ANSI C136.41 Dimming Receptacle with Integrated Gasket Qualification

1. INTRODUCTION

1.1 Purpose

Qualification testing was performed on the TE Connectivity (TE) ANSI C136.41 Dimming Receptacle with integrated gasket to determine their conformance to the requirements of Product Specification 108-160322 Rev. D.

1.2 Scope

This report covers the electrical, mechanical, and environmental performance of the TE ANSI C136.41 Dimming Receptacle with integrated gasket. Testing was performed at the Harrisburg Electrical Components Test Laboratory (HECTL) between 12-January-2022 and June 10, 2022. Detailed test data is on file and maintained at HECTL under EA20210528T and EA20220174T.

1.3 Conclusion

The specimens listed in paragraph 1.4 conformed to the electrical, mechanical, and environmental performance requirements of the product specification. See Section 2 for detailed test results.

1.4 Product Description

TE Connectivity's ANSI C136.41 compliant LUMAWISE dimming receptacle and spring leaf contacts provides an electrical and mechanical interconnection between an ANSI C136.41-2013 photo control cell and luminaire. Ideal for outdoor commercial and utility lighting the ANSI C136.41 compliant dimming receptacle is available with two or four dimming contacts to support either 0-10 VDC dimming methods or Digital Addressable Lighting Interface (DALI), while providing a reliable power interconnect with three robust twist lock contacts.

1.5 Test Specimens

Specimens as identified in Table 1 were submitted for testing and subjected to the test sequences defined in Paragraph 1.5.

Table 1 – Test Specimens

Test Set	Qty	Part Number	Rev.	Description
1	6	2376865-2	11	Receptacle Assembly, LUMAWISE* Endurance N With Integrated Gasket
	6	2359482-2	6	Base Assembly, Light Controller, LUMAWISE Endurance N Gen 2
	6	2359615-3	A	Cover Photocell, LUMAWISE Endurance N+
2	6	2376865-2	11	Receptacle Assembly, LUMAWISE Endurance N With Integrated Gasket
	6	2359482-2	6	Base Assembly, Light Controller, LUMAWISE Endurance N Gen 2
	6	2359615-5	A	Cover Photocell, LUMAWISE Endurance N+
3(a)	3	2376865-2	11	Receptacle Assembly, LUMAWISE Endurance N With Integrated Gasket
	3	2359482-2	6	Base Assembly, Light Controller, LUMAWISE Endurance N Gen 2
	3	2359615-3	A	Cover Photocell, LUMAWISE Endurance N+
4(a)	3	2376865-2	11	Receptacle Assembly, LUMAWISE Endurance N With Integrated Gasket
	3	2361116-1	A	Assembly, Shorting Cap LUMAWISE Endurance N+
	3	2359482-2	6	Base Assembly, Light Controller, LUMAWISE Endurance N Gen 2
5(a)	3	2376865-2	11	Receptacle Assembly, LUMAWISE Endurance N With Integrated Gasket
	3	2361116-1	A	Assembly, Shorting Cap LUMAWISE Endurance N+
6	5	2376865-2	11	Receptacle Assembly, LUMAWISE Endurance N With Integrated Gasket
	5	2361116-1	A	Assembly, Shorting Cap LUMAWISE Endurance N+
7	3	2376865-2	11	Receptacle Assembly, LUMAWISE Endurance N With Integrated Gasket

Table 1 – Test Specimens (Continued)

Test Set	Qty	Part Number	Rev.	Description
8(a)	5	2376865-2	11	Receptacle Assembly, LUMAWISE Endurance N With Integrated Gasket
	5	2361116-1	A	Assembly, Shorting Cap LUMAWISE Endurance N+
9(a)	3	2376865-2	A6	Receptacle Assembly, LUMAWISE Endurance N+ with Integrated Gasket
	3	2359482-2	6	Base Assembly, Light Controller, LUMAWISE Endurance N+ Gen 2
	3	2359615-6	A	Tall Cover, LUMAWISE Endurance N+

(a) The receptacle assembly was secured to the lid of an aluminum IP Box. For Test Sets 5, 8, & 9, the lids, gaskets, and boxes were assembled with a torque of 15 in-lbs.

