STRADA Mesa* High Speed Mezzanine Press-Fit Differential Connector System Qualification Testing

1. INTRODUCTION

1.1 Purpose

Testing was performed on the TE Connectivity (TE) STRADA Mesa High Speed Mezzanine Press-Fit Differential Connector System to determine its conformance to the requirements of Product Specification 108-2375, Revision A.

1.2 Scope

This report covers the electrical, mechanical, and environmental performance of the TE STRADA Mesa High Speed Mezzanine Press-Fit Differential Connector System. Testing was performed at the Harrisburg Electrical Components Test Laboratory between 12/29/2010 and 8/7/2012. The test file numbers for the testing are: EA20100095T, EA20110188T, EA20110904T, EA20120025T, EA20120294T, and EA20120359T. This documentation is on file at and available from the Harrisburg Electrical Components Test Laboratory.

1.3 Conclusion

All part numbers listed in paragraph 1.5 conformed to the electrical, mechianical, and environmental performance requirements of Product Specification 108-2375, Revision A.

1.4 Product Description

The STRADA Mesa High Speed Mezzanine Press-Fit Differential Connector System provides for interconnection of parallel printed wiring boards. These connectors are available with contact configurations for high speed differential pairs, high-density, single-ended signals, or power applications.

1.5 Test Specimens

The test specimens were representative of normal production lots, and specimens identified with the following part numbers were used for this test. Refer to Table 1 for specimen details.

Table 1 – Test Specimens

Test Group	Qty	Part Number	Description
1, 2, 4, 7	5 each	7-2057470-8 & 5-2057471-1	STRADA Mesa 28 mm Header and Receptacle Au contacts
3	3 each	2-2057470-8 & 2057471-1	STRADA Mesa 28 mm Header and Receptacle Au contacts
5	5 each**	7-2057470-8 & 5-2057471-1	STRADA Mesa 28 mm Header and Receptacle Au contacts
6	4 each	7-2057470-8 & 5-2057471-1	STRADA Mesa 28 mm Header and Receptacle Au contacts
8	10 each	7-2057470-8 & 5-2057471-1	STRADA Mesa 28 mm Header and Receptacle Au contacts
1, 2, 4, 7	5 each	7-2057470-8 & 5-2057471-1	STRADA Mesa 28 mm Header and Receptacle PdNi contacts
5	5 each**	7-2057470-8 & 5-2057471-1	STRADA Mesa 28 mm Header and Receptacle PdNi contacts
6	4 each	7-2057470-8 & 5-2057471-1	STRADA Mesa 28 mm Header and Receptacle PdNi contacts
8	10 each	7-2057470-8 & 5-2057471-1	STRADA Mesa 28 mm Header and Receptacle PdNi contacts
6	4 each	60-1042759 Rev A & 60-1042759-1 Rev A	STRADA Mesa Receptacle & Header T-rise PCB

Table 1 – Test Specimens, continued

Test Group	Qty	Part Number	Description
1, 2, 4, 5, 7, 8	70	60-1042518-1 & 60-1042518-2	STRADA Mesa LLCR PCB's

NOTE The low level contact resistance printed circuit boards were designed to read all 109 contacts in the differential pair region, and 83 of the 84 contacts in the single-ended region.

**Test Group 5 contained one set of 5 specimens for LLCR Testing, and two additional sets of 5 specimens each populated with either signal only or power only contacts for mating/unmating force measurements.

1.6 Qualification Test Sequence

The test specimens referred to in paragraph 1.5 were tested according to the test sequences listed in Table 2.

Table 2 – Test Sequence

Test or Examination	Test Group (a)							
	1	2	3	4	5	6	7	8
	Test Sequence (b)							
Initial Examination of Product	1	1	1	1	1	1	1	1
LLCR	2,4,6,8,10,12,14,16	2,4,6,8,10,12		2,4,6,8,10,12	3,5	2,5,7,9,11,13	2,4	2,4,6,8,10,12,14
Contact Resistance, rated current						15		
Insulation Resistance			2,6					
Withstanding Voltage			3,7					
Current rating						3,14		
Vibration, sinusoidal				7				
Mechianical Shock				9				
Durability, 25 cycles	3(c), 15(d)	5(c), 11(d)		3(c), 11(d)				
Durability, 20 cycles						4		3
Durability, 250 cycles							3	
Mating/Unmating Force					2,6			
Disturbed Interface	13							
Reseating								13
Humidity/ Temperature Cycling		9	5					
High Temperature Life, 105°C, 120 hours						6		5
High Temperature Life, 105°C, 500 hours					4			
Thermal Shock		3	4					
Thermal Disturbance						12		11
Mixed Flowing Gas, 14 days						8(e),10(f)		7(e),9(f)
Mixed Flowing Gas, 20 days	5(g),7(g),9(h),11(h)							
Dust		7		5				
Final Examination of Product	17	13	8	13	7	16	5	15

NOTE

(a) See paragraph 1.5.
(b) Numbers indicate sequence which tests were performed.
(c) First half of the total number of specified cycles.
(d) Second half of the total number of specified cycles.
(e) Ten days unmated.
(f) Four days mated.
(g) Five days unmated.
(h) Five days mated.

1.7 Environmental Conditions

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

Temperature: 15°C to 35°C
Relative Humidity: 20% to 80%

2. SUMMARY OF TESTING

2.1 Initial Examination of Product – All Test Groups

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

2.2 Low Level Contact Resistance (LLCR) – Test Groups 1, 2, 4, 5, 6, 7 and 8

All low level contact resistance measurements taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage were less than 21 milliohms initially for the signal contacts and had a change in resistance (ΔR) of less than 10 milliohms after testing. All power contacts were less than 2.0 milliohms initially and had a change in resistance (ΔR) of less than 4 milliohms after testing. Refer to Tables 3 through 16.

Table 3 – Test Group 1, Au LLCR Summary Data in milliohms

	Initial	After 13 Cycl Dur.	After 5 days MFG UM	After 10 days MFG UM	After 5 days MFG Mated	After 10 days Mated MFG	After Dist Interface	After Final Durability
	Actual	*Delta*	*Delta*	*Delta*	*Delta*	*Delta*	*Delta*	*Delta*
Differential Pair Contact Region								
Min	7.75	-1.15	-0.92	-0.99	-1.20	-1.09	-1.25	-1.27
Max	9.73	0.34	0.71	3.15	5.05	5.93	4.43	1.50
Avg	8.42	-0.14	-0.03	-0.01	-0.07	-0.05	0.00	-0.07
Std	0.32	0.21	0.23	0.32	0.43	0.47	0.45	0.26
N =	545	545	545	545	545	545	545	545
Single-Ended Signal Contact Region								
Min	7.76	-1.80	-1.76	-1.82	-1.85	-1.84	-1.74	-1.78
Max	10.09	0.89	0.74	1.72	1.61	1.57	0.62	0.56
Avg	8.45	-0.15	-0.05	-0.05	-0.10	-0.08	-0.06	-0.12
Std	0.31	0.25	0.25	0.27	0.28	0.29	0.26	0.26
N =	414*	414*	414*	414*	414*	414*	414*	414*
Power Contacts								
Min	0.96	-0.01	-0.02	-0.03	-0.08	-0.02	-0.01	-0.02
Max	1.00	0.03	0.03	0.02	0.75	0.01	0.03	0.03
Avg	0.97	0.00	0.01	0.00	0.03	0.00	0.01	0.00
Std	0.01	0.01	0.01	0.01	0.14	0.01	0.01	0.01
N =	30	30	30	30	30	30	30	30

Note Reading # 72 of specimen # 106 was not measured because of a missing pin on access connector.

