AMP*

QUALIFICATION TEST REPORT

AMP* Ultra-Fast Plus Fully Insulated
FASTON* Receptacle Terminals

501-62 Rev. A

Product Specification:	108-2044, Rev. A
CTL Numbers:	CTL1117-301-005, CTL1117-020 CTL1117-038-021
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Prepared By:	Daniel E. McClure James D'Angelo
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AMP INCORPORATED

HARRISBURG, PENNSYLVANIA 17105 PHONE: 717-564-0100 TWX: 510-657-4110

CORPORATE TEST LABORATORY

Qualification Test Report on
AMP Ultra-Fast Plus Fully Insulated
FASTON Receptacle Terminals

AMP P/N 2-520401-2, 3-520402-2,
2-520405-2, 3-520406-2,
2-520932-2

1. Introduction

1.1 Purpose

Testing was performed on AMP Ultra-Fast Plus Fully Insulated FASTON Receptacle Terminals to determine if they meet the performance requirements of AMP Product Specification 108-2044, Rev. A.

1.2 Scope

This report covers the electrical, mechanical and environmental performance of the Ultra-Fast Fully Insulated FASTON Receptacle Terminals, manufactured by the Automotive/Consumers Business Group. Testing on the Series 187 and 250 Receptacles was performed between April 16, 1985 and November 18,1987. Testing on the Series 110 Receptacles was performed between February 13, 1989 and April 21, 1989.

1.3 Conclusions

The Ultra-Fast Plus Fully Insulated FASTON Receptacle Terminals meet the electrical, mechanical and environmental performance requirements of AMP Product Specification 108-2044, Rev. A.

1.4 Product Description

AMP Ultra-Fast Plus Fully Insulated FASTON Receptacle Terminals mate with FASTON tabs, which are used in appliances and other commercial equipment. The tin plated copper alloy FASTON terminal is completely enclosed in a Nylon housing. Assemblies are color coded by wire size, and terminated on solid, fused, or stranded wire ranging from AWG 22 thru AWG 14.

1.5 Test Samples

The samples were taken randomly from current production, and all samples tested were receptacles. The following sample quantities were used for each test group:

Test Groups	Quantity	Part Number	Wire Sizes	Description
1,2,3,4,12	60	2-520401-2	22,20,18	187 Series
	40	3-520402-2	16,14	187 Series
	60	2-520405-2	22,20,18	250 Series
	40	3-520406-2	16,14	250 Series
1,2	60	2-520932-2	22,20,18	110 Series
12	55	2-520932-2	22,18	110 Series
6,8,10,11	20	2-520401-2	22	187 Series
	20	3-520402-2	16	187 Series
	20	2-520405-2	22	250 Series
	20	3-520406-2	16	250 Series
8,10,11	20	2-520932-2	22	110 Series
5,7,9,13	20	2-520401-2	Unwired	187 Series
	20	3-520402-2	Unwired	187 Series
	20	2-520405-2	Unwired	250 Series
	20	3-520406-2	Unwired	250 Series
7,9,13	20	2-520932-2	Unwired	110 Series

1.6 Test Sequence

Test or Examination	Test Group												
	1	2	3	4	5	6	7	8	9	10	11	12	13
	Test Sequence (a)												
Examination of Product	1	1	1	1	1	1	1	1	1	1	1	1	1
Dielectric Withstand, Test Condition A		2	3	3 (b)									
Dielectric Withstand, Test Condition C					2								
Dielectric Withstand, Tab Receptacle Entry Position						2							
Heating (T-Rise)	2(c)												
Heat Cycling (Current Cycle)	3(c)												
Pull Out (Crimp Tensile)		4											
Pull Out (Insulation Crimp Tensile)												2	
Secureness of Insulation (Unassembled)							2		3				
Secureness of Insulation (Assembled)								2		3	3(b)		
Engagement & Disengagement													2
Flex Insulation Crimp		3											
Heat Age, 136 ° C			2						2	2			
Heat Age, Humidity				2							2		

Figure 1

(a) Number indicates sequence in which tests are performed.
(b) Uncrimped terminals and wires in Test Groups 4 and 11 were conditioned in the environments indicated. After conditioning, each sample was crimped to an appropriate wire, and the electrical or mechanical test was performed.
(c) Temperature rise and voltage drop measurements, during current cycling, were collected simultaneously. Samples were prepared, in accordance with Figure 3. Thermocouples must have strain relief suitable to protect interface.

