Power Triple Lock MFBL

1. SCOPE

1.1. Contents

This specification covers the requirements for product performance, test methods, and quality assurance provisions of 3 Position Make First Break Last (MFBL) Power Triple Lock Wire to Wire connectors. A complete connector consists of a PTL MFBL Cap housing with 2 Tab contacts and a Ground Tab contact crimped to wires and inserted, a PTL MFBL Plug housing with Receptacle contacts crimped to wires and inserted, and a TPA (optional) and a CPA (optional). The Ground Tab located in the center position is longer to make the first electrical connection when mating the housings.

1.2. Qualification

When tests are performed on the subject product line, procedures specified in 3.5 shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

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 Connectivity Specifications

A. 102-950 Quality specification (Qualification of Separable Interface Connectors).

B. 501-134056 Qualification Test Report

C. 114-106147 Application Specification.

2.2. Commercial Standards and Specifications

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

2.3. Reference Document

A. 109-197: Test Specification (TE Test Specifications vs. EIA and IEC Test Methods).

3. REQUIREMENTS

3.1. Design and Construction

Product shall be of the design, construction and physical dimension 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.

A. Contact (Crimp Type): Copper Alloy Pre-tin plated. Refer to TE drawing for details.

B. Housing: Thermoplastic. Refer to TE drawing for details.

C. Terminal Position Assurance (TPA): Thermoplastic. Refer to TE drawing for details.

3.3. Ratings

A. Voltage Rating: 600V AC.

B. Current Rating: See Appendix II for applicable current carrying capability. Maximum rated current that can be carried by this product is limited by the maximum operating temperature of the housings and the temperature rise of the contacts (30°C).

C. Temperature Rating: Glow Wire versions: -55°C to +105°C (Includes Ambient Temperature plus Thermal increase due to Current flow).

3.4. Performance Requirements & Test Description:

The product shall be designed to meet the electrical, mechanical and environmental performance requirements specified in 3.5. All tests are to be performed at room temperature unless otherwise specified.

3.5. Test requirements and Procedure Summary:

No.	**3.5.1**
Test Items	Examination of Product
Requirements	Meets requirements of product drawing and TE application specification (114-106147). After test, there shall be no corrosive influence on the performance and no physical damage.
Procedures	EIA-364-18 Visual inspection
ELECTRICAL REQUIREMENTS	
No.	**3.5.2**
Test Items	Termination Resistance (Low Level Contact Resistance)
Requirements	3.5 mΩ Max.(Initial) 10 mΩ Max.(Final)
Procedures	Subject mated contacts assembled in a housing to 20mV Max open circuit at 100mA. Measure resistance of each circuit per Appendix 1 and subtract the resistance of the wire. EIA-364-23.
No.	**3.5.3**
Test Items	Insulation Resistance
Requirements	1000 MΩ Min.(Initial) 100 MΩ Min.(Final)
Procedures	Apply 500 V DC for 2 minutes. Test between adjacent circuits and between the surface of the housing and contact of mated connectors. EIA-364-21.
No.	**3.5.4**
Test Items	Dielectric withstanding Voltage
Requirements	Neither creeping discharge nor flashover shall occur. Current leakage: 5 mA Max.
Procedures	5 kilovolts AC at sea level (initial), 3 kilovolts AC at sea level (final). Hold above voltage for 1 minute. Test between adjacent circuits and between the surface of the housing and contact of mated connectors. EIA-364-20, Condition I, Method C
No.	**3.5.5**
Test Items	Temperature Rise vs. Current
Requirements	30ºC Max. under loaded specified current (Refer to Appendix 1)
Procedures	Measure temperature rise at the specified current. Measurements shall be conducted in a draft free room or enclosure with the contacts assembled in a housing. The thermocouple is to be attached to the center contact, except if that circuit is not energized. Stabilize at a single current level until 3 readings at 5 minute intervals are within 1ºC. EIA-364-70, Method 1.
MECHANICAL REQUIREMENTS	
No.	**3.5.6**
Test Items	Sinusoidal Vibration (Low Frequency)

