Mini UMNL Contact Verification Testing Comparing Contacts with 0.0004mm Gold Plating on Internal & External Surface with Current Design

1. INTRODUCTION

1.1 Purpose

To perform verification testing of the 170361-3 contact using 0.0004mm gold plating thickness on the internal mating surface and external surface compared to the current manufacturing process per TE specification 108-5138 Rev J2.

1.2 Scope

This report covers the electrical, mechanical, and environmental performance of the Mini UMNL contacts. Testing was performed at the Harrisburg Electrical Components Test Laboratory between July 7, 2020 and July 24, 2020. Detailed test data is on file and maintained at HECTL under test number EA20200261T.

1.3 Conclusion

All specimens met the requirements of TE specification 108-5138 Rev J2. See Section 2 for more detailed testing results.

1.4 Test Specimens

Specimens identified with the following part numbers were used for this test. Refer to Table 1 for test specimen identification information.

Table 1 – Specimen Identification

Test Set	Quantity	Part Number	Description
1	10	170361-3	Mini UMNL Socket – Current Gold Plating
2	10	170361-3	Mini UMNL Socket – Proposed Design Change
3	10	170361-3	Mini UMNL Socket – Current Gold Plating
	2	172169-1	9P Mini UMNL Plug
4	10	170361-3	Mini UMNL Socket – Proposed Design Change
	2	172169-1	9P Mini UMNL Plug
5	10	170361-3	Mini UMNL Socket – Current Gold Plating
	10	170359-3	Mini UMNL Pin
	5	172165-1	2P Mini UMNL Plug
	5	172157-1	2P Mini UMNL Cap
6	10	170361-3	Mini UMNL Socket – Proposed Design Change
	10	170359-3	Mini UMNL Pin
	5	172165-1	2P Mini UMNL Plug
	5	172157-1	2P Mini UMNL Cap
7	45	170361-3	Mini UMNL Socket – Current Gold Plating
	45	170359-3	Mini UMNL Pin
	5	172169-1	9P Mini UMNL Plug
	5	172161-1	9P Mini UMNL Cap
8	45	170361-3	Mini UMNL Socket – Proposed Design Change
	45	170359-3	Mini UMNL Pin
	5	172169-1	9P Mini UMNL Plug
	5	172161-1	9P Mini UMNL Cap

Table 1 – Specimen Identification *(Continued)*

Test Set	Quantity	Part Number	Description
9	10	170361-3	Mini UMNL Socket – Current Gold Plating
	10	170359-3	Mini UMNL Pin
	5	172165-1	2P Mini UMNL Plug
	5	172157-1	2P Mini UMNL Cap
10	10	170361-3	Mini UMNL Socket – Proposed Design Change
	10	170359-3	Mini UMNL Pin
	5	172165-1	2P Mini UMNL Plug
	5	172157-1	2P Mini UMNL Cap
11	45	170361-3	Mini UMNL Socket – Current Gold Plating
	45	170359-3	Mini UMNL Pin
	5	172169-1	9P Mini UMNL Plug
	5	172161-1	9P Mini UMNL Cap
12	45	170361-3	Mini UMNL Socket - Proposed Design Change
	45	170359-3	Mini UMNL Pin
	5	172169-1	9P Mini UMNL Plug
	5	172161-1	9P Mini UMNL Cap

1.5 Test Sequence

Specimens identified in Table 1 were subjected to the test sequence outlined in Table 2.

Table 2 – Test Sequence

Test or Examination	Test Set			
	1 and 2	3 and 4	5 thru 8	9 thru 12
	Test Sequence *(a)*			
Contact Insertion/Extraction Force (1st and 25th cycles)	1			
Contact Insertion Force		1		
Contact Retention Force		2		
Low Level Contact Resistance			1,3	1,3
Thermal Shock			2	
Temperature-Humidity Cycling				2

(a) Numbers indicate the sequence in which testing was performed.

1.6 Environmental Conditions

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

Temperature: 15°C to 35°C
Relative Humidity: 20% to 80%

2. SUMMARY OF TESTING

2.1 Contact Insertion/Extraction Force (1st and 25th Cycles) (Test Sets 1 and 2)

All specimens passed the contact insertion and extraction force testing. See Table 3 and 4 for testing results.

Table 3 – Test Set 1 – Current Gold Plating
Contact Insertion/Extraction Force Results (gf)

	1st Cycle		25th Cycle	
	Insertion	Extraction	Insertion	Extraction
Min	292.28	135.66	230.96	194.25
Max	318.39	249.22	268.75	285.94
Average	302.22	178.06	250.62	233.48
Std. Dev.	8.50	40.94	12.73	28.60

Table 4 – Test Set 2
Contact Insertion/Extraction Force Results (gf)

	1st Cycle		25th Cycle	
	Insertion	Extraction	Insertion	Extraction
Min	284.86	155.38	239.28	149.47
Max	331.01	215.77	306.65	314.29
Average	302.69	176.96	265.52	223.71
Std. Dev.	14.29	20.97	20.25	48.53

2.2 Contact Mounting Force (Test Sets 3 and 4)

All specimens passed contact mounting force testing. See Table 5 for testing results.