1.6 Test Sequence

The test specimens referred to in paragraph 1.4 were tested according to the test sequences listed in Table 2.

Table 2 – Test Sequence

Test or Examination	Test Groups							
	A	B	C	D	E	F	G1	G2
	Test Sets							
	1	2	3, 4	5	6	7	8	9
	Test Sequence (a)							
Initial Examination of Product	1	1	1	1	1	1	1	1
Low Level Contact Resistance	2, 6	2, 5, 7,9		2, 4				
Insulation Resistance			2, 7					
Dielectric Withstanding Voltage			3, 6					
Current Cycling					2 (b)			
Temperature Rise vs Current		3, 10						
Contact Retention Housing						2		
Vibration	4	8 (c)						
Mechanical Shock	5							
Durability	3							
Salt Spray				3				
Thermal Shock			4					
Humidity		4 (b)	5					
Temperature Life		6						
Temperature Life – IP							2	2
Ingress Protection 6X (Dust)							3	
Ingress Protection X6 (Water Spray)								3
Final Examination of Product	7	11	8	5	3	3	4	4

(a) Numbers indicate the sequence in which tests were performed.
(b) Preconditioned with 5 durability cycles
(c) The mated receptacle and shorting cap were energized to an 18°C temperature rise.

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

After a visual examination, there were no indications of cracking, breaking or other damage which would interfere with the performance requirements of the subsequent tests on the specimens.

All specimens submitted for testing were representative of normal production lots. A Certificate of Conformance was issued by Product Assurance.

2.2 Low Level Contact Resistance – Test Groups A, B, D

Specimens had a maximum change in resistance (ΔR) of 23.66 milli-Ohms, meeting the maximum 30 milli-Ohm ΔR requirement listed in the product specification. See Table 3 through Table 5 for Low Level Contact Resistance test results.

Table 3 – Low Level Contact Resistance Test Results in Milli-Ohms for Test Set 1

Test Group A	Power Contacts		Test Group A	Signal Contacts	
	Initial	After Vibration – Final (ΔR)		Initial	After Vibration – Final (ΔR)
Minimum	4.30	-2.52	Minimum	14.27	-4.11
Maximum	7.36	0.99	Maximum	18.84	2.49
Average	5.09	-0.09	Average	16.16	-0.72

Table 4 – Low Level Contact Resistance Test Results in Milli-Ohms for Test Set 5

Test Group D	Initial	After Salt Spray – Final (ΔR)
Minimum	4.30	-1.26
Maximum	4.36	-0.09
Average	4.32	-0.78

Table 5 – Low Level Contact Resistance Test Results in Milli-Ohms for Test Set 2

Test Group B	Power Contacts				Test Group B	Signal Contacts			
	Initial	After Humidity (ΔR)	After Temp Life (ΔR)	After Vibration – Final (ΔR)		Initial	After Humidity (ΔR)	After Temp Life (ΔR)	After Vibration – Final (ΔR)
Minimum	2.02	2.03	0.78	1.71	Minimum	8.42	4.17	2.45	1.04
Maximum	3.01	7.19	5.73	7.03	Maximum	11.42	23.66	13.89	17.19
Average	2.24	2.89	2.82	3.05	Average	9.18	8.41	7.44	7.12
Std. Dev.	0.23	1.15	1.14	1.14	Std. Dev.	0.66	4.36	3.15	4.29
Count	18	18	18	18	Count	24	24	24	24

2.3 Insulation Resistance – Test Group C

All positions on all specimens for both test sets had minimum Insulation Resistances greater than 100 Giga-Ohms, meeting the 500 Mega-Ohm minimum requirement listed in the product specification.

2.4 Dielectric Withstanding Voltage – Test Group C

There were no specimens with breakdown or flashover after subjecting specimens to 2500 VAC for 1 minute, meeting the requirements listed in the product specification.

