*LUMAWISE Endurance N Shorting and Open Caps

1. INTRODUCTION

1.1 Purpose

Testing was performed on the TE Connectivity Lumawise Endurance N shorting and open caps to determine its conformance to the requirements of Product Specification 108-133113.

1.2 Scope

This report covers the electrical, mechanical and environmental performance of the TE Connectivity Lumawise Endurance N Shorting and Open Caps. Testing was performed at the Harrisburg Electrical Components Test Laboratory (HECTL) and the Harrisburg Fiber Optic Component Test Lab between January 02, 2019 and August 21, 2019. Detailed test data is stored at HECTL under EA20180473T and EA20190271T.

1.3 Conclusion

The TE Connectivity Lumawise Endurance N Shorting and Open Caps specimens listed in paragraph 1.4 conformed to the electrical, mechanical and environmental performance requirements of the Product Specification 108-133113.

1.4 Product Description

The LUMAWISE Endurance N shorting and open caps are used roadway and area lighting applications utilizing the ANSI C136.10 or C136.41 interface. The LUMWISE Endurance N open caps are used to disconnect service but provide a sealed interface for the ANSI C136 receptacle mounted to the lighting fixture. The LUMAWISE Endurance N shorting caps are used to provide continual power from the pole to the lighting fixture.

1.5 Test Specimens

The specimens as identified in Table 1 were submitted for testing.

Table 1 – Specimen Identification

Test Group	Quantity	Part Number	Description
A	3	2328118-1	Shorting Cap Assembly
	3	2328118-2	Shorting Cap Assembly with Surge
	6	2-2213362-4	Dimming Receptacle
B	6	2328118-1	Shorting Cap Assembly
	6	2-2213362-4	Dimming Receptacle
C	3	2328118-1	Shorting Cap Assembly
	3	2-2213362-4	Dimming Receptacle
D	2	2328118-1	Shorting Cap Assembly
	2	2328118-2	Shorting Cap Assembly with Surge
	4	2-2213362-4	Dimming Receptacle
E	6	2328118-1	Shorting Cap Assembly
	6	2-2213362-4	Dimming Receptacle
F	6	2328118-1	Shorting Cap Assembly
	6	2-2213362-4	Dimming Receptacle
G	1	2328118-1	Shorting Cap Assembly
	2	2328118-2	Shorting Cap Assembly with Surge
	1	2328118-3	Open Cap Assembly
	4	2-2213362-4	Dimming Receptacle

1.6 Qualification Test Sequence

The specimens listed in Table 1 were subjected to the test sequences outlined below in Table 2.

Table 2 – Test Sequence

Test or Examination	Test Group						
	A	B	C	D	E	F	G
	Test Sequence (a)						
Initial Examination of Product	1	1	1	1	1	1	1
LLCR	2,6						
Insulation Resistance		2,7					
Dielectric Withstanding Voltage		3,6	2,4				
Current Cycling (Heating Test)				2(b)			
Vibration	4						
Mechanical shock	5						
Durability	3						
Salt Spray			3				
Thermal shock		4					
Humidity		5					
Shelf Aging					2	2	
Immersion Protection 6X (dust)					3		
Immersion Protection X6 (jet spray)						3	
Impact							2
Final examination of product	7	8	5	3	4	4	3

(a) Numbers indicate the sequence in which tests are performed.
(b) Preconditioned with 5 durability cycles.

1.7 Environmental Conditions

Unless otherwise stated, the following environmental conditions prevailed during testing:

Temperature:	15°C to 35°C
Relative Humidity	20% to 80%

2. SUMMARY OF TESTING

2.1 Initial Examination of Product – All Test Groups

Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

2.2 LLCR – Test Group A

All low-level contact resistance measurements taken at 100 mA maximum and 20 mV maximum open circuit voltage had a change in resistance (ΔR) of less than 30 mΩ after testing. See Table 3 for low level contact resistance data. The wire bulk resistance is included in all initial resistance values.

Table 3 –Low Level Contact Resistance (mΩ)

	Initial (Actual)	Final (Delta)
Minimum	13.52	0.07
Maximum	14.94	1.72
Average	14.18	0.84
Std. Dev.	0.50	0.62
N =	6	6

2.3 Insulation Resistance – Test Group B

All insulation resistance measurements were greater than 500 MΩ at both initial and final readings.

