AMP

QUALIFICATION TEST REPORT

AMP-HDI* Connectors

501-48 Rev. 0

P/N 532841-5, 532840-5, 533404-1,
532840-6, 532944-5, 533525-6,
1-532428-3, 1-532429-3, 532944-5,
1-532420-8, 1-543421-8

Product Specification:	108-9063 Rev. 0
CTL No.:	CTL5248-500-001
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WCT/kd
(CTL5248-500-001/LABREP(8)

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CORPORATE TEST LABORATORY

Qualification Test on AMP-HDI Connectors
P/N's 532841-5, 532840-5, 533404-1, 532840-6
532944-5, 533525-6, 1-532428-3, 1-532429-3,
532944-5, 1-532420-8, 1-532421-8

1. Introduction

The AMP-HDI Connectors were submitted to the Corporate Test Laboratory for qualification testing, in accordance with the AMP Product Specification 108-9063. Testing was performed from August 1985 to June 1986.

1.1 Purpose

To determine product compliance to the specification requirements.

1.2 Conclusion

The test samples conform to the requirements of the specification.

1.3 Product Description

The AMP-HDI (high density interconnect) connector is a box-type receptacle and pin two-piece connector, which provides a connection method on a 0.100 inch centerline. The connectors are available with two, three or four rows of contacts on a 2.54(.100) grid, totaling a maximum of 684 positions. The pin headers with Action Pin contacts are press fitted.

1.4 Test Samples

The following connectors were submitted for test:

Part Number	Description	Position	Quantity
532841-5	733 Duplex	612	2
532840-5	Receptacle	612	2
533404-6	733-30µ inch Au	636	2
532840-6	Receptacle	636	2
532944-5	.190 Solder Post	612	2
532840-5	Receptacle	612	2
533525-6	Right Angle .180 Solder Post	636	2
532840-6	Receptacle	636	2
1-532428-3	733 Duplex	140	2
1-532429-3	Receptacle	140	2
532944-5	.190 Solder Post	612	3
532840-5	Receptacle	612	3
1-532420-4	Contacts .800 Length	N/A	40

1.5 Qualification Test Sequence

The test sequence contained in the Tentative AMP Product Specification 108-9063 Rev. 0, dated October 22, 1984, is as follows:

Test or Examination	Test Group (a)			
	1	2	3	4
	Test Sequence (b)			
Examination of Product	1,20	1,19	1,13	1,7
Termination Resistance, Specified Current	6,16	6,15		6
Termination Resistance, Low Level	5,9,15	5,9,14		5
Dielectric Withstanding Voltage			7,10	
Insulation Resistance			8,11	
Vibration	13			
Physical Shock	14			
Mating Force	4,11,17	4,10,16	5	
Unmating Force	7,12,18	7,11,17	6	
Contact Retention			12	
Contact Engaging Force	2	2	3	
Contact Separating Force (c)	3,10,19	3,12,18	4	
Durability	8			
Resistance to Soldering Heat (b)			2	
Insertion Force, ACTION PIN*				2
Retention Force, ACTION PIN				4
Torque, ACTION PIN				3
Thermal Shock		8		
Humidity-Temperature Cycling		13	9	

(a) Numbers indicate sequence in which tests are performed.

(b) This test is not applicable to ACTION PIN Connectors.

(c) Sizing contacts three times is required only before the initial test.

FIGURE 2

2. Summary of Testing - Group 1

2.1 Examination of Product

The test samples, randomly selected from stock, were examined visually for dimensional and functional defects.

Summary of Results

The test samples passed the Division Quality inspection. There was no evidence of defects.

After Group 1 Tests

There was no evidence of physical or electrical damage after the Group 1 testing was completed.

2.2 Contact Engaging Force - Group 1

The test samples were subjected to the Contact Engaging Force Test as follows: The force required to engage a #2(0.0260") gage pin was recorded. The test was performed on 30 randomly selected positions per row for each connector.

Summary of Results

All test samples conform to the specification requirements of 4.0 ounces maximum per contact.

Test Results

The maximum, minimum, and average measurements are as follows:

All measurements are in ounces.

Sample #1 612 Position P/N's 532841-5, 532840-5

	Row 1		Row 2		Row 3		Row 4	
	Position	Engaging Force	Position	Engaging Force	Position	Engaging Force	Position	Engaging Force
Max.	97	3.30	114	3.20	1	1.88	6, 8 136	2.98
Min.	62	2.56	8	2.28	64	3.14	45	3.36
Avg.		2.966		2.502		2.249		3.086

Sample #2 636 Position P/N's 533404-6, 532840-6

	Row 1		Row 2		Row 3		Row 4	
	Position	Engaging Force	Position	Engaging Force	Position	Engaging Force	Position	Engaging Force
Max.	112	2.46	75	2.08	129	3.54	43, 118 126	2.78
Min.	41	1.72	25, 38	1.74	63	2.70	153	2.08
Avg.		2.060		1.922		3.031		2.479

Sample #3 612 Position P/N's 532944-5, 532840-6

	Row 1		Row 2		Row 3		Row 4	
	Position	Engaging Force	Position	Engaging Force	Position	Engaging Force	Position	Engaging Force
Max.	28	2.80	127	2.36	116	2.44	24	2.66
Min.	6, 86	1.98	11	1.80	97	1.52	65	2.14
Avg.		2.373		2.132		1.817		2.347

Sample #4 636 Position P/N's 533525-6, 532840-6

	Row 1		Row 2		Row 3		Row 4	
	Position	Engaging Force	Position	Engaging Force	Position	Engaging Force	Position	Engaging Force
Max.	31	1.68	29	2.20	72, 157	1.70	46, 84	2.32
Min.	82	0.94	126	1.34	23	1.36	57	1.86
Avg.		1.197		1.765		1.536		2.131

Sample #5 150 Position P/N's 1-532429-4, 1-532428-4

	Row 1		Row 2	
	Position	Engaging Force	Position	Engaging Force
Max.	65	2.92	11, 53	2.58
Min.	2	2.52	73, 75	2.02
Avg.		2.752		2.345

Specification Limit 4.0 ounces per contact maximum.

2.3 Contact Separating Force - Group 1

The test samples were subjected to the Contact Separating Force Test as follows: The test samples were sized 3 times with a #2(0.0260") gage pin before the separating force measurements were recorded. The measurements were performed using a #1(0.0250") gage pin. The force required to separate the pin from the socket was recorded. Each sample had 30 randomly selected positions per row.

Summary of Results

All samples conform to the specification requirement of 0.1 ounce minimum.

Test Results - Initial

The maximum, minimum and average of the recorded data is as follows:

All measurements are in ounces.

