Mini-Universal MATE-N-LOK* Connector

1. INTRODUCTION

1.1. Purpose

Testing was performed on the Tyco Electronics Mini-Universal MATE-N-LOK* Connectors to determine their conformance to the requirements of Product Specification 108-1542 Revision C.

1.2. Scope

This report covers the electrical, mechanical, and environmental performance of the Mini-Universal MATE-N-LOK Connectors . Testing was performed at the Harrisburg Electrical Components Test Laboratory between 24May04 and 02Aug04. The test file numbers for this testing are CTL 7166-007 and CTL 1314-004. Additional testing was performed on specimens with palladium nickel plating between 26May10 and 21Jan11. The test file number for this additional testing is EA20100461T. This documentation is on file at and available from the Harrisburg Electrical Components Test Laboratory.

1.3. Conclusion

The Mini-Universal MATE-N-LOK Connectors listed in Paragraph 1.5., conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-1542 Revision C.

1.4. Test Specimens

Test specimens were representative of normal production lots. Specimens identified with the following part numbers were used for test:

A. Test Reports CTL7166-007 and CTL1314-004

Test Group	Quantity	Part Number	Description
1,3	20 each	172160-1	6 position cap housing
2	40	172163-1	15 position cap housing
5	10	172163-1	15 position cap housing
1	20	172168-1	6 position plug housing
3	5	172168-1	6 position plug housing
2	40	172171-1	15 position plug housing
3	5	172331-1	6 position cap housing
5	10	172334-1	15 position cap housing
3	5	172339-1	6 position plug housing
2	75	770834-1	26-30 AWG socket contact w/12 inches of 30 AWG
4	70	770834-1	26-30 AWG socket contact w/12 inches of 30 AWG
2	75	770834-3	26-30 AWG socket contact w/12 inches of 30 AWG
2	75	770834-4	26-30 AWG socket contact w/12 inches of 30 AWG
4	45	770834-4	26-30 AWG socket contact w/12 inches of 30 AWG

Figure 1 (continued)

| Indicates Change

Test Group	Quantity	Part Number	Description
2	75	770834-6	26-30 AWG socket contact w/12 inches of 30 AWG
2	150	770835-1	26-30 AWG pin contact w/12 inches of 30 AWG
2	150	770835-3	26-30 AWG pin contact w/12 inches of 30 AWG
4	30	770902-1	22-26 AWG socket contact w/6 inches of 22 AWG
4	30	770902-4	22-26 AWG socket contact w/6 inches of 22 AWG
1,3	60 each	770903-1	18-22 AWG pin contact w/12 inches of 18 AWG
1	60	770903-3	18-22 AWG pin contact w/12 inches of 18 AWG
1,4	30 each	770904-1	18-22 AWG socket contact w/12 inches of 18 AWG
1,4	30 each	770904-4	18-22 AWG socket contact w/6 inches of 18 AWG
1	30	770904-6	18-22 AWG socket contact w/12 inches of 18 AWG
2	150	794406-1	16-20 AWG pin contact w/12 inches of 16 AWG
2	150	794406-3	16-20 AWG pin contact w/12 inches of 16 AWG
2	75	794407-1	16-20 AWG socket contact w/12 inches of 18 AWG
3	30	794407-1	16-20 AWG socket contact w/12 inches of 18 AWG
2	75	794407-3	16-20 AWG socket contact w/12 inches of 16 AWG
2	75	794407-4	16-20 AWG socket contact w/12 inches of 18 AWG
3	30	794407-4	16-20 AWG socket contact w/12 inches of 18 AWG
2	75	794407-6	16-20 AWG socket contact w/12 inches of 16 AWG
3	10	794895-1	6 position plug housing
3	5	794940-1	6 position cap housing
5	10	794942-1	10 position cap housing

Figure 1 (end)

