Truck Lighting Connector System

1. INTRODUCTION

1.1. Purpose

Testing was performed on the Tyco Electronics Truck Lighting Connector System to determine its conformance to the requirements of Product Specification 108-2430 Revision A.

1.2. Scope

This report covers the electrical, mechanical, and environmental performance of the Truck Lighting Connector System. Testing was performed at the Tyco Electronics Product Reliability Center in Winston Salem North Carolina and the National Technical Systems Laboratory in Detroit Michigan. The test file numbers for this testing are 20070087ACL, 20070088ACL and 20090211ACL. This documentation is on file at and available from the Tyco Electronics Product Reliability Center.

1.3. Conclusion

The Truck Lighting Connector System listed in paragraph 1.5., conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-2430 Revision A.

1.4. Product Description

The Truck Lighting Connector System is composed of a cap connector assembly, a plug connector assembly and wire covers and utilizes the Tyco Electronics AMP MCP2.8 contact system with crimped wire termination. The assembly is designed to meet the needs of the electrical interface(s) between the heavy duty lighting device(s) and the truck and truck/trailer wiring harness system.

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
1-962915-1	Sn plated 2.8 x 0.8 tab with 0.8 mm^2 wire lead
1-962915-2	Ag plated 2.8 x 0.8 tab with 0.8 mm^2 wire lead
1-926916-1	Sn plated 2.8 x 0.8 tab with 2.0 mm^2 wire lead
1-962916-2	Ag plated 2.8 x 0.8 tab with 2.0 mm^2 wire lead
1-968855-1	Sn plated receptacle with 0.8 mm^2 wire lead
1-968855-3	Ag plated receptacle with 0.8 mm^2 wire lead
1-968857-1	Sn plated receptacle with 2.0 mm^2 wire lead
1-968857-3	Ag plated receptacle with 2.0 mm^2 wire lead
1326455-1	2 position sealed plug assembly
1326459-1	2 position wire dress, 180 degree, hinged
1326460-1	3 position sealed plug assembly
1326464-1	3 position wire dress, 180 degree, hinged
1326743-1	2 position sealed cap assembly
1326744-1	3 position sealed cap assembly

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
	Test Sequence (b)					
Examination of product	1	1	1	1	1	1
Visual examination	18	13		11	17	7
Low voltage (dry circuit) resistance			2,4,6,8,10,15		3,6,8,10,12	
Specified rated resistance				2,8	4,14,16	
Insulation resistance	2,7,9,11,13,15,17	2,6,8,10,12				2,6
Current cycling					13	
Current test					15	
Vibration	3	5	11		9	
Shock	4		12			
Durability		3	3	3	2	
Mating force			14	7		
Unmating force			13	6		
Maintenance aging				4		
Terminal retention				10		
Connector retention			16	9		
Side load force						4
Drop test	5					
Thermal shock	6		9		7	
Temperature/humidity	8		7		11	
Temperature life		4	5		5	3
Corrosion	12	7				
Steam cleaning/pressure washing	16	11				
Fluid immersion	14	9				
Water submersion	10					5
Dust test				5		

NOTE *(a) See paragraph 1.5.*
(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 and dimensionally inspected per the product drawing and found to be conforming to product drawing requirements, and were manufactured using the same core manufacturing processes and technologies as production parts.

2.2. Visual Examination - Test Groups 1, 2, 4, 5 and 6

All specimens were inspected after testing for form, fit, and function. No evidence of physical damage detrimental to product performance was observed.

2.3. Low Voltage (Dry Circuit) Resistance - Test Groups 3 and 5

All LLCR measurements, taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage were less than 7.5 milliohms with 0.8 mm^2 conductor, 6.5 milliohms with 1.0 mm^2 conductor, and 5.0 milliohms with 2.0 mm^2 conductor.

2.4. Specified Rated Resistance - Test Groups 4 and 5

All specified rated resistance measurements were less than 20 megohms at 10 amperes for 0.8 mm^2 conductor, 20 megohms at 15 amperes for 1.0 mm^2 conductor, and 15 megohms at 20 amperes for 2.0 mm^2 conductor.