Table 4 – Test Group 1, PdNi LLCR Summary Data in milliohms

	Initial	After 13 Cycl Dur.	After 5 days MFG UM	After 10 days MFG UM	After 5 days MFG Mated	After 10 days Mated MFG	After Dist Interface	After Durability
	Actual	*Delta*	*Delta*	*Delta*	*Delta*	*Delta*	*Delta*	*Delta*
Differential Pair Contact Region								
Min	7.36	-1.74	-1.48	-1.76	-1.63	-1.77	-1.35	-1.58
Max	9.58	1.24	1.57	2.46	5.81	8.65	7.41	0.79
Avg	8.06	-0.19	0.07	0.05	0.04	0.05	0.10	-0.04
Std	0.31	0.18	0.23	0.34	0.52	0.64	0.59	0.24
N =	545	545	545	545	545	545	545	545
Single-Ended Signal Contact Region								
Min	7.39	-2.28	-2.13	-2.22	-2.26	-2.27	-2.29	-2.27
Max	10.36	1.94	0.62	0.85	1.48	1.90	1.22	0.47
Avg	7.98	-0.12	0.10	0.04	0.02	0.03	0.04	-0.05
Std	0.30	0.22	0.23	0.23	0.25	0.28	0.25	0.22
N =	415	415	415	415	415	415	415	415
Power Contacts								
Min	0.98	-0.03	-0.02	-0.02	-0.18	-0.03	-0.01	-0.01
Max	1.03	0.08	0.03	0.05	0.24	0.05	0.06	0.07
Avg	1.00	0.00	0.01	0.01	0.01	0.00	0.03	0.03
Std	0.01	0.02	0.01	0.02	0.07	0.01	0.02	0.02
N =	30	30	30	30	30	30	30	30

Table 5 – Test Group 2, Au LLCR Summary Data in milliohms

	Initial	After T-Shock	After 13 Cycles Dur	After Dust	After Humidity/ Temp Cycling	After 12 Cycles Dur
	Actual	*Delta*	*Delta*	*Delta*	*Delta*	*Delta*
Differential Pair Contact Region						
Min	7.77	-1.74	-1.75	-1.68	-1.97	-2.03
Max	10.15	0.96	0.45	1.63	3.48	1.04
Avg	8.54	-0.36	-0.19	-0.19	-0.34	-0.36
Std	0.34	0.25	0.24	0.29	0.39	0.29
N =	545	545	545	545	545	545
Single-Ended Signal Contact Region						
Min	7.78	-2.51	-2.31	-2.27	-2.56	-2.43
Max	10.69	0.48	1.19	0.97	1.26	3.23
Avg	8.59	-0.35	-0.22	-0.26	-0.43	-0.39
Std	0.38	0.28	0.28	0.31	0.35	0.37
N =	415	415	415	415	415	415
Power Contacts						
Min	0.95	-0.03	-0.02	-0.02	-0.04	-0.03
Max	1.00	0.03	0.02	0.03	0.00	0.02
Avg	0.98	-0.01	0.00	0.00	-0.02	0.00
Std	0.01	0.01	0.01	0.01	0.01	0.01
N =	30	30	30	30	30	30

Table 6 – Test Group 2, PdNi LLCR Summary Data in milliohms

	Initial	After T-Shock	After 13 Cycles Dur	After Dust	After Humidity/ Temp Cycling	After 12 Cycles Dur
	Actual	*Delta*	*Delta*	*Delta*	*Delta*	*Delta*
Differential Pair Contact Region						
Min	6.66	-2.39	-2.44	-2.38	-2.40	-2.54
Max	10.13	0.93	0.66	2.66	6.37	1.42
Avg	8.08	-0.08	-0.01	0.04	0.09	-0.03
Std	0.30	0.22	0.21	0.37	0.54	0.30
N =	545	545	545	545	545	545
Single-Ended Signal Contact Region						
Min	7.42	-1.53	-1.50	-1.56	-1.83	-1.71
Max	9.84	0.51	0.52	2.70	2.84	0.83
Avg	8.10	-0.09	-0.05	-0.04	-0.04	-0.12
Std	0.31	0.20	0.20	0.36	0.40	0.27
N =	415	415	415	415	415	415
Power Contacts						
Min	0.98	-0.01	0.00	0.00	-0.02	-0.01
Max	1.03	0.03	0.07	0.05	0.02	0.05
Avg	1.00	0.01	0.02	0.02	0.00	0.02
Std	0.01	0.01	0.02	0.01	0.01	0.01
N =	30	30	30	30	30	30

Table 7- Test Group 4, Au LLCR Summary Data in milliohms

	Initial	Durability 13 Cycles	After Dust	After Vibration	After Mechanical Shock	After Durability 12 Cycles
	Actual	*Delta*	*Delta*	*Delta*	*Delta*	*Delta*
Differential Pair Contact Region						
Min	7.77	-1.78	-1.79	-1.92	-2.03	-2.05
Max	10.27	0.42	0.45	1.35	2.22	0.23
Avg	8.64	-0.31	-0.38	-0.48	-0.50	-0.59
Std	0.40	0.28	0.31	0.34	0.38	0.33
N	545	545	545	545	545	545
Single-Ended Signal Contact Region						
Min	7.78	-1.78	-1.76	-1.88	-1.94	-2.04
Max	9.93	0.26	0.17	0.16	0.32	0.09
Avg	8.64	-0.31	-0.36	-0.46	-0.46	-0.55
Std	0.37	0.25	0.27	0.28	0.29	0.30
N	415	415	415	415	415	415
Power Contacts						
Min	0.95	-0.03	-0.02	-0.03	-0.04	-0.03
Max	1.00	0.02	0.01	0.01	0.02	0.02
Avg	0.98	0.00	0.00	-0.01	-0.01	-0.01
Std	0.01	0.01	0.01	0.01	0.01	0.01
N	30	30	30	30	30	30

Table 8- Test Group 4, PdNi LLCR Summary Data in milliohms

	Initial	Durability 13 Cycles	After Dust	After Vibration	After Mechanical Shock	After Durability 12 Cycles
	Actual	*Delta*	*Delta*	*Delta*	*Delta*	*Delta*
Differential Pair Contact Region						
Min	7.32	-3.86	-3.86	-4.07	-4.06	-4.13
Max	12.02	0.31	2.47	0.85	1.69	0.89
Avg	8.02	-0.08	-0.08	-0.11	-0.15	-0.12
Std	0.34	0.22	0.27	0.31	0.28	0.26
N	545	545	545	545	545	545
Single-Ended Signal Contact Region						
Min	7.48	-2.15	-2.02	-2.08	-2.20	-2.18
Max	9.79	2.29	2.29	0.43	0.33	0.45
Avg	8.05	-0.02	-0.07	-0.17	-0.21	-0.16
Std	0.31	0.27	0.30	0.20	0.21	0.21
N	415	415	415	415	415	415
Power Contacts						
Min	0.99	-0.02	-0.03	-0.04	-0.04	-0.04
Max	1.04	0.04	0.02	0.01	0.01	0.01
Avg	1.01	0.00	-0.01	-0.02	-0.02	-0.01
Std	0.01	0.02	0.01	0.01	0.01	0.01
N	30	30	30	30	30	30

Table 9 – Test Group 5, Au LLCR Summary Data in milliohms

	Initial	After T-Life	Initial	After T-Life	Initial	After T-Life
	Actual	*Delta*	*Actual*	*Delta*	*Actual*	*Delta*
	Differential Pair Contact Region		**Single-Ended Signal Contact Region**		**Power Contacts**	
Min	7.80	-0.78	7.84	-0.68	0.96	-0.01
Max	9.75	2.13	9.84	2.54	0.99	0.02
Average	8.51	0.03	8.51	0.08	0.98	0.00
Std Dev	0.33	0.28	0.35	0.32	0.01	0.01
N =	545	545	415	415	30	30

Table 10 – Test Group 5, PdNi LLCR Summary Data in milliohms

	Initial	After T-Life	Initial	After T-Life	Initial	After T-Life
	Actual	*Delta*	*Actual*	*Delta*	*Actual*	*Delta*
	Differential Pair Contact Region		**Single-Ended Signal Contact Region**		**Power Contacts**	
Min	7.26	-0.20	7.31	-0.07	0.99	0.00
Max	9.06	1.81	10.04	1.14	1.02	0.13
Average	8.08	0.58	8.01	0.40	1.00	0.04
Std Dev	0.29	0.35	0.31	0.20	0.01	0.04
N =	545	545	415	415	30	30

