resistance measurements at low level current were made using a four terminal measuring technique. The test current was maintained at 100 milliamperes maximum with a 20 millivolt maximum open circuit voltage thru the entire specimen. For the wire to board measurements the reading were taken from the voltage probe point on the board to the end of the connector wire which was approximately 9 inches as shown in Figure 1, measurement (X). Testing was conducted in accordance with EIA-364-23.

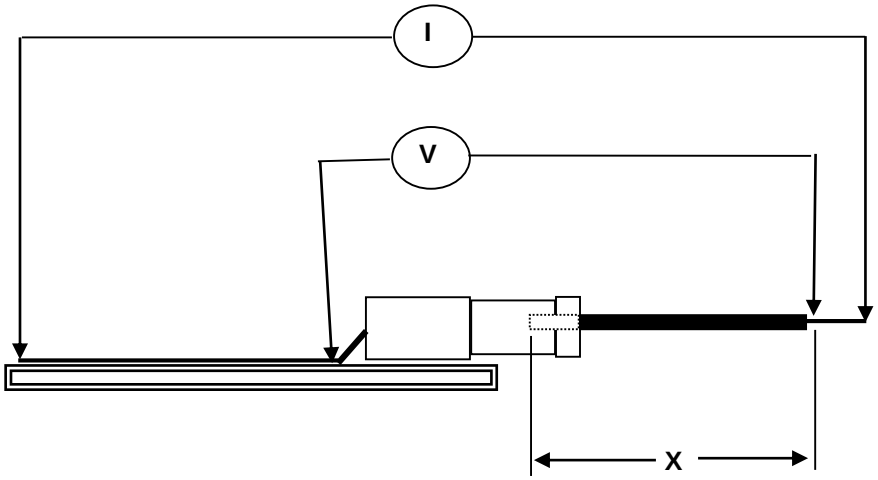

Figure 1 – Low Level Contact Resistance Points

For the wire to wire measurements the reading was taken from the end of the 9 inch Pin header connector wire (X) to the end of the 9 inch Receptacle connector wire (X) shown in Figure 2.

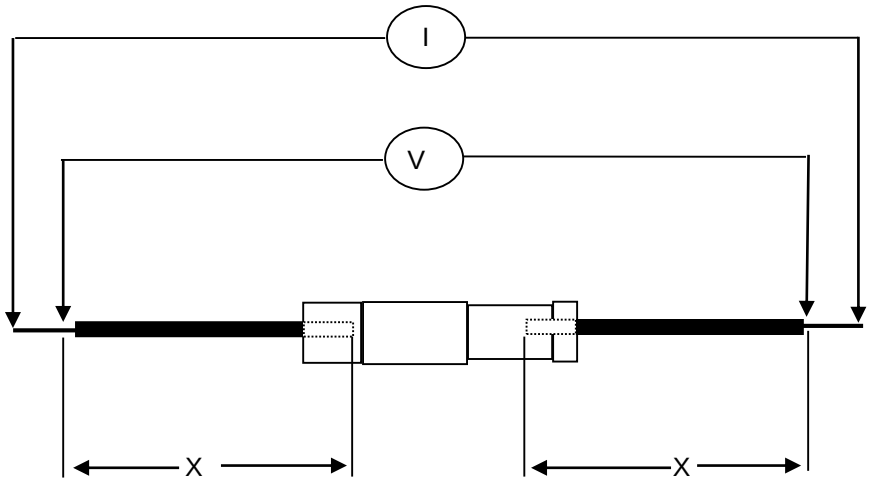

Figure 2 – Low Level Contact Resistance Points

3.3 Insulation Resistance

Insulation resistance was measured between adjacent contacts of mated specimens. A test voltage of 500 volts DC was applied for two minutes before the resistance was measured. Testing was conducted in accordance with EIA-364-21.

3.4 Withstanding Voltage

Specimens were subjected to 1800 VAC applied between adjacent contacts of mated specimens. The test potential was applied from 0 to 1800 volts at a slew rate of 500 volts per second and then held for one minute. Testing was conducted in accordance with EIA-364-20, Condition I.

3.5 Temperature Rise vs Current

The test specimens were wired in a series circuit and subjected to Temperature Rise at Specified Current testing. Specimens were subjected to the 5 amperes for the 20 AWG specimens and 3.5 amperes for the 24 AWG specimens. Thirty gauge Type-T thermocouples were attached to the SMT header contacts by means of thermally conductive epoxy. These contacts were then monitored for thermal stability. Thermal stability is defined as when the temperature rise of 3 consecutive readings taken at 5 minute intervals did not differ by more than 1°C. Once thermal stability was obtained, the temperature measurements were recorded. See Figure 3 and 4 for test setup. Testing was conducted in accordance with EIA-364-70, Method 1.

