Universal MATE-N-LOK* Connector

1. INTRODUCTION

1.1. Purpose

Testing was performed on Universal MATE-N-LOK* connectors to determine their conformance to the requirements of Product Specification 108-1031 Revision J.

1.2. Scope

This report covers the electrical, mechanical, and environmental performance of Universal MATE-N-LOK connectors. Testing was performed at the Environmental Testing Department of the Automatic Machine Group between 15Sep76 and 12Jan77. The test file number for this testing is ELR 472-1. Additional testing was performed at the Engineering Assurance Product Testing Laboratory between 29May 07 and 04Jun07. The test file number for this testing is CTLB084620-003. This documentation is on file at and available from the Engineering Assurance Product Testing Laboratory.

1.3. Conclusion

The Universal MATE-N-LOK connectors listed in paragraph 1.5., conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-1031 Revision J.

1.4. Product Description

This connector system is available in 1, 2, 3, 4, 5, 6, 9, 12 and 15 circuit configurations. Both plug and cap have positive locking housings to prevent accidental disengagement when used in panel mounted applications or as free-hanging connectors. They are molder from 6/6 Nylon 94V2. Contacts are furnished in continuous strip for automatic machine termination and in loose-piece for hand tool crimping. They are made from pre-tin brass and include sockets, solid pins and split pins.

1.5. Test Specimens

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

Part Number	Description
350867	1circuit plug housing
350868	1 circuit cap housing
1-480698-0	2 circuit plug housing
1-480699-0	2 circuit cap housing
1-480700-0	3 circuit plug housing
1-480701-0	3 circuit cap housing
1-480702-0	4 circuit plug housing
1-480703-0	4 circuit cap housing
1-480704-0	6 circuit plug housing
1-480705-0	6 circuit cap housing
1-480706-0	9 circuit plug housing
1-480707-0	9 circuit cap housing
1-480708-0	12 circuit plug housing

Part Number	Description
1-480709-0	12 circuit cap housing
1-480710-0	15 circuit plug housing
1-480711-0	15 circuit cap housing
350218-1	Solid pin
350536-1	Socket
350537-1	Socket
350538-1	Solid pin
350561-1	Solid pin
350570-1	Socket
350687-1	Split pin
350699-1	Split pin
195444-3	Switched probe yoke subassembly

Figure 1

* Trademark
| Indicates change

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	6	7
	Test Sequence (b)						
Examination of product	1						
Termination resistance, specified current			2				
Termination resistance, dry circuit		4,6,10,12		1,3,5,7			
Dielectric withstanding voltage		2,9,14					
Insulation resistance		3,13					
Temperature rise vs current			1				
Vibration				2			
Physical shock				4			
Mating force		1					
Unmating force		7					
Contact insertion force						1	
Contact retention force						2	
Crimp tensile					1		
Durability		5					
Housing panel retention							1
Housing lock strength		15					
Thermal shock		8					
Humidity/temperature cycling		11					
Salt spray corrosion				6			

NOTE *(a) See paragraph 4.1.A.*
(b) Numbers indicate sequence in which tests are performed.

Figure 2

2. SUMMARY OF TESTING

2.1. Examination of Product - All Test Groups

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

2.2. Termination Resistance, Specified Current - Test Group 3

All termination resistance measurements taken at a specified current of 4.5 amperes for 20 AWG wire and 10 amperes for 14 AWG wire were less than 3 milliohms initially.

2.3. Termination Resistance, Dry Circuit - Test Groups 2 and 4

All termination resistance measurements taken at 100 milliamperes maximum and 50 millivolts maximum open circuit voltage were less than 3.5 milliohms initially.

2.4. Dielectric Withstanding Voltage - Test Group 2

No dielectric breakdown or flashover occurred.

2.5. Insulation Resistance - Test Group 2

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

2.6. Temperature Rise Vs Current - Test Group 3

All specimens had a temperature rise of less than 30˚C above ambient when tested using a baseline rated current of 6 amperes for 20 AWG wire in a 12 position housing, 11 amperes for 14 AWG wire in a 12 position housing, 7 amperes for 20 AWG wire in 4 a position housing and 15 amperes for 14 AWG wire in a 4 position housing.

2.7. Vibration - Test Group 4

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

2.8. Physical Shock - Test Group 4

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

2.9. Mating Force - Test Group 2

All mating force measurements were less than 22.2 N [5 lbf] average per contact for solid pins when fully mated (based on a sample size of 30 mated, loaded housings) and 6.67 N [1.5 lbf] maximum per contact for split pins.