Table 11 – Test Group 6, Au LLCR Summary Data in milliohms

	Initial	After 20 Dur.	After T-Life	After MFG Unmated	After Mated MFG
	Actual	*Delta*	*Delta*	*Delta*	*Delta*
	Differential Pair Contact Region				
Min	8.13	-1.39	-1.26	-1.33	-3.19
Max	10.28	0.47	2.14	2.36	2.38
Avg	8.89	-0.16	0.19	0.14	-0.06
Std	0.38	0.31	0.44	0.63	0.72
N =	100	99***	100	100	100
	Single-Ended Signal Contact Region				
Min	7.59	-0.71	-1.35	-0.81	-1.08
Max	9.67	0.82	1.41	1.45	1.41
Avg	8.83	-0.17	0.11	-0.04	-0.24
Std	0.35	0.26	0.37	0.36	0.34
N =	112	112	112	112	112
	Power Contacts				
Min	0.94	-0.08	-0.09	-0.02	-0.23
Max	1.13	0.15	0.08	0.24	0.23
Avg	1.07	0.01	-0.01	0.06	0.01
Std	0.05	0.06	0.04	0.06	0.11
N =	24	24	24	24	24

Note

***Measurement 19 of specimen 1103 was eliminated because of a recording error.

Table 12 – Test Group 6, PdNi LLCR Summary Data in milliohms

	Initial	After 20 Dur.	After T-Life	After MFG Unmated	After Mated MFG
	Actual	*Delta*	*Delta*	*Delta*	*Delta*
	Differential Pair Contact Region				
Min	7.86	-0.49	-1.36	-0.04	-0.39
Max	9.01	0.42	3.08	4	5.06
Avg	8.46	-0.1	0.83	1.02	0.99
Std	0.28	0.19	0.55	0.79	1.03
N =	100	100	100	100	100
	Single-Ended Signal Contact Region				
Min	7.72	-0.79	-0.23	-0.35	-0.92
Max	9.21	0.38	1.62	1.18	1.44
Avg	8.5	-0.22	0.37	0.32	0.11
Std	0.33	0.2	0.33	0.29	0.36
N =	112	112	112	112	112
	Power Contacts				
Min	0.9	-0.07	-0.15	0.07	0.12
Max	1.17	0.28	0.23	1	1.33
Avg	1.09	0.03	0.04	0.43	0.52
Std	0.05	0.07	0.08	0.25	0.31
N =	24	24	24	24	24

Table 13 – Test Group 7, Au LLCR Summary Data in milliohms

	Initial	After Durability	Initial	After Durability	Initial	After Durability
	Actual	*Delta*	*Actual*	*Delta*	*Actual*	*Delta*
	Differential Pair Contact Region		Single-Ended Signal Contact Region		Power Contacts	
Min	7.70	-0.82	7.86	-0.55	0.95	-0.03
Max	9.82	4.81	9.12	2.16	0.99	0.04
Average	8.38	0.17	8.36	0.13	0.97	0.00
Std Dev	0.29	0.43	0.25	0.25	0.01	0.02
N =	545	545	415	415	30	30

Table 14 – Test Group 7, PdNi LLCR Summary Data in milliohms

	Initial	After Durability	Initial	After Durability	Initial	After Durability
	Actual	*Delta*	*Actual*	*Delta*	*Actual*	*Delta*
	Differential Pair Contact Region		Single-Ended Signal Contact Region		Power Contacts	
Min	6.65	-2.61	7.45	-0.65	0.99	-0.03
Max	10.56	7.23	8.81	1.51	1.03	0.07
Average	8.07	0.17	8.11	-0.09	1.01	0.01
Std Dev	0.31	0.82	0.26	0.25	0.01	0.02
N =	545	545	415	415	30	30

Table 15 – Test Group 8, Au LLCR Summary Data in milliohms

	Initial	After 20 Cycles Durability	After 120 hrs T-Life	After MFG Unmated	After MFG Mated	After Thermal Disturbance	After Reseating
	Actual	*Delta*	*Delta*	*Delta*	*Delta*	*Delta*	*Delta*
Differential Pair Contact Region							
Min	7.76	-2.35	-2.62	-2.23	-2.17	-2.34	-2.16
Max	10.97	0.54	0.94	2.23	3.19	3.90	2.64
Avg	8.68	-0.25	-0.38	-0.02	-0.07	-0.26	-0.06
Std	0.39	0.28	0.32	0.33	0.35	0.38	0.35
N =	1090	1090	1090	1090	1090	1090	1090
Single-Ended Signal Contact Region							
Min	7.83	-1.32	-1.51	-0.89	-1.22	-1.42	-1.22
Max	9.82	0.56	0.28	2.85	1.07	0.56	2.29
Avg	8.55	-0.15	-0.29	0.06	-0.02	-0.21	-0.04
Std	0.34	0.21	0.25	0.29	0.25	0.26	0.27
N =	830	830	830	830	830	830	830
Power Contacts							
Min	0.95	-0.01	-0.02	0.00	-0.01	-0.03	-0.01
Max	0.98	0.03	0.04	0.08	0.05	0.04	0.10
Avg	0.97	0.00	0.00	0.02	0.01	0.00	0.03
Std	0.01	0.01	0.01	0.02	0.01	0.01	0.02
N =	60	60	60	60	60	60	60

Table 16 – Test Group 8, PdNi LLCR Summary Data in milliohms

	Initial	After 20 Cycles Durability	After 120 hrs T-Life	After MFG Unmated	After MFG Mated	After Thermal Disturbance	After Reseating
	Actual	*Delta*	*Delta*	*Delta*	*Delta*	*Delta*	*Delta*
Differential Pair Contact Region							
Min	7.55	-0.43	-0.52	-0.20	-0.24	-0.30	-0.22
Max	9.00	0.42	0.73	2.96	3.08	2.94	2.83
Avg	8.20	-0.02	0.08	0.40	0.33	0.21	0.38
Std	0.27	0.13	0.18	0.26	0.23	0.27	0.26
N =	1090	1090	1090	1090	1090	1090	1090
Single-Ended Signal Contact Region							
Min	7.47	-2.73	-2.60	-2.27	-2.26	-2.22	-2.44
Max	10.85	0.39	0.89	1.05	1.07	1.05	1.46
Avg	8.16	-0.02	0.05	0.30	0.27	0.16	0.29
Std	0.29	0.16	0.19	0.20	0.21	0.21	0.21
N =	830	830	830	830	830	830	830
Power Contacts							
Min	0.96	-0.06	-0.04	-0.03	-0.04	-0.03	0.00
Max	1.02	0.00	0.03	0.06	0.04	0.03	0.14
Avg	0.98	-0.02	-0.01	0.02	0.01	0.00	0.04
Std	0.01	0.01	0.01	0.02	0.01	0.01	0.03
N =	60	60	60	60	60	60	60

2.3 Contact Resistance, rated current – Test Group 6

Both differential pair and single ended signal contacts were under the maximum resistance requirement of 21 milliohms; and the power contacts were under the maximum resistance requirement of 3 milliohms for a 28 millimeter stack height connector system. Refer to Tables 17 and 18 for the rated current results summary data.

Table 17– Resistance at Rated Current Data Summary in milliohms

	Gold Plating				PdNi Plating			
	Differential Pair				Differential Pair			
Id ->	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*
Min	8.52	8.65	8.58	8.41	5.25	4.57	5.01	5.59
Max	13.02	11.76	10.82	9.16	6.85	8.32	8.44	8.23
Avg	9.47	9.13	9.21	8.82	6.00	5.29	5.83	6.44
Std	1.19	0.60	0.57	0.21	0.39	0.79	0.79	0.76
N	25	25	25	25	25	25	25	25
	Single Ended Contacts				Single Ended			
Id ->	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*
Min	8.36	8.50	8.55	8.48	4.59	6.45	7.08	7.71
Max	9.48	9.22	9.16	9.19	6.82	7.80	8.15	8.54
Avg	8.74	8.77	8.81	8.82	6.33	7.04	7.79	8.15
Std	0.30	0.22	0.20	0.21	0.46	0.28	0.33	0.25
N	28	28	28	28	28	28	28	28

Table 18 – Resistance at Rated Current Data Summary in milliohms

	Gold Plating				PdNi Plating			
	Power				Power			
Id ->	*1*	*2*	*3*	*4*	*1*	*2*	*3*	*4*
Min	1.11	1.10	1.12	1.08	1.37	1.20	1.28	1.33
Max	1.18	1.14	1.16	1.18	2.64	1.77	1.69	1.96
Avg	1.14	1.12	1.14	1.13	1.74	1.42	1.58	1.57
Std	0.02	0.02	0.02	0.03	0.46	0.19	0.16	0.25
N	24	24	24	24	24	24	24	24

2.4 Insulation Resistance – Test Group 3

All initial and final insulation resistance measurements were greater than the requirement of 1000 megohms minimum.

