Nector M-Line Sealed Connectors

DESIGN OBJECTIVES
The product described in this document has not fully been tested to ensure conformance to the requirements outlined below. TE Connectivity (TE) makes no representation or warranty, express or implied that the product will comply with these requirements. Further, TE may change these requirements based on results of additional testing and evaluation. Contact TE engineering for details.

1. SCOPE

1.1. Content

This specification covers performance, tests and quality requirements for the TE Connectivity 3, 5, 6, and 7 Position Nector M-Line sealed connectors a system for power wiring applications.

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. The Qualification Test Report number for this testing is 501-TBD. 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

- 114-32111: Application Specification
- 501-TBD: Qualification Test Report

2.2. Industry Document

EIA-364: Electrical Connector/Socket Test Procedures Including Environmental Classifications
UL-486D: Sealed Wire Connector Systems
IEC-60529: Degrees of Protection Provided by Enclosures (IP Code)
IEC 60695-2-11: Fire hazard testing: Glowing/hot-wire based test methods

2.3. Reference Document

109-197: Test Specification (Tyco Electronics Test Specifications vs EIA and IEC Test Methods)

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

- Voltage: 400 volts AC (IEC application), 600 volt AC (UL application)
- Current:

Current (Max) Single Phase Circuit	Current (Max) Multi-Phase Circuit (5,6,7P only)	Wire Conductor Size
7A	7A	18AWG
10A	10A	16AWG
15A	15A	14AWG
16A	10A	1.5mm^2
20A	16A	2.5 mm^2

- Temperature: -40 to 85°C

3.4. Performance and Test Description

Product is designed to meet the electrical, mechanical and environmental performance requirements specified in Figure 1. Unless otherwise specified, all tests shall be performed at ambient environmental conditions.

3.5. Test Requirements and Procedures Summary

Test Description	Requirement	Procedure
Initial examination of product.	Meets requirements of product drawing and Application Specification 114-32111.	EIA-364-18. Visual and dimensional (C of C) inspection per product drawing.
Final examination of product.	Meets visual requirements.	EIA-364-18. Visual inspection.
ELECTRICAL		
Low Level Contact Resistance (LLCR).	15 milliohms maximum initial. Δ10 milliohms maximum.	EIA-364-23. Subject specimens to 100 milliamperes maximum and 20 millivolts maximum open circuit voltage. See Figure 3.
Insulation resistance.	100 mega ohms minimum initial. 10 mega ohms minimum final.	EIA-364-21. 500 volts DC, 2 minute hold. Test between adjacent contacts of mated specimens.
Withstanding voltage.	One minute hold with no breakdown or flashover.	EIA-364-20, Condition I. 3000 volts AC at sea level
Temperature rise vs current.	45°C maximum temperature rise at specified current. Refer to section 3.3 for current values for L (3P) or L1, L2, L3 (5/6/7P) and N positions. For S1, S2, and S3 positions energize at 2A.	EIA-364-70, Method 1. Stabilize at a single current level until 3 readings at 5 minute intervals are within 1°C.
MECHANICAL		
Sinusoidal vibration.	No discontinuities of 1 microsecond or longer duration. See Note (a).	EIA-364-28, Test Condition I. Subject mated specimens to 10 to 55 to 10 Hz traversed in 1 minute with 1.5 mm maximum total excursion. Two hours in each of 2 mutually perpendicular planes.

Figure 1 (continued)