Sample #1 612 Position P/N's 532841-5, 532840-5

	Row 1		Row 2		Row 3		Row 4	
	Position	Separating Force	Position	Separating Force	Position	Separating Force	Position	Separating Force
Max.	133	2.96	1	2.32	64	2.34	45	3.12
Min.	82	1.92	51	1.86	1	1.38	150	2.18
Avg.		2.257		2.111		1.703		2.540

Sample #2 636 Position P/N's 533404-6, 532840-6

	Row 1		Row 2		Row 3		Row 4	
	Position	Separating Force	Position	Separating Force	Position	Separating Force	Position	Separating Force
Max.	112	1.86	68	1.60	30	3.00	22	2.60
Min.	7	1.26	95	1.12	86	2.02	3	2.12
Avg.		1.508		1.372		2.611		2.341

Sample #3 612 Position P/N's 532944-5, 532840-6

	Row 1		Row 2		Row 3		Row 4	
	Position	Separating Force	Position	Separating Force	Position	Separating Force	Position	Separating Force
Max.	138	1.96	67	1.42	45, 48	1.38	59	2.14
Min.	6	1.34	11,15,20	1.00	95	0.88	10	1.58
Avg.		1.647		1.205		1.072		1.895

Sample #4 636 Position P/N's 533525-6, 532840-6

	Row 1		Row 2		Row 3		Row 4	
	Position	Separating Force	Position	Separating Force	Position	Separating Force	Position	Separating Force
Max.	84	0.92	56	1.28	157	1.06	89	1.46
Min.	132	0.50	126	1.84	43	0.76	60	1.16
Avg.		0.724		1.084		0.905		1.336

Sample #5 150 Position P/N's 1-532429-4, 1-532428-4

	Row 1		Row 2	
	Position	Separating Force	Position	Separating Force
Max.	53	2.00	53	1.96
Min.	2,4	1.46	5	1.38
Avg.		1.679		1.665

After Durability

Sample #1 612 Position P/N's 532841-5, 532840-5

	Row 1		Row 2		Row 3		Row 4	
	Position	Separating Force	Position	Separating Force	Position	Separating Force	Position	Separating Force
Max.	18 136	1.94	96	1.64	43, 130	1.44	45	1.88
Min.	105, 123	1.46	1	0.98	1	0.98	150	1.30
Avg.		1.576		1.389		1.276		1.558

Sample #2 636 Position P/N's 533404-6, 532840-6

	Row 1		Row 2		Row 3		Row 4	
	Position	Separating Force	Position	Separating Force	Position	Separating Force	Position	Separating Force
Max.	116	2.00	95	1.48	52	2.34	96, 105	1.80
Min.	32	1.06	143	1.00	77, 129	1.64	118	1.24
Avg.		1.433		1.667		1.883		1.531

Sample #3 612 Position P/N's 532944-5, 532840-6

	Row 1		Row 2		Row 3		Row 4	
	Position	Separating Force	Position	Separating Force	Position	Separating Force	Position	Separating Force
Max.	141	1.88	90	1.58	35, 49	1.44	44	2.00
Min.	6	1.16	107	0.98	97	0.70	146, 150	1.36
Avg.		1.447		1.327		1.587		1.744

Sample #4 636 Position P/N's 533525-6, 532840-6

	Row 1		Row 2		Row 3		Row 4	
	Position	Separating Force	Position	Separating Force	Position	Separating Force	Position	Separating Force
Max.	84	1.00	146	1.24	13, 26	1.14	26	1.64
Min.	54	0.50	155	0.68	153	0.68	138	1.02
Avg.		1.762		1.035		0.944		1.40

Sample #5 150 Position P/N's 1-532429-4, 1-532428-4

	Row 1		Row 2	
	Position	Separating Force	Position	Separating Force
Max.	30	1.50	53	1.48
Min.	2,17	1.24	24, 75	1.24
Avg.		1.353		1.379

After Physical Shock

Sample #1 612 Position P/N's 532841-5, 532840-5

	Row 1		Row 2		Row 3		Row 4	
	Position	Separating Force	Position	Separating Force	Position	Separating Force	Position	Separating Force
Max.	18	1.76	8,37,84	1.32	6	1.38	45	1.92
Min.	105	1.22	145	0.90	64	0.94	66	1.12
Avg.		1.447		1.219		1.118		1.559

Sample #2 636 Position P/N's 533404-6, 532840-6

	Row 1		Row 2		Row 3		Row 4	
	Position	Separating Force	Position	Separating Force	Position	Separating Force	Position	Separating Force
Max.	116	1.80	117	1.14	63	2.22	105	1.72
Min.	27	1.04	148	1.76	1, 33	1.34	118	1.30
Avg.		1.371		1.947		1.760		1.517

Sample #3 612 Position P/N's 532944-5, 532840-6

	Row 1		Row 2		Row 3		Row 4	
	Position	Separating Force	Position	Separating Force	Position	Separating Force	Position	Separating Force
Max.	141	2.38	130	1.94	116	1.96	95, 96	2.26
Min.	80	1.50	37	1.36	68, 75	1.00	10	1.42
Avg.		1.799		1.624		1.347		1.933

Sample #4 636 Position P/N's 533525-6, 532840-6

	Row 1		Row 2		Row 3		Row 4	
	Position	Separating Force	Position	Separating Force	Position	Separating Force	Position	Separating Force
Max.	39	1.04	5	1.66	26	1.46	111	2.02
Min.	82	0.68	126	0.90	124	0.10	138	1.16
Avg.		1.879		1.245		0.261		1.839

Sample #5 150 Position P/N's 1-532429-4, 1-532428-4

	Row 1		Row 2	
	Position	Separating Force	Position	Separating Force
Max.	68	2.30	70	2.56
Min.	2	1.40	19	1.50
Avg.		1.745		1.746

Specification Limit 0.1 ounce minimum.

2.4 Mating Force - Group 1

The force required to mate the connector assemblies was recorded after three unmonitored cycles. The rate at which the connector assemblies were mated was one inch per minute. The specification limit is 1.9 ounces maximum per contact. The recorded data was calculated to give the mating force per contact.

Summary of Results

The recorded and calculated data is as follows:

Initial - Group 1

Sample #	Total Force - Lbs.	Force Per Contact Ounces
1	72.0	1.88
2	60.0	1.51
3	70.0	1.83
4	61.0	1.53
5	17.5	1.86

After Durability - Group 1

Sample #	Total Force - Lbs.	Force Per Contact Ounces
1	53.0	1.39
2	56.0	1.41
3	66.5	1.74
4	61.5	1.55
5	17.5	1.87

After Physical Shock - Group 1

Sample #	Total Force - Lbs.	Force Per Contact Ounces
1	48.0	1.30
2	51.8	1.30
3	60.0	1.60
4	60.0	1.50
5	16.0	1.70

Specification Limit 1.90 ounces per contact maximum.

2.5 Unmating Force - Group 1

The force required to unmate the connector assemblies was recorded. The recorded data was calculated to give the unmating force per contact. The specification limit was 0.4 ounces minimum per contact.

