Universal MATE-N-LOK* Connectors

1. SCOPE

1.1. Content

This specification covers performance 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 and 501-134032. This documentation is on file at and available from Engineering Practices and Standards (EPS).

2. APPLICABLE DOCUMENTS

The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the latest edition of the document applies. In the event of conflict between the requirements of this specification and the product drawing, the product drawing shall take precedence. In the event of conflict between the requirements of this specification and the referenced documents, this specification shall take precedence.

2.1. TE Documents

110-213: Qualification Test Report (Universal MATE-N-LOK Connector)

114-1010: Application Specification (Universal MATE-N-LOK Pin and Socket Contact)

501-134032: Qualification Test Report (Universal Mate-N-LOK Connector)

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)

2.3. Industry documents

EIA 364: Electrical Connector/Socket Test Procedures Including Environmental Classifications

IEC 60512: Connectors for Electronic Equipment - Tests and Measurements

3. REQUIREMENTS

3.1. Design and Construction

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

3.2. Ratings

Current/Voltage: 19 amperes (2 positions with 10 AWG wire) at 600 volts AC

Temperature: -55° to 105°C

3.3. Test Requirements and Procedures Summary

Unless otherwise specified, all tests shall be performed at ambient environmental conditions.

Test Description	Requirement			Procedure
Examination of Product	Meets requirements of product drawings and 114-1010.			Visual, dimensional, and functional per applicable inspection plan.
Termination Resistance	Wire Size (mm^2 [AWG])	Test Current (amps)	Initial Resistance (Maximum)	EIA 364-6B and IEC 60512-2-2 Measure potential drop of mated contacts. Calculate resistance (without bulk wire resistance). See Figure 2.
	0.05 [30]	0.5	4.00	
	0.09 [28]	0.7	3.75	
	0.13 [26]	0.9	3.75	
	0.2 [24]	1.5	3.50	
	0.3 [22]	3.0	3.50	
	0.5 [20]	4.5	3.00	
	0.8 [18]	6.0	3.00	
	1.3 [16]	8.0	2.75	
	2.1 [14]	10.0	2.75	
	3.3 [12]	16.0	2.50	
	5.3 [10]	24.5	2.50	
Termination Resistance, Dry Circuit	3.5 milliohms maximum initial. 6.0 milliohm maximum final.			EIA 364-23, Condition A Subject mated contacts assembled in housing to 20 millivolt maximum open circuit at 100 milliamperes maximum. See Figur.
Dielectric Withstanding Voltage	5.09 kVAC dielectric withstanding voltage.			EIA 364-20B and IEC 60512-4-1 1-minute hold with no breakdown or flashover.
Insulation Resistance	1000 megaohms minimum initial. 100 megaohms minimum final.			EIA 364-21C and IEC 60512-3-1 500 V DC input Test between adjacent circuits of free hanging connector.
Temperature Rise vs Current	See Notes (a) and (c). For temperature rise, see Figure .			EIA 364-70A and IEC 60512-5-1
Random Vibration	No discontinuities of 1 microsecond or greater.			EIA 364-28, Condition VII, Level E Frequency Range: 20-500 Hz Power Spectral Density: 0.05 g^2/Hz (4.90 g) Duration Each Axis: 15 minutes
Mechanical Shock	No discontinuities of 1 microsecond or greater.			EIA 364-27, Condition A and IEC 60512-6-3 Pulse Type: half sine Pulse Amplitude: 50 g Pulse Duration: 11 milliseconds

Figure 1 Cont.

Mating Force	Will not exceed 5 lbs 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.	EIA 364-13B and IEC 60512-13-1 Measure force necessary to mate connector assembly with locking latches removed. Calculate force per contact.
Un-Mating 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.	EIA 364-13B and IEC 60512-13-1 Measure force necessary to un-mate connector assembly with locking latches removed. Calculate force per contact.
Contact Insertion Force	22.2 N [5 lbf] maximum per contact.	EIA-364-5 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.	EIA-364-29 and IEC 60512-15-1. (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) 0.05 [30] — 6.7 [1.5] 0.09 [28] — 8.9 [2] 0.13[26] — 13.4 [3] 0.2 [24] — 22 [5] 0.3 [22] — 36 [8] 0.5 [20] — 58 [13] 0.8 [18] — 89 [20] 1.3 [16] — 134 [30] 2.1 [14] — 223 [50] 3.3 [12] — 312 [70] 5.3 [10] — 356 [80]	EIA 364-8B, IEC 60512-16-4 & IEC 60512-16-20 Determine crimp tensile at a rate of 25.4 mm [1 in.] per minute.
Durability	See Note (d).	EIA 364-9C and IEC 60512-9-1 Mate and un-mate specimens for 50 cycles at a maximum rate of 500 cycles per hour.
Housing Panel Retention	333.6 N [75 lbf] minimum.	EIA-364-97 Measure panel retention force using nominal panel cut out dimensions at a rate of 0.5 in/min.
Housing Lock Strength	133.4 N [30 lbf] minimum after temperature-humidity cycling.	EIA 364-98 Determine strength of housing locking mechanism.
Thermal Shock	Dielectric withstanding voltage. 3.75 millohms maximum termination resistance, dry circuit. See figure 4	EIA 364-32C and IEC 60512-11-4 Subject mated specimens to 25 cycles between -55 and 85°C.

