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TS/kd
(CTL1001-201-063/LABREP(7)

AMP

QUALIFICATION TEST REPORT

Connector, SDL System
AMP* Specification 108-2047, Rev. 0

501-34 Rev. B

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CORPORATE TEST LABORATORY

Product Qualification Test Report
Connector, SDL System

1. Introduction

1.1 Purpose

Testing was conducted to determine product performance when tested to the requirements of AMP Product Specification 108-2047, Rev. 0.

1.2 Scope

This report covers the electrical and mechanical performance of the SDL Connector System, made by the Connector and Electronic Products Group. Testing was performed between January 29, 1986 and April 25, 1986.

1.3 Conclusions

The SDL Connector System conforms to the performance requirements of the product specification. No failures were observed, even among those samples which exhibited crazing of the plug housing.

1.4 Product Description

The system consists of a printed circuit board mounted shielded receptacle, shielded plug connector, and shielded cable. Receptacle housings are preloaded with contacts and a shield for direct receptacle assembly to a printed circuit board and the mounting panel. Plug housings are preloaded with contacts for mass termination of the plug to the shielded cable. The system is designed to be used in class 2 circuits at voltages as defined by The National Electrical Code Table 725-31 (a) and (b).

1.5 Test Samples

The following parts were tested:

Quantity	Part Number	Description			Wire	
20	5-520423-1	SDL	4 Pos.	Plug	AWG 24,	Flat
10	5-520532-1	SDL	4 Pos.	Plug	AWG 28,	Round
30	5-520421-1	SDL	4 Pos.	Receptacle	----	
10	5-520423-2	SDL	6 Pos.	Plug	AWG 24,	Flat
10	5-520421-2	SDL	6 Pos.	Receptacle	----	
150	5-520423-3	SDL	8 Pos.	Plug	AWG 24,	Flat
140	5-520532-3	SDL	8 Pos.	Plug	AWG 28,	Round
300	5-520421-3	SDL	8 Pos.	Receptacle	----	
10	5-520423-6	SDL	16 Pos.	Plug	AWG 24,	Flat
10	5-520421-6	SDL	16 Pos.	Receptacle	----	

1.6 Qualification Test Sequence

	Test Group																
Test or Examination	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Examination of Product	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Rated Current								2,6									
System Resistance, Dry Circuit			2,4				2,4		2,4			2,4			2,4		
Dielectric Withstanding										5	7			5			
Insulation Resistance										2,4	3,5			2,4			
Temp. vs. Current								3,5									
Current Cycling								4									
Surge Test										3							
Shielding Effectiveness		2,4				2,4					2,6		2,4				2,4
Vibration						3	3										
Mating Force	2																
Unmating Force	3																
Plug to Receptacle Retention					2												
Receptacle to PCB Retention				2													
Cable to Plug Tensile				2													
Durability		3	3														
Resistance to Soldering																2	
Thermal Shock											4	3					
Temperature/Humidity Cycling													3	3	3		
Heat Age									3								3

2. Summary of Testing

All samples were inspected and accepted as conforming to the requirements of the current Quality Inspection Plan.

2.1 Test Group #1

A. Mating Force

Test Method

The force necessary to mate the plug and receptacle was measured. The rate of engagement was 1.0" per minute.

Test Results

All samples conformed with the requirements of the specification.

Wire Size/Type		# Pos.	Min.	Max.	Mean	Spec. Max.
AWG 24	Flat	4	2.5	3.5	2.96	7.5
AWG 24	Flat	6	2.5	6.0	3.76	8.0
AWG 24	Flat	8	2.3	4.5	3.16	8.5
AWG 28	Round	8	2.0	5.0	3.19	8.5
AWG 24	Flat	16	6.0	9.2	7.20	15.0

All Values in Pounds.

B. Unmating Force

Test Method

The force necessary to unmate the plug and receptacle was measured. The locking latches were disengaged. The rate of disengagement was 1.0" per minute.

Test Results

All samples conformed with the requirements of the specification.

