3mm Micro MATE-N-LOK* Connector

1. INTRODUCTION

1.1. Purpose

Testing was performed on the Tyco Electronics 3 mm Micro MATE-N-LOK* Connector to determine its conformance to the requirements of Product Specification 108-1836 Revision A.

1.2. Scope

This report covers the electrical, mechanical, and environmental performance of the 3 mm Micro MATE-N-LOK Connector. Testing was performed at the Engineering Assurance Product Test Laboratory between 01Oct01 and 16Jan02. The test file number for this testing is CTL A309-001. This documentation is on file at and available from the Engineering Assurance Product Test Laboratory.

1.3. Conclusion

The 3 mm Micro MATE-N-LOK Connector listed in paragraph 1.5., conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-1836 Revision A.

1.4. Product Description

The 3 mm Micro MATE-N-LOK Connector is a wire-to-board connector available in 2 to 24 position double row configuration.

1.5. Test Specimens

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

Test Group	Quantity	Part Number	Description
Crimped Specimens			
1,2,3	230	794606-1	Receptacle contact crimped to 12 inches of 20 AWG wire
2	20	794606-2	Receptacle contact crimped to 12 inches of 20 AWG wire
5	30	794606-1	Receptacle contact crimped to 6 inches of 20 AWG wire
5	30	794606-1	Receptacle contact crimped to 6 inches of 22 AWG wire
5	30	794606-1	Receptacle contact crimped to 6 inches of 24 AWG wire
2	170	794607-1	Receptacle contact crimped to 12 inches of 28 AWG wire
5	30	794607-1	Receptacle contact crimped to 6 inches of 26 AWG wire
5	30	794607-1	Receptacle contact crimped to 6 inches of 28 AWG wire
5	30	794607-1	Receptacle contact crimped to 6 inches of 30 AWG wire

Figure 1 (continued)

Test Group	Quantity	Part Number	Description
Header/Receptacle Specimens			
2	5	794617-2	2 position receptacle housing
2	5	794617-4	4 position receptacle housing
1	5	794617-6	6 position receptacle housing
3	5	794617-6	6 position receptacle housing
2	5	794617-8	8 position receptacle housing
2	5	2-794617-4	24 position receptacle housing
2	5	794618-2	2 position thru-hole right angle header
1	5	794618-6	6 position thru-hole right angle header
2	5	794618-8	8 position thru-hole right angle header
2	5	2-794618-4	24 position thru-hole right angle header
2	5	794619-4	4 position thru-hole right angle header
4	5	794627-4	4 position surface mount right angle header
2	5	794630-2	2 position thru-hole vertical header
4	5	794630-4	4 position thru-hole vertical header
3	5	794630-6	6 position thru-hole vertical header
2	5	794630-8	8 position thru-hole vertical header
2	5	2-794630-4	24 position thru-hole vertical header

Figure 1 (end)

1.6. Environmental Conditions

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

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

1.7. Qualification Test Sequence

Test or Examination	Test Group (a)				
	1	2	3	4	5
	Test Sequence (b)				
Initial examination of product	1	1	1	1	1
Termination resistance	3,7	2,6			
Insulation resistance			3,7		
Dielectric withstanding voltage			4,8		
Temperature rise vs current		3,7			
Solderability				2	
Crimp tensile					2
Vibration	5				
Mechanical shock	6				
Durability	4				
Header contact retention			10(c)		
Crimp contact retention			11		
Crimp contact insertion force			2		
Mating force (contacts only)	2				
Unmating force (contacts only)	8				
Housing lock strength			9		
Thermal shock			5		
Humidity/temperature cycling		4(d)	6		
Temperature life		5			
Mixed flowing gas		4(d)			
Final examination of product	9	8	12	3	3

NOTE

(a) See paragraph 1.5.
(b) Numbers indicate sequence in which tests are performed.
(c) Test omitted when testing wire-to-wire connectors.
(d) The fourth test in this sequence will be either humidity-temperature cycling for tin plated specimens or mixed flowing gas for gold plated specimens. Precondition specimens with 10 cycles of durability.

Figure 2

2. SUMMARY OF TESTING

2.1. Initial Examination of Product - All Test Groups

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

2.2. Termination Resistance - Test Groups 1 and 2

All termination resistance measurements, taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage were less than 20 milliohms after testing. Measurements are with wire bulk removed.

Test Group	Number of Data Points	Condition	Termination Resistance		
			Min	Max	Mean
1 (20 AWG)	30	Initial	2.533	3.817	3.223
		Final (ΔR)	0.179	9.921	4.094
2 (28 AWG)	170	Initial	3.967	6.869	5.157
		After temperature life (ΔR)	-0.493	4.132	0.508
2 (20 AWG)	190	Initial	2.541	4.836	3.192
		After temperature life (ΔR)	-0.693	1.943	0.443

NOTE *All values in milliohms.*

Figure 3

2.3. Insulation Resistance - Test Group 3

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

2.4. Dielectric Withstanding Voltage - Test Group 3

No dielectric breakdown, flashover, or leakage exceeding 0.5 milliampere occurred initially or after testing.