Requirements	No electrical discontinuity greater than 1 µs shall occur. LLCR 10 mΩ Max (Final). No physical damage.	
Procedures	Subject mated connectors to 10-55-10 Hz traversed in 1 minute at a maximum total excursion amplitude of 1.52 mm. Duration to be 2 hours in each of 3 mutually normal planes. 100 mA to be applied. EIA-364-28,Test Condition I.	
No.	**3.5.7**	
Test Items	Random Vibration	
Requirements	No electrical discontinuity greater than 1 microsecond shall occur. LLCR 10 mΩ Max (Final). No physical damage.	
Procedures	Subject mated specimens to 3.10G's RMS between 20 and 500 Hz. Perform in each of the 3 mutually perpendicular axes of the connector for 15 minutes each. EIA-364-28, Test Condition VII.	
No.	**3.5.8**	
Test Items	Mechanical Shock	
Requirements	No electrical discontinuity greater than 1 microsecond shall occur. LLCR 10 mΩ Max (Final). No physical damage.	
Procedures	Subject mated connector to 50G half-sine shock pulses of 11ms duration. Perform 3 shocks each to the 3 mutually perpendicular axes of the connector (18 shocks). EIA-364-27,Method A.	
No.	**3.5.9**	
Test Items	Connector Mating Force	
Requirements	20 N Max. (Total with 3 positions)	
Procedures	Measure the force required to mate connectors without locking latches. Operation speed: 12.7mm/min. EIA-364-13.	
No.	**3.5.10**	
Test Items	Contact Insertion Force	
Requirements	20.0 N Max. per contact	
Procedures	Measure the force required to insert contact into housing. EIA-364-5.	
No.	**3.5.11**	
Test Items	Contact Retention Force	
Requirements	With or without Terminal Position Assurance (TPA) engaged.	
	TYPE	MINIMUM (N)
	Glow Wire (GWT)	66.7
Procedures	Apply an axial pull-out load to crimped wire. Operation speed: 12.7mm/min. EIA-364-29.	
No.	**3.5.12**	
Test Items	Wire Crimp Tensile Strength	
Requirements	WIRE SIZE mm^2 [AWG]	CRIMP TENSILE (Min) (N)
	0.7 mm^2 [19]‡	62.3
	0.8 mm^2 [18]	133.4
	1.3 mm^2 [16]	133.4
Procedures	Apply an axial pull-out load to the wire of a crimped contact secured in a tester. Operation speed: 25.4 mm/min. Render insulation barrel ineffective. EIA-364-8.	

‡Refer to product customer drawing for minimum cross-sectional area/CMA.

No.	3.5.13
Test Items	Durability (Manually repeated Mating / Un-mating)
Requirements	LLCR 10 mΩ Max. (Final).
Procedures	Manually mate and un-mate specimens. No. of Cycles: 50.
No.	**3.5.14**
Test Items	Housing Locking Strength
Requirements	98N Min without CPA, 133.5N Min with CPA
Procedures	Measure connector locking strength. Operation speed: 25.4 mm/min. EIA-364-98.
No.	**3.5.15**
Test Items	Housing Panel Retention Force
Requirements	98 N Min
Procedures	Measure panel retention force using nominal panel cutout dimensions as specified in the customer drawing. Operation speed: 100 mm/min. EIA-364-97.
ENVIRONMENTAL REQUIREMENTS	
No.	**3.5.16**
Test Items	Thermal shock
Requirements	LLCR 10 mΩ Max. (Final)
Procedures	Subject mated specimens to 25 cycles between -55ºC and 85ºC with 30 minute dwells at temperature extremes and 1 minute transitions between temperatures. EIA-364-32, Test Condition I. This measurement is taken after 3 hours at ambient temperature and humidity.
No.	**3.5.17**
Test Items	Humidity-Temperature Cycling
Requirements	Dielectric withstanding voltage (final) 3kV AC. 1 minute Insulation resistance (final) 100 M Ω Min. Termination resistance 10 mΩ Max. (Final).
Procedures	Subject mated specimens to 10 cycles between 25ºC and 65ºC at 80~100% R.H. EIA-364-31, Method IV. Measurements taken as specified in paragraph 3.6 are to be recorded after specimens are held for 3 hours at ambient temperature and humidity. 1 cycle=24hours.
No.	**3.5.18**
Test Items	Salt spray
Requirements	Termination resistance 10 mΩ Max. (Final). No corrosion influence performance.
Procedures	Subject mated connectors to 5±1% salt concentration for 48 hours. EIA-364-26, Condition B.
No.	**3.5.19**
Test Items	Temperature Life
Requirements	Termination resistance 10 mΩ Max. (Final).
Procedures	Subject mated connector to 105±2ºC for a duration of 500 hours. EIA-364-17, Method A.
No.	**3.5.20**
Test Items	Glow Wire Test 850°C and 750°C
Requirements	1. Test at 850 °C, flame duration <= 30 seconds. 2. Test at 750 °C, flame duration <=2 seconds. 3. Light tissue paper should not burn

Procedures	1. Test to be conducted on each of 3 perpendicular sides per IEC 60695-2-11 and comply with IEC 60335-1. 2. Execute visual check and take Picture after the test.