2.5 Withstanding Voltage – Test Group 3

All initial and final dielectric withstanding voltage measurements met the requirement of a one minute hold with no breakdown, flashover or excessive leakage current greater than 5 milliamperes.

2.6 Current Rating – Test Group 6

All specimens had a temperature rise of less than 30°C above ambient when tested using a baseline rated current of 1.5 amperes for signal configurations. Refer to Figures 1 through 8 for the current rating curves. All specimens had a temperature rise of less than 30°C above ambient when tested using the currents listed in Figure 9 for the power configurations listed. Refer to Figures 10 through 17.

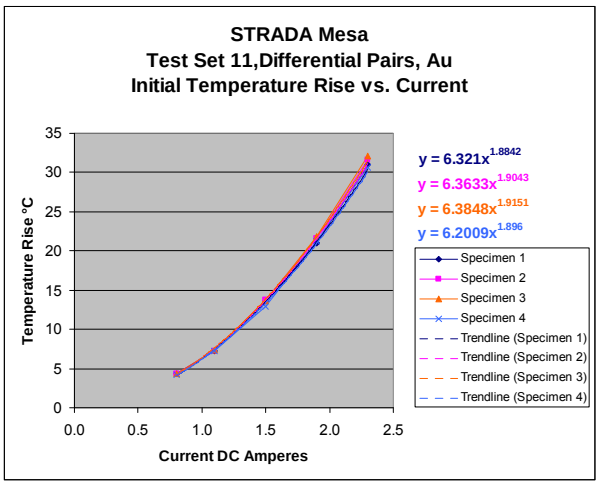

Figure 1 Initial T-Rise DP Au

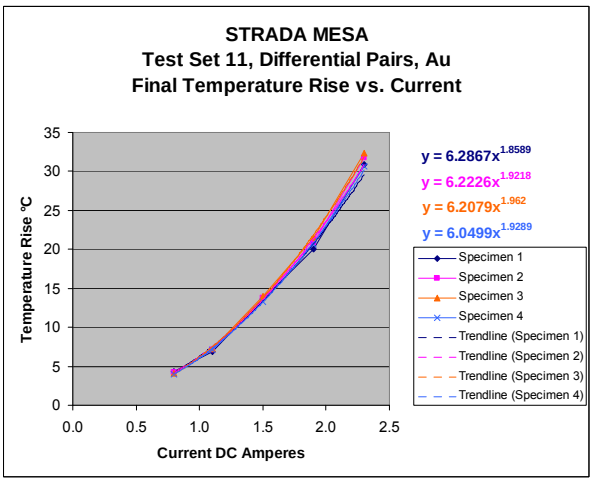

Figure 2 Final T-Rise DP Au

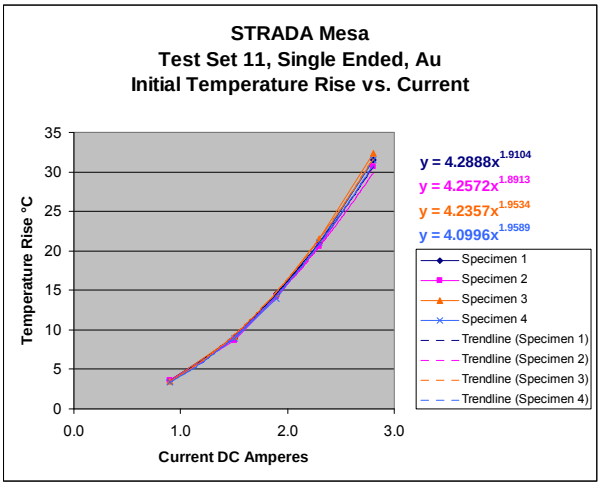

Figure 3 Initial T-Rise Single Ended, Au

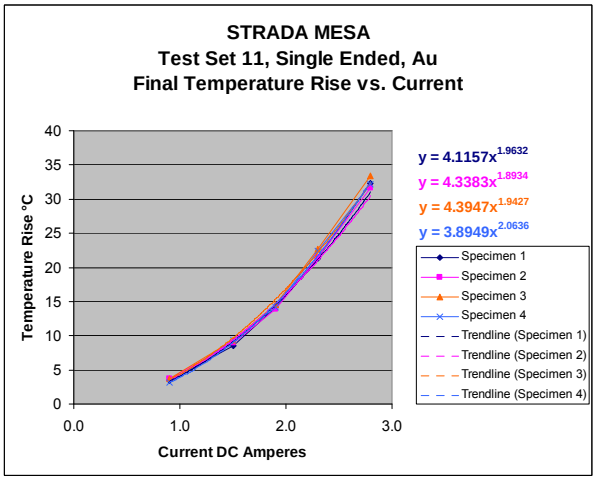

Figure 4 Final T-Rise Single Ended, Au

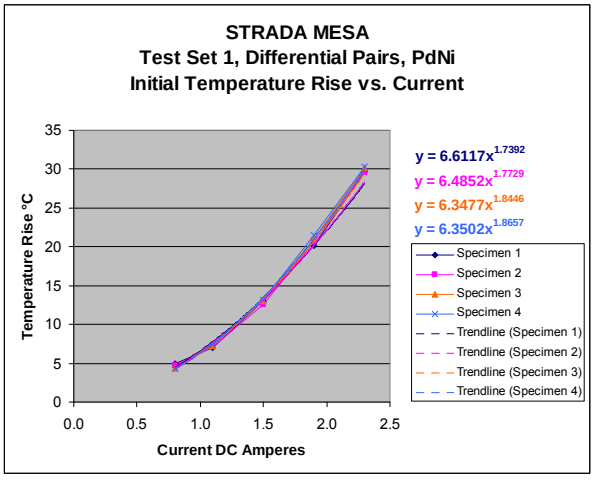

Figure 5 Initial T-Rise DP, PdNi

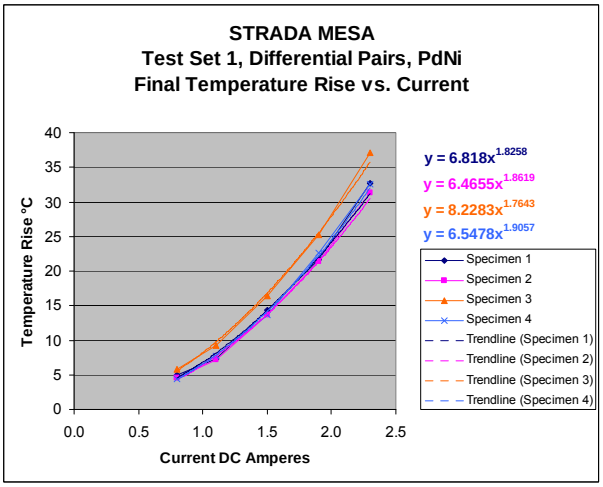

Figure 6 Final T-Rise DP, PdNi

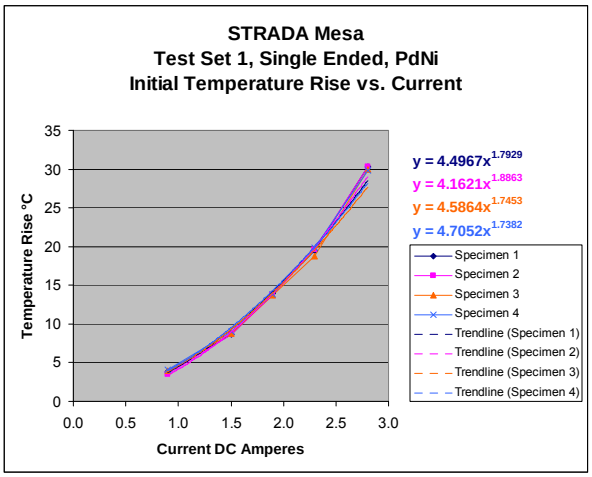

Figure 7 Initial T-Rise Single Ended, PdNi

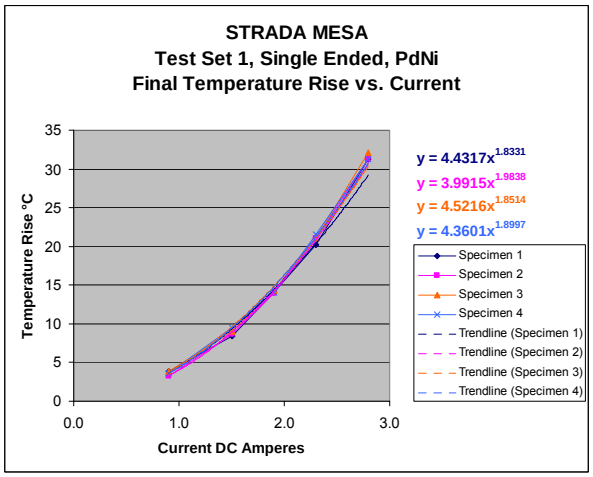

Figure 8 Final T-Rise Single Ended, PdNi

Number of Contacts Energized	Single Contact	2 Adjacent Contacts	3 Adjacent Contacts	4 Adjacent Contacts	5 Adjacent Contacts	6 Adjacent Contacts
Current (amperes)	24	22	20	19	19	18