2. Summary of Testing

2.1 Examination of Product - Groups 1-14

All connectors submitted for testing were selected from production lots that were subjected to inspection and found to be acceptable by the Product Assurance Department of Automotive/Consumers Business Group.

2.2 Dielectric Withstanding, Test Condition A - Groups 2, 3, and 4

There was no dielectric breakdown or flashover on any sample, when a test voltage of 3.4 kv ac was applied for a one-minute hold period.

2.3 Dielectric Withstanding, Test Condition C - Group 5

There was no dielectric breakdown or flashover on any sample, when the test voltage of 3.0 kv ac was applied for a one-minute hold period.

2.4 Dielectric Withstanding, Tab Receptacle Entry Position - Group 6

There was no dielectric breakdown or flashover on any sample, when the test voltage of 1.0 kv ac was applied for a one-minute hold period.

2.5 Heating (Temperature Rise) - Group 1

All terminals tested met the specification requirement of 20°C or less temperature rise above ambient temperature.

All Temperatures are in Degrees C

Part No.	Temp. Rise Max.	Temp. Rise Avg.	Crimp Height*	Wire Size	Specified Current**	Ambient Temp.
2-520401-2	11.2	10.5	.065	22	6	26.1
2-520401-2	14.6	13.5	.065	20	8	26.1
2-520401-2	7.0	5.4	.070	18	14	25.1
3-520402-2	4.3	3.8	.075	18	14	26.2
3-520402-2	7.9	7.3	.075	16	20	26.2
3-520402-2	13.1	12.5	.080	14	30	27.1
2-520405-2	1.4	1.2	.065	22	6	26.2
2-520405-2	1.9	1.7	.065	20	8	25.9
2-520405-2	4.9	4.5	.070	18	14	26.3
3-520406-2	6.4	5.9	.075	16	20	26.2
3-520406-2	10.7	9.6	.080	14	30	26.7
2-520932-2	2.2	2.0	.065	22	6	24.6
2-520932-2	1.9	1.7	.065	20	8	24.9
2-520932-2	0.9	0.7	.070	18	14	25.7

*Measurements are in inches
**Direct Current

2.6 Heat Cycling (Current Cycling) - Group 1

All terminals tested met the specification requirement of 65°C or less temperature rise above ambient. All voltage drop measurements were less than the specification requirement.

24th Cycle

Part Number	Wire Size	Test Curr.*	Temp. Rise** Max.	Temp. Rise** Mean	Millivolts# Max.	Millivolts# Mean	Spec. Requirement
2-520401-2	22	6	6.2	5.6	4.88	3.98	14 mv
2-520401-2	20	8	10.0	8.6	5.98	4.91	15 mv
2-520401-2	18	14	20.0	18.2	13.75	11.75	17 mv
3-520402-2	18	14	17.4	16.7	9.66	8.79	17 mv
3-520402-2	16	20	29.9	28.1	11.97	10.99	19 mv
3-520402-2	14	30	51.6	46.3	19.81	18.73	21 mv
2-520405-2	22	6	5.4	4.7	4.49	3.13	10 mv
2-520405-2	20	8	7.4	6.5	4.79	4.21	11 mv
2-520405-2	18	14	16.3	14.9	7.66	6.99	13 mv
3-520406-2	16	20	29.5	26.6	9.71	9.02	15 mv
3-520406-2	14	30	38.5	36.9	14.76	13.32	20 mv
2-520932-2	22	4	3.1	2.6	5.43	4.04	14 mv
2-520932-2	20	6	5.5	4.9	5.19	4.63	15 mv
2-520932-2	18	8	8.0	7.6	6.03	5.16	17 mv

