AMP

QUALIFICATION TEST REPORT

AMP* COMMERCIAL MATE-N-LOK*
PRINTED CIRCUIT BOARD HEADERS

501-63 REV. 0

Rev D 4/5/88

Product Specification:	108-1077
CTL Numbers:	CTL1349-501-001
	CTL1349-002
Date:	December 4, 1987
Classification:	Unrestricted
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CORPORATE TEST LABORATORY

Qualification Test Report
AMP Commercial MATE-N-LOK
Printed Circuit Board Headers

1. Introduction

1.1 Purpose

Testing was conducted to measure product performance of Commercial MATE-N-LOK Headers when tested to the requirements of AMP Product Specification 108-1077, Rev.0.

1.2 Scope

This report covers electrical and mechanical performance of Commercial MATE-N-LOK Headers made by the Commercial Products Division of the Automotive/Consumer Business Group. Testing was performed between March 1985 and January 1986 at the Corporate Test Laboratory.

1.3 Conclusion

AMP Commercial MATE-N-LOK Printed Circuit Board Headers conform to the performance requirements of product specification 108-1077, Rev.0.

1.4 Product Description

AMP Commercial MATE-N-LOK printed circuit board headers provide an economical means of interfacing with printed boards in commercial equipment. Pin headers and socket headers are available in several sizes from 2 through 16 positions. Both straight and 90° angle headers are available. Housings are made of self-extinguishing thermoplastic material. Contacts are made of copper alloy with gold or tin over nickel plating.

1.5 Test Samples

Samples were taken randomly from current production. The test samples were:

Groups 1 and 2:

Part Number	Description
350213-1	12 Position Pin Header
350643-1	12 Position Socket Header
350641-1	6 Position Socket Header
1-380999-0	6 Position Pin Header
641986-1	6 Position Anti-wicking Pin Header
641737-1	4 Position 90° Angle Header

Groups 3 and 4:

Part Number	Description
350213-1	12 Position Pin Header
350643-1	12 Position Socket Header
350641-1	6 Position Socket Header
1-380999-0	6 Position Pin Header
641986-1	6 Position Anti-wicking Pin Header
350543-1	4 Position Pin Header
641737-1	4 Position 90° Angle Header
641985-1	4 Position Anti-wicking Pin Header

Group 5:

Part Number	Description
350213-1	12 Position Pin Header
1-380999-0	6 Position Pin Header
641986-1	6 Position Anti-wicking Pin Header
350543-1	4 Position Pin Header
641737-1	4 Position 90° Angle Header
641985-1	4 Position Anti-wicking Pin Header

1.5 Test Samples, Cont'd.

Mating Parts used in testing headers were:

Part Number	Description
61116-4	Pin Contact for Wire Size 20 AWG
61117-4	Socket Contact for Wire Size 14 AWG
61118-4	Pin Contact for Wire Size 14 AWG
66314-4	Socket Contact for Wire Size 20 AWG
1-480278-0	12 Position Cap for Socket Headers
1-480287-0	12 Position Plug for Pin Headers
1-480270-0	6 Position Plug for Pin Headers
1-480276-0	6 Position Cap for Socket Headers
1-480424-0	4 Position Plug for Pin Headers

1.6 Qualification Test Sequence

Test or Examination	Test Group				
	1	2	3	4	5
	Test Sequence (a)				
Examination of Product	1	1	1	1	1
Termination Resistance, Specified Current	2,4,6				
Termination Resistance, Dry Circuit		2,4	4,7	2,4,6	
Dielectric Withstanding Voltage			8	7	
Insulation Resistance			9	8	
Temperature Rise vs Current	3				
Current Cycling	5				
Vibration				3	
Mating Force			2		
Unmating Force			5		
Durability			3		
Thermal Shock			6		
Housing Lock Strength					2
Humidity-Temperature Cycling				5	
Industrial Mixed Flowing Gas		3			

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

2. Summary of Testing

2.1 Examination of Product - All Groups

All connectors submitted for testing were selected from production lots. They were subjected to inspection and found to be acceptable by the Product Assurance Department of the Commercial Products Division.