Wire Size/Type		# Pos.	Min.	Max.	Mean	Spec. Max.
AWG 24	Flat	4	1.7	3.5	2.14	6.0
AWG 24	Flat	6	1.1	3.7	2.54	6.5
AWG 24	Flat	8	1.3	3.2	2.25	7.0
AWG 28	Round	8	1.5	2.8	2.17	7.0
AWG 24	Flat	16	4.5	6.8	5.47	8.0

All Values in Pounds.

2.2 Test Group #2

A. Shielding Effectiveness

Test Method

The radiated response from an unshielded reference sample was measured. All circuit conductors were excited between 70 MHz and 1.0 GHz. The procedure, using a shielded sample, was then repeated. The difference in response is effective shielding in "dB".

Test Results

Reading	70 MHz. - 500 MHz. Min.	70 MHz. - 500 MHz. Spec. Min.	500 MHz. - 1.0 GHz. Min.	500 MHz. - 1.0 GHz. Spec. Min.
Initial	28	20	16	10
After 500 Cycles Durability	26	20	20	10
After 3000 Cycles Durability	20	20	15	10

All Values in db.

B. Durability

Test Method

Plug and receptacle assemblies were mated and unmated by hand a total of 3,000 times, at a rate of 20 cycles per minute.

Test Results

All samples conformed with the requirements of shielding effectiveness.

2.3 Test Group #3

A. System Resistance, Dry Circuit

Test Method

System resistance was measured on all contacts. Current was maintained at 100 milliamperes, and the open circuit voltage was 50 millivolts. Measurement was taken between the PCB and a point 3" back from the friction interface. All resistance values have had the resistance of 3" of wire subtracted from them. These wire values were 15.36 milliohms for AWG 28 and 6.26 milliohms for AWG 24.

Test Results

Reading	Wire Size/Type		Min.	Max.	Mean	Spec. Max.
Initial	AWG 28	Round	7.87	12.15	9.43	25
	AWG 24	Flat	7.74	13.50	9.25	20
After 500 Cycles Durability	AWG 28	Round	7.97	16.98	9.74	30
	AWG 24	Flat	7.77	15.56	9.83	25
After 1000 Cycles Durability	AWG 28	Round	7.83	14.56	9.39	30
	AWG 24	Flat	7.80	13.84	9.61	25
After 1500 Cycles Durability	AWG 28	Round	7.74	13.65	9.26	30
	AWG 24	Flat	7.83	12.75	9.55	25
After 2000 Cycles Durability	AWG 28	Round	7.74	14.07	9.38	30
	AWG 24	Flat	7.93	12.89	9.48	25
After 2500 Cycles Durability	AWG 28	Round	7.63	17.60	9.33	30
	AWG 24	Flat	7.78	13.91	9.43	25
After 3000 Cycles Durability	AWG 28	Round	7.53	14.30	9.21	30
	AWG 24	Flat	7.50	11.44	9.18	25

All Values in Milliohms.

B. Durability

Test Method - See Paragraph 2.2B.

Test Results

One test sample did experience crazing of plug housing after 400 cycles of durability. All samples, however, conformed with the requirements of System Resistance - Dry Circuit.

2.4 Test Group #4

A. Receptacle Retention to PCB

Test Method

The force necessary to dislodge the receptacle from the PCB was measured. The rate of travel was 2.0" per minute.

Test Results

All samples conformed with the requirements of the specification.

Condition	Min.	Spec. Min.
Unsoldered	*	1.0
Soldered	8.1	5.5

All Values in Pounds.

*No actual retention data available. A 1.0 lb. weight was attached to the sample to verify retention.

B. Cable to Plug Tensile

Test Method

The force necessary to cause discontinuities between the plug and wire was measured. The rate of travel was 2.0" per minute.

Test Results

All samples conformed with the requirements of the specification.

Wire Size/Type		Min.	Spec. Min.
AWG 28	Round	25.5	20.0
AWG 24	Flat	28.3	20.0

All Values in Pounds.

2.5 Test Group #5

A. Plug to Receptacle Retention

Test Method

The force necessary to unmate a plug and receptacle was measured. The locking latches were engaged. The rate of disengagement was 2.0" per minute.

Test Results

All samples conformed with the requirements of the specification.

Wire Type/Size		# Pos.	Min.	Spec. Min.
AWG 28	Round	8	22.2	20
AWG 24	Flat	8	51.0	20

All Values in Pounds.

