

**Product Verification of AMP\* Power Series 120 Connectors**

**1. INTRODUCTION**

1.1. Purpose

Testing was performed on AMP\* Power Series 120 Double and Single Pole Connectors to verify performance of product subjected to a variety of electrical, mechanical and environmental tests including: crimp tensile, durability, low level contact resistance, contact retention, mating and unmating forces, temperature rise, UL 1977 Section 16, and CSA C22.2 No. 182.3-M1987.

1.2. Scope

This report covers connectors tested under test reports CTL B034992-003, B034992-004, B034992-005, B034992-006, B034992-007 and B034992-010. Testing was performed by the Engineering Assurance Product Test Laboratory.

**2. DOUBLE POLE TESTING**

2.1. Test Samples

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

Sample Group	Quantity	Part Number	Description
CTL B034992-003 - Crimp Tensile			
1,2	4 each	1604072-2	Reducing bushing crimped with 6 AWG wire
	4 each	1445995	2 AWG contact
CTL B034992-004 - Durability, Contact Retention, Temperature Rise			
1	4	1445998-2	Housing with 2, 2 AWG contacts
3	10	1445998-2	Housing with 2, 4 AWG contacts
8	2	1445998-2	Housing with 2, 6 AWG contacts with wire
9	2	1445998-2	Housing with 2, 4 AWG contacts with wire
CTL B034992-007 - Temperature Rise at Rated Current			
1	6	1445994-2	Housing with 2, 2 AWG contacts
CTL B034992-010 - Mating/Unmating Force			
1	2	1445994-1	Housing loaded with 2, 120 ampere contacts

Figure 1

2.2. Test Results

A. CTL B034992-003 - Crimp Tensile

Summary of crimp tensile results are shown in Figure 2. Samples were tensiled at a maximum rate of .5 inch per minute. Maximum force values recorded until wires pulled from contacts.

Sample ID	Maximum Load (lbs)	Proof Load (lbs)
1	378.29	20.00
2	381.20	20.00
3	387.76	20.00
4	389.51	20.00

Figure 2  
Crimp Tensile

B. CTL B034992-004 - Durability, Contact Retention and Temperature Rise vs Current.

1. Sample Group 1 - Durability with Temperature Rise vs Current
2. Test Sequence:
  - a. Initial temperature rise
  - b. Durability, 10,000 mating cycles at maximum rate of 500 cycles per hour
  - c. Final temperature rise
3. Temperature rise for Sample Group 1 was measured initially, and after 10,000 cycles of durability testing was performed. Thermocouples were soldered to the underside of the contact as close to the interface area as possible.

Sample ID's 101, 102	°C 30 Amperes		°C 60 Amperes		°C 90 Amperes		°C 120 Amperes		°C 150 Amperes	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final
Minimum	2.100	2.400	6.900	7.600	14.600	15.800	25.300	25.300	40.200	38.500
Maximum	2.900	3.500	8.400	10.300	21.000	20.800	34.700	34.600	50.600	53.800
Average	2.550	2.850	7.750	8.738	16.650	17.950	28.300	29.150	43.275	44.700