Figure 1 Cont.

Humidity/Temperature Cycling	Dielectric withstanding voltage. 100 megaohms minimum insulation resistance. 6.0 milliohms maximum termination resistance, dry circuit. See Note (b).	EIA 364-31B, Method IV, IEC 60512-11-3 and IEC 60512-11-12 Subject mated specimens to ten 24-hour cycles between 25° and 65°C at 95% RH with a -10°C cold shock between cycles.
Salt Spray Corrosion	7.0 milliohms maximum termination resistance, dry circuit.	EIA 364-26B Subject unmated specimens 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.

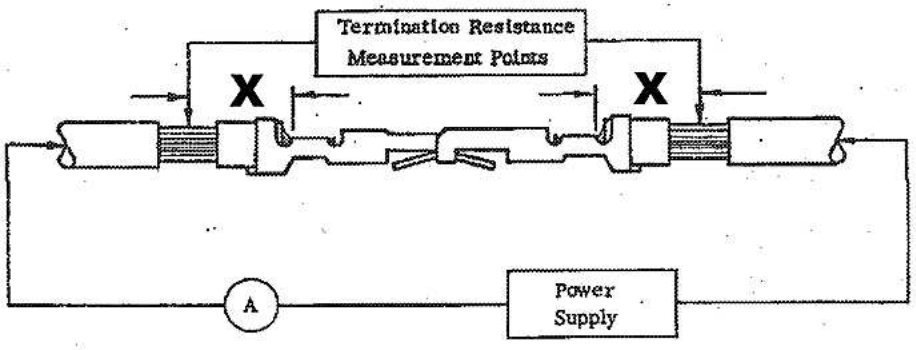
(b) Shall meet visual requirements, show no physical damage, and meet requirements of additional test as specified in the separable interface testing in test sequence 2.

(c) Temperature rise test currents are based on the test current from the termination resistance test. The temperature should be measured at 6 relatively evenly spaced currents. Figure 3 suggests current levels for each wire size.

(d) Shall meet visual requirements, show no physical damage, and meet requirements of additional tests as specified in the connector tests product qualification and re-qualification test sequences given in Figure 5.

Figure 1 end

Wire-to-Wire Termination Resistance Measurement Points



A = 1-Foot Minimum Length of Continuous Lead for Heat Dissipation
X = Wire Length in inches
Termination Resistance = (millivolts ÷ Test Current) - Resistance of Wire Length

Figure 2

Spaced Test Currents for Temperature Rise Testing **(amperes)**											**Temperature Expectation**
Wire Size (mm^2 [AWG])											
0.05 [30]	**0.09 [28]**	**0.13 [26]**	**0.2 [24]**	**0.3 [22]**	**0.5 [20]**	**0.8 [18]**	**1.3 [16]**	**2.1 [14]**	**3.3 [12]**	**5.3 [10]**	—
0.13	0.18	0.23	0.4	0.8	1.1	1.5	2.0	2.5	4.0	6.1	—
0.25	0.35	0.45	0.8	1.5	2.3	3.0	4.0	5.0	8.0	12.3	—
0.38	0.53	0.68	1.1	2.3	3.4	4.5	6.0	7.5	12.0	18.4	—
0.50	0.70	0.90	1.5	3.0	4.5	6.0	8.0	10.0	16.0	24.5	Less than 30°C
0.63	0.88	1.13	1.9	3.8	5.6	7.5	10.0	12.5	20.0	30.6	Greater than 40°C
0.75	1.05	1.35	2.3	4.5	6.8	9.0	12.0	15.0	24.0	36.8	Greater than 60°C