2.5. Insulation Resistance - Test Groups 1, 2 and 6

All insulation resistance measurements were greater than 20 megohms.

2.6. Current Cycling - Test Group 5

No evidence of physical damage was visible as a result of current cycling testing.

2.7. Current Test - Test Group 5

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

2.8. Vibration - Test Groups 1, 2, 3 and 5

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

2.9. Shock - Test Groups 1 and 3

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

2.10. Durability - Test Groups 2, 3, 4 and 5

No evidence of physical damage was visible as a result of manually mating and unmating Ag/Ag and Ag/Sn plated specimens 25 times, and Sn/Sn plated specimens 10 times.

2.11. Mating Force - Test Groups 3 and 4

All mating force measurements were less than 70 N.

2.12. Unmating Force - Test Groups 3 and 4

All unmating force measurements were less than 70 N.

2.13. Maintenance Aging - Test Group 4

No evidence of physical damage was visible as a result of maintenance aging testing.

2.14. Terminal Retention - Test Group 4

All terminals maintained their original position and there were no terminal latch failures.

2.15. Connector Retention - Test Groups 3 and 4

There was no evidence of physical damage or latch failures.

2.16. Side Load Force - Test Group 6

No evidence of physical damage was visible as a result of side load force testing.

2.17. Drop Test - Test Group 1

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

2.18. Thermal Shock - Test Groups 1, 3 and 5

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

2.19. Temperature/humidity - Test Groups 1, 3 and 5

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

2.20. Temperature Life - Test Groups 2, 3, 5 and 6

No evidence of physical damage was visible as a result of temperature life testing.

2.21. Corrosion - Test Groups 1 and 2

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

2.22. Steam Cleaning/Pressure Washing - Test Groups 1 and 2

There was no evidence of physical damage or ingress of water.

2.23. Fluid Immersion - Test Groups 1 and 2

There was no evidence of physical damage or ingress of fluids.

2.24. Water Submersion - Test Groups 1 and 6

There was no evidence of physical damage or ingress of water.

2.25. Dust Test - Test Group 4

There was no evidence of physical damage or ingress of dust.

3. TEST METHODS

3.1. Examination of Product

Specimens were visually and dimensionally inspected to ensure they were produced, inspected, and accepted as conforming to product drawing requirements, and were manufactured using the same core manufacturing processes and technologies as production parts.

3.2. Visual Examination

Examination was performed with the naked eye under fluorescent lights. Each specimen was visually examined prior to testing; no manufacturing or material defects such as cracks, tarnishing, flash, etc. were noticed. After testing was completed, each specimen was re-examined to check for changes such as swelling, corrosion, discoloration, contact plating wear, physical distortions, cracks, etc.

3.3. Low Voltage (Dry Circuit) Resistance

Mated specimens were subjected to a 20 millivolt open circuit voltage with current not to exceed 100 milliamperes. Measurements were taken using the 4-wire probe method. The overall resistance included 150 mm of wire, 2 crimps, bulk terminal material, and terminal interface. The resistance of 150 mm of conductor wire was subtracted from the resistance values at the end of testing.

3.4. Specified Rated Resistance

Specimens were attached to a non-conductive wood surface, data was collected using the 4-wire probe method. Terminals of like wire sizes were connected in series. The 2.0 mm^2 interfaces had 20 amperes applied while the 0.8 mm^2 interfaces had 10 amperes applied. Current was allowed to stabilize for 30 minutes before readings were taken. The overall resistance of the mated specimens consisted of 12.5 inches of wire, crimp, bulk female terminal, terminal interface, and bulk male terminal, and 12.5 inches of wire. A total of 25 inches of wire was subtracted out of the mated assembly's resistance measurements after testing was completed.

3.5. Insulation Resistance

Insulation resistance was measured between adjacent terminals and between the connector shell wrapped in aluminum foil and contacts. A test voltage of 1000 volts DC was applied for 1 minute or until stabilization occurred before the resistance was measured.

