AMPMODU* Mod IV Wire-to-Board Standard Pressure Gold Contact Interconnection System

1. INTRODUCTION

1.1. Purpose

Testing was performed on AMPMODU* Mod IV wire-to-board standard pressure gold contact interconnection system to determine conformation to the requirements of product specification 108-25020.

1.2. Scope

This report covers the electrical, mechanical, and environmental performance of the interconnection system manufactured by the Printed Circuit Board Products Group of the Capital Goods business unit. The testing was performed between July 28, 1994 and July 21 1995 (group 2) and between August 24, 1989 and January 16, 1990 (groups 1 and 3). Original testing data and results are available under CTL5207-188-047. Additional testing was performed at the Harrisburg Electrical Components Test Laboratory between October 3, 2013 and May 06, 2014 on test groups 1 and 2 using copper-nickel-silicon base material. Original testing data and results are available under EA20130559T.

1.3. Conclusion

The interconnection system meets the electrical, mechanical, and environmental performance requirements of 108-25020.

1.4. Product Description

This miniature system consists of standard pressure receptacle contacts crimped onto either solid or stranded wire and then inserted into a Mod IV housing. The system is designed to mate with AMPMODU Mod II .025-inch square posts or headers.

1.5. Test Specimens

The test specimens were representative of normal production lots, and the following part numbers were used for testing:

Test Group	Qty	Part Number	Description
1, 3	90	1-85969-9	Receptacle, 15 Au Be Cu
1, 2, 3	282	1-87523-5	Receptacle, 15 Au Cu Sn/Ph Bz
2	192	1-87523-8	Receptacle, 30 Au Cu Sn/ Ph Bz
1, 2, 3	282	85969-6	Receptacle, 15 Au Be Cu
2	192	85969-8	Receptacle, 30 Au Be Cu
1, 3	90	87523-4	Receptacle, 15 Au Cu Sn/Ph Bz
1, 3	90	85969-8	Receptacle, 30 Au Be Cu
1	10	1-87456-0	Housing, 20-Position
3	5	4-87456-0	Housing, 50-Position
2	12	5-87456-3	Housing, 64-Position
1	8	1-103186-0	Header, 15 Au
1	2	1-103240-0	Header, 30 Au
2	6	3-87215-2	Header, 30 Au
2	6	3-87543-2	Header, 15 Au

Figure 1 (Cont'd)

Test Group	Qty	Part Number	Description
1	5	2-87456-6	30-Position Mod IV Housing Dr Mrkd .100 CL
		6-146261-5	30-Position Mod II Header Dr Vert B/A .100 CL LF
	160	87666-2	Mod IV Receptacle 30 Au, Stamped from Cu-Ni-Si Material, Crimped to 22 AWG Wire
2	8	2-87456-5	30-Position Mod IV Housing Dr .100 CL
		6-146261-5	30-Position Mod II Header Dr Vert B/A .100 CL LF
	250	87666-2	Mod IV Receptacle 30 Au, Stamped from Cu-Ni-Si Material, Crimped to 22 AWG Wire

Figure 1 (End)

1.6. Qualification Test Sequence

TEST OR EXAMINATION	TEST GROUP (a)		
	1	**2**	**3**
	TEST SEQUENCE (b)		
Initial Examination of Product	1	1	1
Termination Resistance Dry Circuit	3,7	2,7	
Dielectric Withstanding Voltage			3,7
Insulation Resistance			2,6
Temperature Rise vs Current		3,8	
Vibration	5	6	
Physical Shock	6		
Mating Force	2		
Un-Mating Force	8		
Durability	4		
Thermal Shock			4
Humidity-Temperature Cycling			5
Mixed Flowing Gas		4	
Temperature Life		5	
Final Examination of Product	9	9	8

(a) See paragraph 1.5

(b) Numbers indicate sequence that tests were performed.

Figure 2

1.7. Environmental Conditions

Unless otherwise stated, the following environmental conditions prevailed during testing:

Temperature: 15° to 35°C

Relative humidity: 20 to 80%

2. SUMMARY OF TESTING

2.1. Examination of Product —All Groups

All samples submitted for testing were selected from normal current production lots. They were inspected and accepted by the Product Assurance department of the Capital Goods business unit.