2.2 Termination Resistance, Specified Current - Group 1

All samples met the requirements of the specification.

The termination resistance of the contacts in Test Group 1 was as follows:

		Resistance in milliohms			
Part Number	Condition	Min.	Max.	Avg.	Specified Maximum
350213-1	Initial	0.89	1.06	0.932	3.25
	After T-Rise	0.94	1.58	1.218	none
	After Current Cycling	0.97	1.71	1.253	3.75
Specified Test Current: 10.0 amperes, with 14 AWG wire.					
350213-1	Initial	0.63	0.99	0.828	3.25
	After T-Rise	0.90	1.07	0.995	none
	After Current Cycling	0.89	1.10	0.985	3.75
Specified Test Current: 4.5 amperes, with 20 AWG wire.					
350643-1	Initial	1.77	1.93	1.846	3.25
	After T-Rise	1.94	2.31	2.088	none
	After Current Cycling	1.98	2.47	2.178	3.75
Specified Test Current: 10.0 amperes, with 14 AWG wire.					
350643-1	Initial	1.16	1.98	1.577	3.25
	After T-Rise	1.70	2.18	1.859	none
	After Current Cycling	1.90	2.57	2.134	3.75
Specified Test Current: 4.5 amperes, with 20 AWG wire.					
350641-1	Initial	1.77	1.91	1.842	3.25
	After T-Rise	2.00	2.22	2.108	none
	After Current Cycling	2.18	2.57	2.342	3.75
Specified Test Current: 10.0 amperes, with 14 AWG wire.					
350641-1	Initial	1.65	1.92	1.803	3.25
	After T-Rise	1.94	2.24	2.072	none
	After Current Cycling	1.95	2.50	2.123	3.75
Specified Test Current: 4.5 amperes, with 20 AWG wire.					

2.2 Termination Resistance, Specified Current - Group 1, Cont'd.

Part Number	Condition	Min.	Max.	Avg.	Specified Maximum
1-380999-0	Initial	0.84	0.91	0.881	3.25
	After T-Rise	1.00	1.42	1.247	none
	After Current Cycling	1.00	1.35	1.256	3.75
Specified Test Current: 10.0 amperes, with 14 AWG wire.					
1-380999-0	Initial	0.67	0.90	0.843	3.25
	After T-Rise	0.93	1.03	0.980	none
	After Current Cycling	0.90	1.02	0.965	3.75
Specified Test Current: 4.5 amperes, with 20 AWG wire.					
641986-1	Initial	0.91	0.99	0.949	3.25
	After T-Rise	0.99	1.27	1.089	none
	After Current Cycling	1.00	1.19	1.094	3.75
Specified Test Current: 10.0 amperes, with 14 AWG wire.					
641986-1	Initial	0.54	0.95	0.680	3.25
	After T-Rise	1.01	1.07	1.042	none
	After Current Cycling	0.95	1.09	1.025	3.75
Specified Test Current: 4.5 amperes, with 20 AWG wire.					
641737-1	Initial	2.47	2.59	2.538	3.25
	After T-Rise	2.63	2.78	2.705	none
	After Current Cycling	2.50	2.98	2.698	3.75
Specified Test Current: 10.0 amperes, with 14 AWG wire.					
641737-1	Initial	2.39	2.66	2.470	3.25
	After T-Rise	2.59	2.70	2.638	none
	After Current Cycling	2.60	2.65	2.628	3.75
Specified Test Current: 4.5 amperes, with 20 AWG wire.					

2.3 Temperature Rise vs Specified Current (T-Rise) - Group 1

All samples passed the temperature rise requirement of 30°C maximum above ambient at the specified current. The ambient temperature varied between 24.9°C and 28.3°C during testing.