2.4 Dielectric Withstanding Voltage – Test Groups B, C

No dielectric breakdown or flashover occurred.

2.5 Current Cycling (Heating Test) – Test Group D

Prior to current cycling the specimens were mated and unmated 5 times by hand. All temperature readings were below the maximum of 30°C temperature rise above ambient during current cycling. The maximum recorded temperature rise was 15.42°C.

2.6 Vibration – Test Group A

No apparent physical damage or discontinuities of one microsecond or greater occurred during testing.

2.7 Mechanical Shock – Test Group A

No apparent physical damage or discontinuities of one microsecond or greater occurred during testing. The pulse velocity change was 79.9 inches per second.

2.8 Durability – Test Group A

No physical damage detrimental to product performance was visible due to 25 durability cycles.

2.9 Salt Spray – Test Group C

No damage detrimental to product performance was visible due to salt spray exposure.

2.10 Thermal Shock – Test Group B

No physical damage detrimental to product performance was visible due to exposure to thermal shock.

2.11 Humidity – Test Group B

No physical damage detrimental to product performance was visible due to exposure to steady state humidity.

2.12 Shelf Aging – Test Group E, F

No physical damage detrimental to product performance was visible due to exposure to shelf aging.

2.13 Immersion Protection 6X (Dust) – Test Group E

No dust ingress was observed in any specimens exposed to dust IP6X testing.

2.14 Immersion Protection x6 (jet spray) – Test Group F

The specimens were subjected to 3 minutes of water spray at a flow rate of 100 ± 5% liters per minute. No water ingress was observed inside of the dome.

2.15 Impact – Test Group G

No physical damage detrimental to product performance was visible due to IK08 impact testing.

2.16 Final Examination of Product – All Test Groups

Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

3. TEST METHODS

3.1. Initial Examination of Product

A Certification of Conformance was issued stating that all specimens in this test package 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. Where specified specimens were visually examined with the unaided eye for signs of physical damage detrimental to product performance. Testing was performed in accordance with EIA-364-18B.

3.2 LLCR

Low level contact resistance measurements at low level current were made using a four-terminal measuring technique. The test current was maintained at 100mA maximum with a 20mV maximum open circuit voltage. Testing was performed in accordance with EIA-364-23C.

3.3 Insulation Resistance

Mated shorting cap assemblies were tested between the line/neutral and the load/neutral. A potential of 500VDC was applied and maintained for 2 minutes. The insulation resistance was recorded at the completion of the two-minute energized period. Testing was performed in accordance with EIA-364-21E.

3.4 Dielectric Withstanding Voltage

Mated shorting cap assemblies were tested between the line/neutral and the load/neutral. A potential of 2500V AC was applied and maintained for 1 minute while monitoring for dielectric breakdown or flashover. Testing was performed in accordance with UL 773, Fifth edition, dated November 15, 2017 - Section 32.

3.5 Current Cycling (Heating Test)

A 30 AWG type T thermocouple was attached to the shorting bar between the line and load power contacts on each specimen using thermally conductive epoxy (Figure 1). The specimens were preconditioned with 5 mating/unmating cycles. All specimens were wired together in a series circuit. The thermocouples were connected to a data acquisition system to monitor the temperature of the shorting bar. The specimens were cycled for 15 cycles. Each cycle consisted of 20 consecutive hours energized at 15.0 Amps DC and 4 hours off. The temperature rise of the power contacts was monitored and recorded at the end of each of the 20-hour and 4-hour sub-cycles. Refer to Figure 2 for an image of the typical test setup. Testing was performed in accordance with ANSI C136.10-2010, Section 11.1.