2.5. Temperature Rise vs Current - Test Group 2

All specimens had a temperature rise of less than 30˚C above ambient when tested using a specified current (100% energized).

Wire Size (AWG)	Connector Position	Amperes
20	2 to 6	5
20	8 to 24	4.25
28	2 to 20	2
28	22 to 24	1.8

Figure 4

2.6. Solderability - Test Group 4

All specimens tested had a minimum solder coverage of 95% of the critical surface area with little to no de-wetting, non-wetting, pin-holes or other anomalies.

2.7. Crimp Tensile - Test Group 5

All values were greater than specified in Figure 5.

Wire Size (AWG)	Crimp Tensile (kg [lb] minimum)
20	7.95 [17.5]
22	5.00 [11]
24	3.60 [7.9]
26	2.05 [4.5]
28	1.40 [3.1]
30	0.77 [1.7]

Figure 5

2.8. Vibration - Test Group 1

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

2.9. Mechanical Shock - Test Group 1

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

2.10. Durability - Test Group 1

No physical damage occurred as a result of mating and unmating the specimens 30 times for tin plated specimens, 75 times for 15 µin gold plated specimens, and 150 times for 30 µin gold plated specimens.

2.11. Header Contact Retention - Test Group 3

All contacts maintained 1.4 kg [3.1 lb] for 6 seconds without dislodging from the housing.

2.12. Crimp Contact Retention - Test Group 3

All contacts maintained 1.81 kg [4 lb] for 6 seconds without dislodging from the housing.

2.13. Crimp Contact Insertion - Test Group 3

All contacts were less than the 0.7 kg [1.5 lb] maximum requirement.

2.14. Mating Force (contacts only) - Test Group 1

All mating force measurements were less than 0.7 kg [1.5 lb] per contact.

2.15. Unmating Force (contacts only) - Test Group 1

All unmating force measurements were greater than 0.07 kg [0.15 lb] per contact.

2.16. Housing Lock Strength - Test Group 3

All latches maintained a minimum force of 2.7 kg [6 lb] before separation.

2.17. Thermal Shock - Test Group 4

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

2.18. Humidity-temperature Cycling - Test Group 4

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

2.19. Temperature Life - Test Group 2

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

2.20. Mixed Flowing Gas - Test Group 3

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

2.21. Final Examination of Product - All Test Groups

Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

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. Termination Resistance

Termination resistance measurements at low level current were made using a 4 terminal measuring technique (Figure 6). The test current was maintained at 100 milliamperes maximum with a 20 millivolt maximum open circuit voltage.

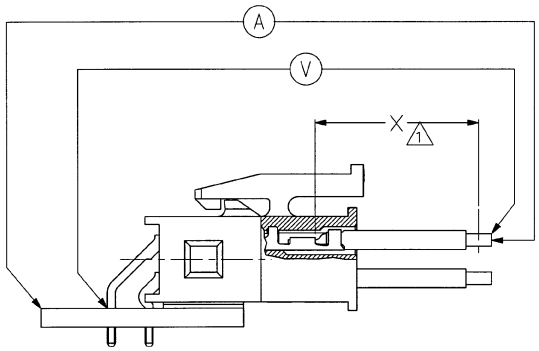

Figure 6
Termination Resistance Measurement Points

3.3. Insulation Resistance

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. Dielectric Withstanding Voltage

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

Specimens were 100% energized at rated current. Thermocouples were attached to individual contacts to measure their temperatures. 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. Solderability

A. Through Hole

Prior to the application of flux and immersion into solder, the specimens were exposed to a steam aging environment for 8 hours. Then within 24 hours, the area of the specimens to be evaluated was immersed in flux type "R", (a non-activated water white rosin) for 5 to 10 seconds. The flux was maintained at room temperature. The specimens were then removed from the flux and the excess was allowed to drain off for 5 to 20 seconds. The specimens were attached to a dipping machine where the dross and any oxidized flux were skimmed away. The specimens were immersed at a rate of approximately 1 inch per minute into a soldering bath filled with melted 60% tin and 40% lead, controlled at 245 ± 5˚C [473˚F] until the entire surface to be evaluated was coated. The specimens were held in the solder bath for 4 to 5 seconds. The specimens were removed from the solder at a rate of approximately 1-inch per minute and then subjected to a 5 minute cleaning in isopropyl alcohol. The test specimens were then given a visual examination under a microscope at 10X magnification.

B. Surface Mount

Prior to testing, specimens were prepared by removing the center legs and all the standoffs. This was done to enable the specimens to sit flush on the ceramic substrate. A solder paste with a composition of 63 Sn/37 Pb RMA, Visc./KCPS 1000 ± 10%, with a mesh of -325/+500 was placed onto a stencil with pad geometry opening and thickness that was appropriate for the specimens being tested. The stencil was supplied with the specimens. The solder paste was printed onto a 4.5x4.5x.0395 inch ceramic substrate. The screen was removed and the specimens were placed onto the solder paste print under appropriate magnification. Care was taken to ensure that the specimens were not contaminated in any way and were tested in the “as received” condition. The specimens and ceramic substrates were placed on a conveyor belt through an infrared oven. The specimens were exposed to 60 seconds between the temperatures of 150 and 170˚C and to 60 seconds between the temperatures of 215 and 230˚C as specified in EIA-638. The temperature on the ceramic substrate, at a point close to the specimen, was monitored to enable temperature profiling. After reflow was completed, the specimens were removed from the ceramic substrate and allowed to cool. Any flux residue was removed by immersing the specimens in alcohol in an ultra-sonic cleaner for 5 minutes. The specimens were then given a visual examination under a microscope at 10X magnification.