Summary of Results

The recorded and calculated data is as follows:

Initial - Group 1

Sample Number	Positions	Part Number	Total Force Lbs.	Force Per Contact Ounces
1	612	532841-5 532840-5	55.0	1.44
2	636	533404-6 532840-6	45.0	1.13
3	612	532944-5 532840-6	56.0	1.46
4	636	532525-6 532840-6	55.0	1.38
5	150	1-532429-4 1-532428-4	14.0	1.49

After Durability

Sample Number	Positions	Part Number	Total Force Lbs.	Force Per Contact Ounces
1	612	532841-5 532840-5	56.5	1.48
2	636	533404-6 532840-6	55.0	1.38
3	612	532944-5 532840-6	62.5	1.63
4	636	532525-6 532840-6	68.5	1.72
5	150	1-532429-4 1-532428-4	16.5	1.76

After Vibration

Sample Number	Positions	Part Number	Total Force Lbs.	Force Per Contact Ounces
1	612	532841-5 532840-5	55.6	1.45
2	636	533404-6 532840-6	54.0	1.36
3	612	532944-5 532840-6	66.0	1.73
4	636	532525-6 532840-6	72.5	1.82
5	150	1-532429-4 1-532428-4	19.4	2.07

Specification Limit 0.4 ounces per contact minimum.

2.6 Termination Resistance, Low Level - Group 1

The termination resistance was recorded using the test circuit in the Appendix. The circuit parameters were 50mv open circuit at 100ma maximum. The specification limit is 0.015 ohms maximum initial, and 0.020 ohms maximum final.

Summary of Results

The maximum, minimum and average of the recorded data is as follows:

All data is in milliohms.

Sample #		Row 1	Row 2	Row 3	Row 4
1	Max.	7.79	8.90	9.92	11.04
	Min.	6.21	7.67	8.94	10.24
	Avg.	6.718	7.969	9.357	10.552
2	Max.	8.08	10.93	10.39	11.71
	Min.	6.46	7.82	8.71	10.63
	Avg.	6.954	8.566	9.335	10.931
3	Max.	9.87	10.73	10.53	10.86
	Min.	6.43	7.50	9.15	10.20
	Avg.	6.927	8.398	9.477	10.495
4*	Max.	17.26	14.15	12.04	9.71
	Min.	15.19	12.77	10.24	7.74
	Avg.	16.114	13.374	11.135	9.066

*Row #1 was the right angle with the extended current path.

5	Max.	14.33	8.02
	Min.	5.97	7.36
	Avg.	6.228	7.624

After Durability

Sample #		Row 1	Row 2	Row 3	Row 4
1	Max.	7.34	8.36	10.24	10.85
	Min.	6.20	7.77	8.90	10.24
	Avg.	6.636	7.998	9.217	10.551
2	Max.	7.56	8.68	9.63	10.95
	Min.	6.40	7.76	8.58	10.32
	Avg.	6.761	8.240	9.056	10.609
3	Max.	7.04	8.32	10.34	10.52
	Min.	6.35	7.45	8.84	10.12
	Avg.	6.565	7.932	9.195	10.344

Sample #		Row 1	Row 2	Row 3	Row 4
4	Max.	16.48	14.01	11.71	9.74
	Min.	14.96	12.41	10.35	8.00
	Avg.	16.191	13.250	11.126	9.139
5	Max.	6.62	8.02		
	Min.	6.01	7.24		
	Avg.	6.319	7.621		

After Vibration and Physical Shock

Sample #		Row 1	Row 2	Row 3	Row 4
1	Max.	7.05	8.28	9.69	10.92
	Min.	6.11	7.64	8.75	10.11
	Avg.	6.554	7.878	9.105	10.432
2	Max.	7.46	13.58	12.13	13.47
	Min.	6.37	7.81	9.06	10.67
	Avg.	6.703	9.907	10.241	11.943
3	Max.	7.09	8.26	10.31	10.59
	Min.	6.33	7.47	8.84	10.08
	Avg.	6.559	7.816	9.183	10.333
4	Max.	16.44	14.03	11.80	9.75
	Min.	14.36	12.40	10.28	7.80
	Avg.	15.818	13.155	11.051	9.046
5	Max.	6.57	8.01		
	Min.	6.00	7.34		
	Avg.	6.050	7.62		

2.7 Termination Resistance, Specified Current

The termination resistance at the specified current of 1 amp was recorded using the test circuit shown in the Appendix. The specification limit was 0.015 ohms maximum initial and 0.020 ohms maximum final.

Summary of Results

The maximum, minimum and average of the recorded data is as follows:

Sample #		Row 1	Row 2	Row 3	Row 4
1	Max.	7.45	8.99	10.08	11.13
	Min.	6.24	7.63	8.90	10.26
	Avg.	6.69	7.94	9.39	10.58
2	Max.	8.04	9.47	9.92	12.21
	Min.	6.43	7.73	8.68	10.56
	Avg.	6.88	8.40	9.31	10.91

Sample #		Row 1	Row 2	Row 3	Row 4
3	Max.	9.49	10.91	10.43	10.80
	Min.	6.44	7.59	9.11	10.26
	Avg.	7.05	8.51	9.47	10.56
4*	Max.	16.99	13.93	11.95	9.97
	Min.	14.87	12.56	10.31	7.89
	Avg.	16.01	13.28	11.21	9.21
5	Max.	16.79	7.98		
	Min.	5.85	7.35		
	Avg.	6.19	7.61		

*Row #1 was the right angle with the extended current path.

After Vibration and Physical Shock

Sample #		Row 1	Row 2	Row 3	Row 4
1	Max.	7.11	8.53	9.66	11.02
	Min.	6.11	7.66	8.82	10.02
	Avg.	6.655	7.887	9.161	10.407
2	Max.	7.30	9.28	9.85	11.33
	Min.	6.41	7.67	8.77	10.50
	Avg.	6.771	8.485	9.313	10.924
3	Max.	6.87	8.77	10.35	10.70
	Min.	6.33	7.54	8.86	10.13
	Avg.	6.523	8.010	9.215	10.384
4	Max.	16.57	14.02	11.82	9.77
	Min.	14.36	12.42	10.21	7.81
	Avg.	15.939	13.201	11.010	9.060
5	Max.	6.57	8.06		
	Min.	6.00	7.28		
	Avg.	6.050	7.657		

2.8 Durability - Group 1

The connector assemblies were mated and unmated for 250 cycles.

Summary of Results

No physical damage was observed, electrical and mechanical measurements were recorded after the durability test.

2.9 Vibration - Group 1

The connector assemblies were mounted on the test fixture and subjected to the vibration test as follows: sine waveform, amplitude .06 in peak-to-peak or 15 g's peak, whichever was less. The vibration frequency was varied logarithmically between 10 to 2000 hertz. The frequency range of 10-2000-10 hertz was traversed in 20 minutes. The cycle was performed 12 times in each of the three mutually perpendicular planes, for a total of 36 times. The connector assemblies were monitored for discontinuities of one microsecond or greater. The test current was 100 milliamperes.

Summary of Results

There was no evidence of physical damage or discontinuities during the vibration test. Electrical and mechanical measurements were recorded after the vibration test.

