Product Verification of AMP Power Series 175 and 180 Connectors

1. INTRODUCTION

1.1. Purpose

Testing was performed on AMP Power Series 175 and 180 Connectors to verify performance of product subjected to force vs deflection, and temperature rise vs current per UL 1977 Section 16, and CSA C22.2 No. 182.3-M1987.

1.2. Scope

Testing was performed at the Harrisburg Electrical Components Test Laboratory between 05Nov02 and 28Apr03. The test file numbers for this testing are CTLB034993-005, CTLB034993-008 and CTLB034993-010. This documentation is on file at and available from the Harrisburg Electrical Components Test Laboratory.

2. TEST SPECIMENS

Test specimens were representative of normal production lots. Specimens identified with the following part numbers were used for test.

Part Number	Description
CTLB034993-005	
1604038-1	AMP Power Series 175 contact with 1/0 AWG wire
1604062-4	Housing subassembly (red) with spring
CTLB034993-008	
1604007-1	AMP Power Series 175 retaining spring
1604049-1	AMP Power Series 350 retaining spring
Unknown	175 ampere Anderson springs
Unknown	350 ampere Anderson springs
CTLB034993-010	
1604038-1	AMP Power Series 175 contact with 1/0 AWG wire
1604062-1	Housing subassembly (blue) with spring

Figure 1

3. TEST RESULTS

3.1. CTL B034993-005 - Temperature Rise vs Current

Monitored maximum temperature of the current carrying contacts did not exceed a 30°C temperature rise or the Relative Thermal Index (RTI) of 125°C specified in UL 1977, Section 16 issued December 2000, and CSA C22.2 No 182.3-M1987, Section 6.5 issued December 1987. Summary of temperature rise data is shown in Figure 2.

Specimen ID	Contact Position	Ambient Temperature (°C)	Actual Temperature (°C)	Temperature Rise (°C)
100% Energized at 165 Amperes 1X1 Configuration				
101	1	27.8	54.2	26.4
102	1		51.7	23.9
103	1		52.0	24.2
104	1		55.5	27.7
105	1		55.0	27.2
106	1		51.7	23.9
Minimum			51-7	23.9
Maximum			55.5	27.7
Average			53.4	25.6
Standard Deviation			1.8	1.8
100% Energized at 160 Amperes 2X1 Configuration				
101	1	27.1	55.3	28.2
	2		55.7	28.6
102	1		54.1	27.0
	2		56.0	28.9
103	1		53.0	25.9
	2		54.2	27.1
104	1		56.4	29.3
	2		54.2	27.1
105	1		54.8	27.7
	2		55.1	28.0
106	1		54.3	27.2
	2		54.2	27.1
Minimum			45.0	25.9
Maximum			56.0	28.9
Average			54.7	27.6
Standard Deviation			1.1	1.1

Figure 2 (continued)

Specimen ID	Contact Position	Ambient Temperature (°C)	Actual Temperature (°C)	Temperature Rise (°C)
100% Energized at 145 Amperes 2X2 Configuration				
101	1	25.2	53.2	28.0
	2		53.6	28.4
102	1		52.2	27.0
	2		49.9	24.7
103	1		49.4	24.2
	2		40.2	25.0
104	1		51.6	26.4
	2		49.2	24.0
105	1		51.3	26.1
	2		50.9	25.7
106	1		53.3	28.1
	2		49.3	24.1
Minimum			49.2	24.0
Maximum			53.6	28.4
Average			51.175	25.975
Standard Deviation			1.6226	1.6226

Figure 2 (end)

3.2. CTL B034993-008 - Force vs Deflection

Testing was performed to generate a force vs deflection curve to determine the spring rate. Summary of spring deflection is shown in Figure 3.