2.5 Current Cycling – Test Group E

After the 4-hour “On” cycle, specimens had a maximum temperature rise of 13.9 °C at 15 Amps, meeting the 30 °C maximum temperature rise requirement listed in the product specification. The specimens had a temperature rise of 0°C after the 20-hour “Off cycle. See Table 6 for detailed test results for the “On” segment of current cycling.

Table 6 – Temperature Rise vs Current Test Results in °C – “On” Cycle

Test Group E	Cycle														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Amb. Temp.	21.1	20.9	18.9	19.2	19.9	19.4	18.4	17.8	18.4	19.4	19.1	20.2	20.5	20.6	20.1
Minimum	12.2	12.2	12.2	12.2	12.2	12.3	12.2	12.2	12.2	12.3	12.2	12.2	12.2	12.4	12.4
Maximum	13.6	13.7	13.7	13.7	13.7	13.8	13.7	13.7	13.7	13.7	13.7	13.9	13.8	13.8	13.8
Average	12.8	12.9	12.9	12.9	12.9	13.0	13.0	12.9	12.8	12.9	13.0	13.0	13.0	13.0	13.0

2.6 Temperature Rise vs Current – Test Group B

Specimens had a maximum initial temperature rise of 11.26 °C at 15 Amps, meeting the 30 °C maximum temperature rise requirement listed in the product specification. See Table 7 for detailed test results.

Table 7 – Temperature Rise vs Current Test Results in °C

Test Group B	Initial	After Vibration – Final
Ambient Temperature	21.5	24.5
Minimum	8.81	10.16
Maximum	11.26	22.03
Average	10.35	13.55

2.7 Contact Retention Housing – Test Group F

Each specimen power contact held a minimum of 45 Newtons for six seconds, meeting the requirements listed in the product specification.

2.8 Vibration – Test Groups A, B

Test specimens had no apparent physical damage or discontinuities of 1 microsecond or longer occurred during vibration testing.

2.9 Mechanical Shock – Test Group A

Test specimen had no apparent physical damage or discontinuities of 1 microsecond or longer occurred during shock testing. Pulse Velocity Change: 6.60 Feet/Second.

2.10 Durability – Test Group A

After 25 cycles of durability, there were no indications of cracking, breaking or other damage which would interfere with the performance requirements of the subsequent tests on the specimens.

2.11 Salt Spray – Test Group D

After salt spray, there were no indications of cracking, breaking or other damage which would interfere with the performance requirements of the subsequent tests on the specimens.

2.12 Thermal Shock – Test Group C

After exposure to thermal shock, there were no indications of cracking, breaking or other damage which would interfere with the performance requirements of the subsequent tests on the specimens.

2.13 Humidity – Test Groups B, C

After exposure to humidity, there were no indications of cracking, breaking or other damage which would interfere with the performance requirements of the subsequent tests on the specimens.

2.14 Temperature Life – Test Group B

After exposure to temperature life, there were no indications of cracking, breaking or other damage which would interfere with the performance requirements of the subsequent tests on the specimens.

2.15 Temperature Life – IP – Test Groups G1, G2

After exposure to temperature life – IP, there were no indications of cracking, breaking or other damage which would interfere with the performance requirements of the subsequent tests on the specimens.

2.16 Ingress Protection 6X (Dust) – Test Group G1

The specimens displayed no signs of dust ingress after being subjected to an IP6X dust exposure and vacuum for 8 hours, meeting the requirements listed in the product specification.

2.17 Ingress Protection X6 (Water Spray) – Test Group G2

All specimens displayed no signs of water ingress after being subjected to IPX6 water spray for 3 minutes, meeting the requirements listed in the product specification.

2.18 Final Examination of Product – All Test Sets

After a visual examination, there were no indications of cracking, breaking or other damage which would interfere with the performance requirements of the subsequent tests on the specimens.

3. TEST METHODS

3.1 Initial Examination of Product – All Test Sets

Specimens were subjected to a visual examination in accordance with EIA 364-18B and the product specification. Specimens were visually examined with an unaided eye.