2.10 Physical Shock - Group 1

The wired and mated connector assemblies were mounted to the test fixture and subjected to the shock test as follows: Sawtooth waveform with an acceleration level of 100 g's with a 6 millisecond time base. The samples were subjected to three shocks in each direction in the three mutually perpendicular planes, for a total of 18 shocks. The samples were monitored for discontinuities of one microsecond or greater during the test. The test current was 100 milliamperes.

Summary of Results

There was no evidence of physical damage or discontinuities during the physical shock test. Electrical and mechanical measurements were recorded after the physical shock test.

2.11 Summary of Testing - Group 2

2.12 Examination of Product

The test samples were randomly selected from stock and examined visually for dimensional and functional defects.

Summary of Results

The test samples passed the Q.I.P. inspection. There was no evidence of defects.

After Completion of Group 2 Tests

There was no evidence of physical or electrical damage after the testing for Group 2 was completed.

2.13 Contact Engaging Force - Group 2

The test samples in Group 2 were subjected to the Contact Engaging Force Test as follows: the force required to engage a #2 gage pin (0.0260") was recorded. Each connector had 30 randomly selected positions per row tested.

Summary of Results

All test samples conform to the specification requirements of 4.0 ounces maximum per contact.

Test Results

The maximum, minimum, and average measurements are as follows:

All measurements are in ounces.

Sample #1 612 Position P/N's 532841-5, 532840-5

	Row 1		Row 2		Row 3		Row 4	
	Position	Engaging Force	Position	Engaging Force	Position	Engaging Force	Position	Engaging Force
Max.	30	2.76	132	2.12	93	1.96	98	2.60
Min.	104	1.78	4	1.46	59	1.46	20	2.22
Avg.		2.292		1.802		1.753		2.379

Sample #2 636 Position P/N's 533404-6, 532840-6

	Row 1		Row 2		Row 3		Row 4	
	Position	Engaging Force	Position	Engaging Force	Position	Engaging Force	Position	Engaging Force
Max.	59	1.80	9	2.14	128,133	1.84	16	2.82
Min.	73	1.02	158	1.46	54,80	1.42	68	2.16
Avg.		1.376		1.769		1.595		2.512

Sample #3 612 Position P/N's 532944-5, 532840-6

	Row 1		Row 2		Row 3		Row 4	
	Position	Engaging Force	Position	Engaging Force	Position	Engaging Force	Position	Engaging Force
Max.	85	1.80	27	2.36	34	2.18	38	3.02
Min.	103	1.38	112	1.68	3	1.56	103	2.52
Avg.		1.603		2.066		1.879		2.734

Sample #4 636 Position P/N's 533525-6, 532840-6

	Row 1		Row 2		Row 3		Row 4	
	Position	Engaging Force	Position	Engaging Force	Position	Engaging Force	Position	Engaging Force
Max.	126	1.92	26	3.56	86	2.62	83	1.44
Min.	101	1.42	21	1.82	1	1.80	4	1.10
Avg.		1.644		2.277		2.193		1.256

Sample #5 150 Position P/N's 1-532429-4, 1-532428-4

	Row 1		Row 2	
	Position	Engaging Force	Position	Engaging Force
Max.	35	2.66	38	2.96
Min.	75	2.04	2	2.44
Avg.		2.349		2.755

Specification Limit 4.0 ounces per contact maximum.

2.14 Contact Separating Force - Group 2

The test samples were subjected to the Contact Separating Force Test as follows: The test samples were sized 3 times with a #2 gage pin (0.0260") before the separating force measurements were recorded. The measurements were performed using a #1 gage pin (0.0250"). The force required to separate the pin from the socket was recorded. Each sample had 30 randomly selected positions per row tested.

Summary of Results

All samples conform to the specification requirements of 0.1 ounce minimum.

Test Results - Initial

The maximum, minimum, and average of the recorded data is as follows:

All measurements are in ounces.

Sample #1 612 Position P/N's 532841-5, 532840-5

	Row 1		Row 2		Row 3		Row 4	
	Position	Separating Force	Position	Separating Force	Position	Separating Force	Position	Separating Force
Max.	101	1.78	132	1.80	148	1.42	149	2.04
Min.	5	0.98	9	1.06	8	0.88	1	1.58
Avg.		1.369		1.469		1.186		1.813

Sample #2 636 Position P/N's 533404-6, 532840-6

	Row 1		Row 2		Row 3		Row 4	
	Position	Separating Force	Position	Separating Force	Position	Separating Force	Position	Separating Force
Max.	29, 31	1.06	22	1.14	81	1.20	30	1.92
Min.	119	0.72	158	0.88	27,111,139	0.98	115	1.34
Avg.		0.878		0.991		1.072		1.701

Sample #3 612 Position P/N's 532944-5, 532840-6

	Row 1		Row 2		Row 3		Row 4	
	Position	Separating Force	Position	Separating Force	Position	Separating Force	Position	Separating Force
Max.	23, 101	1.02	116	1.46	140	1.24	125	2.04
Min.	1	0.68	1	1.06	3	0.94	53, 54	1.64
Avg.		1.865		1.259		1.081		1.857

Sample #4 636 Position P/N's 533525-6, 532840-6

	Row 1		Row 2		Row 3		Row 4	
	Position	Separating Force	Position	Separating Force	Position	Separating Force	Position	Separating Force
Max.	126	0.98	26	2.14	86	1.54	117	0.84
Min.	95	0.58	8	1.12	1	1.06	84, 96	0.62
Avg.		0.791		1.390		1.264		0.709

Sample #5 150 Position P/N's 1-532429-4, 1-532428-4

	Row 1		Row 2	
	Position	Separating Force	Position	Separating Force
Max.	35	1.86	75	2.16
Min.	72	1.46	3	1.84
Avg.		1.657		1.993

After Thermal Shock

Sample #1 612 Position P/N's 532841-5, 532840-5

	Row 1		Row 2		Row 3		Row 4	
	Position	Separating Force	Position	Separating Force	Position	Separating Force	Position	Separating Force
Max.	41	2.00	145	1.42	30	1.26	50	1.64
Min.	108	1.02	4	0.96	89	0.88	1	1.10
Avg.		1.481		1.211		1.034		1.431

Sample #2 636 Position P/N's 533404-6, 532840-6

	Row 1		Row 2		Row 3		Row 4	
	Position	Separating Force	Position	Separating Force	Position	Separating Force	Position	Separating Force
Max.	59	1.04	82, 84	1.20	36, 120	1.10	73	1.76
Min.	1	0.62	125, 126	0.86	139	0.78	147	1.36
Avg.		0.744		1.005		0.955		1.605

Sample #3 612 Position P/N's 532944-5, 532840-6

	Row 1		Row 2		Row 3		Row 4	
	Position	Separating Force	Position	Separating Force	Position	Separating Force	Position	Separating Force
Max.		1.44	133	1.36	48	1.44	110	2.34
Min.		0.66	1	0.98	54	0.98	53	1.76
Avg.		0.968		1.362		1.219		1.989