Part Number	Wire Size (AWG)	Specified Current	Temperature Rise Above Ambient (Max.)
350213-1	14	11.0 a.	24.0°C
	20	5.0 a.	12.9°C
350643-1	14	11.0 a.	24.8°C
	20	5.0 a.	17.1°C
350641-1	14	12.0 a.	29.1°C
	20	8.0 a.	28.6°C

2.3 Temperature Rise vs Specified Current - Group 1, Cont'd.

1-380999-0	14	14.0 a.	28.5°C
	20	8.0 a.	22.1°C
641986-1	14	14.0 a.	27.0°C
	20	8.0 a.	19.1°C
641737-1	14	12.0 a.	30.0°C
	20	8.0 a.	24.5°C

2.4 Current Cycling - Group 1

After 500 current cycles at 125% of specified current, all connectors were undamaged, and they passed the termination resistance requirements.

2.5 Termination Resistance, Dry Circuit - Groups 2, 3 & 4

All samples met the requirements of the specification.

The termination resistance of the contacts in each test group noted was as follows:

		Resistance in milliohms			
Part Number	Condition	Min.	Max.	Avg.	Specified Maximum
Group 2: Readings Initially and after Industrial Mixed Flowing Gas (IMFG) exposure.					
350213-1	Initial	0.92	1.31	1.075	3.25
	After IMFG	1.03	1.57	1.255	3.75
350643-1	Initial	1.88	2.30	2.008	3.25
	After IMFG	1.96	2.40	2.176	3.75
350641-1	Initial	1.97	2.18	2.043	3.25
	After IMFG	2.12	2.58	2.303	3.75
1-380999-0	Initial	0.88	1.07	0.983	3.25
	After IMFG	0.96	1.34	1.172	3.75
641986-1	Initial	0.99	1.19	1.071	3.25
	After IMFG	1.11	1.44	1.229	3.75
641737-1	Initial	2.38	2.48	2.425	3.25
	After IMFG	2.43	2.79	2.578	3.75

2.5 Termination Resistance, Dry Circuit - Groups 2, 3 & 4, Cont'd.

Part Number	Condition	Min.	Max.	Avg.	Specified Maximum
Group 3: Readings after Durability and after Thermal Shock.					
350213-1	After Durability	0.81	1.55	1.075	4.00
	After Thermal Shock	0.78	1.82	1.227	5.00
350643-1	After Durability	1.71	2.32	1.900	4.00
	After Thermal Shock	1.82	2.59	2.126	5.00
350641-1	After Durability	1.82	2.20	2.015	4.00
	After Thermal Shock	2.01	2.85	2.340	5.00
1-380999-0	After Durability	0.99	1.93	1.216	4.00
	After Thermal Shock	1.08	2.50	1.370	5.00
641986-1	After Durability	1.07	1.52	1.281	4.00
	After Thermal Shock	1.32	2.09	1.676	5.00
350543-1	After Durability	0.88	1.29	1.090	4.00
	After Thermal Shock	1.09	2.03	1.523	5.00
641737-1	After Durability	2.48	3.40	2.763	4.00
	After Thermal Shock	2.94	3.63	3.178	5.00
641985-1	After Durability	0.97	1.55	1.153	4.00
	After Thermal Shock	1.19	1.85	1.453	5.00
Group 4: Readings Initially, after Vibration and after Humidity Temperature Cycling.					
350213-1	Initial	0.85	1.11	0.958	3.25
	After Vibration	0.89	1.19	1.042	3.75
	After H-T Cycling	0.69	1.51	1.078	5.00
350643-1	Initial	1.69	1.94	1.841	3.25
	After Vibration	1.78	2.02	1.911	3.75
	After H-T Cycling	1.90	4.13	2.378	5.00
350641-1	Initial	1.76	2.01	1.872	3.25
	After Vibration	1.82	2.36	1.924	3.75
	After H-T Cycling	1.59	4.12	2.502	5.00
1-380999-0	Initial	0.88	1.01	0.932	3.25
	After Vibration	0.85	0.97	0.901	3.75
	After H-T Cycling	0.79	1.59	1.239	5.00

2.5 Termination Resistance, Dry Circuit Groups 2, 3 & 4, Cont'd.

Group 4: Readings Initially, after Vibration and after Humidity Temperature Cycling, Cont'd.