2.6 Test Group #6

A. Shielding Effectiveness

Test Method - See Paragraph 2.2A.

Test Results

Reading	70 MHz. - 500 MHz. Min.	Spec. Min.	500 MHz. - 1.0 GHz. Min.	Spec. Min.
Initial	28	20	17	10
After Vibration	24	20	16	10

All Values in db.

B. Vibration

Test Method

Mated samples were subjected to a random vibration test. The parameters of this test condition were a random motion, starting at 50 Hz. with a power spectral density (PSD) of .005 and increasing at a rate of 6 db per octive to 100 Hz., from 100 Hz. to 1000 Hz. with a PSD of .02 and then decreasing at a rate of 6 db per octive to 2000 Hz. with a PSD of .005. The total GRMS of the test was 5.35. The samples were subjected to this test for fifteen minutes in each of three mutually perpendicular axes for a total test time of 45 minutes.

Test Results

No discontinuities greater than one microsecond were detected. Samples met the shielding effectiveness requirements.

2.7 Test Group #7

A. System Resistance, Dry Circuit

Test Method - See Paragraph 2.3A.

Test Results

All samples conformed with the requirements of the specification.

Reading	Wire Size/Type		# Pos.	Min.	Max.	Mean	Spec. Max.
Initial	AWG 28	Round	8	7.48	10.71	9.11	25
	AWG 28	Flat	8	7.71	11.49	9.44	20
After Vibration	AWG 28	Round	8	7.08	11.37	9.11	30
	AWG 24	Flat	8	7.66	16.28	9.34	25

All Values in Milliohms.

B. Vibration

Test Method - See Paragraph 2.6B.

One (1) test sample did experience crazing of the plug housing following the vibration testing. All samples, however, conformed with the requirements of system resistance, dry circuit.

2.8 Test Group #8

A. System Resistance - 1.5 Amps

Test Method

System resistance was measured on all contacts. Samples were hand probed. Current was maintained at 1.50 amperes and 50 millivolts maximum open circuit voltage. Measurement was taken between the PCB and a point 3" back from the friction interface. All resistance values have had the resistance of 3" of wire subtracted from them. These wire values were 15.36 milliohms for AWG 28 and 6.26 milliohms for AWG 24.

Test Results

All samples conformed with the requirements of the specification.

Reading	Wire Size/Type		Min.	Max.	Mean	Spec. Max.
Initial	AWG 28	Round	15.85	24.04	18.40	45
	AWG 24	Flat	13.58	19.81	16.12	35
After Current Cycling	AWG 28	Round	15.24	21.17	17.78	50
	AWG 24	Flat	13.47	18.37	15.87	40

All Values in Millivolts.

B. Temperature Rise vs. Current

Test Method

Twenty connector assemblies were wired with all contacts in a series circuit and a current of 1.5 amperes (AC) applied. Thermal stability was achieved, and temperature readings were recorded. The temperature probe points were located on the underside of the receptacle.

Test Results

All samples conformed with the requirements of the specification.

Reading	Wire Size/Type		Min.	Max.	Mean	Spec. Max.
Initial	AWG 28	Round	10.7	14.8	12.9	30
	AWG 24	Flat	7.7	10.5	8.8	30
After Current Cycling	AWG 28	Round	8.9	28.3	13.1	30
	AWG 24	Flat	7.1	9.5	8.2	30

All Values in Deg. C.

C. Current Cycling

Test Method

Mated plug and receptacle assemblies were subjected to 500 cycles of current cycling. The test current was 125% of rated current (1.88 amps). Cycle time was 30 minutes (15 On, 15 Off).

Test Results

Test samples (2) did experience crazing of the plug housing following the current cycling. All samples conformed with the requirements of temperature rise vs. current and system resistance at 1.5 amps.

2.9 Test Group #9

A. System Resistance, Dry Circuit

Test Method - See Paragraph 2.3A.

Test Results

All samples conformed with the requirements of the specification.