2.2. Termination Resistance, Dry Circuit—Groups 1 and 2

All termination resistance measurements, taken at 100 milliamperes DC and 50 millivolts open circuit voltage, were less than 12 milliohms for beryllium copper base metal contacts.

Test Group	Number of Data Points	Condition	Termination Resistance (milliohms)		
			Min	Max	Mean
1	120	Initial	4.74	8.06	6.162
		After Mechanical	4.51	7.51	6.133
2	60	Initial	3.35	6.35	5.094
		After Current Verification	3.99	9.63	6.389

Figure 3

All termination resistance measurements, taken at 100 milliamperes DC and 50 millivolts open circuit voltage, were less than 20 milliohms for copper-tin-phosphor bronze base metal contacts.

Test Group	Number of Data Points	Condition	Termination Resistance (milliohms)		
			Min	Max	Mean
1	80	Initial	5.53	10.23	8.057
		After Mechanical	5.09	11.57	7.667
2	60	Initial	3.64	7.93	6.396
		After Current Verification	4.89	10.36	7.603

Figure 4

All termination resistance measurements, taken at 100 milliamperes DC and 50 millivolts open circuit voltage, were less than 12 milliohms for copper-nickel silicon base metal contacts.

Test Group	Number of Data Points	Condition	Termination Resistance (milliohms)		
			Min	Max	Mean
1	150	Initial	3.81	5.82	4.61
		After Mechanical	2.59	5.71	4.68
2	240	Initial	3.47	5.56	4.47
		After Current Verification	2.20	8.37	5.23

Figure 5

2.3. Dielectric Withstanding Voltage—Group 3

No dielectric breakdown or flashover occurred when a test voltage was applied between adjacent contacts.

2.4. Insulation Resistance—Group 3

All insulation resistance measurements were greater than 5,000 megohms.

2.5. Temperature Rise vs Current—Group 2

All samples had a temperature rise of less than 30°C above ambient when 4.4 amperes was applied.

2.6. Vibration—Groups 1 and 2

No discontinuities of the contacts were detected during vibration (group 1 only). Following vibration, no cracks, breaks, or loose parts on the connector assemblies were visible.

2.7. Physical Shock—Group 1

No discontinuities of the contacts were detected during physical shock. Following physical shock testing, no cracks, breaks, or loose parts on the connector assemblies were visible.

2.8. Mating Force—Group 1

All mating force measurements were less than 9 ounces per contact.

2.9. Un-mating Force—Group 1

All un-mating force measurements were greater than 1.5 ounces per contact.

2.10. Durability—Group 1

No physical damage occurred to the samples as a result of mating and un-mating the connector 200 times for contacts with 30 micro-inch gold and 75 cycles for contacts with 15 micro-inch gold.

2.11. Thermal Shock—Group 3

No evidence of physical damage to either the contacts or the connector was visible as a result of thermal shock.

2.12. Humidity-Temperature Cycling—Group 3

No evidence of physical damage to either the contacts or the connector was visible as a result of exposure to humidity-temperature cycling.

2.13. Mixed Flowing Gas—Group 2

No evidence of physical damage to neither the contacts nor the connector was visible as a result of exposure to the pollutants of mixed flowing gas.

2.14. Temperature Life—Group 2

No evidence of physical damage to neither the contacts nor the connector was visible as a result of exposure to an elevated temperature.

2.15. Final Examination of Product—All Groups

All samples submitted for testing were selected from normal current production lots. They were inspected and accepted by the Product Assurance department of the Capital Goods Business Unit and the Industrial Business Unit for the copper-nickel-silicon material.

3. TEST METHODS

3.1. Initial Examination of Product

A Certificate of Conformance was issued stating that all specimens in this test package were produced, inspected, and accepted as conforming to product drawing requirements and were manufactured using the same core manufacturing processes and technologies as production parts.