Part Number	Condition	Min.	Max.	Avg.	Specified Maximum
641986-1	Initial	0.91	1.08	0.996	3.25
	After Vibration	0.93	1.12	1.004	3.75
	After H-T Cycling	0.88	3.46	1.606	5.00
350543-1	Initial	0.83	0.97	0.886	3.25
	After Vibration	0.91	1.13	1.003	3.75
	After H-T Cycling	0.84	1.96	1.374	5.00
641737-1	Initial	2.44	2.72	2.611	3.25
	After Vibration	2.45	2.71	2.600	3.75
	After H-T Cycling	2.71	3.05	2.872	5.00
641985-1	Initial	0.88	1.01	0.947	3.25
	After Vibration	0.96	1.18	1.037	3.75
	After H-T Cycling	0.98	1.79	1.201	5.00

2.6 Industrial Mixed Flowing Gas (IMFG) - Group 2

Connectors were exposed to a Class III environment for 20 days. There was no physical damage and all connectors passed termination resistance.

2.7 Mating Force - Group 3

All samples met the requirements of the specification.

All readings are in pounds.

Part Number	Mating Force per Contact	Specified Maximum
350213-1	1.5	5.0
	1.5	5.0
350643-1	1.6	5.0
	1.0	5.0
350641-1	1.0	5.0
	1.2	5.0
1-380999-0	1.5	5.0
	1.8	5.0

2.7 Mating Force - Group 3, Cont'd.

Part Number	Mating Force per Contact	Specified Maximum
641986-1	1.2	5.0
	1.0	5.0
350543-1	1.5	5.0
	1.3	5.0
	1.4	5.0
	1.6	5.0
641737-1	2.0	5.0
	1.5	5.0
	1.4	5.0
	1.9	5.0
641985-1	1.7	5.0
	2.0	5.0
	1.9	5.0
	2.0	5.0

2.8 Durability - Group 3

After 50 mating and unmating cycles, there was no visible wear or damage. Samples met the unmating force and termination resistance requirements of the product specification.

2.9 Unmating Force - Group 3

All samples met the requirements of the specification.

All readings are in pounds.

Part Number	Mating Force per Contact	Specified Minimum
350213-1	1.0	0.7
	1.0	0.7
350643-1	1.4	0.7
	1.2	0.7
350641-1	1.0	0.7
	0.9	0.7
1-380999-0	1.5	0.7
	1.7	0.7
641986-1	1.8	0.7
	0.8	0.7

2.9 Unmating Force - Group 3, Cont'd.

Part Number	Mating Force per Contact	Specified Minimum
350543-1	1.1	0.7
	1.1	0.7
	1.1	0.7
	1.3	0.7
641737-1	1.6	0.7
	1.4	0.7
	1.0	0.7
	1.1	0.7
641985-1	2.0	0.7
	2.0	0.7
	1.6	0.7
	1.8	0.7

2.10 Thermal Shock - Group 3

Connectors were exposed to five cycles of thermal shock between the temperatures of -55°C and 105°C. There was no damage to the samples.

2.11 Humidity-Temperature Cycling - Group 4

After ten days of humidity-temperature cycling, there was no damage to the connectors.

2.12 Dielectric Withstanding Voltage - Groups 3 & 4

There was no voltage breakdown, flashover or arcing when 1000 volts ac was applied between adjacent contacts.

2.13 Insulation Resistance - Groups 3 & 4

Group 3

The lowest insulation resistance measured on any sample was 5000 megohms. The requirement for Group 3 is 500 megohms.

2.13 Insulation Resistance - Groups 3 & 4, Cont'd.

Group 4

The insulation resistance was greater than the 100 megohms, minimum, required after humidity-temperature cycling. Samples were mounted on printed circuit boards which form a parallel resistance path. Therefore, the insulation resistance of the connectors alone is higher than the values listed.

All readings are in megohms.