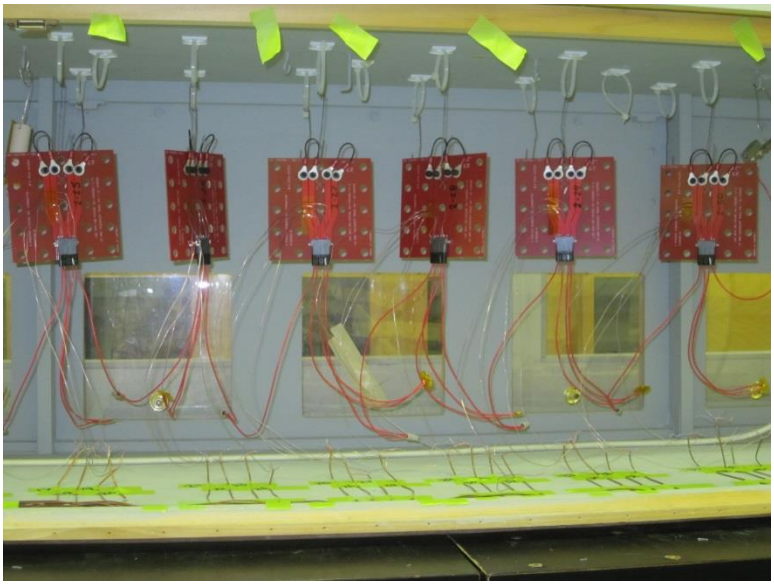

Figure 3 - Typical Temperature at Specified Current test setup (wire to board).

Due to the SlimSeal SSL Connector being a sealed connector the tester used a control group with the housings milled away prior to testing to determine the temperature of the contacts at the crimp of the pins and sockets with 30AWG Type T thermocouple wire attached by means of thermally conductive epoxy. Thermocouples were then attached to the specimens under test on the housings and the measurements from the control group were used to measure the temperature differential. This differential was then added to the connectors in test to determine an accurate temperature measurement.

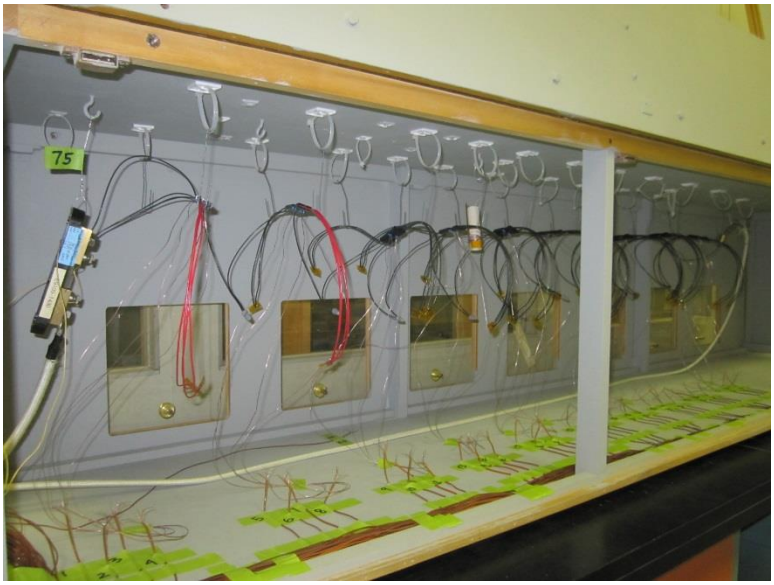

Figure 4 - Typical Temperature at Specified Current test setup (wire to wire).

3.6 Random Vibration

The parameters of this test condition are specified by a random vibration spectrum with excitation frequency bounds of 20 and 500 Hertz (Hz). The spectrum remains flat at 0.02 G^2/Hz from 20 Hz to the upper bound frequency of 500 Hz. The root-mean square amplitude of the excitation was 3.10 GRMS. The test specimens were subjected to this test for 15 minutes in each of the three mutually perpendicular axes, for a total test time of 45 minutes per test specimen. The test specimens were monitored for discontinuities of 1 microsecond or greater using an energizing current of 100 milliamperes. Testing was conducted in accordance with EIA-364-28F, test condition “VII”, test condition letter “D”. See Figure 5 below for the test setup.