*Direct Current
**Degrees C
#Crimp MVD + Friction MVD - E.W.L. = Millivolt Drop

500th Cycle

Part Number	Wire Size	Test Curr.*	Temp. Rise** Max.	Temp. Rise** Mean	Millivolts# Max.	Millivolts# Mean	Spec. Requirement
2-520401-2	22	6	5.8	5.4	4.71	4.38	18 mv
2-520401-2	20	8	8.8	7.9	6.29	5.46	19 mv
2-520401-2	18	14	20.0	17.7	19.11	10.92	21 mv
3-520402-2	18	14	20.5	19.7	10.33	9.18	21 mv
3-520402-2	16	20	28.8	27.6	13.05	12.30	23 mv
3-520402-2	14	30	50.0	47.2	19.84	19.08	25 mv
2-520405-2	22	6	6.0	5.4	5.46	3.72	14 mv
2-520405-2	20	8	7.8	7.0	5.08	4.50	15 mv
2-520405-2	18	14	15.3	14.2	7.50	6.89	17 mv
3-520406-2	16	20	24.7	23.1	9.41	8.77	19 mv
3-520406-2	14	30	40.8	37.7	16.13	14.07	26 mv
2-520932-2	22	4	3.6	2.8	5.31	4.14	18 mv
2-520932-2	20	6	6.4	5.6	5.62	4.84	19 mv
2-520932-2	18	8	10.9	8.4	6.35	5.27	21 mv

*Direct Current
**Degrees C
#Crimp MVD + Friction MVD - E.W.L. = Millivolt Drop

2.7 Pull Out (Wire Crimp Tensile) - Group 2

All samples met the minimum specified requirements for Pull Out (Wire Crimp Tensile), in accordance with the specification.

	Tensile in Pounds					
Part No.	Min.	Max.	Mean	Crimp Ht.	AWG	Min. Req.
2-520401-2	18.0	27.0	22.85	.065"	22	10 lbs.
2-520401-2	27.0	32.0	29.14	.065"	20	16 lbs.
2-520401-2	42.8	48.7	45.19	.070"	18	20 lbs.
3-520402-2	49.5	64.7	54.72	.075"	16	30 lbs.
3-520402-2	95.0	100	98.51	.080"	14	60 lbs.
3-520402-2	35.0	42.4	39.36	.075"	18	20 lbs.
2-520405-2	18.7	26.0	22.09	.065"	22	10 lbs.
2-520405-2	22.2	28.7	26.47	.065"	20	16 lbs.
2-520405-2	40.0	49.0	44.11	.070"	18	20 lbs.
3-520406-2	62.3	71.7	66.35	.075"	16	30 lbs.
3-520406-2	101	111	107.5	.080"	14	60 lbs.
2-520932-2	13.5	21.7	17.93	.065"	22	10 lbs.
2-520932-2	22.7	30.0	27.00	.065"	20	16 lbs.
2-520932-2	41.3	46.6	44.77	.070"	18	20 lbs.

2.8 Pull Out (Insulation Crimp Tensile) - Group 12

All samples met the minimum specified requirement for Pull Out (Insulation Crimp Tensile), in accordance with the specification.

	Tensile in Pounds					
Part No.	Min.	Max.	Mean	Crimp Ht.	AWG	Min. Req.
2-520401-2	5.7	6.9	6.39	.065"	22	3.0 lbs.
2-520401-2	4.2	5.3	4.85	.065"	20	3.0 lbs.
2-520401-2	5.6	6.6	6.05	.070"	18	3.0 lbs.
3-520402-2	4.6	7.0	5.33	.075"	16	3.0 lbs.
3-520402-2	5.5	9.5	7.22	.080"	14	3.0 lbs.
3-520402-2	3.8	5.4	4.39	.075"	18	3.0 lbs.
2-520405-2	4.2	6.9	5.81	.065"	22	3.0 lbs.
2-520405-2	3.4	4.5	3.94	.065"	20	3.0 lbs.
2-520405-2	3.6	4.5	4.09	.070"	18	3.0 lbs.
3-520406-2	3.2	6.8	5.29	.075"	16	3.0 lbs.
3-520406-2	6.2	9.2	7.29	.080"	14	3.0 lbs.
2-520932-2	1.7	3.2	2.42	.065"	22	1.0 lb.
2-520932-2	2.0	3.6	2.84	.070"	18	1.0 lb.

2.9 Secureness of Insulation (Unassembled) - Groups 7 & 9

There was no separation of insulation from the terminal bodies as a result of Secureness of Insulation (Unassembled) testing.

2.10 Secureness of Insulation (Assembled) - Groups 8, 10, & 11

There was no separation of insulation from the terminal bodies as a result of Secureness of Insulation (Assembled) testing.