Reading	Wire Size/Type		# Pos.	Min.	Max.	Mean	Spec. Max.
Initial	AWG 28	Round	8	8.04	10.84	9.38	25
	AWG 24	Flat	8	7.89	12.56	9.36	20
After Heat Age	AWG 28	Round	8	8.07	12.73	9.87	30
	AWG 24	Flat	8	8.24	13.61	9.89	25

All Values in Milliohms.

B. Heat Age

Test Method

Mated samples were subjected to 1000 hours at 80°C.

Test Results

Test samples (16) did experience crazing of the plug housing following the heat age testing. All samples, however, conformed to the requirements of system resistance, dry circuit.

2.10 Test Group #10

A. Insulation Resistance

Test Method

Insulation resistance measurements were made between all adjacent circuits of mated, unmounted samples. A test voltage of 500 VDC was used with an electrification time of one minute.

Test Results

All samples conformed with the requirements of the specification.

Reading	Wire Size/Type		Min.	Max.	Mean	Spec. Min.
Initial	AWG 28	Round	2.5×10^{11}	3.6×10^{11}	3.0×10^{11}	5.0×10^{8}
	AWG 24	Flat	1.6×10^{11}	2.0×10^{12}	1.7×10^{12}	5.0×10^{8}
After Surge Test	AWG 28	Round	1.8×10^{11}	3.0×10^{11}	2.4×10^{11}	5.0×10^{8}
	AWG 24	Flat	8.0×10^{11}	2.0×10^{12}	1.5×10^{12}	5.0×10^{8}

All Values in Ohms.

B. Dielectric Withstanding Voltage

Test Method

A potential of 1000 vac, rms, was applied between all adjacent circuits of mated, unmounted samples. The potential was applied for one minute.

Test Results

No breakdowns or flashovers occurred during testing. Leakage current did not exceed one milliampere.

C. Surge Test

Test Method

Mated plug and receptacle assemblies, with adjacent circuits parallel, were subjected to 5 surges of each polarity at 1 minute intervals. The pulse was 2.0×10^4 microseconds wide and had an amplitude of 1000 VDC.

Test Results

All samples conformed with the requirements of insulation resistance and dielectric withstanding voltage.

2.11 Test Group #11

A. Shielding Effectiveness

Test Method - See Paragraph 2.2A.

Test Results

All samples conformed with the requirements of the specification.

	70 MHz. - 500 MHz.		500 MHz. - 1.0 GHz.	
Reading	Min.	Spec. Min.	Min.	Spec. Min.
Initial	28	20	16	10
After T. Shock	27	20	21	10

All Values in db.

B. Insulation Resistance

Test Method - See Paragraph 2.10A.

Test Results

All samples conformed with the requirements of the specification.

Reading	Wire Size/Type		Min.	Max.	Mean	Spec. Min.
Initial	AWG 28	Round	1.4×10^{11}	2.3×10^{11}	1.8×10^{11}	5.0×10^{8}
	AWG 24	Flat	9.0×10^{11}	1.4×10^{12}	1.1×10^{12}	5.0×10^{8}
After T. Shock	AWG 28	Round	4.0×10^{10}	3.8×10^{10}	3.0×10^{10}	5.0×10^{8}
	AWG 24	Flat	2.4×10^{10}	3.8×10^{10}	3.0×10^{10}	5.0×10^{8}

All Values in Ohms.

C. Dielectric Withstanding Voltage

Test Method - See Paragraph 2.10B.

Test Results

No breakdowns or flashovers occurred during testing. Leakage current did not exceed one milliampere.

D. Thermal Shock

Test Method

Mated samples were subjected to 25 cycles of thermal shock. The temperature extremes were -55°C and 85°C. Dwell time at each extreme was 30 minutes.

Test Results

Test samples (15) did experience crazing of the plug housing following the thermal shock testing. All samples, however, conformed with the requirements of insulation resistance, dielectric withstanding voltage and shielding effectiveness.

2.12 Test Group #12

A. System Resistance, Dry Circuit

Test Method - See Paragraph 2.3A.

Test Results

All samples conformed with the requirements of the specification.

Reading	Wire Size/Type		# Pos.	Min.	Max.	Mean	Spec. Max.
Initial	AWG 28	Round	8	7.48	16.22	9.37	25
	AWG 24	Flat	8	7.88	12.12	9.38	20
After T. Shock	AWG 28	Round	8	8.26	16.02	10.63	30
	AWG 24	Flat	8	7.88	12.18	9.57	25

All Values in Milliohms.