Sample #4 636 Position P/N's 533525-6, 532840-6

	Row 1		Row 2		Row 3		Row 4	
	Position	Separating Force	Position	Separating Force	Position	Separating Force	Position	Separating Force
Max.	119	1.22	26	2.24	30, 48	1.72	8	1.00
Min.	67	0.78	37	1.36	138	1.26	114	0.68
Avg.		0.947		1.652		1.457		0.845

Sample #5 150 Position P/N's 1-532429-4, 1-532428-4

	Row 1		Row 2	
	Position	Separating Force	Position	Separating Force
Max.	62	1.70	46, 50	1.90
Min.	72	1.28	2, 52	1.46
Avg.		1.466		1.694

After Temperature/Humidity Cycling

Sample #1 612 Position P/N's 532841-5, 532840-5

	Row 1		Row 2		Row 3		Row 4	
	Position	Separating Force	Position	Separating Force	Position	Separating Force	Position	Separating Force
Max.	45	1.98	61	1.60	47	1.28	50	2.40
Min.	10	1.16	4	0.92	59	0.82	1	1.24
Avg.		1.605		1.305		1.017		1.682

Sample #2 636 Position P/N's 533404-6, 532840-6

	Row 1		Row 2		Row 3		Row 4	
	Position	Separating Force	Position	Separating Force	Position	Separating Force	Position	Separating Force
Max.	147	1.00	74	1.22	114	1.48	57	2.12
Min.	77	0.72	146,125,126	0.84	134	0.76	115	1.44
Avg.		0.861		1.011		0.970		1.778

Sample #3 612 Position P/N's 532944-5, 532840-6

	Row 1		Row 2		Row 3		Row 4	
	Position	Separating Force	Position	Separating Force	Position	Separating Force	Position	Separating Force
Max.	126	1.34	97	1.66	30	1.32	110	2.52
Min.	1	0.66	1	0.94	54	0.94	31	1.58
Avg.		1.088		1.451		1.129		1.907

Sample #4 636 Position P/N's 533525-6, 532840-6

	Row 1		Row 2		Row 3		Row 4	
	Position	Separating Force	Position	Separating Force	Position	Separating Force	Position	Separating Force
Max.	119	1.22	26	2.24	85	1.80	117	0.96
Min.	27	0.72	56, 60	1.32	1	1.16	73	0.72
Avg.		0.948		1.560		1.426		0.826

Sample #5 150 Position P/N's 1-532429-4, 1-532428-4

	Row 1		Row 2	
	Position	Separating Force	Position	Separating Force
Max.	48	1.65	28	2.58
Min.	4, 5	1.30	52	1.64
Avg.		1.445		1.931

Specification Limit 0.1 ounce per contact minimum.

2.15 Mating Force - Group 2

The force required to mate the connector assemblies was recorded after three unmonitored cycles. The rate at which the connector assemblies were mated was one inch per minute. The specification limit is 1.9 ounce per contact.

Summary of Results

The recorded and calculated data is as follows:

Initial - Group 2

Sample #	Total Force - Lbs.	Force Per Contact Ounces
1	60.0	1.57
2	60.0	1.51
3	66.0	1.73
4	62.0	1.56
5	18.0	1.90

After Thermal Shock - Group 2

Sample #	Total Force - Lbs.	Force Per Contact Ounces
1	62.5	1.63
2	62.0	1.56
3	57.5	1.50
4	66.5	1.67
5	17.5	1.87

After Temperature/Humidity Cycling - Group 2

Sample #	Total Force - Lbs.	Force Per Contact Ounces
1	61.5	1.61
2	72.5	1.82
3	60.0	1.57
4	70.0	1.76
5	17.0	1.81

Specification Limit 1.9 ounce maximum.

2.16 Unmating Force - Group 2

The force required to unmate the connector assemblies was recorded. The recorded data was calculated to give the unmating force per contact. The specification is 0.4 ounces minimum per contact.

Summary of Results

The recorded and calculated data is as follows:

Initial - Group 2

Sample #	Total Force - Lbs.	Force Per Contact Ounces
1	63.0	1.65
2	53.0	1.33
3	54.0	1.41
4	74.0	1.86
5	17.5	1.87

After Thermal Shock - Group 2

Sample #	Total Force - Lbs.	Force Per Contact Ounces
1	67.5	1.76
2	77.5	1.94
3	55.0	1.44
4	74.0	1.86
5	19.0	2.03

After Temperature/Humidity Cycling - Group 2

Sample #	Total Force - Lbs.	Force Per Contact Ounces
1	94.0	2.46
2	102.5	2.58
3	62.5	1.63
4	80.0	2.01
5	24.8	2.65

Specification Limit 0.4 ounces per contact minimum.

2.17 Termination Resistance, Low Level - Group 2

The termination resistance was recorded using the test circuit in the Appendix. The circuit parameters were 50 mv open circuit at 100 ma maximum. The specification limit is 0.015 ohms maximum initial, and 0.020 ohms maximum final.

Summary of Results

The maximum, minimum, and average of the recorded data is as follows:

All data is in milliohms.

Group 2

Sample #		Row 1	Row 2	Row 3	Row 4
1	Max.	8.66	8.99	11.49	11.66
	Min.	6.59	7.87	9.37	10.71
	Avg.	7.128	8.394	9.875	11.072
2	Max.	9.16	8.90	10.21	11.42
	Min.	6.94	7.76	9.14	10.67
	Avg.	7.305	8.218	9.514	11.059
3	Max.	8.07	8.43	9.74	10.99
	Min.	6.86	7.59	8.83	9.90
	Avg.	7.273	7.945	9.238	10.345
4*	Max.	15.76	11.92	9.26	8.04
	Min.	14.72	11.12	8.65	6.66
	Avg.	15.077	11.342	8.851	7.115
5	Max.	8.44	6.85		
	Min.	7.44	5.94		
	Avg.	7.77	6.157		

*Row #1 was the right angle with the extended current path.

After Thermal Shock - Group 2

Sample #		Row 1	Row 2	Row 3	Row 4
1	Max.	7.30	8.33	10.83	10.83
	Min.	6.14	7.52	8.78	10.15
	Avg.	6.595	7.844	9.045	10.479
2	Max.	8.50	8.57	9.92	10.97
	Min.	6.86	7.81	9.21	10.44
	Avg.	7.263	8.124	9.572	10.689
3	Max.	8.03	8.71	9.78	10.65
	Min.	5.65	7.77	9.01	10.08
	Avg.	7.311	8.060	9.328	10.349
4	Max.	15.67	11.71	10.92	8.05
	Min.	14.62	11.05	8.65	6.75
	Avg.	15.144	11.364	8.895	7.247
5	Max.	8.48	7.00		
	Min.	7.50	6.02		
	Avg.	7.950	6.344		

After Temperature/Humidity Cycling - Group 2

Sample #		Row 1	Row 2	Row 3	Row 4
1	Max.	7.31	8.47	10.94	10.86
	Min.	6.30	7.63	8.81	10.19
	Avg.	6.652	7.938	9.194	10.482
2	Max.	7.93	8.77	10.06	11.05
	Min.	6.80	7.70	9.12	10.52
	Avg.	7.216	8.118	9.481	10.783
3	Max.	7.68	8.47	9.82	10.83
	Min.	6.83	7.43	8.67	10.02
	Avg.	7.151	7.999	9.259	10.425
4	Max.	15.45	11.53	10.93	8.28
	Min.	14.37	10.95	8.62	6.74
	Avg.	14.765	11.296	8.901	7.255
5	Max.	8.67	7.78		
	Min.	7.47	6.15		
	Avg.	7.870	6.628		

2.18 Termination Resistance, Specified Current - Group 2

The termination resistance was recorded using the test circuit in the Appendix. The circuit parameters were 50 mv open circuit voltage at 1.0 ampere maximum. The specification limit is 0.015 ohms maximum initial, and 0.020 ohms maximum final.

