Universal MATE-N-LOK* Connector

1. SCOPE

1.1. Content

This specification covers performance, tests and quality requirements for Universal MATE-N-LOK* connectors. These connectors provide a highly reliable and economic means of grouping multiple-lead connections in today's home entertainment centers, appliances, vending machines, computers and other sophisticated commercial equipment.

1.2. Qualification

When tests are performed on the subject product line, procedures specified in Figure 1 shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

1.3. Qualification Test Results

Successful qualification testing on the subject product line was completed on 12Jan77, additional testing on high retention contacts was completed on 04Jun07. The Qualification Test Report number for this testing is 110-213. This documentation is on file at and available from Engineering Practices and Standards (EPS).

2. APPLICABLE DOCUMENTS

2.1. TE Connectivity (TE) Documents

- 109 Series: Test Specifications as indicated in Figure 1
- 110-213: Qualification Test Report (Universal MATE-N-LOK* Connector)
- 114-1010: Application Specification (Contact, Pin and Socket, MATE-N-LOK*, Universal, Application of)

2.2. Reference Documents

- 109-1: General Requirements for Test Specifications
- 502-1256: Engineering Report (Glow Wire Testing of MATE-N-LOK* Connector Insulating Materials)

3. REQUIREMENTS

3.1. Design and Construction

Product shall be of the design, construction and physical dimensions specified on the applicable product drawing.

3.2. Materials

Materials used in the construction of this product shall be as specified on the applicable product drawing.

3.3. Ratings

- Current/Voltage: 19 amperes (2 position with 10 AWG wire) at 600 volts AC
- Operating temperature: -55 to 125°C

| Indicates Change

3.4. Performance and Test Description

Product is designed to meet the electrical, mechanical and environmental performance requirements specified in Figure 1.

3.5. Test Requirements and Procedures Summary

Test Description	Requirement	Procedure
Examination of product.	Meets requirements of product drawing and Application Specification 114-1010.	Visual and dimensional and functional per applicable inspection plan.
ELECTRICAL		
Termination resistance, specified current.	Wire Size (AWG) / Test Current (amperes) / Resistance, Maximum Initial (milliohms) 24 / 1.5 / 3.50 22 / 3.0 / 3.50 20 / 4.5 / 3.00 18 / 6.0 / 3.00 16 / 8.0 / 2.75 14 / 10.0 / 2.75	TE Spec 109-25. Measure potential drop of mated contacts assembled in housing. Calculate resistance. See Figure 3.
Termination resistance, dry circuit.	3.5 milliohms maximum initial.	TE Spec 109-6, Condition A. Subject mated contacts assembled in housing to 50 millivolt maximum open circuit at 100 milliamperes maximum. See Figure 3.
Dielectric withstanding voltage.	5.0 kilovolts AC dielectric withstanding voltage, 1 minute hold.	TE Spec 109-29-1. Test between adjacent contacts of mated connector assemblies.
Insulation resistance.	1000 megohms minimum initial. 100 megohms minimum final.	TE Spec 109-28. Test between adjacent contacts of mated connector assemblies.
Temperature rise vs current. See Note (a).	Temperature rise, see Figures 4 and 5. Temperature resistance, specified current.	TE Spec 109-45. Temperature rise at rated current.
MECHANICAL		
Vibration.	No discontinuities greater than 10 microseconds. 5.0 milliohms maximum termination resistance, dry circuit. See Note (b).	TE Spec 109-21, Condition A. Subject mated connectors to 10-55-10 Hz traversed in 1 minute at 1.5 mm [.06 in] total excursion. Two hours in each of 3 mutually perpendicular directions.

Figure 1 (continued)

Physical shock.	No discontinuities greater than 10 microseconds. 6.0 milliohms maximum termination resistance, dry circuit. See Note (b).	TE Spec 109-26, Condition G. Subject mated connectors to 50 G's at 10 milliseconds. Three shocks in each direction applied along 3 mutually perpendicular planes, 18 total shocks.
Mating force.	Will not exceed 5 pounds average per contact when fully mated (based on a sample size of (30) mated, loaded housings). 6.67 N [1.5 lbf] maximum per contact for split pins.	TE Spec 109-42, Condition A. Measure force necessary to mate connector assembly with locking latches disengaged. Mount connector in fixtures and perform test at 12.7 mm [.5 in] per minute incorporating free floating fixtures. Calculate force per contact.
Unmating force.	3.11 N [0.7 lbf} minimum per contact for solid pins. 2.22 N [0.5 lbf] minimum per contact for split pins.	TE Spec 109-42, Condition A. Measure force necessary to unmate connector assembly with locking latches disengaged. Mount connector in fixtures and perform test at 12.7 mm [.5 in] per minute. Calculate force per contact.
Contact insertion force.	22.2 N [5 lbf] maximum per contact.	TE Spec 109-41. Measure force to insert contact into housing.
Contact retention force.	66.7 N [15 lbf] minimum. 111.2 N [25 lbf] minimum for high retention contacts.	TE Spec 109-30, except grip wire. Apply an axial load to contact at a rate of 12.7 mm [.5 in] per minute.
Crimp tensile.	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]	TE Spec 109-16. Determine crimp tensile at a rate of 25.4 mm [1 in] per minute.
Durability.	Unmating force. 3.6 milliohms maximum termination resistance, dry circuit.	TE Spec 109-27. Manually mate and unmate connector assemblies for 50 cycles. Mount appropriate connector half in panel and manually mate.
Housing panel retention.	333.6 N [75 lbf] minimum. 250N [56 lbf] minimum for 2 position	TE Spec 109-49. Measure panel retention force using nominal panel cut out dimensions as specified in the Customer Drawing.