B. Test Report EA20100461T

Test Group	Quantity	Part Number	Description
1,2	5 each	172163-1	15 position circular Mini-Universal MATE-N-LOK cap
	5 each	172171-1	15 position circular Mini-Universal MATE-N-LOK plug
	5 each	1-770903-0	Mini-Universal MATE-N-LOK pin with 18 AWG wire
	5 each	1-770904-0	Mini-Universal MATE-N-LOK socket with 18 AWG wire
3	15	1-770903-0	Mini-Universal MATE-N-LOK pin with 18 AWG wire
	15	1-770904-0	Mini-Universal MATE-N-LOK socket with 18 AWG wire
	15	1-770903-0	Mini-Universal MATE-N-LOK pin with 22 AWG wire
	15	1-770904-0	Mini-Universal MATE-N-LOK socket with 22 AWG wire

Figure 2

1.5. Environmental Conditions

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

- Temperature: 15 to 35°C
- Relative Humidity: 25 to 75%

1.6. Qualification Test Sequence

A. Test Reports CTL7166-007 and CTL1314-004

Test or Examination	Test Group (a)				
	1	2	3	4	5
	Test Sequence (b)				
Initial examination of product	1	1	1	1	1
Dry circuit resistance	3,7	2,7			
Insulation resistance			3,7		
Withstanding voltage			4.8		
Temperature rise vs current		3,8			
Termination tensile strength				2	
Vibration, sinusoidal	5	6(c)			
Mechanical shock	6				
Durability	4				
Contact retention			10		
Contact insertion force			2		
Mating force	2				
Unmating force	8				
Housing lock strength			9		
Housing panel retention					2
Thermal shock			5		
Humidity/temperature cycling		4(d)	6		
Temperature life		5			
Mixed flowing gas		4(d)			
Final examination of product	9	9	11	3	3

NOTE

(a) See Paragraph 1.4.A.

(b) Numbers indicate sequence in which tests are performed.

(c) Discontinuities shall not be measured. Energize at 18 ℃ level for 100% loadings per Quality Specification 102-950.

(d) The 4th test in this sequence shall be either humidity-temperature cycling for tin plated specimens or mixed flowing gas for gold plated specimens. Precondition specimens with 5 durability cycles.

Figure 3

B. Test Report EA20100461T

Test or Examination	Test Group (a)		
	1	2	3
	Test Sequence (b)		
Initial examination of product	1	1	1
Dry circuit resistance	3,7	2,7	
Temperature rise vs current		3,8	
Termination tensile strength			2
Vibration, sinusoidal	5	6(c)	
Mechanical shock	6		
Durability	4		
Mating force	2		
Unmating force	8		
Temperature life		5	
Mixed flowing gas		4(d)	
Final examination of product	9	9	3

NOTE

(a) See Paragraph 1.4.B
(b) Numbers indicate sequence in which tests are performed.
(c) Discontinuities shall not be measured. Energize at 18 ℃ level for 100% loadings per Quality Specification 102-950.
(d) Precondition specimens with 5 durability cycles.

Figure 4

2. SUMMARY OF TESTING

2.1. Initial Examination of Product - All Test Groups (Test Reports CTL7166-007, CTL1314-004 and EA20100461T)

All specimens submitted for testing were representative of normal production lots. A Certificate of Conformance (C of C) was issued by Product Assurance. Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

2.2. Dry Circuit Resistance - Test Groups 1 and 2 (Test Reports CTL7166-007, CTL1314-004 and EA20100461T)

All dry circuit resistance measurements, taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage were less than 10 milliohms initially and 20 milliohms after testing.

2.3. Insulation Resistance - Test Group 3 (Test Reports CTL7166-007 and CTL1314-004)

All insulation resistance measurements were greater than 1000 megohms initially and 100 megohms after testing.

2.4. Withstanding Voltage - Test Group 3 (Test Reports CTL7166-007 and CTL1314-004)

No dielectric breakdown or flashover occurred.