Table 5 – Contact Mounting Force Summary Results (gf)

	Test Set 3- Current Gold Plating	Test Set 4 - Proposed Design Change
Min	272.39	297.01
Max	396.50	334.90
Average	311.71	318.93
Std. Dev.	35.90	13.56

2.3 Contact Retention Force (Test Sets 3 and 4)

All specimens passed contact retention force testing. See Table 6 for testing results.

Table 6 – Contact Retention Force Summary Results (Kg)

	Test Set 3 -Current Gold Plating	Test Set 4 - Proposed Design Change
Min	5.83	5.95
Max	7.91	7.10
Average	6.58	6.62
Std. Dev.	0.63	0.37

2.4 Low Level Contact Resistance (Test Sets 5 thru 12)

All specimens passed low level contact resistance testing. See Table 7 for summary test results.

Table 7 – Low Level Contact Resistance Summary Results w/o Bulk Resistance (mΩ)

Test Set	Step	Min	Max	Average	Std. Dev.
Current Gold Plating – 2P Mini UMNL					
5	Initial	2.623	2.996	2.888	0.116
	After Thermal Shock	3.005	4.506	3.493	0.485
Proposed Design Change – 2P Mini UMNL					
6	Initial	2.704	3.744	3.169	0.304
	After Thermal Shock	2.897	4.970	3.719	0.807
Current Gold Plating – 9P Mini UMNL					
7	Initial	2.775	4.109	3.085	0.205
	After Thermal Shock	2.858	5.668	3.516	0.542
Proposed Design Change – 9P Mini UMNL					
8	Initial	2.532	3.360	2.974	0.165
	After Thermal Shock	3.012	6.702	3.656	0.631
Current Gold Plating – 2P Mini UMNL					
9	Initial	2.679	3.391	2.967	0.201
	After Temp/Humidity Cycling	2.983	5.089	3.542	0.641
Proposed Design Change – 2P Mini UMNL					
10	Initial	2.807	3.223	2.978	0.150
	After Temp/Humidity Cycling	2.891	5.572	3.664	0.803
Current Gold Plating – 9P Mini UMNL					
11	Initial	2.590	3.215	2.970	0.166
	After Temp/Humidity Cycling	2.913	4.751	3.553	0.407
Proposed Design Change – 9P Mini UMNL					
12	Initial	2.618	3.620	3.075	0.255
	After Temp/Humidity Cycling	2.950	4.739	3.695	0.461

2.5 Thermal Shock (Test Sets 5 thru 8)

Specimens showed no signs of physical damage as a result of thermal shock testing.

2.6 Temperature-Humidity Cycling (Test Sets 9 thru 12)

Specimens showed no signs of physical damage as a result of temperature/humidity cycling.

3. TEST METHODS

3.1 Contact Insertion/Extraction Force (1st and 25th Cycles) (Test Sets 1 and 2)

A 0.039 inch rounded tip gage pin was attached to the movable crosshead of the tensile/compression machine. A Jacobs chuck was attached to a X-Y rotational table, which was attached to the base of the tensile/compression machine. The specimen was placed and secured in the Jacobs chuck. The gage pin was inserted in the tip of the contact to the point where force was beginning to be detected. The machine was run at a rate of 100mm/min for a total of 25 cycles on each specimen. Max value of both insertion force and extraction force on each cycle was recorded.

3.2 Contact Mounting Force (Test Sets 3 and 4)

A goal post fixture with a slotted plate was used to hold the housing in place. The goal post was mounted to a free floating X-Y rotational table that was attached to the base of the tensile compression machine. The wire of the specimen was fed up through a Jacobs Chuck that was attached to the movable crosshead of the tensile compression machine. The contact was slowly inserted into the housing until it was fully seated. The test was then run at a rate of 25 millimeters per minute. The maximum value during the insertion was recorded.

3.3 Contact Retention Force (Test Sets 3 and 4)

A slotted plate was used to hold the housing, which was mounted to a free floating X-Y rotational table that was attached to the base of the tensile compression machine. Air jaws were used to grip the wire that was attached to the movable crosshead of the tensile compression machine. Each wire was pulled at a rate of 0.5 inches per minute until failure occurred. The peak value was recorded.

3.4 Low Level Contact Resistance (Test Sets 5 thru 12)

Low level contact resistance measurements were taken at 20mV maximum and 100mA maximum. Measurements were taken of each wire position. Measurements were taken initially and after exposure to the environments. Testing was conduct in accordance with EIA-364-23C.

3.5 Thermal Shock (Test Sets 5 thru 8)

The mated specimens were subjected to 25 cycles of thermal shock between -20 C and +95 C with 30 minutes at each extreme. After thermal shock testing specimens were left in room temperature for a minimum of three hours prior to having the next low level contact resistance measurements taken. Testing was conducted in accordance to TE specification 108-5138 Rev J2.

3.6 Temperature-Humidity Cycling (Test Sets 9 thru 12)

Mated pair specimens were subjected to 10 cycles of temperature/humidity cycling ranging in temperature from 25 C and 65 C with a relative humidity of 80% - 98%. Also including 10 cycles of low temperature shocks during testing. Testing was conducted in accordance with test method 106D of Mil-STD-202. After testing specimens were recondition at room temperature before conducting low level contact resistance measurements.