3.7. Crimp Tensile

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.

3.8. Vibration, Random

Mated specimens were subjected to a random vibration test, specified by a random vibration spectrum, with excitation frequency bounds of 20 and 500 Hertz (Hz). The spectrum remains flat at 0.02 G^2/Hz from 20 Hz to the upper bound frequency of 500 Hz. The root-mean square amplitude of the excitation was 3.10 GRMS. The specimens were subjected to this test for 15 minutes in each of the 3 mutually perpendicular axes, for a total test time of 45 minutes per specimen. The test specimens were monitored for discontinuities of 1 microsecond or greater using an energizing current of 100 milliamperes.

3.9. Mechanical Shock, Half-sine

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.

3.10. Durability

Specimens were mated and unmated 30 times for tin plated specimens, 75 times for 15 µin gold plated specimens, and 150 times for 30 µin gold plated specimens at a maximum rate of 500 cycles per hour.

3.11. Header Contact Retention

A 6 position vertical header assembly was placed on a free floating fixture. An increasing axial force was applied at a rate of 0.45 kg [1 lb] per second to each contact in a direction consistent with normal mating. A force of 1.4 kg [3.1 lb] was maintained for 6 seconds, then released. Contacts were monitored for displacement from the housing.

3.12. Crimp Contact Retention

A 6 position vertical receptacle assemble was placed on a free floating fixture. An increasing axial force was applied at a rate of 0.45 kg [1 lb] per second to each contact in a direction consistent with normal mating. A force of 1.81 kg [4 lb] was maintained for 6 seconds, then released. Contacts were monitored for displacement from the housing.

3.13. Crimp Contact Insertion

Vertical receptacle connector housings were held in a small vice attached to a free floating fixture. The terminated receptacle contacts, while held in a fixture attached to the movable crosshead of a tensile machine, were inserted into each cavity of the receptacle housing at a speed of 12.7 mm [.5 in] per minute.

3.14. Mating Force (contacts only)

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 5.08 mm [.2 in] per minute.

3.15. Unmating Force (contacts only)

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.

3.16. Housing Lock Strength

Six position pin and receptacle housings without contacts were mated and checked for proper latch engagement. The vertical receptacle connector housings were held in a vice attached to a free floating fixture. The pin header housing was held in a fixture attached to the movable crosshead of a tensile machine. The mated housings were separated at a maximum rate of 12.7 mm [.5 in] per minute and the maximum force recorded.

3.17. Thermal Shock

Mated specimens were subjected to 5 cycles of thermal shock with each cycle consisting of 30 minute dwells at -40 and 105˚C. The transition between temperatures was less than 1 minute.

3.18. Humidity-temperature Cycling

Mated 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 (Figure 7).

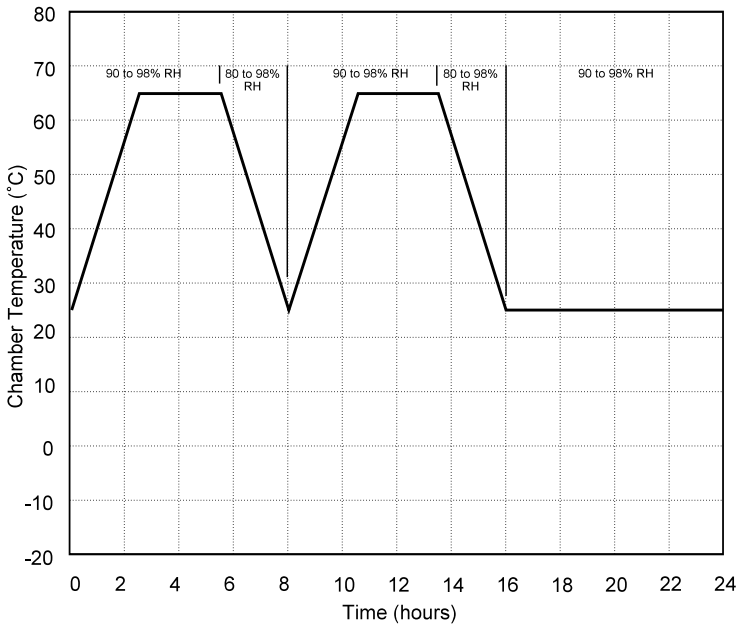

Figure 7
Humidity-Temperature Cycling Profile

3.19. Temperature Life

Mated specimens were exposed to a temperature of 105˚C for 500 hours. Specimens were preconditioned with 10 cycles of durability.

3.20. Mixed Flowing Gas, Class IIA

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 10 cycles of durability.

3.21. Final Examination of Product

Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.