2.5 Temperature Rise vs Current

A. Test Group 2 (Test Reports CTL7166-007 and CTL1314-004)

All specimens had a temperature rise of less than 30°C above ambient when tested using a baseline rated current of 11.2 amperes and the correct derating factor value based on the specimens wiring configuration.

B. Test Group 2 (Test Report EA20100461T)

All specimens had a temperature rise of less than 30°C above ambient when tested using a baseline rated current of 8.55 amperes and the correct derating factor value based on the specimens wiring configuration.

2.6. Termination Tensile Strength

A. Test Group 4 (Test Reports CTL7166-007 and CTL1314-004)

All termination tensile strength values were greater than specified in Figure 5.

Wire Size (AWG)	Termination Tensile Strength (N [lbf] minimum)
30	8.9 [2]
28	13.3 [3]
26	17.8 [4]
24	31.1 [7]
22	48.9 [11]
20	62.3 [14]
18	80.1 [18]
16	102.3 [23]

Figure 5

B. Test Group 3 - (Test Report EA20100461T)

All termination tensile strength values were greater than specified in Figure 6.

Test Condition	18 AWG Pin Contact	18 AWG Socket Contact	22 AWG Pin Contact	22 AWG Socket Contact
Minimum	115.6 [25.98]	108.0 [24.27]	72.1 [16.21]	75.7 [17.02]
Maximum	142.3 [31.98]	142.8 [32.11]	87.1 [19.59]	87.6 [19.69]
Average	129.3 [29.06]	131.2 [29.50]	78.6 [17.66]	84.2 [18.93]
Standard Deviation	8.4 [1.89]	9.3 [2.08]	4.3 [0.97]	3.5 [0.78]
N	15	15	15	15

NOTE *All values in N [lbf].*

Figure 6

2.7. Vibration - Test Groups 1 and 2 (Test Reports CTL7166-007, CTL1314-004 and EA20100461T)

No discontinuities were detected during vibration testing. Following vibration testing, no cracks, breaks, or loose parts on the specimens were visible.

2.8. Mechanical Shock - Test Group 1 (Test Reports CTL7166-007, CTL1314-004 and EA20100461T)

No discontinuities were detected during mechanical shock testing. Following mechanical shock testing, no cracks, breaks, or loose parts on the specimens were visible.

2.9. Durability - Test Group 1 (Test Reports CTL7166-007, CTL1314-004 and EA20100461T)

No physical damage occurred as a result of mating and unmating tin plated specimens 20 times and gold plated specimens 50 times.

2.10. Contact Retention - Test Group 3 (Test Reports CTL7166-007 and CTL1314-004)

No physical damage occurred to either the contacts or the housing, and no contacts dislodged from the housings as a result of supplying an axial load of 35.6 N [8 lbf] to the contacts.

2.11. Contact Insertion Force - Test Group 3 (Test Reports CTL7166-007 and CTL1314-004)

The force required to insert each contact into its housing cavity was less than 13.3 N [3 lbf].

2.12. Mating Force - Test Group 1 (Test Reports CTL7166-007, CTL1314-004 and EA20100461T)

All mating force measurements were less than 6.7 N [1.5 lbf].

2.13. Unmating Force - Test Group 1 (Test Reports CTL7166-007, CTL1314-004 and EA20100461T)

All unmating force measurements were greater than 0.7 N [.15 lbf].

2.14. Housing Lock Strength - Test Group 3 (Test Reports CTL7166-007 and CTL1314-004)

Mated specimens did not unmate under an axial load of 40 N [9 lbf].

2.15. Housing Panel Retention - Test Group 5 (Test Reports CTL7166-007 and CTL1314-004)

The housings did not dislodge from the test panel, and no damage occurred to the locking mechanism when a force of 133.4 N [30 lbf] was applied.

2.16. Thermal Shock - Test Group 3 (Test Reports CTL7166-007 and CTL1314-004)

No evidence of physical damage was visible as a result of exposure to thermal shock.