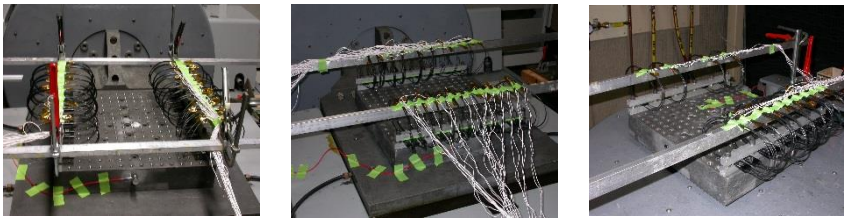

Figure 5 – Vibration Test Setup

3.7 Mechanical Shock

The parameters of this test condition are a half-sine waveform with an acceleration amplitude of 50 gravity units (g's peak) and a duration of 11 milliseconds. Three shocks in each direction were applied along the three mutually perpendicular axes of the test specimens, for a total of eighteen shocks. The test specimens were monitored for discontinuities of 1 microsecond or greater using an energizing current of 100 milliamperes. Testing was conducted in accordance with specification EIA-364-27B, test condition “A”. See Figures 6 thru 8 below for the test setup.

Figure 6 – Shock Setup Images

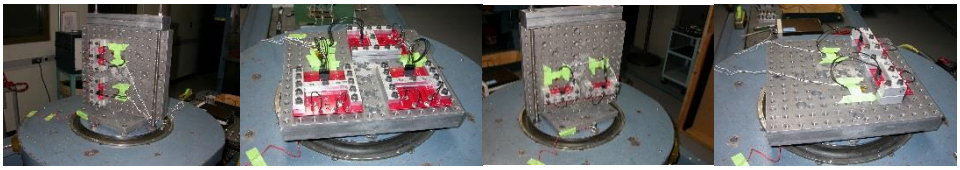

Figure 7 – Shock Setup Images Continued

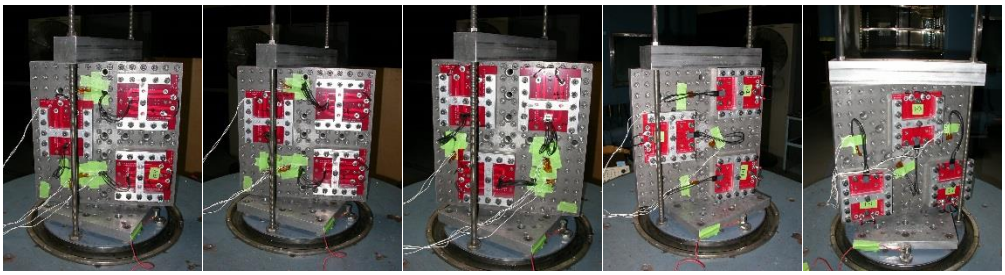

Figure 8 – Shock Setup Images Continued

3.8 Durability

Specimens were subjected to 30 cycles of durability. Specimens were mechanically mated and unmated at a maximum rate of 500 cycles per hour by hand. Testing was conducted in accordance with EIA-364-9.

3.9 Mating Force

Specimens were mounted to a tensile / compression machine and compressed until fully mated. The specimens were mated at a rate of 12.7 mm [0.5 in.] per minute with the latches disengaged. The peak force was recorded and then divided by the number of contacts to determine the average contact mating force. Testing was conducted in accordance with EIA-364-13.

3.10 Unmating Force

Specimens were mounted to a tensile / compression machine and unmated at a rate of 12.7 mm [0.5 in.] per minute with the latches disengaged. The peak force was then recorded. Testing was conducted in accordance with EIA-364-13.

3.11 Thermal Shock

Mated specimens were subjected to 5 cycles between temperature extremes of -40°C and 105°C with a 30 minute dwell at each extreme. Transition between extremes was less than 1 minute. Testing was conducted in accordance with EIA-364-32, Test Method A, Test Condition VIII.

3.12 Humidity-Temperature Cycling

Mated specimens were exposed to 10 cycles of humidity-temperature cycling. Each cycle lasted 24 hours and consisted of cycling the temperature between 25°C and 65°C twice while maintaining high humidity. Refer to Figure 22 for an image of the cycle. Testing was conducted in accordance with EIA-364-31, Method IV.