Summary of Results

The maximum, minimum and average of the recorded data is as follows:

All data is in milliohms.

Sample #		Row 1	Row 2	Row 3	Row 4
1	Max.	8.24	9.13	11.61	11.88
	Min.	6.56	8.11	9.40	10.68
	Avg.	7.07	8.45	9.97	11.08
2	Max.	9.00	9.01	10.16	11.40
	Min.	6.91	7.85	9.19	10.61
	Avg.	7.26	8.21	9.57	10.98
3	Max.	8.21	8.57	9.99	10.91
	Min.	6.97	7.68	9.01	10.21
	Avg.	7.37	8.04	9.46	10.49

Sample #		Row 1	Row 2	Row 3	Row 4
4*	Max.	15.37	11.65	10.88	8.58
	Min.	14.45	10.90	8.50	6.67
	Avg.	14.83	11.21	8.75	7.15
5	Max.	8.47	6.83		
	Min.	7.41	5.90		
	Avg.	7.80	6.18		

*Row #1 was the right angle with the extended current path.

After Temperature/Humidity Cycling - Group 2

Sample #		Row 1	Row 2	Row 3	Row 4
1	Max.	7.90	8.47	10.80	10.80
	Min.	6.17	7.63	8.84	10.19
	Avg.	6.504	7.846	9.111	10.467
2	Max.	7.76	8.35	9.87	10.99
	Min.	6.79	7.73	9.07	10.47
	Avg.	7.197	8.026	9.535	10.745
3	Max.	7.92	8.21	9.74	10.70
	Min.	6.83	7.42	8.65	9.68
	Avg.	7.255	7.935	9.237	10.377
4	Max.	15.57	11.48	10.85	8.14
	Min.	14.41	10.93	8.61	6.71
	Avg.	14.956	11.316	8.914	7.270
5	Max.	8.79	7.64		
	Min.	7.46	6.02		
	Avg.	7.820	6.368		

2.19 Thermal Shock - Group 2

The connector assemblies were subjected to the thermal shock test as follows:

-65.0°C + 0°, -5°C 0.5 hours
Transfer 25°C + 10°C, -5°C less than 5 minutes
125°C + 5°, -0°C 0.5 hours

The two extremes were one cycle; the test was continued for 5 cycles. After the thermal shock test, mechanical and electrical measurements were performed.

2.20 Temperature/Humidity Cycling - Group 2

The connector assemblies were subjected to ten temperature/humidity cycles. A graphical representation of the test is shown in the Appendix. Steps 7a and 7b were omitted.

Summary of Results

No physical damage was observed. The samples were then subjected to mechanical and electrical measurements.

2.21 Summary of Testing - Group 3

2.22 Examination of Product - Group 3

The test samples were randomly selected from stock and examined visually for dimensional and functional defects.

Summary of Results

The test samples passed the Q.I.P. inspection. There was no evidence of defects.

After the Completion of Group 3 Tests

There was no evidence of physical or electrical damage after the testing for Group 3 was completed.

2.23 Insulation Resistance

The test samples were tested unmated. The resistance was measured between adjacent contacts. The minimum resistance is 5000 megohms initial, and 1000 megohms final.

Summary of Results

The minimum resistance of the measured data is as follows:

All measurements are in megohms.

Sample #	Plug	Receptacle
1	4.8×10^6	10.0×10^6
2	11.0×10^6	10.0×10^6
3	12.0×10^6	12.0×10^6

After Temperature/Humidity Cycling

Sample #	Plug	Receptacle
1	1.1×10^3	3.1×10^3
2	1.6×10^3	2.8×10^3
3	1.5×10^3	14.0×10^3

Specification Limit 5000 megohms initial, and 1000 megohms after temperature/humidity test.

2.24 Dielectric Withstand Voltage - Group 3

The test samples tested were unmated. The test voltage was applied between adjacent contacts. The applied voltage was 900 volts at sea level, and 200 volts at 70,000 ft. altitude. The maximum leakage current was less than 2.0 milliamps. The voltage was applied at 500 volts per second.

Summary of Results

There was no evidence of flashover or breakdown during the test. The leakage current was less than 2.0 milliamps.

After Temperature/Humidity Cycling Test - Group 3

There was no evidence of flashover or breakdown during the test. The leakage current was less than 2.0 milliamps.

2.25 Contact Retention Test - Group 3

An axial load of three pounds was applied to 30 randomly selected contacts. The load was maintained for 5.0 seconds.

Summary of Results

The contacts tested did not dislodge from their normal locking position.

2.26 Temperature/Humidity Cycling - Group 3

The connector assemblies were subjected to ten temperature/humidity cycles. A graphical representation of the test is shown in the Appendix. Steps 7a and 7b were omitted.

Summary of Results

No physical damage was observed. The samples were then subjected to mechanical and electrical measurements.

2.27 Resistance to Soldering Heat

One test sample was cut in half to fit into the solder bath. The eyelets and plating in the through holes was removed before the test. The samples were lowered into the solder bath until the terminal posts were submerged to the bottom of the printed circuit board. The samples were held in the bath for 10 seconds and then removed. The bath temperature was 260.0°C.

Summary of Results

There was no evidence of physical damage after the test.

2.28 Summary of Testing - Group 4

2.29 Examination of Product - Group 4

The test samples were randomly selected from stock and examined visually for dimensional and functional defects.

Summary of Results

The test samples conform to the Q.I.P. inspection. There was no evidence of defects.

After Insertion and Retention

There was no evidence of physical or electrical damage after the testing for Group 4 was completed.

2.30 Insertion Force - Group 4

The 40 Action Pin samples of Group 4 were fully inserted into a printed circuit wiring board. The specification limit is 40.0 pounds maximum to insert a single pin.

Summary of Results

The maximum, minimum and average insert force was as follows:

All measurements in pounds.

Sample #		
22	Max.	20.9
14	Min.	16.1
	Avg.	18.42

Specification Limit is 40.0 pounds maximum.