3.6. Current Cycling

Specimens were subjected to 500 cycles at a specified current of 7.5 amperes. First, specimens were subjected to 200 cycles of 45 minutes ON and 15 minutes OFF at 85 ± 3°C. Next, specimens were subjected to 50 cycles of current ON for 20 minutes at 85 ± 3°C and 60 minutes OFF at ambient room conditions. The above cycles were repeated to complete 500 cycles.

3.7. Current Test

Specimens fully energized with a current of 7.5 amperes were subjected to a temperature of 85 ± 3°C for 24 hours.

3.8. Vibration

Specimens were vibrated for 8 hours in each of the 3 mutually perpendicular axes (see Figure 3) for a duration of 24 hours per the profile shown in Figure 4.

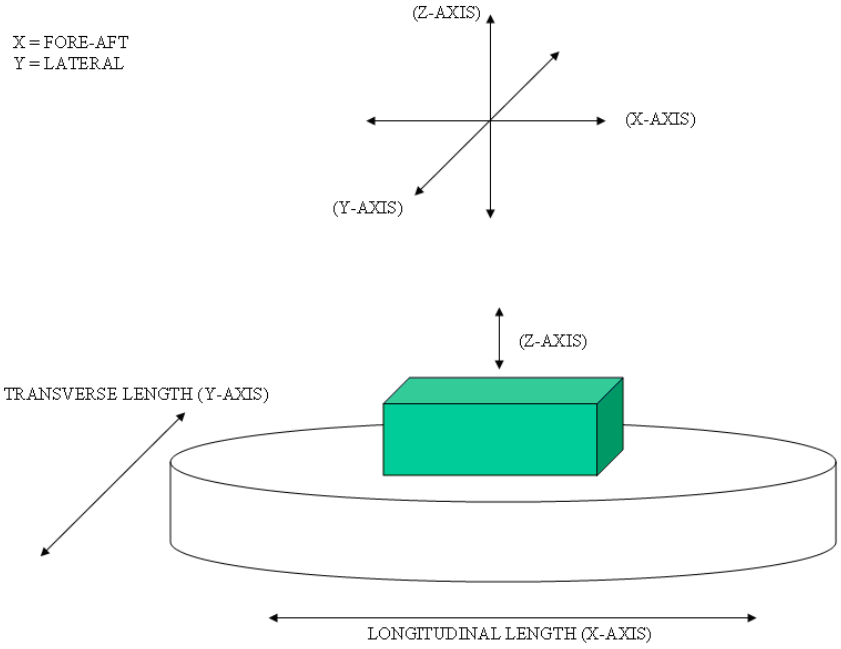

Figure 3

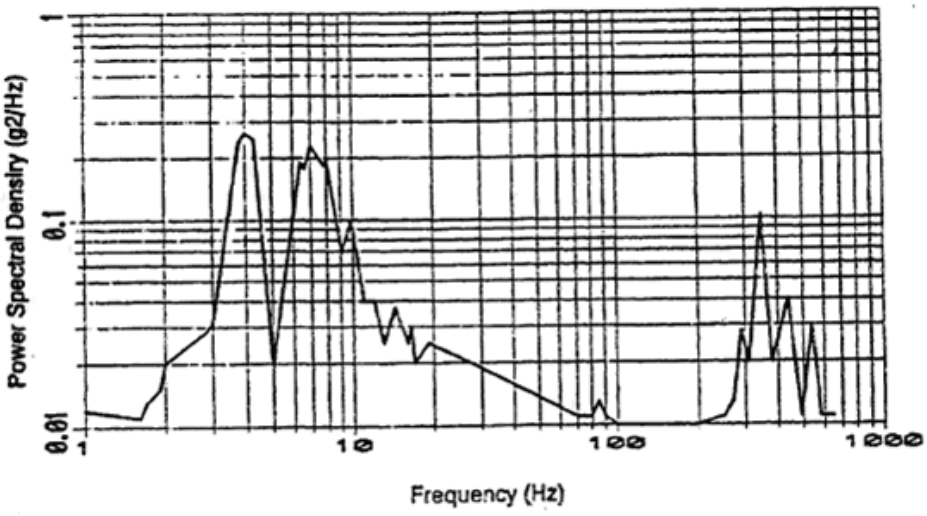

Figure 4

3.9. Shock

Mated specimens were subjected to a mechanical shock test having a half-sine waveform of 50 gravity units (g peak) and a duration of 11 milliseconds. Ten shocks in each direction were applied along the 3 mutually perpendicular planes for a total of 30 shocks. Specimens were monitored for discontinuities of 1 microsecond or greater using a current of 100 milliamperes DC.

3.10. Durability

Ag/Ag and Ag/Sn plated specimens were manually mated and unmated 25 times. Sn/Sn plated specimens were manually mated and unmated 10 times.

3.11. 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 50 mm per minute. An L-vise attached to the crosshead of an Instron machine was used to push the plug onto the cap until it was fully mated. The cap was held by an L-vise attached to a free floating table on the base of the Instron machine.

3.12. Unmating Force

The force required to unmate individual specimens with latches disengaged was measured using a tensile/compression device with a free floating fixture and a rate of travel of 50 mm per minute. An L-vise attached to the crosshead of an Instron machine was used to pull the plug until it was fully unmated from the cap. The cap was held by an L-vise attached to a free floating table on the base of the Instron machine.