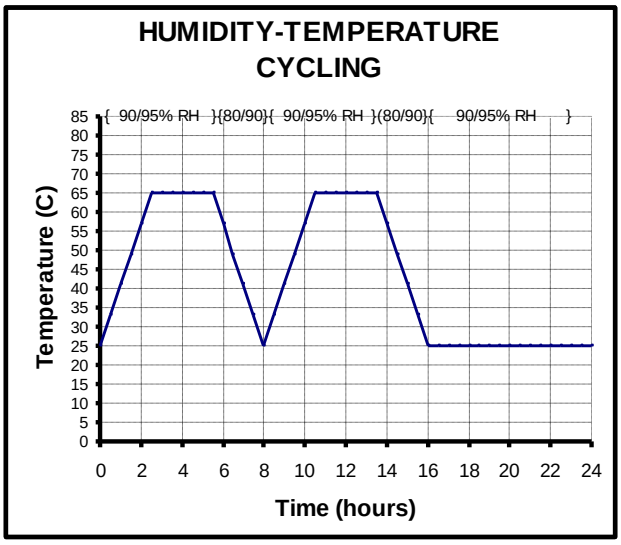

Figure 22 – Typical Humidity-Temperature Cycling Profile

3.13 Temperature Life

The mated specimens were subjected to 105°C for 500 hours in an air circulating oven. Testing was conducted in accordance with EIA-364-17, Method A, Test Condition 4, Test Time Condition C.

3.14 Header Contact Retention

Test specimens were clamped in a vise mounted to a free floating X-Y table. The contacts were subjected to a 1.4 kg [3.1 lb.] force for six seconds in the opposite direction of the insertion of the header contacts. The force was applied at a maximum rate of 25.4 mm per minute. See Figure 23 for the test setup. Testing was conducted in accrodance with EIA-364-29.

3.15 Crimp Contact Retention

Test specimens were clamped in a vise mounted to a free floating X-Y table. The contacts were subjected to a 1.81 kg [4 lb.] force for six seconds in the opposite direction of the insertion of the contacts. The force was applied at a maximum rate of 25.4 mm per minute. See Figure 23 for the test setup. Testing was conducted in accrodance with EIA-364-29.

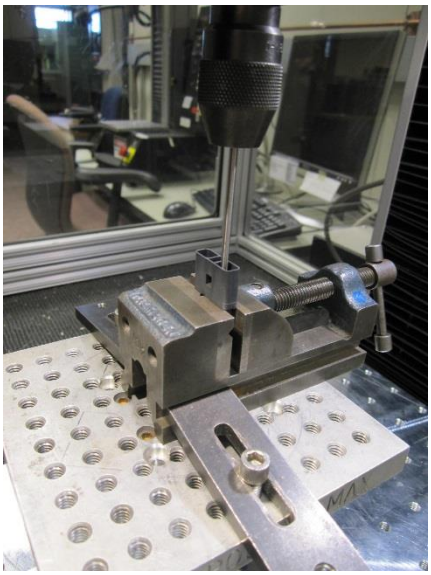

Figure 23 - Header Contact Retention and Crimp Contact Retention

3.16 Crimp Contact Insertion Force

All pins and sockets were inserted into the SlimSeal SSL connectors by hand due to inconsistent results when inserted by the tensile machine. All test specimen plugs were held by a vise attached to the tensile machines crosshead. The crosshead moved at a rate of 0.01 inches per minute in the down direction. The tester then inserted the contact and guided it into the correct position. When the tester heard the contact retention clip engage the contact the measurement was recorded. See Figure 24 for test setup. Testing was conducted in accordance with EIA-364-5.

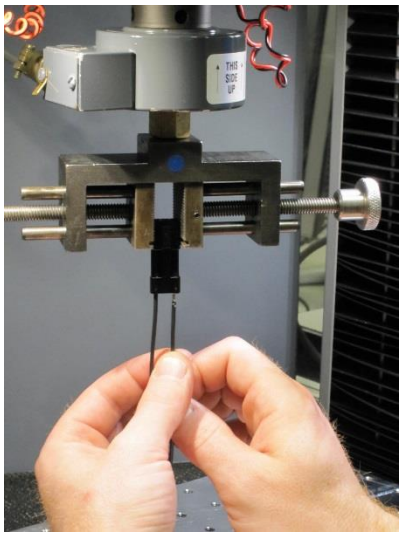

Figure 24 - Contact Insertion Setup

3.17 Housing Lock Strength

All test specimens were clamped in a vise mounted to the tensile machine's cross head. The specimens in Test Set 1 and 3 had the mating half of the connector, therefore the mating half was clamped in a vise mounted to a free floating X-Y Table and pulled at a rate of 1/2 inche per minute. Test Set 2's mating half was held by a slotted fixture mounted to a free floating X-Y Table. See Figures 25, 26, and 27 for the test setups. Testing was conducted in accordance with EIA-364-98.