2.31 Torque Force - Group 4

The test samples were inserted into printed circuit wiring boards, and a torque of 2.0 inch-ounces was applied in each direction. The torque force was applied for ten seconds.

Summary of Results

The test sample did not move or dislodge during the torque test.

2.32 Retention Force - Group 4

The test samples were inserted into printed circuit wiring boards, and an axial load of 10.0 pounds was applied for 10.0 seconds.

Summary of Results

None of the test samples were dislodged from the printed circuit wiring board.

2.33 Termination Resistance Low Level - Group 4

The interface resistance was measured between the Action Pin and the through-hole in the printed circuit wiring board. See the Appendix for circuit diagram. The circuit parameters were 50.0 millivolts at 100.0 milliamps. The specification limit is 1.0 milliohm maximum. Forward and reverse measurements were taken to get an averaged reading.

Summary of Results

The maximum, minimum and average of the recorded data is as follows:

All measurements in milliohms.

Sample #		
25	Max.	0.51
1	Min.	0.35
	Avg.	0.419

Specification Limit is 1.0 milliohm maximum.

2.34 Termination Resistance - Specified Current - Group 4

The interface resistance was measured between the Action Pin and the through-hole in the printed circuit wiring board. See the Appendix for the circuit diagram. The specified current was 1.0 amp. The specification limit is 1.0 milliohm maximum. Forward and reverse measurements were averaged for the recorded measurement.

Summary of Results

The maximum, minimum, and average of the recorded data is as follows:

All measurements in milliohms.

Sample #		
31	Max.	0.45
7	Min.	0.38
	Avg.	0.410

3. Validation

Report prepared by,

William C. Taylor 12/8/86

William C. Taylor
Test Engineer
Design Assurance Testing
Corporate Test Laboratory

Reviewed by,

J. J. Edwards 12/8/86

J. J. Edwards
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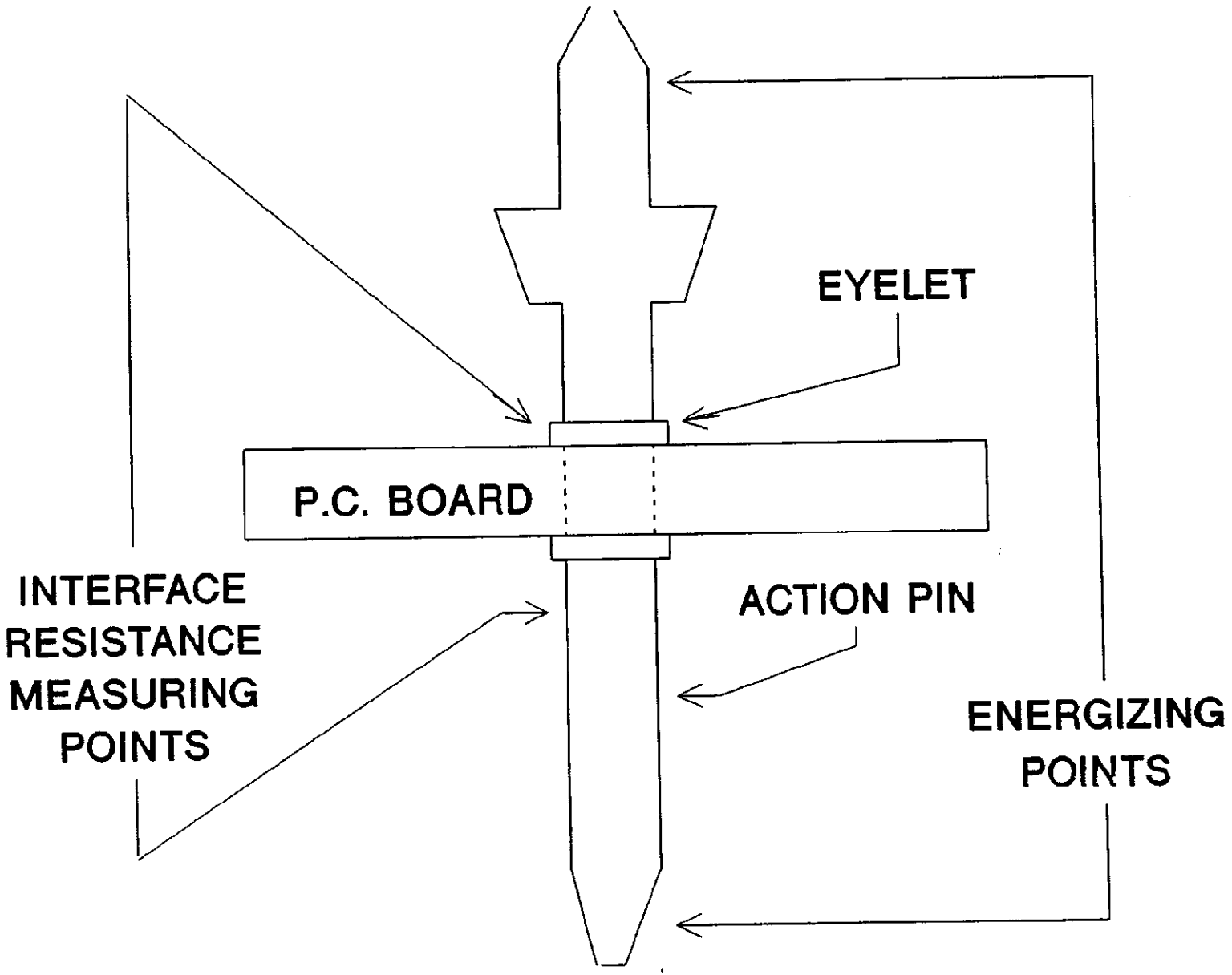
Design Assurance Testing
Corporate Test Laboratory

Approved by,

Thomas England 2/9/87

Thomas England
Product Assurance Manager
Packaging Components
General Products Group

APPENDIX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P.C. BOARD
INTERFACE
RESISTANCE
MEASURING
POINTS
ACTION PIN
ENERGIZING
POINTS