Figure 3

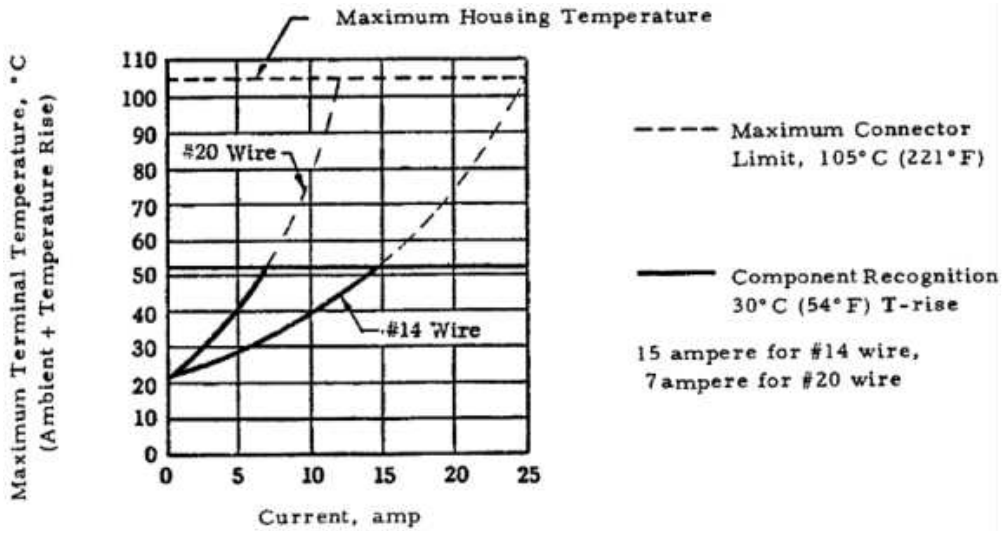


Figure 4

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

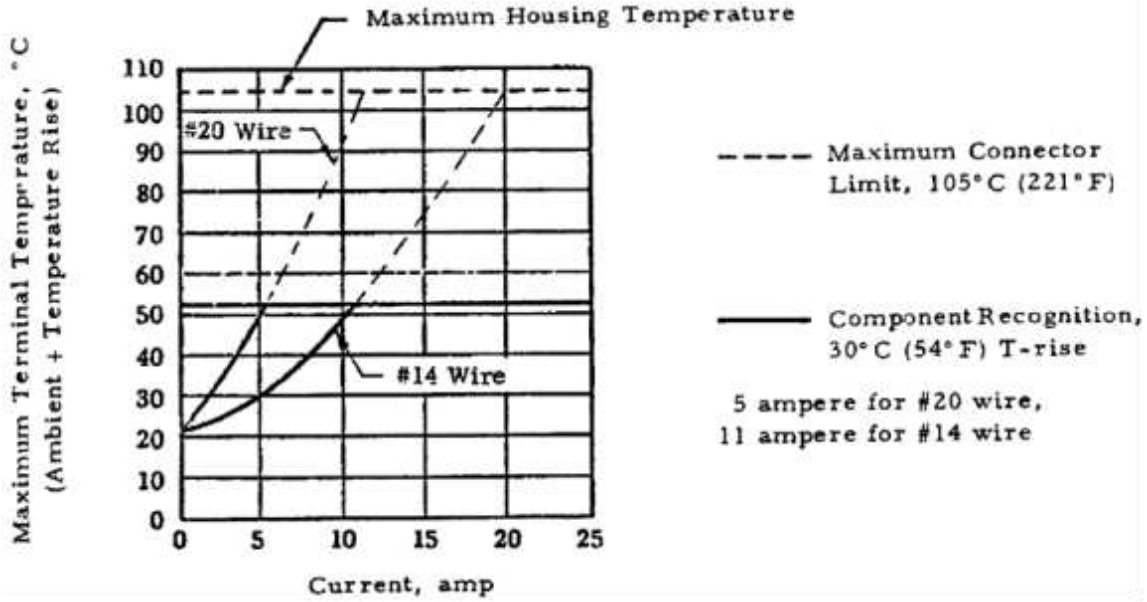


Figure 5

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

3.4. Product Test Sequence

TEST OR EXAMINATION	TEST GROUP (a)							
	1	2	3	4	5	6	7	8
	TEST SEQUENCE (b)							
Initial Examination of Product	1	1	1	1	1	1	1	1
Termination Resistance Specified Current			3					
Termination Resistance Dry Circuit		5,7, 11,13		2,4,6,8				3,7
Dielectric Withstanding Voltage		3,10,15						
Insulation Resistance		4,14						
Temperature Rise vs Current			2					
Vibration				3				5
Mechanical Shock				5				6
Mating Force		2						2
Unmating Force		8						8
Contact Insertion Force						2		
Contact Retention Force						3		
Crimp Tensile					2			
Durability		6						4
Housing Panel Retention							2	
Housing Lock Strength		16						
Thermal Shock		9						
Salt Spray Corrosion				7				
Humidity/Temperature Cycling		12						
Final Examination of Product		17	4	9	3	4	3	9

NOTE

(a) 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. Test groups 8 shall consist of enough contacts and housing to generate 30 data points.

(b) Number indicates sequence of tests performed.

Figure 6