Part Number	Insulation Resistance (Min.)
350213-1	1.6×10^4
	2.8×10^2
350643-1	1.3×10^2
	1.8×10^2
350641-1	5.0×10^2
	1.7×10^3
1-380999-0	1.1×10^2
	1.1×10^2
641986-1	1.1×10^2
	3.0×10^2
350543-1	4.8×10^4
	1.8×10^2
	2.5×10^2
	4.5×10^4
641737-1	9.5×10^2
	1.4×10^2
	3.5×10^2
	1.2×10^3
641985-1	1.6×10^2
	1.4×10^2
	9.0×10^3
	1.8×10^2

2.14 Vibration - Group 4

During vibration testing there were no discontinuities greater than ten microseconds. Following vibration, there were no cracks, breaks or loose parts.

2.15 Housing Lock Strength - Group 5

All connector assemblies met the housing lock strength requirements. Actual values, in pounds, are listed as follows:

Part Number	Measured Locking Strength	Minimum Required Locking Strength
350213-1	40.4	25.0
1-380999-0	43.5	25.0
641986-1	45.9	25.0
350543-1	6.3	1.0
641737-1	1.6	1.0
641985-1	5.7	1.0

3. Test Methods

3.1 Examination of Product

The product drawing and inspection plan were used to examine the samples. They were examined visually, dimensionally and functionally.

3.2 Termination Resistance, Specified Current

Termination resistance was measured on all contacts in each test group. Current during the test was maintained at 4.5 or 10.0 amperes, as noted in the data summary.

3.3 Temperature Rise vs Specified Current (T-Rise)

The connector temperature at the specified steady state current was measured. All contacts in each connector were wired in series. Thermocouples were attached to the connectors to measure their temperatures, and the rise above ambient was calculated. When three readings at five minute intervals were the same, readings were recorded.

3.4 Current Cycling

Connectors were cycled 500 times at a current which was 125% of the specified temperature rise test current. All contacts in each connector were wired in series. The current was on for 15 minutes, then off for 15 minutes for each cycle. No additional measurements were taken.

3.5 Termination Resistance, Dry Circuit

Termination resistance was measured on all contacts in each test group. A four terminal resistance measuring station was used. Current during the test was maintained at 100 milliamperes with 50 millivolts maximum open circuit voltage.

RESISTANCE AND TEMPERATURE MEASUREMENT POINTS

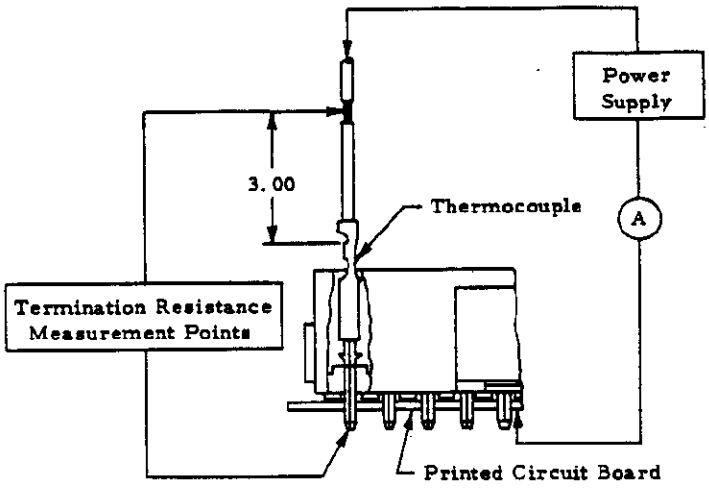

Figure 1

3.6 Industrial Mixed Flowing Gas (IMFG)

Mated connectors were exposed for 20 days in the industrial mixed flowing gas chamber. Class III exposure is defined as a temperature of 30°C and a relative humidity of 75%. Pollutants are Cl_2 at 20 ppb, NO_2 at 200 ppb and H_2S at 100 ppb.

3.7 Mating Force

Connector halves were mounted in free floating fixtures. The force required to mate them was measured. The speed of mating was 0.5 inch per minute.

3.8 Durability

Connectors were mated and unmated 50 times at a rate of 500 cycles per hour. The mating force fixturing was used.