3.2. Low Level Termination Resistance

Termination resistance measurements at low level current were made using a four-terminal measuring technique. See Figure 6. The test current was maintained at 100 milliamperes DC with an open circuit voltage of 50 millivolts DC.

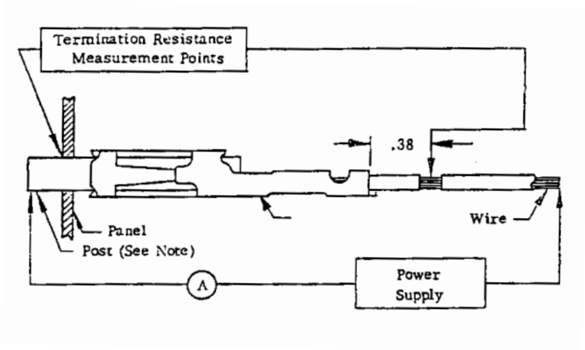
3.3. Dielectric Withstanding Voltage

A test potential of 750 volts AC at sea level, 300 volts AC at 50,000 feet, and 275 volts AC at 70,000 feet were applied between the adjacent contacts. This potential was applied for one minute and then returned to zero.

3.4. Insulation Resistance

Insulation resistance was measured between adjacent contacts using a test voltage of 500 volts DC. This voltage was applied for two minutes before the resistance was measured.

Typical Termination Resistance Measurement Points



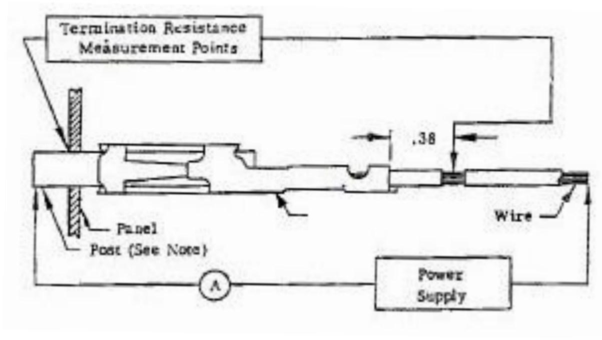


Figure 6

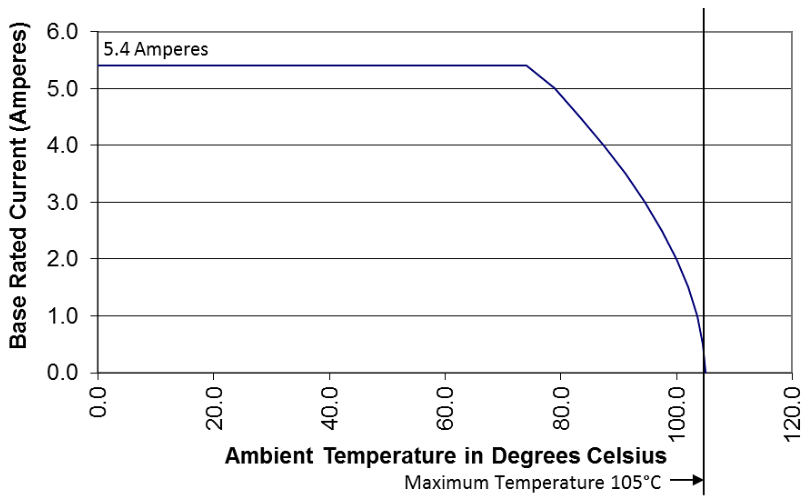
3.5. Temperature Rise vs Current

Connector temperature was measured while energized at various current levels. Thermocouples were attached to the connectors to measure their temperatures. 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 readings were recorded.

The current rating de-rating curve for the specimens in test group 2 are shown in Figure 7. The current rating factor (F factor) is given for contacts made from copper-nickel-silicon base metal.

NOTE
To determine acceptable current rating for percentage connector loading, use the multiplication factor (F) from the chart and multiply it times the base rated current for a single circuit at the desired ambient operating temperature shown in Figure 7.