Figure 9 – Power Contact Current Rating Within Single Column of 6 Power Contacts

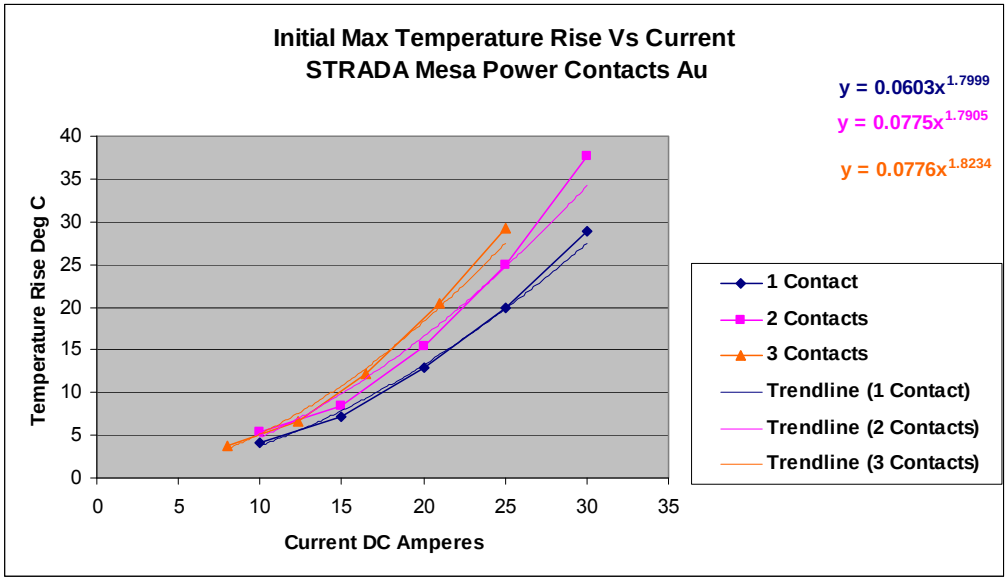

Figure 10 Initial Max T-Rise, 1 - 3 Power Contacts, Au

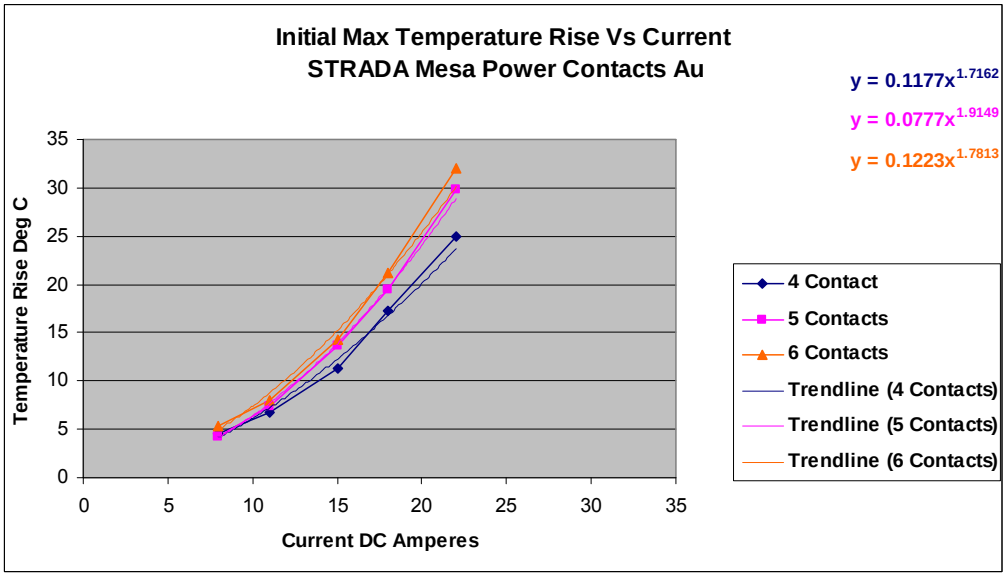

Figure 11 Initial Max T-Rise, 4 - 6 Power Contacts, Au

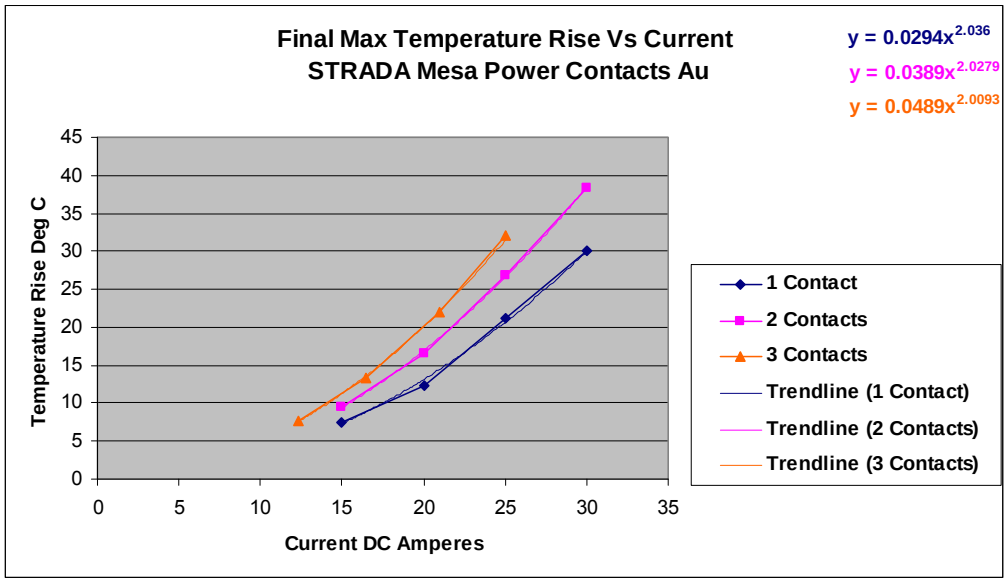

Figure 12 Final Max T-Rise, 1 - 3 Power Contacts, Au

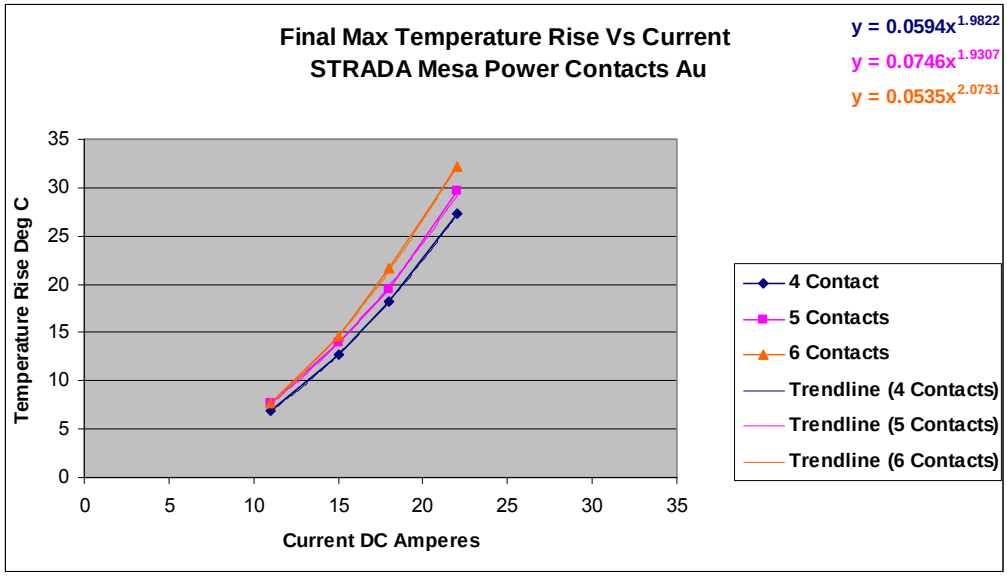

Figure 13 Final Max T-Rise, 4 - 6 Power Contacts, Au

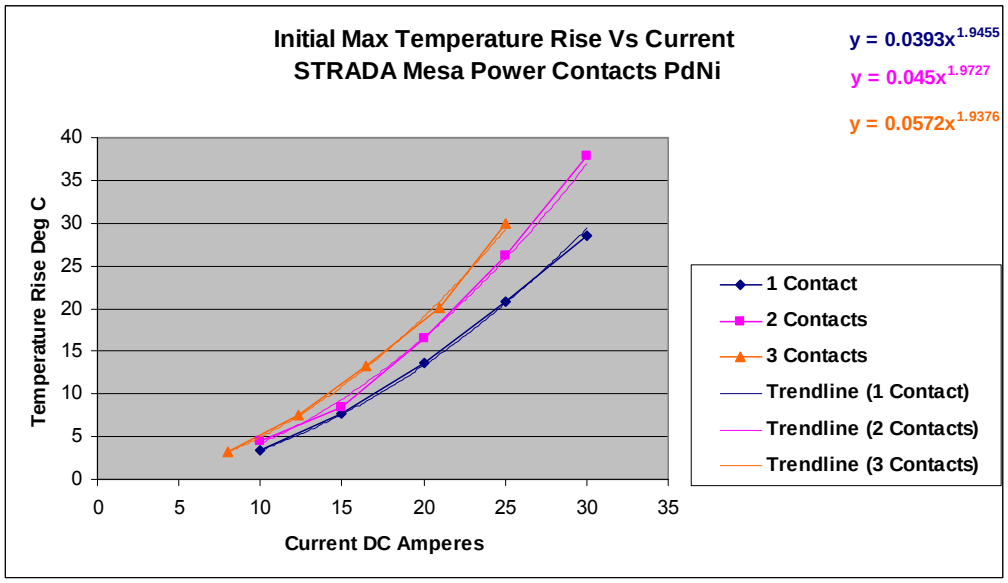