Figure 3  
Temperature Rise

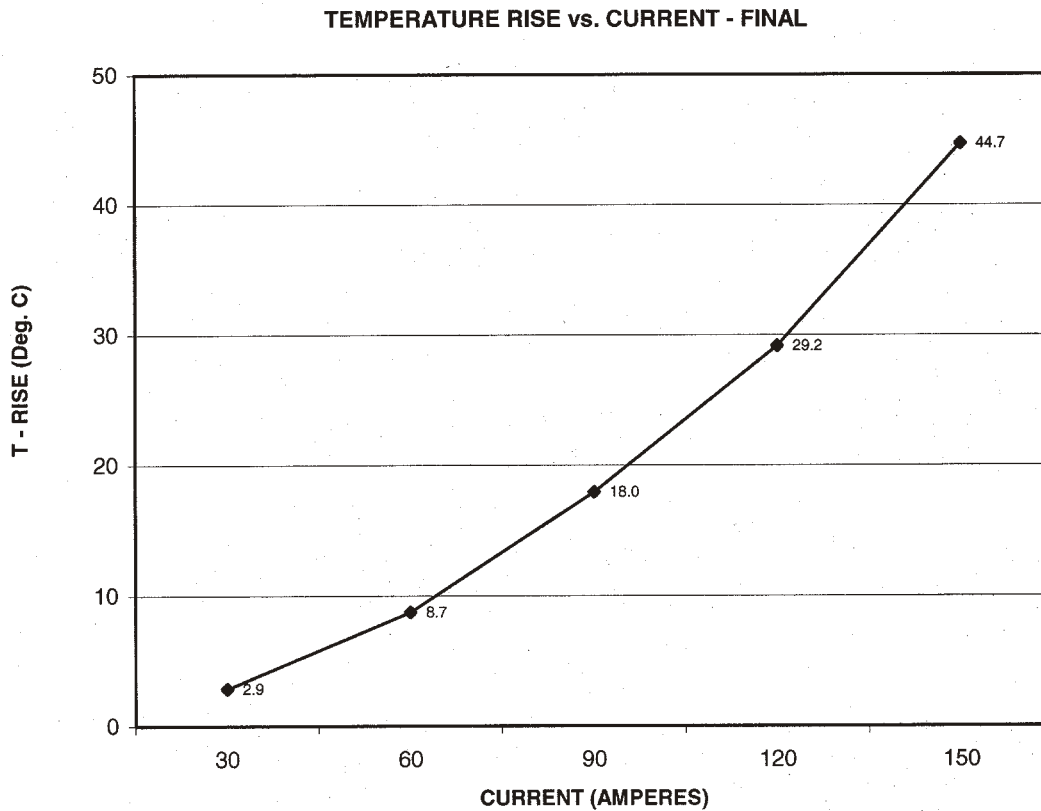


Figure 4  
Final Temperature Rise vs Current

4. Sample Group 3 - Contact Retention

Contact retention was performed at a maximum rate of .5 inch per minute. The force required to pull the contact from the housing was measured and recorded. See Figure 5.

Sample Group 3	Data
Contact Retention (lbs)	
Minimum	122.300
Maximum	146.000
Average	134.238

Figure 5  
Contact Retention

5. Sample Test Group 8 and 9 - Temperature Rise - 6AWG and 4AWG

Temperature rise (Test Groups 8 and 9) was measured until a 30°C temperature rise value was sustained. Thermocouples were soldered to the underside of the contact as close to the interface area as possible. See Figures 6 and 7.

Sample ID 801	Δ°C 20 Amperes	Δ°C 40 Amperes	Δ°C 60 Amperes	Δ°C 80 Amperes
Minimum	4.400	10.100	19.000	32.300
Maximum	4.700	10.900	20.700	34.200
Average	4.525	10.550	19.875	33.275

Figure 6  
Sample Group 8, Temperature Rise, 6AWG

Sample ID 901	Δ°C 20 Amperes	Δ°C 40 Amperes	Δ°C 60 Amperes	Δ°C 80 Amperes	Δ°C 100 Amperes	Δ°C 120 Amperes
Minimum	1.900	5.700	11.000	18.900	27.500	28.400
Maximum	2.200	5.900	11.400	19.500	28.600	41.300
Average	2.000	5.850	11.225	19.225	28.075	37.400

Figure 7  
Sample Group 9, Temperature Rise, 4AWG

C. CTL B034992-007 - Temperature Rise at Rated Current

Six paired samples using 2 AWG wires were subjected to a temperature rise test for 4 hours with 100% of the contacts energized with a current of 115 amperes. Thermocouples were soldered to the underside of the contact as close to the interface area as possible. Ambient temperature was 25°C. See Figure 8.