3.9 Unmating Force

The force needed to unmate the connectors was measured. The mating force fixturing was used. The speed of unmating was 0.5 inch per minute.

3.10 Thermal Shock

Mated connectors were subjected to five cycles of thermal shock. The temperature extremes were -55°C and +105°C. Each cycle consisted of 30 minutes at each temperature. Transition between temperatures was less than five minutes.

3.11 Humidity-Temperature Cycling

Mated connectors were exposed to 10 days of humidity-temperature cycling. One cycle took 24 hours, and consisted of cycling the temperature between 25°C and 65°C twice. The relative humidity was held at 95%. During five of the first nine cycles, connectors were exposed to a cold shock at -10°C for 3 hours.

TEMPERATURE/HUMIDITY CYCLING FOR INSULATION RESISTANCE AND DIELECTRIC WITHSTANDING VOLTAGE SAMPLES

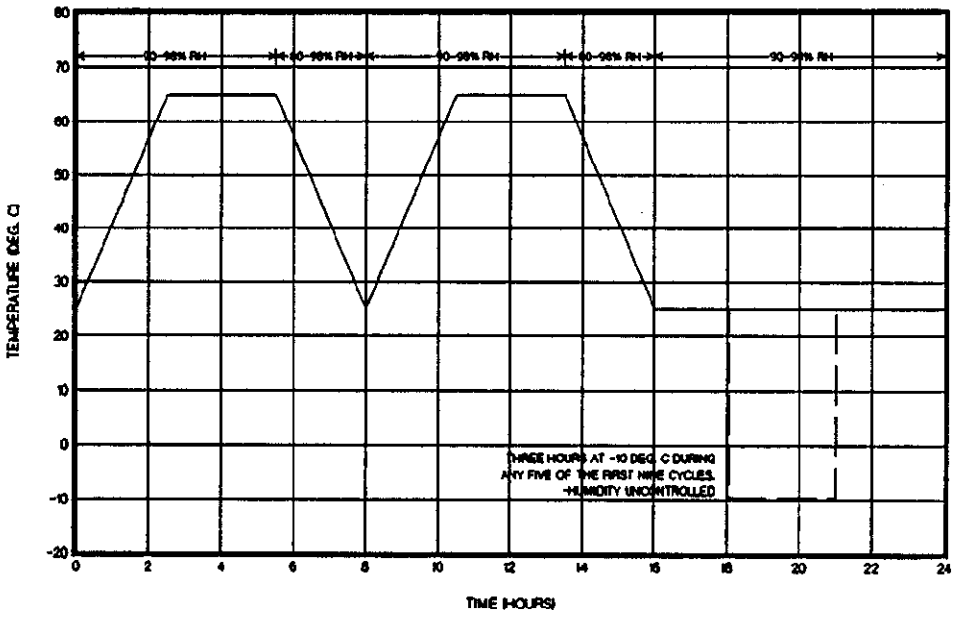

Figure 2

3.12 Dielectric Withstanding Voltage

A test voltage of 1000 volts ac was applied between adjacent contacts of mated connectors. The voltage was applied at a rate of 500 volts per second, and was held for one minute.

3.13 Insulation Resistance

Insulation resistance was measured between adjacent contacts of mated connectors. A voltage of 500 volts dc was applied for two minutes and the insulation resistance was measured.

3.14 Vibration

Mated connectors were subjected to vibration having sinusoidal motion. The amplitude was 0.06 inch, double amplitude. The vibration frequency was varied between the limits of 10 and 55 Hz and returned to 10 Hz in one minutes. This motion was performed for two hours in each of three mutually perpendicular planes, a total of six hours. Connectors were monitored for discontinuities greater than ten microseconds, using a current of 100 milliamperes in the monitoring circuit.

3.15 Housing Lock Strength

Mated connector assemblies, without contacts were placed in the mating/unmating force fixtures. The locking mechanism was intact. A force was applied to separate the connector halves at a rate of 1/2 inch per minute. When the halves separated, the force was recorded.

4. Validation

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12/11/87

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