Figure 14 Initial Max T-Rise, 1 - 3 Power Contacts, PdNi

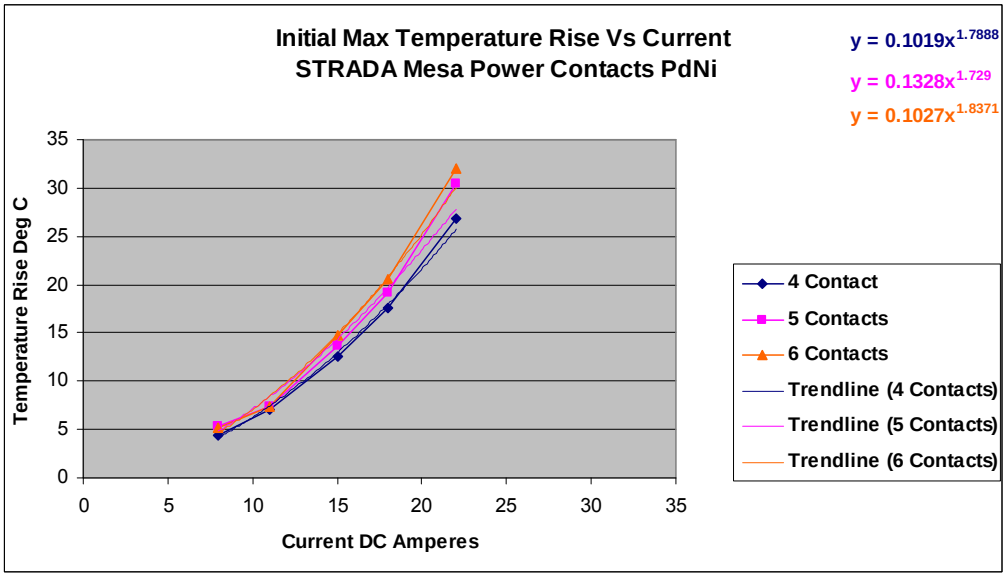

Figure 15 Initial Max T-Rise, 4 - 6 Power Contacts, PdNi

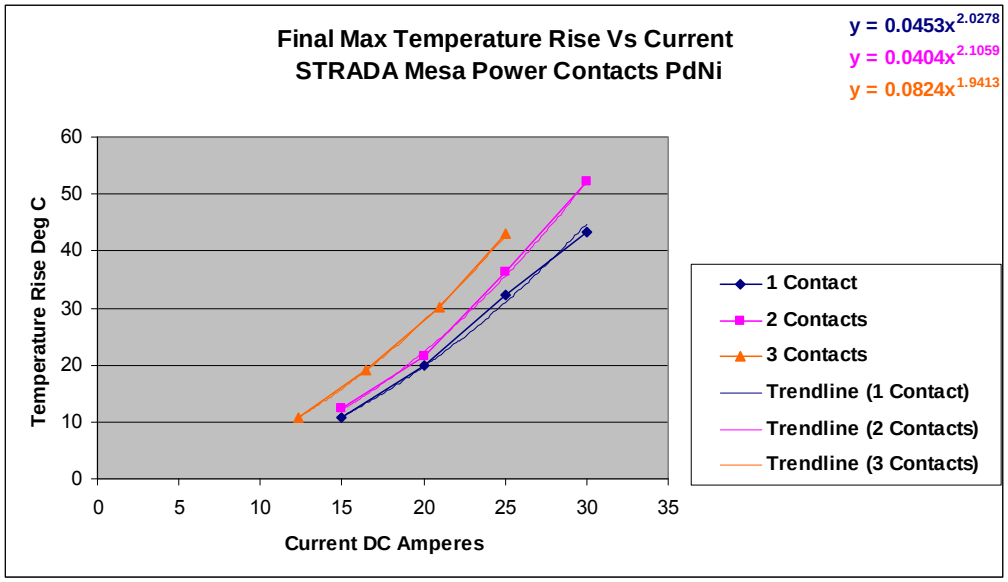

Figure 16 Final Max T-Rise, 1- 3 Power Contacts PdNi

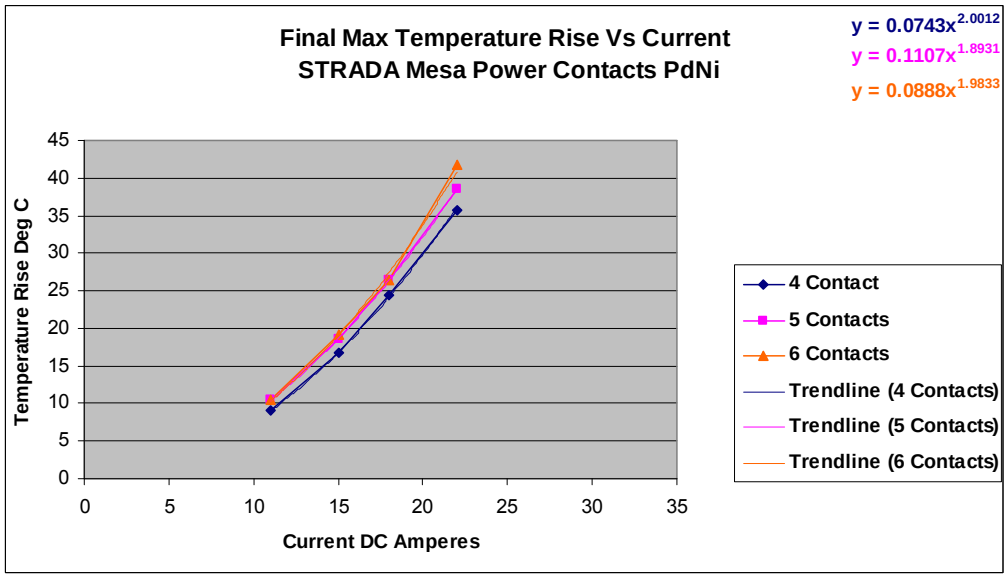

Figure 17 Final Max T-Rise, 4 - 6 Power Contacts PdNi

2.7 Vibration, sinusoidal – Test Group 4

The vibration exposure was completed with no evidence of physical damage and no discontinuities of one microsecond or greater.