Current Rating



Test Set Connector Type	Base Rated Current (Amperes)	Percentage Connector Loading		
		Single	50%	100%
TS 2	5.4	1.0	0.523	0.354

Figure 7

3.6. Vibration Sine

Mated connectors were subjected to sinusoidal vibration having a simple harmonic motion with an amplitude of 0.06 inch, double amplitude, or 20 g (whichever is less). The vibration frequency was varied logarithmically between the limits of 10 and 2,000 Hz and returned to 10 Hz in 20 minutes. This cycle was performed 12 times in each of three mutually perpendicular planes for a total vibration time of 12 hours. Connectors were monitored for discontinuities greater than one microsecond using a current of 100 milliamperes in the monitoring circuit (group1). Samples were energized with 2.4 amperes AC (group 2).

3.7. Physical Shock

Mated connectors were subjected to a physical shock test having a sawtooth waveform of 100 gravity units (g peak) and a duration of 6 milliseconds. Three shocks in each direction were applied along the three mutually perpendicular planes for a total of 18 shocks. The connectors were monitored for discontinuities greater than one microsecond using a current of 100 milliamperes in the monitoring circuit.

3.8. Mating Force

The force required to mate individual connectors was measured using a tensile/compression device and a free floating fixture. The cross-head rate of travel was 1.0 inch/minute. The force per contact was calculated.

3.9. Unmating Force

The force required to unmate individual connectors was measured using a tensile/compression device and a free floating fixture. The crosshead rate of travel was 1.0 inch/minute. The force per contact was calculated.

3.10. Durability

Connectors were mated and unmated at a rate not exceeding 600 cycles per hour.

3.11. Thermal Shock

Unmated connectors were subjected to 5 cycles of temperature extremes with each cycle consisting of 30 minutes at each temperature. The temperature extremes were -65°C and 105°C. The transition between temperatures was less than one minute.

3.12. Humidity-Temperature Cycling

Unmated connectors were exposed to 10 cycles of humidity-temperature cycling. Each cycle lasted 24 hours and consisted of cycling the temperature between 25 °C and 65°C twice, while the relative humidity was held at 95%. See Figure 8.

Typical Humidity-Temperature Cycling (109-23-3) Profile

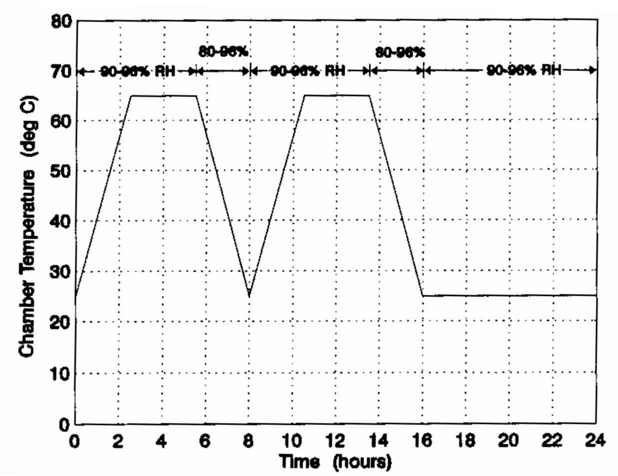


Figure 8

3.13. Mixed Flowing Gas

A. Class II

Mated connectors with 15 micro-inch gold plating, were exposed for 14 days to a mixed flowing gas class II exposure.

NOTE
Class II exposure is defined as a temperature of 30°C and a relative humidity of 70% with the pollutants of Cl2 at 10 ppb, NO02 at 200 ppb, and H2 S at 10 ppb. Samples were preconditioned with 10 cycles of durability.

B. Class Ill

Mated connectors with 30 micro-inch gold plating were exposed for 20 days to a mixed flowing gas class Ill exposure.

NOTE
Class Ill exposure is defined as a temperature of 30°C and a relative humidity of 75% with the pollutants of Cl2 at 20 ppb, NO0 2 at 200 ppb, and H 2 S at 100 ppb. Samples were preconditioned with 10 cycles of durability.

3.14. Temperature Life

Mated samples were exposed to a temperature of 105°C.

3.15. Final Examination of Product

Specimens were visually examined for signs of physical damage.