2.10. Unmating Force - Test Group 2

All unmating force measurements were greater than 3.11 N [0.7 lbf] per contact for solid pins and 2.22 N [0.5 lbf] per contact for split pins.

2.11. Contact Insertion Force - Test Group 6

The force required to insert each contact into its housing cavity was less than 22.2 N [5 lbf].

2.12. Contact Retention Force - Test Group 6

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 66.7 N [15 lbf] to standard contacts, and 111.2 N [25 lbf] to high retention contacts.

2.13. Crimp Tensile - Test Group 5

All crimp tensile values were greater than shown in Figure 3.

Wire Size (mm^2 [AWG])	Crimp Tensile (N [lbf] min)
0.20 [24]	35.6 [8]
0.30 [22]	62.3 [14]
0.50 [20]	62.3 [14]
0.80 [18]	133.4 [30]
1.32 [16]	200.2 [45]
2.28 [14]	222.4 [50]

Figure 3

2.14. Durability - Test Group 2

No physical damage occurred as a result of manually mating and unmating the specimens 50 times.

2.15. Housing Panel Retention - Test Group 7

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

2.16. Housing Lock Strength - Test Group 2

Mated specimens did not unmate under an axial load of 113.4 N [30 lbf].

2.17. Thermal Shock - Test Group 2

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

2.18. Humidity/temperature Cycling - Test Group 2

No evidence of physical damage was visible as a result of humidity/temperature cycling.

2.19. Salt Spray Corrosion - Test Group 4

No evidence of physical damage was visible as a result of exposure to a salt spray atmosphere.

3. TEST METHODS

3.1. Examination of Product

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

3.2. Termination Resistance, Specified Current

The potential drop of mated contacts assembled in housing was measured and the resistance calculated.

3.3. Termination Resistance, Dry Circuit

Dry circuit termination resistance measurements were made using a 4 terminal measuring technique. The test current was maintained at 100 milliamperes maximum with a 50 millivolt maximum open circuit voltage.

3.4. Dielectric Withstanding Voltage

A test potential of 5 kVAC was applied between the adjacent contacts of mated specimens. This potential was applied for 1 minute and then returned to zero.

3.5. 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.

3.6. Temperature Rise vs Current

Temperature rise curves were produced by measuring individual contact temperatures at different current levels. 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 consecutive readings did not differ by more than 1˚C, the temperature measurement was recorded.

3.7. Vibration

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 10 microseconds or greater using a current of 100 milliamperes DC.

3.8. Physical Shock

Mated specimens were subjected to a physical shock test having a sawtooth waveform of 50 gravity units (g peak) and a duration of 10 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 10 microseconds or greater using a current of 100 milliamperes DC.

3.9. Mating Force

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 12.7 mm [.5 in] per minute. The maximum average force per contact was calculated.

3.10. Unmating Force

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 12.7 mm [.5 in] per minute. The minimum average force per contact was calculated.

3.11. Contact Insertion Force

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

3.12. Contact Retention Force

An axial load of 66.7 N [15 lbf] was applied to standard contacts and 111.2 N [25 lbf] for high retention contacts and held for 60 seconds. The force was applied in a direction to cause removal of the contacts from the housing.

3.13. Crimp Tensile

The force load was applied to each specimen using a tensile/compression device with the rate of travel at 25.4 mm [1 in] per minute.

3.14. Durability

Specimens were manually mated and unmated 50 times.

3.15. Housing Panel Retention

Specimens were mounted rigidly into a test panel. An axial load of 333.6 N [75 lbf] was applied to each end of the specimen in a direction which would cause the specimen to dislodge from the panel.

3.16. Housing Lock Strength

An axial load of 133.4 N [30 lbf] was applied to mated specimens in a manner which would cause the specimen locking latches to disengage.

3.17. Thermal Shock

Mated specimens were subjected to 25 cycles of thermal shock with each cycle consisting of 30 minute dwells at -55 and 85˚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. During 5 of the first 9 cycles, the specimens were exposed to a cold shock of -10˚C for 3 hours and vibration.

3.19. Salt Spray Corrosion

Unmated specimens were subjected to a 5% salt spray environment for 48 hours. The temperature of the box was maintained at 95 +2/-3°C, while the pH of the salt solution was between 6.5 and 7.2.