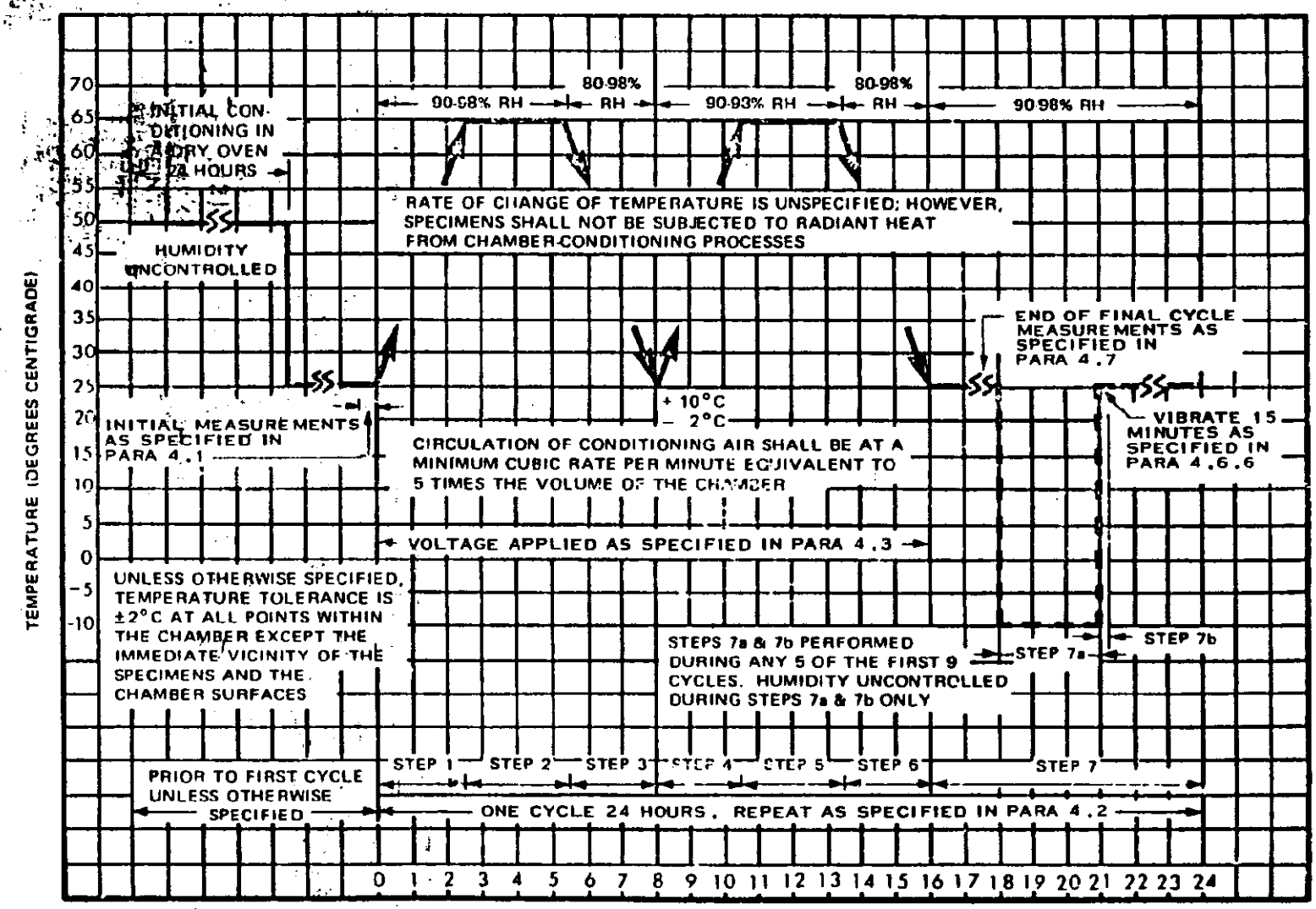


FIG. 2

Graphical Representation of Moisture-Resistance Test

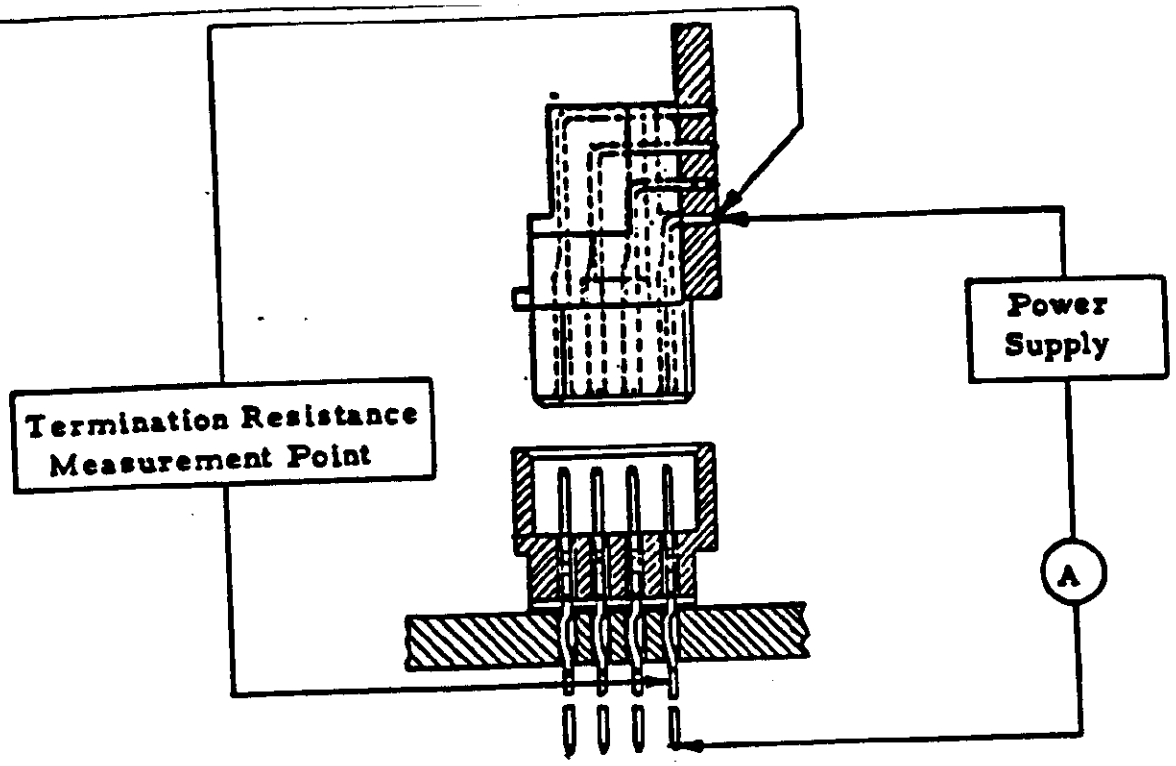
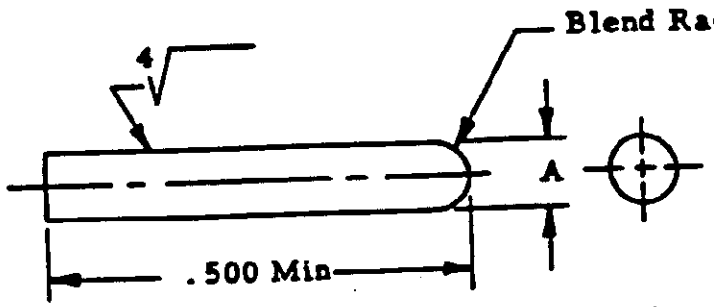


Figure 3

Termination Resistance Measurement Points



Notes:
1. Tolerance: ±.005 as applicable, unless otherwise specified.
2. Material: Tool steel
3. Heat Treat: Rockwell C 50 - 55
4. Gage Surface: Shall be clean of contaminants or lubricants

Gage Number	A
1	$.0250^{+.0001}_{-.0000}$
2	$.0260^{+.0000}_{-.0001}$

Figure 4

Gage Insertion and Extraction