Specimen ID	Maximum Force (pounds)	Maximum Deflection (inches)	Spring Rate (lbs/in)	Permanent Set (inches)
Group 1, AMP Power Series 175 Spring Rate				
1	10.39	.374	27.78	.013
2	10.28		27.49	.012
3	8.55		22.86	.049
4	8.99		24.04	.056
5	10.93		29.22	.012
Average	9.83	.374	26.28	.028

Figure 3 (continued)

Specimen ID	Maximum Force (pounds)	Maximum Deflection (inches)	Spring Rate (lbs/in)	Permanent Set (inches)
Group 2, AMP Power Series 350 Spring Rate				
1	19.38	.374	51.82	.046
2	19.25	.375	51.33	.050
3	18.85	.374	50.40	.048
4	18.97	.374	50.72	.026
5	19.37	.375	51.65	.047
Average	19.16	.374	51.19	.043
Group 3, Anderson 175 Spring Rate				
1	10.42	.374	27.86	.021
2	11.01	.374	29.44	.014
3	10.68	.374	28.56	.021
4	10.60	.375	28.27	.029
5	11.07	.374	29.60	.022
Average	10.76	.374	28.74	.021
Group 4, Anderson 350 Spring Rate				
1	23.05	.374	61.63	.063
2	23.95	.374	64.04	.058
3	23.41	.375	62.43	.062
4	22.71	.375	60.56	.058
5	22.12	.375	58.99	.076
Average	23.05	.375	61.53	.063
Group 5, Anderson 350 Spring Rate After Stress Relaxation				
1	24.72	.375	65.92	.044
2	25.34	.375	67.57	.042
3	25.64	.375	68.37	.036
4	25.10	.375	66.93	.037
Average	25.20	.375	67.20	.040
Group 6, AMP Power Series 350 Spring Rate After Stress Relaxation				
1	21.15	.374	56.55	.017
2	21.19	.374	56.66	.012
3	21.10	.374	56.42	.017
4	21.68	.375	57.81	.022
Average	21.28	.374	56.86	.017

Figure 3 (continued)

Specimen ID	Maximum Force (pounds)	Maximum Deflection (inches)	Spring Rate (lbs/in)	Permanent Set (inches)
Group 7, AMP Power Series 175 Spring Rate After Stress Relaxation				
1	11.03	.374	29.49	.010
2	10.54	.374	28.18	.009
3	11.68	.374	31.23	.009
4	10.57	.374	28.26	.010
Average	10.96	.374	29.29	.010
Group 8, Anderson 175 Spring Rate After Stress Relaxation				
1	12.57	.374	33.61	.010
2	11.43	.374	30.56	.006
3	11.63	.374	31.10	.009
4	10.80	.374	28.88	.008
Average	11.61	.374	31.04	.008
Group 9, AMP Power Series 175 Spring Rate After Stress Relaxation				
1	10.83	.374	28.96	.011
2	12.62	.374	33.74	.011
Average	11.73	.374	31.35	.011
Group 10, Anderson 175 Spring Rate After Stress Relaxation				
1	11.48	.374	30.70	.007
2	12.13	.374	32.43	.007
Average	11.81	.374	31.56	.007

Figure 3 (end)

3.3. CTL B034993-010 - Temperature Rise vs Current

Monitored maximum temperature of the current carrying contacts did not exceed a 30°C temperature rise or the Relative Thermal Index (RTI) of 125°C specified in UL 1977, Section 16 issued December 2000, and CSA C22.2 No 182.3-M1987, Section 6.5 issued December 1987. Summary of temperature rise data is shown in Figure 2. Summary of temperature rise data is shown in Figure 4.