2.8 Mechanical Shock – Test Group 4

The mechanical shock exposure was completed with no evidence of physical damage and no discontinuities of one microsecond or greater.

2.9 Durability, 25 cycles – Test Groups 1, 2 and 4

No physical damage occurred to the specimens as a result of manually mating and unmating the specimens 25 times.

2.10 Durability, 20 cycles – Test Groups 6 and 8

No physical damage occurred to the specimens as a result of manually mating and unmating the specimens 20 times.

2.11 Durability, 250 cycles – Test Group 7

No physical damage occurred to the specimens as a result of manually mating and unmating the specimens 250 times.

2.12 Mating/Unmating Force – Test Group 5

All specimens met a maximum mating force requirement of 75 grams for signals and 1200 grams for power contacts. All specimens met a minimum unmating force requirement of 15 grams for signal contacts and 120 grams for power contacts. Refer to tables 19 through 22 below for the initial and final mating and unmating forces for the power and signal contacts.

Table 19 – Mating and Unmating Force Data for Signal Contacts Au (grams per contact)

	Initial		Final	
Specimen #	Mate	Unmate	Mate	Unmate
Min	30.55	18.41	14.09	6.91
Max	32.27	20.53	16.00	9.32
Avg	31.50	19.68	15.17	8.11
Std	0.616	0.992	0.809	0.996

NOTE There are 193 signal pins therefore the individual contact force was determined by dividing the connector force by 193.

Table 20 – Mating and Unmating Force Data for Signal Contacts PdNi (grams per contact)

	Initial		Final	
Specimen #	Mate	Unmate	Mate	Unmate
Min	33.69	15.49	14.73	5.42
Max	34.78	17.12	15.52	10.24
Avg	34.08	16.09	15.17	7.71
Std	0.424	0.628	0.359	1.71

Table 21 – Mating and Unmating Force Data for Power Contacts Au (grams per contact)

	Initial		Final	
Specimen #	Mate	Unmate	Mate	Unmate
Min	718.28	232.23	431.31	156.65
Max	1159.8	284.94	587.47	201.92
Avg	900.742	267.96	508.974	181.828
Std	169.549	21.882	61.043	18.670

NOTE There are 6 power contacts therefore the individual contact force was determined by dividing the connector force by 6.

Table 22 – Mating and Unmating Force Data for Power Contacts PdNi (grams per contact)

Specimen #	Initial		Final	
	Mate	Unmate	Mate	Unmate
Min	1044.99	230.07	480.29	178.8
Max	1085.07	248.67	528.1	183.39
Avg	1056.586	241.118	496.504	181.544
Std	16.232	7.037	18.842	1.734

2.13 Disturbed Interface – Test Group 1

No evidence of physical damage was visible as a result of disturbing the interface approximately 0.10 mm or less.

2.14 Reseating – Test Group 8

No evidence of physical damage was visible as a result of reseating (mating and unmating) the specimens three times.

2.15 Humidity/temperature Cycling – Test Groups 2 and 3

No evidence of physical damage detrimental to produce performance was visible as a result of exposure to humidity-temperature cycling.

2.16 High Temperature Life, 105°C, 120 hours – Test Groups 6 and 8

No evidence of physical damage detrimental to product performance was visible as a result of exposure to high temperature life for 120 hours.

2.17 High Temperature Life, 105°C, 500 hours – Test Group 5

No evidence of physical damage detrimental to product performance was visible as a result of exposure to high temperature life for 500 hours.

2.18 Thermal Shock – Test Groups 2 and 3

No evidence of physical damage detrimental to product performance was visible as a result of exposure to thermal shock.

2.19 Thermal Disturbance – Test Groups 6 and 8

No evidence of physical damage detrimental to product performance was visible as a result of exposure to a thermal disturbance environment.

2.20 Mixed Flowing Gas, 14 days – Test Groups 6 and 8

No evidence of physical damage detrimental to product performance was visible as a result of exposure to the pollutants of Class IIA mixed flowing gas for 14 days.

2.21 Mixed Flowing Gas, 20 days – Test Group 1

No evidence of physical damage was visible as a result of exposure to the pollutants of Class IIA mixed flowing gas for 20 days.

2.22 Dust – Test Groups 2 and 4

No evidence of physical damage was visible as a result of exposure to circulating benign dust.

2.23 Final Examination of Product – All Test Groups

Where specified, 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.

3.2 Low Level Contact Resistance (LLCR)

Low level contact resistance measurements at low level current were performed in accordance with EIA-364-23 using a four terminal measuring technique. The test current was maintained at 100 milliamperes maximum with a 20 millivolt maximum open circuit voltage.

3.3 Contact Resistance, rated current

Resistance at rated current was measured energizing the series string of differential pair and single ended contacts at 1.5 amps and the six power contacts wired in series at 18 amps. The three contact types were energized and measured independently of each other. See Figure 18 for signal contact and power contact energizing patterns.

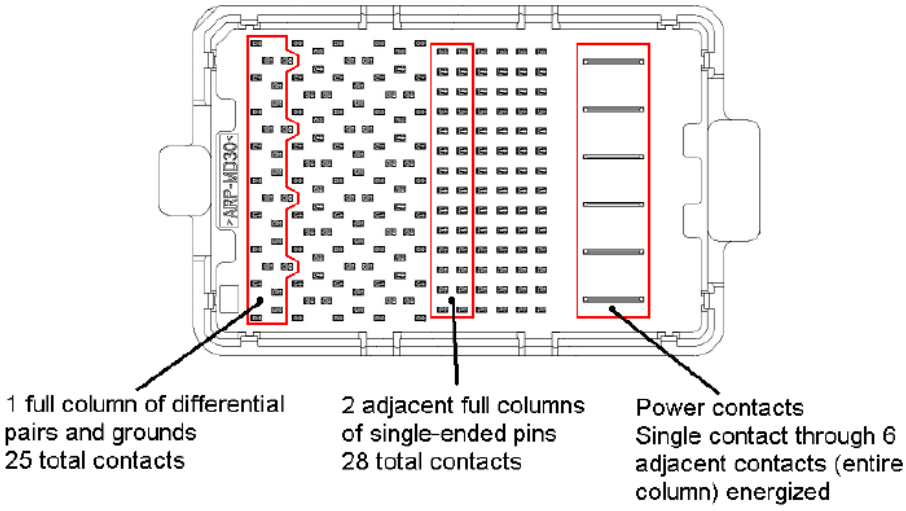

Figure 18 – Energized Contact Pattern for Current Rating and Temperature Rise Testing

3.4 Insulation Resistance

Insulation resistance was measured between 10 signal-signal differential pairs and between 10 signal-signal adjacent single ended positions of the mated specimens. A test voltage of 500 volts DC was applied for one minute before the resistance was measured.

3.5 Withstanding Voltage

A test potential of 750 volts AC was applied between 10 signal to signal differential parts and between 10 signal-signal adjacent single ended positions of mated specimens. This potential was applied for one minute and then returned to zero.