2.17. Humidity/temperature Cycling - Test Groups 2 and 3 (Test Reports CTL7166-007 and CTL1314-004)

No evidence of physical damage was visible as a result of exposure to humidity-temperature cycling.

2.18. Temperature Life - Test Group 2 (Test Reports CTL7166-007, CTL1314-004 and EA20100461T)

No evidence of physical damage was visible as a result of exposure to temperature life.

2.19. Mixed Flowing Gas - Test Group 2 (Test Reports CTL7166-007, CTL1314-004 and EA20100461T)

No evidence of physical damage was visible as a result of exposure to the pollutants of mixed flowing gas.

2.20. Final Examination of Product - All Test Groups (Test Reports CTL7166-007, CTL1314-004 and EA20100461T)

Specimens were visually examined and no damage detrimental to product performance were observed.

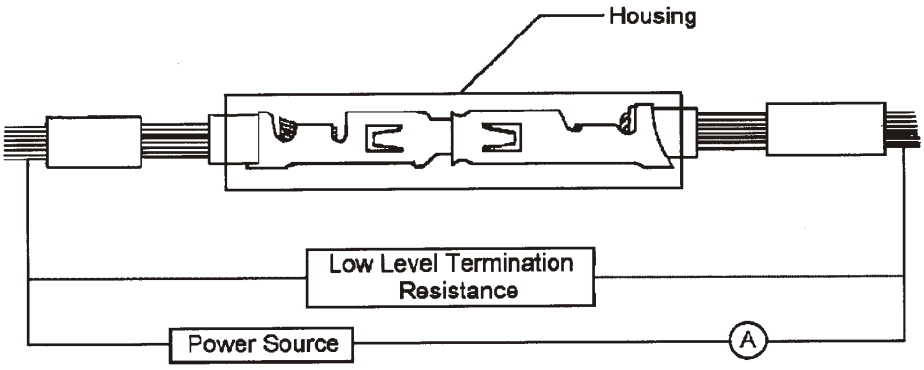
3. TEST METHODS

3.1. Initial Examination of Product (Test Reports CTL7166-007, CTL1314-004 and EA20100461T)

A C of C 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. Dry Circuit Resistance (Test Reports CTL7166-007, CTL1314-004 and EA20100461T)

Low level dry circuit resistance measurements were made using a 4 terminal measuring technique (Figure 7). The test current was maintained at 100 milliamperes maximum with a 20 millivolt maximum open circuit voltage.



NOTE *Bulk wire resistance shall be subtracted from resistance readings.*

Figure 7
Dry Circuit Resistance Measurement Points

3.3. Insulation Resistance (Test Reports CTL7166-007 and CTL1314-004)

Insulation resistance was measured between adjacent contacts of mated specimens. A test voltage of 500 volts DC was applied for 2 minutes before the resistance was measured.

3.4. Withstanding Voltage (Test Reports CTL7166-007 and CTL1314-004)

A test potential of 1500 volts AC was applied between the adjacent contacts of mated specimens. This potential was applied for 1 minute and then returned to zero.

3.5. Temperature Rise vs Current (Test Reports CTL7166-007, CTL1314-004 and EA20100461T)

Temperature rise curves were produced by measuring individual contact temperatures. These measurements were plotted to produce a temperature rise vs current curve. Thermocouples were attached to individual contacts to measure their temperatures. The ambient temperature was then subtracted from this measured temperature to find the temperature rise. When the temperature rise of 3 consecutive readings taken at 5 minute intervals did not differ by more than 1°C, the temperature measurement was recorded.

3.6. Termination Tensile Strength (Test Reports CTL7166-007, CTL1314-004 and EA20100461T)

The force load was applied to each specimen using a tensile/compression device with the rate of travel at 25 ± 6 mm [.98 ± .24 in] per minute.