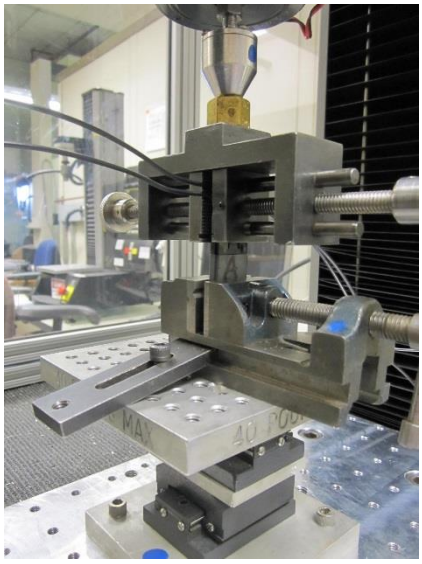

Figure 25 - Test setup for Housing Lock Strength on the 4 position Special Vertical Thru Hole Specimens.

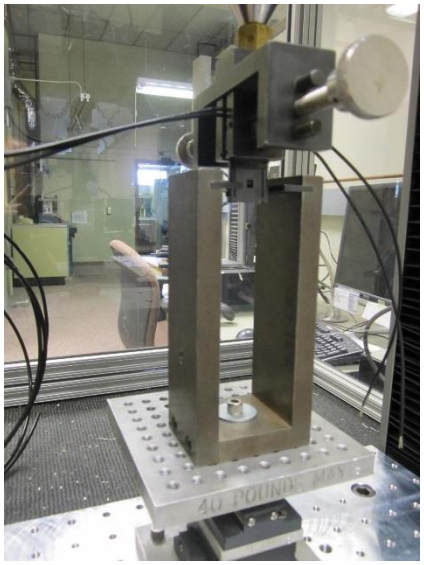

Figure 26 - Test setup for Housing Lock Strength on the 4 position Vertical SMT Specimens.

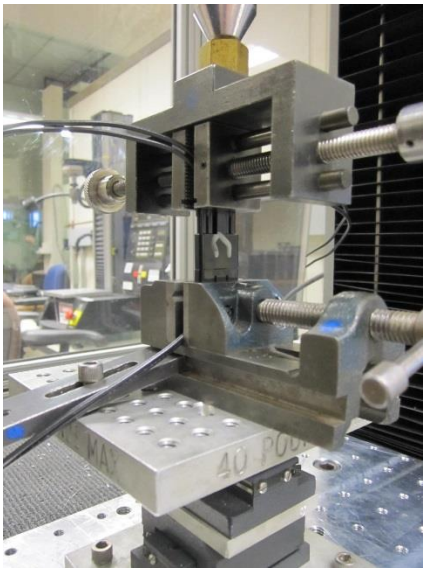

Figure 27 - Test setup for Housing Lock Strength on the 4 position Wire to Wire Specimens.

3.18 Crimp Tensile

Crimp tensile testing was performed with a tensile/compression machine. The insulation crimp was removed from each specimen. The pin/socket contact was secured in a machinist vise at the base of the machine. The wire was clamped in a set of pneumatic jaws attached to the load cell and force was applied in the upward direction at a rate of 25 mm per minute until the wire broke or pulled out of the crimp. Refer to Figure 28 for a detailed image of the test setup. Testing was conducted in accordance with EIA-364-8.

Figure 28 – Crimp Tensile Setup

3.19 Ingress Protection

Test specimen lead in wires were sealed with dielectric wax to prevent water intrusion. All specimens were submerged into one meter of water containing Tinopal for thirty minutes. Tinopal fluoresces when placed under a black light is used to detect water intrusion. The specimens were allowed to dry for twenty-four hours and then were un-mated and inspected under a black light. Testing was conducted in accordance with IEC 60529.

3.20 Use Aging – Test Group 5

All test specimens were subjected to 113°C for 168 hrs. Testing was conducted in accordance with UL 486D, Sections 9.4.1.1(a).

3.20 Final Examination of Product

Specimens were visually examined for evidence of physical damage detrimental to product performance. Testing was conducted in accrodance with EIA-364-18.