3.13. Maintenance Aging

Terminals in the plugs and caps were inserted and removed 1 at a time for a total of 10 cycles.

3.14. Terminal Retention

An axial load of 110 N was applied to the wires of each specimen at a rate of travel of 50 mm per minute and held for 1 minute. The specimens were held in an L-vise attached to the crosshead of an Instron machine. The wires were gripped by an L-vise attached to a free floating table on the base of the Instron machine.

3.15. Connector Retention

An axial load of 110 N was applied to the wires of each specimen at a rate of travel of 50 mm per minute and held for 1 minute. The plug wires were held in an L-vise attached to the crosshead of an Instron machine. The cap wires were gripped by an L-vise attached to a free floating table on the base of the Instron machine.

3.16. Side Load Force

Specimens were held by an L-vise attached to a free floating table on the base of an Instron machine. A dowel pin held in a Jacobs chuck attached to the crosshead of the Instron machine was used to apply a 65 N minimum load at a rate of travel of 50 mm per minute to the plug levers in a direction perpendicular to the actuation axis.

3.17. Drop Test

Specimens were attached to the free end of a 2 meter long cable attached to a wall at a height of 1 meter from the floor. The cable with the specimen attached was fully extended perpendicular to the wall and allowed to drop.

3.18. Thermal Shock

Specimens were preconditioned at -40° for 2 houts and then subjected to 5 cycles of thermal shock with each cycle consisting of 2 hour dwells at -40 and 85°C.

3.19. Temperature/humidity

Specimens were subjected to 42, 8 hour cycles between -40 and 85°C at 0 to 90% RH (see Figure 5).