3.6 Current Rating

Specimens were mounted to a 1.57 mm nominal thickness print circuit board. The power contact area of the test board has 2 oz copper layers on the top and bottom surfaces, the traces were 6.89 mm wide and connected to the power contacts. Two additional 2 oz copper internal planes were added to the board, evenly spaced through the thickness. The internal planes were not connected to the contacts. The boards were designed to allow 1, 2, 3, 4, 5, or 6 adjacent power contacts to be energized. The signal contact area of the test board has a 2 oz copper layer on the bottom surface; the traces were 0.7 mm wide and connected to the inputs between contacts to create the desired contact chains for the temperature rise measurements. The chains used for the measurements consisted of one full column of ground pins and signal pins in the differential pair section of the connector and two full columns of signal pins in the single-ended section of the connector. The receptacle housing supports were removed allowing the temperature rise to be measured with the infrared camera. The exposed contacts were coated with flat black paint, which is used as an emissivity correction coating. The coating has a known value of 0.95 emittance; by knowing and raising the emittance value accurate temperature measurements can be taken. The infrared camera was used with the 34/80mm close up lens attached to the camera's standard optics (24° lens) to image the test specimens. ThermaCAM Researched 2001 thermal imaging processing system was used for the data analysis. The area tool software feature was used to determine maximum temperature of the exposed contacts. The area tool software feature allows a shape, which can be sized, to be placed on an area of interest. The pixels inside the shape are analyzed giving minimum, maximum, average, and standard deviation measurements of temperature. Refer to Figure 19 for an image of a test specimen.

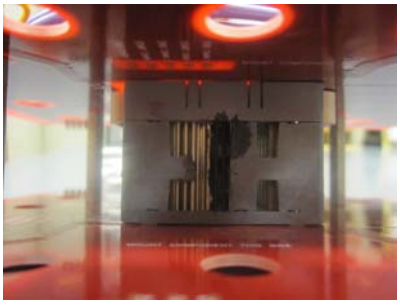

Figure 19 - T-rise Specimen

3.7 Vibration, sinusoidal

Mated specimens were subjected to sinusoidal vibration testing of 10 to 500 to 10 Hz traversed in 15 minutes with 1.5 mm maximum total excursion. Testing was performed for two hours in each of 3 mutually perpendicular planes. Contacts were monitored for discontinuities of 1 microsecond or longer duration.

3.8 Mechanical Shock

Mated specimens were subjected to 30 G's half-sine shock pulses of 11 milliseconds duration. Three shocks in each direction applied along 3 mutually perpendicular planes, for a total of 18 shocks. Contacts were monitored for discontinuities of 1 microsecond or longer duration.

3.9 Durability, 25 cycles

Specimens were mated and unmated 25 times at a maximum rate of 500 cycles per hour by hand. The first 13 cycles were performed prior to the specific environmental test in the sequence. The remaining 12 cycles shall be performed after environmental test.

3.10 Durability, 20 cycles

Specimens were mated and unmated 20 times at a maximum rate of 500 cycles per hour by hand.

3.11 Durability, 250 cycles

Specimens were mated and unmated 250 times at a maximum rate of 500 cycles per hour by hand.

3.12 Mating/Unmating Force

The forces required to mate and unmate each specimen was measured using a tensile/compression device along with a floating x-y table. The mating force was obtained as shown in Figure 20 and the unmating force was measured using the setup in Figure 21. The crosshead speed for both mating and unmating force was set for 0.5 in/min. Specimens were supplied on prototype test boards. Five specimens of each plating configuration were fully loaded with power contacts and five specimens of each plating configuration were fully loaded with signal contacts.

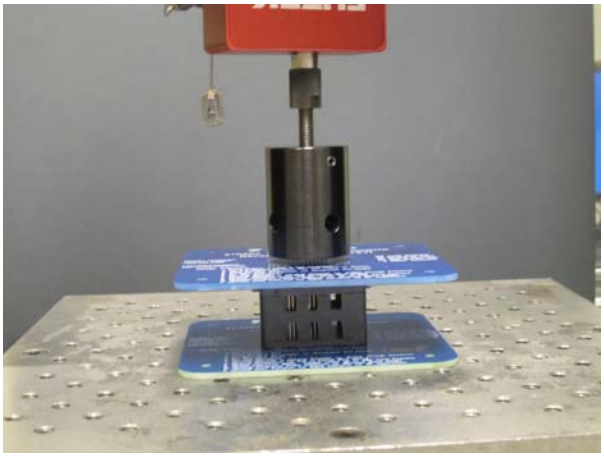

Figure 20 – Mating Force Setup

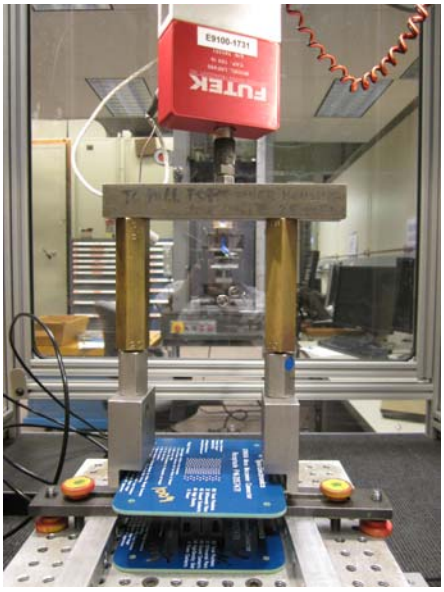

Figure 21 – Unmating Force Setup

3.13 Disturbed Interface

Each specimen was manually unmated to a distance of 0.10 mm, to ensure that the contact surfaces moved about 0.10 mm or less.

3.14 Reseating

Specimens were manually unmated and mated three times.

3.15 Humidity/temperature Cycling

Mated specimens were exposed to 50 cycles (500 hours) of humidity-temperature cycling. Each cycle lasted 10 hours and consisted of cycling the temperature between 25°C and 65°C while maintaining high humidity of 90 to 98% relative humidity. The temperature ramp was 2 hours per transition with a 4 hour dwell at 65°C and 2 hour dwell at 25°C.

3.16 High Temperature Life, 105°C, 120 hours

Mated specimens were exposed to an elevated dry heat temperature of 105°C for 120 hours.

3.17 High Temperature Life, 105°C, 500 hours

Mated specimens were exposed to an elevated dry heat temperature of 105°C for 500 hours.

3.18 Thermal Shock

Mated specimens were subjected to 5 cycles of thermal shock with each cycle consisting of 30 minute dwells at -55 and 105°C. The transition between temperatures was less than one minute.

3.19 Thermal Disturbance

Mated specimens were exposed to 10 cycles between 15 and 85°C with a minimum temperature ramp of 2°C per minute and a minimum dwell time of 5 minutes at each temperature extreme.

3.20 Mixed Flowing Gas, 14 days

Specimens were subjected to Class IIA mixed flowing gas in accordance with EIA-364-65, Class IIA. Both halves of the specimens were exposed in the unmated condition for the first ten days of exposure. The specimens were mated for the remaining four days of exposure. The average copper corrosion rate was 14.8$\mu g/cm^2$/day (Required: 12-16).

3.21 Mixed Flowing Gas, 20 days

Specimens were subjected to Class IIA mixed flowing gas in accordance with EIA-364-65, Class IIA. Both halves of the specimens were exposed in the unmated condition for the first ten days of exposure. The specimens were mated for the remaining ten days of exposure. Low level contact resistance measurements were taken after each five day interval of exposure. The average copper corrosion rate was 14.8$\mu g/cm^2$/day (Required: 12-16).

3.22 Dust

Unmated receptacle specimens were subjected to dust exposure in accordance with EIA-364-91. The dust composition was #1 benign and 9 grams of dust per cubic foot of chamber space was utilized. The chamber space has been estimated at 4.6 cubic feet, resulting in the use of approximately 42 grams of dust. The dust was dried for an hour at 50°C prior to being spread inside the chamber. The specimens were hung in the chamber and the blower system was turned on for an hour with a flow rate of 300 feet per minute. The blower system was then turned off and the specimens remained in the closed chamber for an additional hour. The specimens were then removed and tapped 5 times at a rate of 1.0 inch per minute to remove any excess accumulation of dust.

3.23 Final Examination of Product

Specimens were visually examined for evidence of physical damage detrimental to product performance.