3.6. Product Qualification Test Sequence

TEST OR EXAMINATION		TEST GROUP (a)								
		1	2	3	4	5	6	7	8	9
		TEST SEQUENCE (b)								
1	Examination of Product	1, 7	1, 9	1, 8	1, 3	1, 4	1, 4	1, 7	1, 3	1, 3
2	Termination Resistance (Low Level)	2, 6	2, 7					2, 5		
3	Insulation Resistance			2, 6				3, 6		
4	Dielectric Withstanding Voltage			3, 7						
5	Temperature Rising		3, 8							
6	Sinusoidal Vibration (Low Frequency)	4								
7	Random Vibration		6 (c)							
8	Mechanical Shock	5								
9	Connector Mating Force									2
10	Contact Insertion Force					2				
11	Contact Retention Force					3				
12	Crimping Tensile Strength				2					
13	Durability(Repeated Mating/Un-mating)	3								
14	Housing Locking Strength						2			
15	Housing Panel Retention Force						3			
16	Thermal Shock			4						
17	Humidity-Temperature Cycling		4 (d)	5						
18	Salt Spray							4		
19	Temperature Life		5							
20	Glow Wire Test								2	

(a) See paragraph 4.2.A.

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

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

(d) Precondition specimens with 5 durability cycles.

4. QUALITY ASSURANCE PROVISIONS

4.1. Test Conditions

Unless otherwise specified, all the test shall be performed in any combination of the following test conditions.

Temperature	15～35ºC
Relative Humidity	20-80%
Atmospheric Pressure	685 to 785 in/HG

Figure 1

4.2. Tests

A. Test Specimens

The test specimens to be employed for tests shall conform to the requirements specified in the applicable product drawings. The crimped contacts shall be prepared in accordance with the requirements of Application Specification 114-106147, and should be selected at random from current production.

B. Applicable Wires

The wires to be used for crimping the samples for performance testing shall conform to the requirements specified in Application Specification 114-106147.

4.3. Requalification Testing

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

4.4. Acceptance

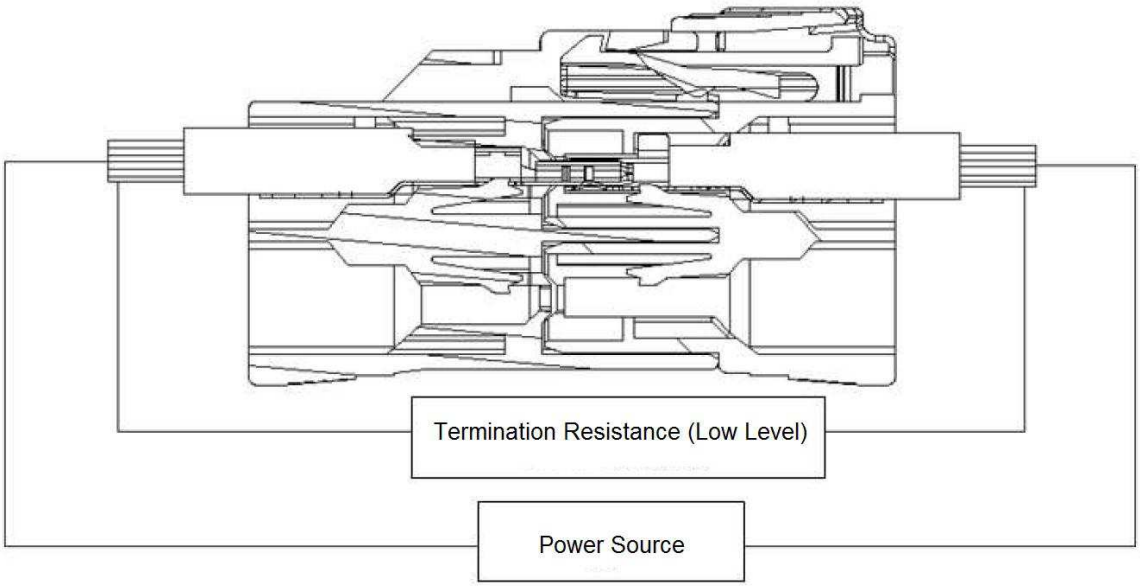
Acceptance is based on verification that the product meets the requirements of Section 3.5. Failures attributed to equipment, test setup, or operator deficiencies shall not disqualify the product. If product failure occurs, corrective action shall be taken and specimens resubmitted for qualification. Testing to confirm corrective action is required before resubmittal.

4.5. 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.

5. APPENDICES

5.1. APPENDIX I – Terminal Resistance (Low Level Contact Resistance) Layout Diagram



5.2. APPENDIX II – Current Rating

Current Rating (Amps)	Wire Size		
Positions	16 AWG	18 AWG	19 AWG
2†	10.7	9‡	8.2‡
3	9.5	8	7.2

NOTE
These Currents are expected to produce a 30°C Maximum final temperature rise at the contacts at the end of sequence 2 as specified in Paragraph 3.6. This applies to contacts with part numbers ending in -1. Contact part numbers ending in -2 (when available) are expected to have a maximum current that is 20% higher.

†Center position of the 3-position connector is not energized.

‡Current indicated may be higher than the UL rating.