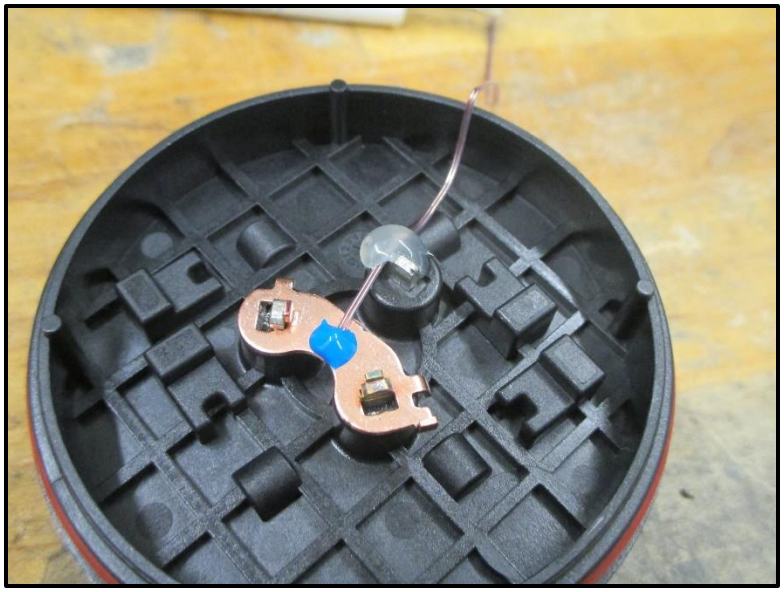

Figure 1 – Thermocouple Setup

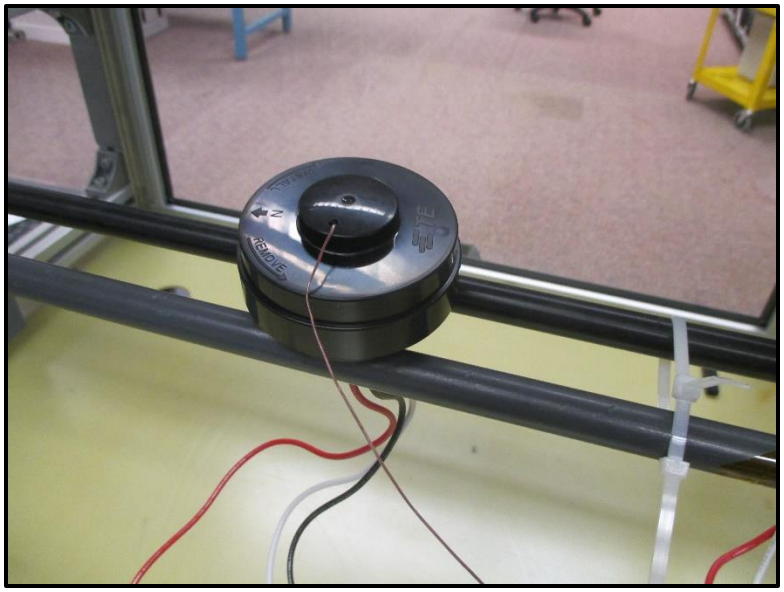

Figure 2 – Current Cycling Test Setup

3.6 Vibration

The test specimens were subjected to a simple harmonic motion having an amplitude of either 0.250 in double amplitude (maximum total excursion) or 3.5 g peak, whichever is less. The vibration frequency was varied logarithmically between the approximate limits of 5 Hz and 55 Hz. The entire frequency range of 5 Hz to 55 Hz and return to 5 Hz was traversed at a rate of one octave/minute. This cycle was repeated for one hour in each of three mutually perpendicular directions, so that the motion was applied for a total period of 3 hours. Lead wires coming out of bottom of specimens were secured to vibration table 76.2 mm from rear of connector. The test specimens were monitored for discontinuities of 1 microsecond or greater using an energizing current of 100 mA. See Figures 3 through 5 for typical test setups. Testing was performed in accordance with 108-133113.