Sample ID's 101 -106	Actual (°C)	Temperature Rise (°C)
Minimum	46.5	21.5
Maximum	52.8	27.8
Average	49.35	24.35

Figure 8  
Temperature Rise at Rated Current

D. CTL B034992-010 - Mating and Unmating Force

The force required to mate and unmate the samples after the initial, 5th and 10th cycles at a maximum rate of .5 inch per minute was measured and recorded. See Figure 9.

Sample ID A-C	Initial (lbs)		5 <sup>th</sup> Cycle (lbs)		10 <sup>th</sup> Cycle (lbs)	
	Mating	Unmating	Mating	Unmating	Mating	Unmating
Minimum	16.66	17.7	17.53	16.11	18.73	18.07
Maximum	20.29	19.99	18.62	19.88	19.07	20.44
Average	18.49	18.52	17.98	17.48	18.93	19.13

Figure 9  
Mating and Unmating Force

**3. SINGLE POLE TESTING**

3.1. Test Samples

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

Sample Group	Quantity	Part Number	Description
CTL B034992-005 - Durability, Contact Retention, Mating/Unmating Force, Temperature Rise			
1	4	1604002-2	Housing with 2 AWG contacts
3	10	1604002-2	Housing with 2 AWG contacts
4	20	1604002-2	Housing with 2 AWG contacts with wire
6	2	1604001-2	Housing with 6 AWG contacts with wire
7	2	1604001-2	Housing with 4 AWG contacts with wire
CTL B034992-006 - Temperature Test			
1	6	1604002-2	Housing with 2 AWG contacts in 1X2 configuration
	6	1604002-2	Housing with 2 AWG contacts in 2X2 configuration

Figure 10

3.2. Test Results

A. CTL B034992-005 - Durability, Contact Retention, Mating/Unmating Force, and Temperature Rise vs Current

1. Sample Group 3 -Contact Retention

Contact retention was performed at a maximum rate of 1 inch per minute. The force required to pull the contact from the housing was measured and recorded. See Figure 11.

Sample Group 3	Data
Contact Retention (lbs)	
Minimum	109.0
Maximum	139.3
Average	127.3

Figure 11  
Contact Retention

2. Samples from Sample Group 4 were subjected to 5 mating/unmating cycles. The force required to mate and unmate the samples at a maximum rate of 1 inch per minute was measured and recorded. See Figure 12.

Sample Group 4 Mating Force (lbs)		Sample Group 4 Unmating Force (lbs)	
Minimum	7.25	Minimum	5.50
Maximum	9.82	Maximum	11.25
Average	8.18	Average	7.95

Figure 12  
Mating/Unmating Force

3. Sample Group 1 - Durability with Temperature Rise vs Current

a. Test Sequence:

- (1) Initial temperature rRise
- (2) Durability 10,000 mating cycles at maximum rate of 500 cycles per hour
- (3) Final temperature rise

b. Temperature rise for Sample Group 1 was measured initially, and after 10,000 cycles of durability testing was performed. Thermocouples were soldered to the underside of the contact as close to the interface area as possible.

Sample ID's 101, 102	°C 30 Amperes		°C 60 Amperes		°C 90 Amperes		°C 120 Amperes		°C 140 Amperes	
	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final
Minimum	3.200	2.400	8.600	6.900	16.700	13.800	29.200	23.300	32.700	31.300
Maximum	3.600	3.000	9.300	9.300	18.500	18.900	30.300	32.200	34.000	44.400
Average	3.375	2.725	8.925	8.075	17.575	16.325	29.750	27.700	33.350	37.850