B. Thermal Shock

Test Method - See Paragraph 2.11D.

Test Results

Test samples (13) did experience crazing of the plug housing following the thermal shock testing. All samples, however, conformed with the requirements of system resistance, dry circuit.

2.13 Test Group #13

A. Shielding Effectiveness

Test Method - See Paragraph 2.2A.

Test Results

All samples conformed with the requirements of the specification.

	70 MHz. - 500 MHz.		500 MHz. - 1.0 GHz.	
Reading	Min.	Spec. Min.	Min.	Spec. Min.
Initial	28	20	16	10
After Temperature/Humidity	26	20	18	10

All Values in db.

B. Temperature/Humidity Cycling

Test Method

Mated samples were subjected to 10 temperature/humidity cycles between 5° and 30°C at 95% RH. A cycle consisted of 4 hours at 30°C - 95% RH, a 3 hour transition to 5°C, 3 hours at 5°C - 95% RH, a 2 hour transition to 30°C. Each cycle was a total of 12 hours.

Test Results

All samples conformed with the requirements of shielding effectiveness.

2.14 Test Group #14

A. Insulation Resistance

Test Method - See Paragraph 2.10A.

Test Results

All samples conformed with the requirements of the specification.

Reading	Wire Size/Type		Min.	Max.	Mean	Spec. Min.
Initial	AWG 28	Round	2.5×10^{11}	3.9×10^{11}	3.1×10^{11}	5.0×10^{8}
	AWG 24	Flat	1.8×10^{12}	2.0×10^{12}	1.9×10^{12}	5.0×10^{8}
After Temperature/ Humidity	AWG 28	Round	1.7×10^{11}	2.4×10^{11}	2.0×10^{11}	5.0×10^{8}
	AWG 24	Flat	7.0×10^{10}	1.3×10^{12}	7.5×10^{11}	5.0×10^{8}

All Values in Ohms.

B. Dielectric Withstanding Voltage

Test Method - See Paragraph 2.10B.

Test Results

No breakdowns or flashovers occurred during testing. Leakage current did not exceed one milliampere.

C. Temperature/Humidity Cycling

Test Method - See Paragraph 2.13B.

Test Results

All samples conformed to the requirements of insulation resistance and dielectric withstanding voltage.

2.15 Test Group #15

A. System Resistance, Dry Circuit

Test Method - See Paragraph 2.3A.

Test Results

All samples conformed with the requirements of the specification.

Reading	Wire Size/Type		# Pos.	Min.	Max.	Mean	Spec. Max.
Initial	AWG 28	Round	8	7.71	13.25	9.50	25
	AWG 24	Flat	8	7.69	12.25	9.36	20
After Humidity	AWG 28	Round	8	7.85	14.34	9.37	30
	AWG 24	Flat	8	7.68	15.79	9.43	25

All Values in Milliohms.

B. Temperature/Humidity Cycling

Test Method - See Paragraph 2.13B.

Test Results

One test sample did experience crazing of the plug housing following the temperature/humidity cycling test. All samples, however, conformed to the requirements of System Resistance, Dry Circuit.

2.16 Test Group #16

A. Resistance to Soldering Heat

Test Method

Printed circuit board mounted receptacles were immersed so that the bottom of the board rested on the molten solder. The solder temperature was 260°C, and the immersion duration was 10 seconds.

Test Results

There was no physical damage observed.

2.17 Test Group #17

A. Shielding Effectiveness

Test Method - See Paragraph 2.2A.

Test Results

All samples conformed with the requirements of the specification.

	70 MHz. - 500 MHz.		500 MHz. - 1.0 GHz.	
Reading	Min.	Spec. Min.	Min.	Spec. Min.
Initial	23	20	13	10
After Heat Age	21	20	16	10

All Values in db.

B. Heat Age

Test Method - See Paragraph 2.9B.

Test Results

The test samples (18) did experience crazing at the plug housing following the heat age testing. All samples, however, conformed to the requirements of shielding effectiveness.

3. Validation

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