Specimen ID	Contact Position	Ambient Temperature (°C)	Actual Temperature (°C)	Temperature Rise (°C)
100% Energized at 180 Amperes and 53% RH 1X1 Configuration				
101	1	25.4	55.1	29.7
102	1		54.4	29.0
103	1		54.9	29.5
104	1		54.8	29.4
105	1		55.2	29.8
106	1		54.2	28.8
Minimum			54.2	28.8
Maximum			55.2	29.8
Average			54.8	29.4
Standard Deviation			0.393	0.393
100% Energized at 165 Amperes and 49% RH 2X1 Configuration				
101	1	25.2	49.9	24.7
	2		52.0	26.8
102	1		50.4	25.2
	2		50.8	25.6
103	1		51.7	26.5
	2		51.6	26.4
104	1		50.1	24.9
	2		49.2	24.0
105	1		50.6	25.4
	2		51.3	26.1
106	1		51.8	26.6
	2		51.5	26.3
Minimum			49.2	24.0
Maximum			52.0	26.8
Average			50.9	25.7
Standard Deviation			0.882	0.882

Figure 4 (continued)

Specimen ID	Contact Position	Ambient Temperature (°C)	Actual Temperature (°C)	Temperature Rise (°C)
100% Energized at 150 Amperes and 52% RH 2X2 Configuration				
101	1	27.1	51.1	24.0
	2		52.0	24.9
102	1		50.5	23.4
	2		52.1	25.0
103	1		52.4	25.3
	2		53.7	26.6
104	1		51.1	24.0
	2		52.4	25.3
105	1		50.9	23.8
	2		52.3	25.2
106	1		51.8	24.7
	2		52.1	25.0
Minimum			50.5	23.4
Maximum			53.7	26.6
Average			51.9	24.8
Standard Deviation			0.865	0.865

Figure 4 (end)

4. TEST METHODS

4.1. CTLB034993-005

Specimens were single pole stackable connectors tested in 1X1, 2X1 and 2X2 configurations. Six contacts were monitored in the 1X1 configuration, 12 contacts were monitored in the 2X1 and 2X2 configurations. In the 1X1 and 2X1 configurations, 1 contact in each mated pair was monitored, in the 2X2 configuration, 2 contacts across from each other diagonally were monitored.

Specimens connected in series circuit were placed in a draft-free room at an ambient temperature of 25 ± 5°C. Both specimen and ambient temperatures were monitored using a data logger. Specimen temperatures were monitored using Type “J” 30 AWG thermocouples attached to the underside of the contact interface. Ambient temperature was monitored using a Type “J” thermocouple inside a .5 inch diameter, 2 inch long plastic tube standing upright in the center of the specimens.

Specified currents of 165, 160 and 145 amperes AC were applied to 100% of the contacts for a period of 4 hours. Measurements were recorded at the end of the test prior to de-energizing the circuit.

4.2. CTLB034993-008

A. Test Groups 1, 2, 3 and 4

Specimens were held in a vise in a manner as to create a cantilever. Each specimen was deflected .375 ± .002 inch and returned to a state of no load. The maximum force generated from the deflection and the permanent set of each specimen was recorded. The speed of the deflection during testing was .5 inch per minute.

B. Test Groups 5, 6, 7, 8, 9 and 10

Specimens were loaded into the proper connector housings after which the housings were loaded with unterminated contacts and then mated with their proper mating halves. Mated specimens were then preconditioned at 115°C for 216 hours. After cooling, the contacts and spring members were removed from the housings and the spring rate tested as described in paragraph 4.2.A.

4.3. CTLB034993-010

Specimens were single pole connectors tested in 1X1 and 2X1 configurations. One contact was monitored in the 1X1 and 2X1 configurations. One contact of 1 upper and 1 lower pair of contacts was monitored in the 2X2 configuration.

Specimens connected in series circuit were placed in a draft-free room at an ambient temperature of 25 ± 5°C. Both specimen and ambient temperatures were monitored using a data logger. Specimen temperature was monitored by inserting a Type “J” thermocouple into a drilled hole in the interface area of the contact and peening the contact material around it. Ambient temperature was monitored using a Type “J” thermocouple inside a .5 inch diameter, 2 inch long plastic tube standing upright in the center of the specimens.

Specified currents of 180, 165 and 150 amperes AC were applied to 100% of the contacts for a period of 4 hours. Measurements were recorded at the end of the test prior to de-energizing the circuit.