Figure 13  
Sample Group 1, Final Temperature Rise

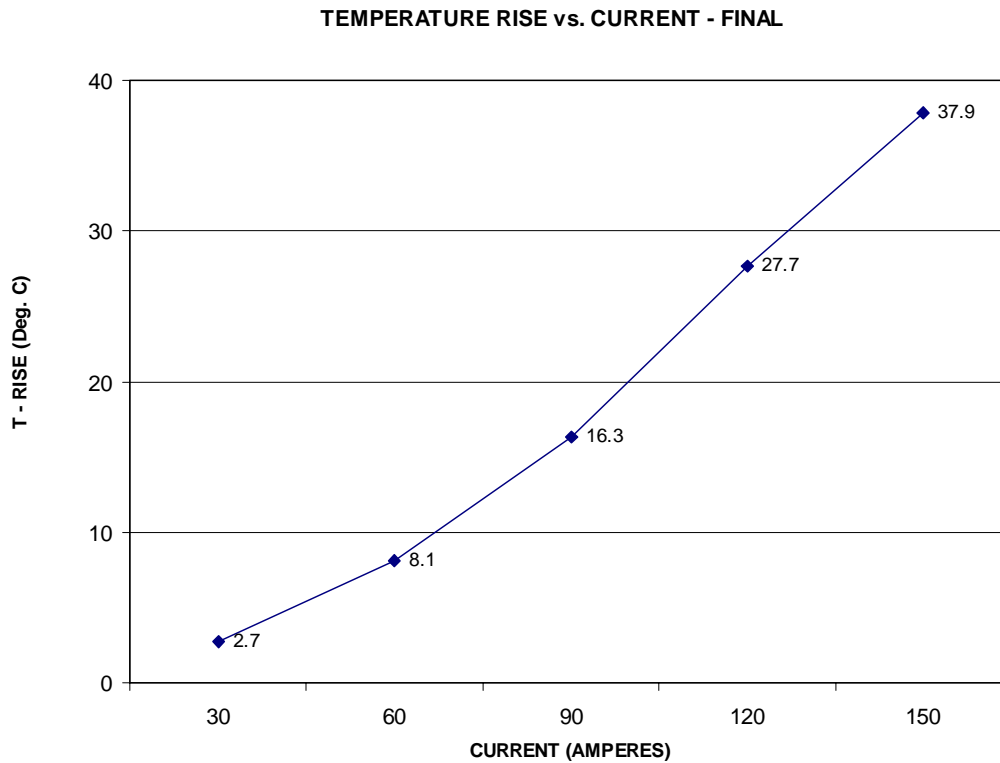


Figure 14  
Sample Group 1, Final Temperature Rise

4. Sample Test Groups 6 and 7 - Temperature Rise, 6AWG and 4AWG

Temperature rise (Test Groups 6 and 7) was measured until a 30°C temperature rise value was sustained. Thermocouples were soldered to the underside of the contact as close to the interface area as possible. See Figures 15 and 16.

Sample Group 6	Δ°C 30 Amperes	Δ°C 50 Amperes	Δ°C 70 Amperes	Δ°C 80 Amperes	Δ°C 90 Amperes
Minimum	4.300	9.900	19.600	24.300	32.200
Maximum	4.300	10.000	19.600	24.400	32.200
Average	4.300	9.950	19.600	24.350	32.200

Figure 15  
Sample Group 6, Temperature Rise, 6AWG

Sample Group 7	Δ°C 30 Amperes	Δ°C 50 Amperes	Δ°C 70 Amperes	Δ°C 90 Amperes	Δ°C 110 Amperes
Minimum	3.100	7.100	13.600	22.600	32.500
Maximum	3.400	7.100	13.800	22.800	32.700
Average	3.250	7.100	13.700	22.700	32.600

Figure 16  
Sample Group 7, Temperature Rise, 4AWG

B. CTL B034992-006 - Temperature Rise at Rated Current

Six paired samples using 2 AWG wires, in connector configurations of 1x2 and 2x2, were subjected to a temperature rise test for 4 hours with 100% of the contacts energized with a current of 115 amperes. Thermocouples were soldered to the underside of the contact as close to the interface area as possible. Ambient temperature was 25°C. See Figure 17.

Data	Actual (°C)	Temperature Rise (°C)	Actual (°C)	Temperature Rise (°C)
	1X2 Configuration		2X2 Configuration	
Minimum	46.9	22.5	48.8	22.8
Maximum	53.1	28.7	55.8	29.8
Average	48.7	24.3	52.3	26.3

Figure 17  
Temperature Rise at Rated Current, Single-Pole