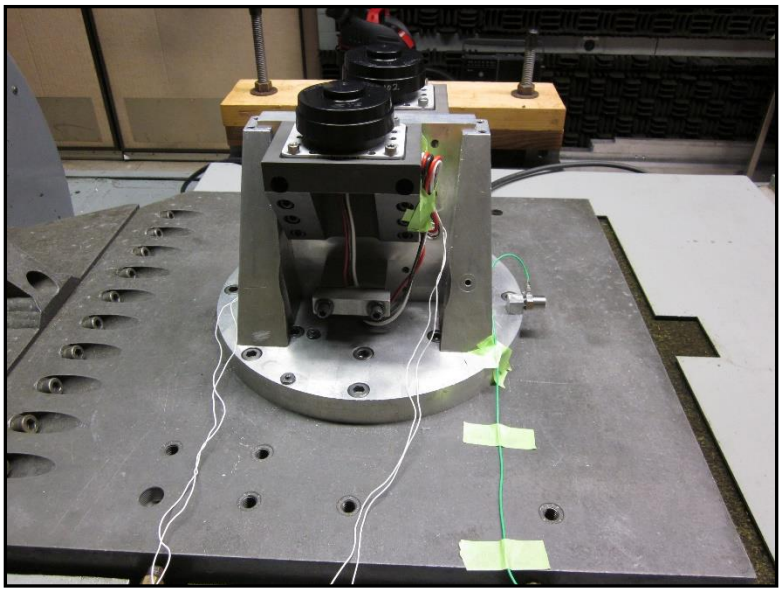

Figure 3 – Typical Vibration & Mechanical Shock Test Setup

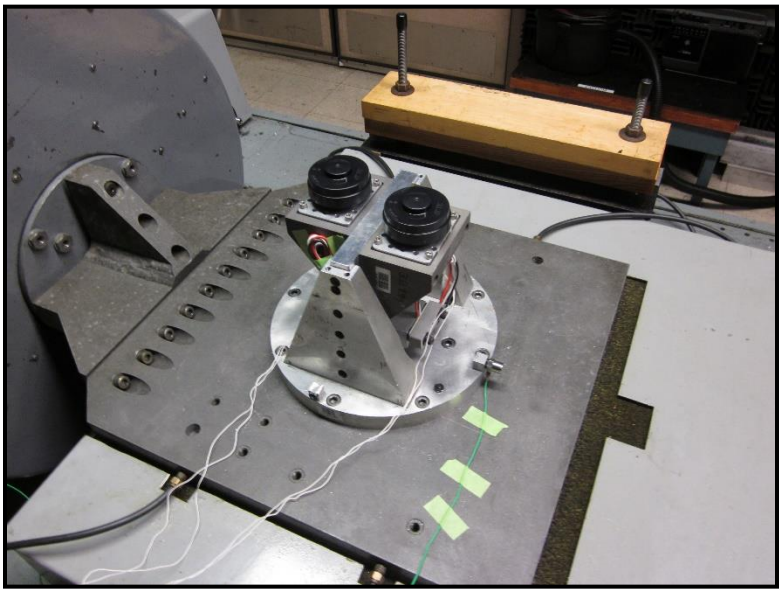

Figure 4 – Typical Vibration & Mechanical Shock Test Setup

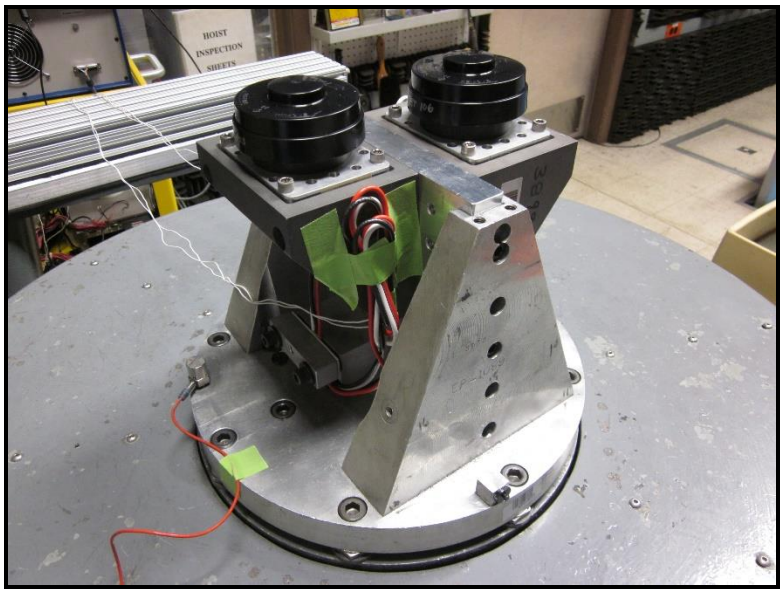

Figure 5 – Typical Vibration & Mechanical Shock Test Setup

3.7 Mechanical Shock

The test specimens were subjected to a mechanical shock test in accordance with specification EIA-364-27C, test condition H. The parameters of this test condition are a half-sine waveform with an acceleration amplitude of 30 gravity units (g's peak) and a duration of 11 ms. Three shocks in each direction were applied along the three mutually perpendicular axes of the test specimens, for a total of eighteen shocks. Lead wires coming out of bottom of specimens were secured to vibration table 76.2 mm from rear of connector. The test specimens were monitored for discontinuities of 1 microsecond or greater using an energizing current of 100 mA. See Figures 3 through 5 for typical test setups.

3.8 Durability

Specimens were mated and unmated (full motion of connector including twist lock) 25 times by hand. Testing was performed in accordance with EIA-364-9D.

3.9 Salt Spray

The specimens were placed in the chamber on horizontal racks mounted in sealed boxes with the shorting caps facing upward at the 12:00 position. The chamber was operated for a total of 240hrs. Upon completion of the test the specimens were not rinsed to prevent water injection, then allowed to dry at room ambient conditions. Testing was performed in accordance with IEC 60512-11-6. The chamber operating parameters were as follows:

Salt Fog Chamber Operating Parameters:

- Chamber Temperature: 35°C.
- Aeration Tower temperature: 48°C.
- 5% Brine Solution Purity: Sodium Chloride with no more than .3% impurities.
- Aeration Tower Pressure: 15 PSI.
- Brine Solution pH Range: 6.5 to 7.2.
- Specific Gravity Range: 1.031 to 1.037.
- Collection rate: .5 to 3ml per hour.

3.10 Thermal Shock

Mated specimens were subjected to 150 cycles between -40 and 85°C with 30-minute dwells at temperature extremes and 1 minute transitions between temperatures. Testing was performed in accordance with EIA-364-32G.

3.11 Humidity