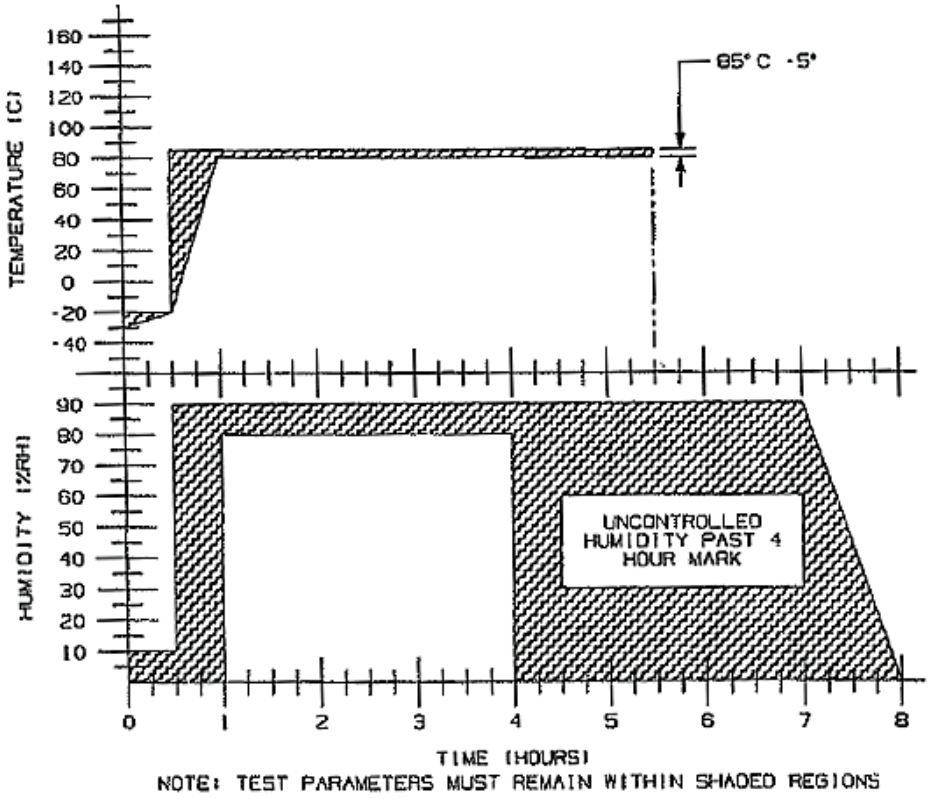

Figure 5

3.20. Temperature Life

Mated and unpowered specimens were exposed to a temperature of 85°C for 1008 hours.

3.21. Corrosion

Specimens were exposed to a salt-laden atmosphere at a temperature of 35°C for 240 hours.

3.22. Steam Cleaning/pressure Washing

Specimens were subjected to 100% water coverage using a flat fan spray from a distance of 20 to 30 cm at a source pressure of 7000 kPa gage and source flow rate of 9460 cm^3 per minute. Specimens were exposed to the spray for 3 of every 6 seconds for a single cycle with a total exposure of 375 cycles. For pressure washing, water temperature was 40°C with detergent added. For steam cleaning, water temperature was 93°C with a source pressure of 14000 kPa and source flow rate of 9460 cm^3 per minute.

3.23. Fluid Immersion

One specimen was submerged in 1 of the fluids listed below (1 specimen for each fluid) for 5 minutes, removed from the fluid and allowed to dry, this was repeated every 24 hours for 5 days.

- Motor oil 30 wt (ASTM D 471, IRM-902);
- Brake fluid (disc type 1- SAE RM66-04);
- Diesel fuel #2 (90/10% - IRM-903/T-xylene);
- 50/50 antifreeze mixture (ASTM D 471 service fluid 104);
- Gear oil 90 wt (ASTM STP 512, API GL-5);
- Windshield washer fluid (methyl alcohol, SAE J1944);
- Magnesium chloride (5% - SAE J 2174);
- Muratic acid (diluted 1:8 parts water by volume);
- Calcium chloride (5% - SAE J2174);
- Cleaning fluid (85% mineral spirits/15% xylene trisodium phosphate).

3.24. Water Submersion

Specimens were preconditioned at 85°C for 96 hours and then submerged into a salt water solution to a depth of 30 to 40 cm and held for 30 minutes. After 5 minutes of submersion, a 31 N pull was applied for 30 seconds on each wire in all 4 directions while observing for air bubbles. At the conclusion of the 30 minute submersion, the specimens were removed from the salt water solution, isolation resistance measurements were performed, and the specimens unmated and examined for evidence of water ingress.

3.25. Dust Test

Specimens were exposed to fine Grade A2 Arizona Road Dust per ISO 12103-1 for 5 hours. The dust was agitated for 5 seconds every 15 minutes. A current of 7.5 amperes was applied for 45 minutes ON and 15 minutes OFF.