2.11 Engagement & Disengagement - Group 13

All samples met the minimum and maximum force requirements, as specified in Figure 2.

Tab Size Plain Brass	Terminal Plating	Force, pounds					
		1st Insertion	1st Withdrawal			6th Withdrawal	
		Individual Maximum	Indv., max.	Average minimum	Indv., minimum	Average minimum	Indv., minimum
.250	Tin	17	17	5	3	4	3
.187	Tin	15	20	5	3	3	2
.110	Tin	12	14	3	2	2	1

Figure 2

All Forces in Pounds

Part No.	Tab Size	1st Insert. Max.	1st Withdrawal Max.	1st Withdrawal Avg.	1st Withdrawal Min.	6th Withdrawal Avg.	6th Withdrawal Min.
2-520401-2	187	8.7	9.8	6.5	4.0	10.6	4.8
3-520402-2	187	8.0	8.5	6.5	5.5	12.0	9.5
2-520405-2	250	9.8	10.8	8.1	5.3	9.7	5.5
3-520406-2	250	11.3	12.0	10.3	6.3	11.2	8.3
2-520932-2	110	6.8	6.5	4.7	3.5	6.0	4.0

2.12 Flex Insulation Crimp - Group 2

All samples met the flex insulation test requirement. There was no insulation disengaging from the insulation crimp on any samples tested.

2.13 Heat Age, 136°C - Groups 3, 9, & 10

There was no evidence of physical damage to any receptacles, as a result of exposure to a temperature of 136°C for 7 days.

2.14 Heat Age/Humidity - Groups 4 & 11

There was no evidence of physical damage to any receptacles, as a result of exposure to a temperature of 100°C for 7 days, followed by a steady state humidity for 24 hours. Samples from Group 4 met the Dielectric Withstanding, Test Condition A requirement, and samples from Group 11 met the Secureness of Insulation (Assembled) requirement.

3. Test Methods

3.1 Examination of Product - Groups 1 thru 13

The product drawings and inspection plans were used to examine the samples. They were examined visually and functionally.

3.2 Dielectric Withstanding, Test Condition A - Groups 2, 3, and 4

Assembled terminals were subjected to a dielectric withstanding voltage, in accordance with Test Condition A of UL310. With the tab entry section of each sample sealed with dielectric wax, the sample was embedded vertically in #12 lead shot, so that only the portion of the outer insulating surface that covers live parts is to be covered with lead shot. A test potential of 3.4 kv ac was applied, at a rate of 500 volts per second, between the lead shot and the end of the assembled wire. This potential was applied for one minute. The voltage was then returned to zero. This test was not performed on Series 110 contacts for Groups 3 and 4.

3.3 Dielectric Withstanding, Test Condition C - Group 5

Unassembled terminals were subjected to a dielectric withstanding voltage, in accordance with Test Condition C of UL310. Each unwired sample was mated with a receptacle tab, and the crimp end of the sample was mounted vertically on a flat metal plate. A test potential of 3.0 kv ac was applied, at a rate of 500 volts per second, between the plate and the receptacle tab. This voltage was applied for one minute. The voltage was then returned to zero. This test was not performed on Series 110 contacts.

3.4 Dielectric Withstanding, Tab Receptacle Entry Position - Group 6

The tab receptacle entry section of each wired terminal was mounted vertically on a flat metal plate. A test potential of 1.0 kv ac was then applied, at a rate of 500 volts per second, between the wire end of the assembled terminals and the metal plate. This potential was applied for one minute. The voltage was then returned to zero. This test was not performed on Series 110 Ultra-Fast Plus Receptacles.

3.5 Heating (Temperature Rise) - Group 1

The wired terminals were mounted on fixture boards, as specified in NEMA DC2. The terminals were energized at the specified current, and the receptacle temperature was measured. Thermocouples were attached to the receptacles to measure the temperature, as shown in Figure 3 below. This temperature was then subtracted from the ambient temperature to find the temperature rise. When three readings at five minute intervals were the same, the temperature was recorded.

3.6 Heat Cycling (Current Cycle) - Group 1

The wired terminals were mounted on fixture boards, as specified in NEMA DC2 and UL310. The samples were then subjected to 500 cycles of current cycling. With each cycle consisting of current ON for 45 minutes and current OFF for 15 minutes, there were millivolt drop readings and t-rise readings measured initially, at the 24th cycle, and at the 500th cycle at points shown in Figure 3 below. The temperature rise measurements were recorded with ac applied, while voltage drop measurements were recorded with dc applied.