Figure 1 (continued)

Housing lock strength.	133.4 N [30 lbf] minimum after temperature-humidity cycling.	TE Spec 109-50. Determine strength of housing locking mechanism.
ENVIRONMENTAL		
Thermal shock.	Dielectric withstanding voltage. 3.75 milliohms maximum termination resistance, dry circuit. See Note (b).	TE Spec 109-22. Subject mated connectors to 25 cycles between -55 and 85°C.
Humidity/temperature cycling.	Dielectric withstanding voltage. 100 megohms minimum insulation resistance. 6.0 milliohms maximum termination resistance, dry circuit.	TE Spec 109-23, Method III, Condition B with cold shock and -10°C and low frequency vibration as specified. Subject mated connectors to humidity-temperature cycling between 25 and 65°C at 95% RH.
Salt spray corrosion.	7.0 milliohms maximum termination resistance, dry circuit.	TE Spec 109-24, Condition B. Subject unmated connectors to 48 hours at 5% concentration.

NOTE

(a) Maximum rated current that can be carried by this product is limited by maximum operating temperature of housings which is 105°C and temperature rise of contacts which is 30°C. Variables which shall be considered for each application are wire size, connector size, contact material and ambient temperature.

(b) Connector assemblies shall remain mated and shall show no evidence of cracking or chipping.

Figure 1 (end)

3.6. Product Qualification and Requalification 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

4. QUALITY ASSURANCE PROVISIONS

4.1. Qualification Testing

A. Sample Selection

Connector housings and contacts shall be prepared in accordance with applicable Instruction Sheets and shall be selected at random from current production. Test group 1 shall consist of 1 housing of each size, 5 pins and 5 sockets all representative of the entire lot being tested. Test groups 2 through 4 shall consist of 4 connector assemblies per group. The housings and wire sizes shall be chosen randomly to cover the range of the product line. Test group 5 samples shall consist of 15 pin and socket contacts per wire size. Test group 6 samples shall consist of 15 pin and socket contacts crimped on 14 AWG wire and tested with appropriate random housings. Test group 7 samples shall consist of 15 random housings. All contacts shall be crimped to appropriate part number 103501 and 103502 tin plated test conductors in accordance with Application Specification 114-1010.

B. Test Sequence

Qualification inspection shall be verified by testing samples as specified in Figure 2.

4.2. Requalification Testing

If changes significantly affecting form, fit or function are made to the product or manufacturing process, product assurance shall coordinate requalification testing, consisting of all or part of the original testing sequence as determined by development/product, quality and reliability engineering.

4.3. Acceptance

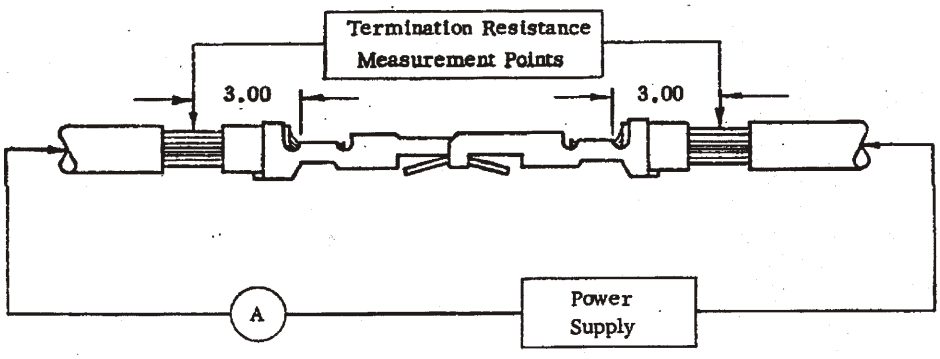
Acceptance is based on verification that the product meets the requirements of Figure 1. Failures attributed to equipment, test setup or operator deficiencies shall not disqualify the product. If product failure occurs, corrective action shall be taken and specimens resubmitted for qualification. Testing to confirm corrective action is required before resubmittal.

4.4. Quality Conformance Inspection

The applicable quality inspection plan shall specify the sampling acceptable quality level to be used. Dimensional and functional requirements shall be in accordance with the applicable product drawing and this specification.

4.5. Certification

This product has been recognized under the Component Recognition Program of Underwriter’s Laboratories Inc., Electrical File Number E-28476 and certified by Canadian Standards Association Certification Number LR-16455.