3.7. Vibration, Sinusoidal (Test Reports CTL7166-007, CTL1314-004 and EA20100461T)

Mated specimens were subjected to sinusoidal vibration, having a simple harmonic motion with an amplitude of 1.5 mm [0.06 in], double amplitude. The vibration frequency was varied uniformly between the limits of 10 and 55 Hz and returned to 10 Hz in 1 minute. This cycle was performed 120 times in each of 3 mutually perpendicular planes for a total vibration time of 6 hours. Specimens were monitored for discontinuities of 1 microsecond or greater using a current of 100 milliamperes DC.

3.8. Mechanical Shock, Half-sine (Test Reports CTL7166-007, CTL1314-004 and EA20100461T)

Mated specimens were subjected to a mechanical shock test having a half-sine waveform of 50 gravity units (g peak) and a duration of 11 milliseconds. Three shocks in each direction were applied along the 3 mutually perpendicular planes for a total of 18 shocks. Specimens were monitored for discontinuities of 1 microsecond or greater using a current of 100 milliamperes DC.

3.9. Durability (Test Reports CTL7166-007, CTL1314-004 and EA20100461T)

Tin plated specimens were mated and unmated 20 times, and gold plated specimens 50 times at a maximum rate of 500 cycles per hour. Palladium nickle specimens were manually mated and unmated 50 times.

3.10. Contact Retention (Test Reports CTL7166-007 and CTL1314-004)

An axial load of 35.6 N [8 lbf] was applied to each contact and held for 60 seconds. The force was applied in a direction to cause removal of the contacts from the housing.

3.11. Contact Insertion Force (Test Reports CTL7166-007 and CTL1314-004)

Contact insertion force was measured by applying a force to each contact until the contact was properly seated in the housing.

3.12. Mating Force (Test Reports CTL7166-007, CTL1314-004 and EA20100461T)

The force required to mate individual specimens was measured using a tensile/compression device with a free floating fixture and a rate of travel of 0.5 inch per minute.

3.13. Unmating Force (Test Reports CTL7166-007, CTL1314-004 and EA20100461T)

The force required to unmate individual specimens was measured using a tensile/compression device with a free floating fixture and a rate of travel of 0.5 inch per minute.

3.14. Housing Lock Strength (Test Reports CTL7166-007 and CTL1314-004)

An axial load was applied to mated specimens in a manner which would cause the specimen lacking latches to disengage.

3.15. Housing Panel Retention (Test Reports CTL7166-007 and CTL1314-004)

The housings did not dislodge from the test panel, and no damage occurred to the locking mechanism.

3.16. Thermal Shock (Test Reports CTL7166-007 and CTL1314-004)

Specimens were subjected to 25 cycles of thermal shock with each cycle consisting of 30 minute dwells at -55 and 105°C. The transition between temperatures was less than 1 minute.

3.17. Humidity/temperature Cycling (Test Reports CTL7166-007 and CTL1314-004)

Specimens were exposed to 10 cycles of humidity/temperature cycling. Each cycle lasted 24 hours and consisted of cycling the temperature between 25 and 65°C twice while maintaining high humidity.

3.18. Temperature Life (Test Reports CTL7166-007, CTL1314-004 and EA20100461T)

Mated specimens were exposed to a temperature of 105°C for 580 hours.

3.19. Mixed Flowing Gas, Class IIA (Test Reports CTL7166-007, CTL1314-004 and EA20100461T)

Mated specimens were exposed for 20 days to a mixed flowing gas Class IIA exposure. Class IIA exposure is defined as a temperature of 30°C and a relative humidity of 70% with the pollutants of Cl_2 at 10 ppb, NO_2 at 200 ppb, H_2S at 10 ppb and SO_2 at 100 ppb. Specimens were preconditioned with 5 cycles of durability.

3.20. Final Examination of Product (Test Reports CTL7166-007, CTL1314-004 and EA20100461T)

Specimens were visually examined for evidence of physical damage detrimental to product performance.