Mated specimens were exposed to 96% non-condensing humidity for a duration of 168 hours at a temperature of 50°C. The DWV specimens were removed from the chamber one at a time to allow DWV to be performed within 10 minutes. Testing was performed in accordance with UL 773, Fifth edition, dated November 15, 2017 - Section 23.

3.12 Shelf Aging

Mated specimens were exposed to 65°C for a duration of 240 hours in an air circulating oven. Testing was performed in accordance with 108-133113.

3.13 Immersion Protection 6x (dust)

The specimens were subjected to a dust test in accordance with IP6X paragraph 13.4 of IEC 60529, Edition 2.2 2013-08. The specimens were prepared for IP6X testing by drilling a hole in the aluminum base of the shorting cap assembly then inserting a vacuum line and sealing the line with silicone. The shorting cap was mated to a receptacle during testing. The specimens were placed into the talcum dust chamber and the vacuum lines were attached to the vacuum manifold. A vacuum was applied to the specimens through the vacuum lines at a pressure not exceeding 2.0 KPa, maintained for the entire test. The specimens were exposed for a total duration of 8 hours. Following exposure, the specimens were allowed to rest in the dust chamber for a minimum of one hour. The specimens were then removed for inspection.

3.14 Immersion Protection x6 (jet spray)

The specimens were mated to a receptacle mounted to an enclosure during testing. The specimens were sprayed with a stream of water from a standard test nozzle with an internal diameter of 12.5 mm positioned 2.5 to 3 meters above the test specimen for 3 minutes. The specimens were sprayed from all directions with a water delivery rate of 100 l/min ±5%. Testing was performed in accordance with IPX6 paragraph 14.2.5 of IEC 60529, Edition 2.2 2013-08.

3.15 Impact

The specimens were placed on a concrete floor and five IK08 (5 Joule) impacts were applied to each specimen by dropping a 1.7 kg mass a distance of 300 mm. Testing was performed in accordance with IEC 62262, First Edition, dated 2002-02.

3.16 Final Examination of Product

Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed. Testing was performed in accordance with EIA-364-18B.