NOTE

1. *A 1 foot minimum length of continuous lead for heat dissipation.*
2. *Termination resistance equals millivolts divided by test current less resistance of 6 inches of wire.*

Figure 3

Termination Resistance Measurement Points

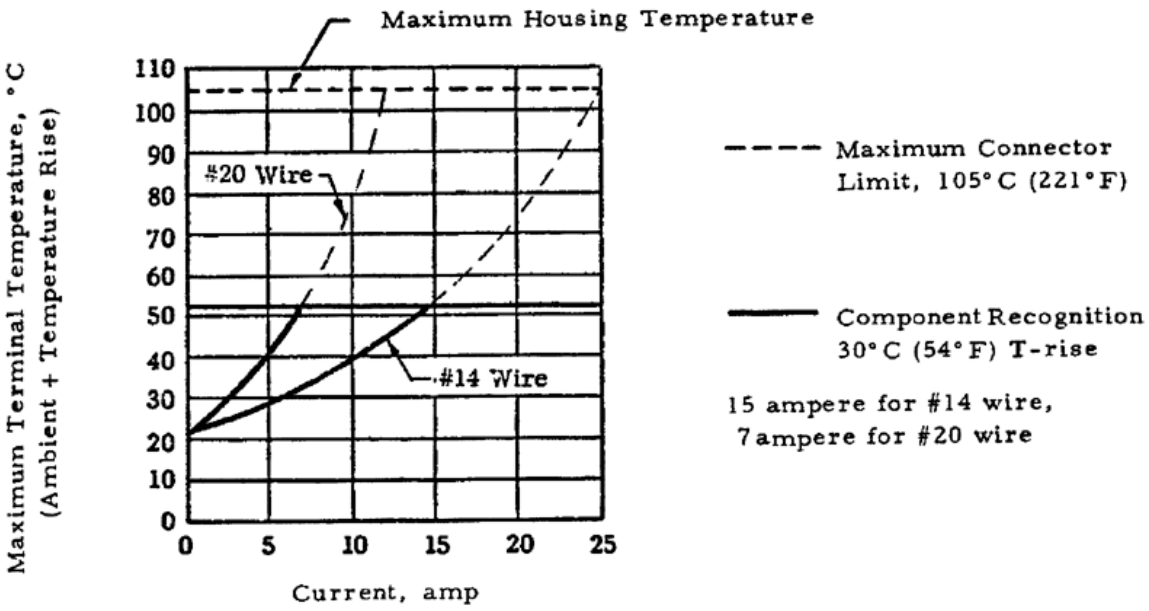


Figure 4

**Terminal Temperature vs Current/Circuit, Phosphor Bronze Contacts,
4 Circuit Free Hanging Housing**

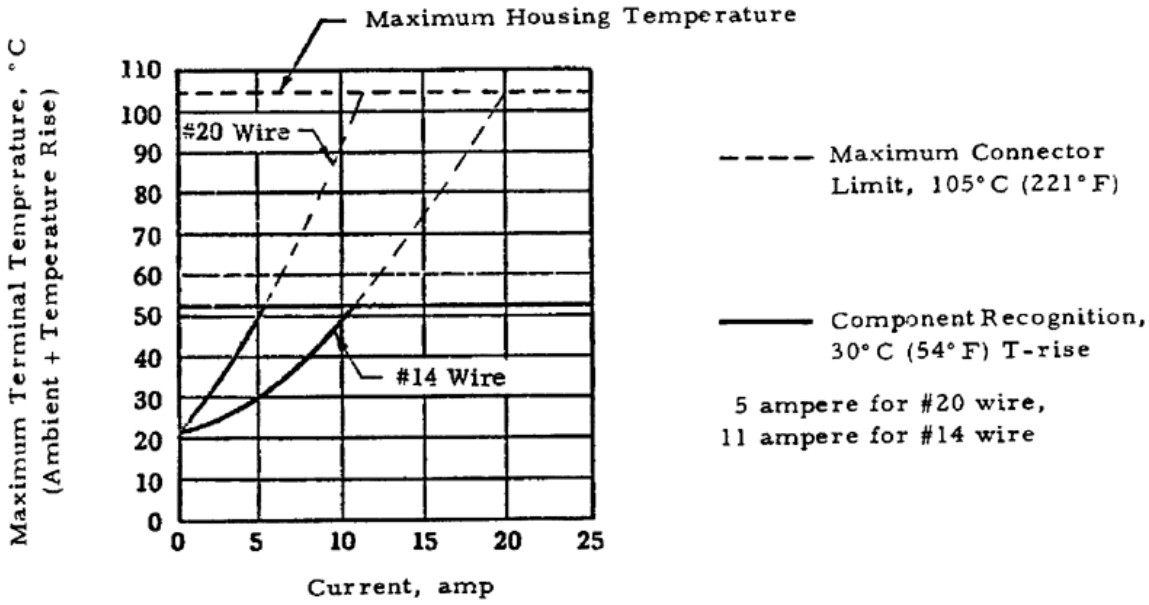


Figure 5

**Terminal Temperature vs Current/Circuit, Phosphor Bronze Contacts,
12 Circuit Free Hanging Housing**