Mechanical shock.	No discontinuities of 1 microsecond or longer duration. See Note (a).	EIA-364-27, Condition A. Subject mated specimens to 50 G's half-sine shock pulses of 11 milliseconds duration. Three shocks in each direction applied along 3 mutually perpendicular planes, 18 total shocks.
Crimp Tensile Strength.	80N min: 18AWG 150N min: 16AWG, 1.5mm^2 300N min: 14AWG, 2.5mm^2	EIA-364-8B. Measure force necessary to remove wire from specimens at a maximum rate of 12.7 mm per minute.
Wire Retention Force (Field Install Contact).	20N min: 18AWG 40N min: 16AWG, 1.5mm^2 50N min: 14AWG, 2.5mm^2	EIA-364-8B. Measure force necessary to remove wire from specimens at a maximum rate of 12.7 mm per minute.
Connector Mating Force.	60N maximum	EIA-364-8B. Measure force necessary to mate a fully populated connector assembly at a maximum rate of 12.7 mm per minute.
Connector Latch Pull Force.	Connectors shall remain mated with no evidence of damage.	EIA-364-98. Apply an 80N pull force in axial direction.
Cable Pull Force	Cable shall remain engaged with connector with no evidence of damage. 2mm maximum displacement of the cable allowed	EIA-364-38C, Condition E. Apply an 80N (cable OD up to 16mm) or 100N (cable OD over 16mm) pull force in axial direction.
Durability.	See Note (a)	EIA-364-9. Mate and un-mate specimens for 10 cycles at a maximum rate of 500 cycles per hour.
ENVIRONMENTAL		
Thermal shock.	See Note (a)	EIA-364-32, Test Condition I. Subject unmated specimens to 50 cycles between -40 and 85°C with 30 minute dwells at temperature extremes and 1 minute transition between temperatures.
Humidity/temperature cycling.	See Note (a)	EIA-364-31, Method IV. Subject unmated specimens to 10 cycles (10 days) between 25 and 65°C at 80 to 100% RH
Temperature life.	See Note (a)	EIA-364-17, Method A, Test Condition 4, Test Time Condition B. Subject mated specimens to 120°C for 250 hours.
Ingress Protection.	See Note (a)	IEC-60529, IP67
Shelf Aging.	See Note (a)	UL 486D, Sections 9.3.1.1(b). Subject specimens to 65 ± 3°C for 240 hours.
Glow Wire Test	No visible flame or self-extinguishes flames within 30 seconds of glow wire removal	IEC 60695-2-11. Subjected to 850°C probe temperature

NOTE (a): *Shall meet visual requirements, show no physical damage, and meet requirements of additional tests as specified in the Product Qualification and Requalification Test Sequence shown in Figure 2.*

Figure 1 (end)

3.6. Product Qualification and Requalification Test Sequence

Test or Examination	Test Group (b)						
	A	B	C	D	E	F	G
	Test Sequence (c)						
Initial examination of product	1	1	1	1	1	1	1
LLCR	3,7	2,5,7,9	2, 7				
Insulation resistance			3,8				
Withstanding voltage			4,9				
Temperature rise vs current		3,10					
Sinusoidal vibration	5	8					
Mechanical shock	6						
Crimp Tensile Strength					2		
Wire retention force						2	
Connector Mating force	2						
Cable Pull force			10				
Durability	4						
Connector Latch Pull	8						
Thermal shock			5				
Humidity/temperature cycling		4(d)	6				
Temperature life		6					
Ingress Protection				3			
Shelf Aging				2			
Glow Wire							2
Final examination of product	9	11	11	4	3	3	3

NOTES ***(b)*** *See paragraph 4.1.A.*
(c) *Numbers indicate sequence in which tests are performed.*
(d) *Precondition with 5 durability cycles*

Figure 2

4. QUALITY ASSURANCE PROVISIONS

4.1. Qualification Testing

A. Specimen Selection

Specimens shall be prepared in accordance with applicable Instruction Sheets and shall be selected at random from current production. Test group A and B shall each consist of a minimum of 5 mated connector assemblies terminated to each conductor size (18-14AWG, 1.5-2.5mm^2). Test group C shall consist of a minimum of 5 mated connector assemblies terminated to the largest and smallest conductor sizes (18 and 14AWG). Test group D shall consist of a minimum of 5 mated connector assemblies utilizing the smallest OD cable specified for the connector and a minimum of 5 mated assemblies utilizing the largest OD cable specified. Test group E and F shall consist of a minimum of 10 contacts terminated with each wire size. Test group G shall consist of a minimum of 2 molded housing specimens. Test group H shall consist of a minimum of 5 mated connector assemblies utilizing the smallest OD cable specified for the connector and a minimum of 5 mated assemblies utilizing the largest OD cable specified.

B. Test Sequence

Qualification inspection shall be verified by testing specimens 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.

TBD

Figure 3
LLCR Measurement Points