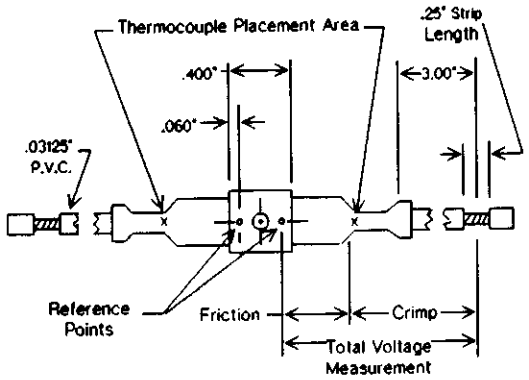

Figure 3

3.7 Pull Out (Wire Crimp Tensile) - Group 2

The minimum axial load, specified for each wire size, was applied to each sample for a one-minute hold period. This load was applied at a rate of one inch per minute. After the one-minute hold period, each sample was pulled to failure.

3.8 Pull Out (Insulation Crimp Tensile) - Group 12

Testing was performed on receptacles with only the wire insulation section crimped on each sample. (The wire was not in the crimp barrel for this test.) An axial load was applied to each sample, at a rate of one inch per minute. Twenty samples of each wire size and terminal type were tested, except on Series 110 Receptacles, where only minimum and maximum wire applications were tested. Testing was performed on single wire applications only.

3.9 Secureness of Insulation (Unassembled) - Groups 7 & 9

Samples were suspended vertically from a mating tab, which was inserted into each receptacle. A 3.0 pound weight was applied to the insulation at the wire crimp end of each terminal for a one-minute hold period.

3.10 Secureness of Insulation (Assembled) - Groups 8, 10, & 11

Samples were suspended vertically from a slotted plate fixture, which allowed an axial load to be applied to the crimped end of the terminal insulation. A 6.0 pound load was then gradually applied, at a rate of approximately 1.0 pound per second, to the receptacle end of each sample. The load was held for one minute, when the required force was reached.

3.11 Engagement & Disengagement - Group 13

Samples from Group 13 were subjected to engagement & disengagement testing. Each receptacle was mounted horizontally in a force actuation fixture. This fixture was equipped with a device used to measure engagement and disengagement forces. The specified mating tab for each receptacle was used for these measurements. Each receptacle and tab was engaged and disengaged 6 times, while forces were recorded.

3.12 Flex Insulation Crimp - Group 2

Flex Insulation testing was performed on all samples of Group 2. Each sample wire was subjected to four 90° flexures, in relation to the terminal, when mounted in a vertical plane. Flexing was performed in four directions, at 90° apart from each other. The holding point for the sample wire was a distance 5 times the diameter of the wire insulation from the wire crimp insulation.

3.13 Heat Age, 136°C - Groups 3, 9, & 10

All samples in Groups 3, 9 and 10 were subjected to Heat Aging. The samples were subjected to 7 days of exposure to a temperature of 136°C. After conditioning, all samples in Groups 3, 9 and 10 were subjected to Dielectric Withstanding Voltage, Test Condition A, Secureness of Insulation (Unassembled) and Secureness of Insulation (Assembled), respectively.

3.14 Heat Age/Humidity - Groups 4 & 11

All samples in Groups 4 and 11 were subjected to 100°C for 7 days, followed by 85% R.H. at 30°C for 24 hours. After conditioning, each sample was crimped to appropriate size wire, and the samples in Groups 4 and 11 were subjected to Dielectric Withstanding Voltage, Test Condition A, and Secureness of Insulation (Assembled), respectively.

3. Validation

Report prepared by,

James A. D'Angelo 5/3/89

James A. D'Angelo
Engineering Assistant
Product Testing Section
Corporate Test Laboratory

Reviewed by,

Richard A. Groft 5/30/89

Richard A. Groft
Supervisor, Design Assurance Testing
Product Testing Section
Corporate Test Laboratory

Approved by,

William Zelner 6/19/89

William Zelner
Manager, Product Assurance
Automotive/Consumer Business Group