3.2 Low Level Contact Resistance – Test Groups A, B, D

Specimens were subjected to a low level contact resistance test in accordance with EIA 364-23C and the product specification. Specimens were tested for low level contact resistance using a 4-point measurement technique. Specimens were subjected to 100 milliamperes maximum and 20 millivolts maximum open circuit voltage. For Test Set 1 and Test Set 2, each measurement included one set of receptacle and blade contacts with bulk wire. For Test Set 3, each measurement included a pair of receptacle and blade power contacts connected via the shorting cap and bulk wire.

3.3 Insulation Resistance – Test Group C

Specimens were subjected to an insulation resistance test with a dielectric analyzer in accordance with EIA 364-21F and the product specification. Unmated receptacles were subjected to 500VDC for two minutes between adjacent power contacts; between power and signal contacts; and between all contacts and grounded mounting plate. The insulation resistance was measured and recorded at the end of the two minute application.

3.4 Dielectric Withstanding Voltage – Test Group C

Specimens were subjected to a dielectric withstanding voltage test with a dielectric analyzer in accordance with UL 773, Section 32 and the product specification. Unmated receptacles were subjected to 2500VAC for one minute between adjacent power contacts; between power and signal contacts; and between all contacts and grounded mounting plate. Leakage current and any breakdown or flashover occurring were recorded.

3.5 Current Cycling – Test Group E

Specimens were subjected to a temperature rise test in accordance with ANSI C136.10-2017 Section 11.1 and the product specification. Each specimen was prepared using beaded, 30 AWG, type T thermocouples placed on the PCB to monitor the Line and Load circuits during testing. The specimens were preconditioned with 5 cycles of durability before testing. The specimens were suspended in an air-flow free enclosure. The Line and Load circuits were then wired in series to a power supply. The thermocouples were then connected to a data acquisition station to monitor temperature. A thermocouple for ambient temperature was placed in the center of the enclosure. The specimens were then subjected to 15 24-hour cycles of current cycling. Each cycle consisted of applying a current of 15 amps for 20 hours followed by 4 hours of zero current. The temperature was measured at the end of the 20 hour segment and the 4 hour segment of a cycle.

3.6 Temperature Rise vs Current – Test Group B

Specimens were subjected to a temperature rise test in accordance with EIA 364-70D and the product specification. Each specimen was prepared using beaded, 30 AWG, type T thermocouples placed on the PCB to monitor the Line and Load circuits during testing. A specimen was suspended in an air-flow free enclosure. The Line and Load circuits were then wired in series to a power supply. The thermocouples were then connected to a data acquisition station to monitor temperature. A thermocouple for ambient temperature was placed in the center of the enclosure and a current of 15 amps was applied. When each temperature reached stability, 3 consecutive readings taken at 5-minute intervals not differing by more than 1°C, the temperature measurements were recorded.

3.7 Contact Retention Housing – Test Group F

Specimens were subjected to a contact retention test using a tensile / compression machine in accordance with Test Procedure EIA 364-29D, Method A and the product specification. A specimen was secured to a free-floating XYR alignment table attached to the base of the tensile / compression machine. A wire was axially aligned with and gripped by air jaws attached to the load cell and crosshead of the tensile / compression machine. The crosshead was slowly raised until a maximum preload of 13.3 newtons was applied. The crosshead was then raised at a rate of 25.4 mm / min until a force of 45 Newtons was applied. The 45 Newtons was then held for 6 seconds and the crosshead was lowered to its original position. The peak force applied and the force vs time graph were recorded.

3.8 Vibration – Test Groups A, B

Test specimens were subjected to a Sinusoidal Vibration test in accordance with product specification. The parameters of this test condition are a simple harmonic motion having an amplitude of either 0.250-inch double amplitude (maximum total excursion) or 3.5 gravity unit (g's peak) whichever is less. The vibration frequency was varied logarithmically between the approximate limits of 5 Hz to 55 Hz. The entire frequency range of 5 Hz to 55 Hz and return to 5 Hz was traversed at a rate of 1 octave/minute. This cycle was repeated for 1 hour in each of the three mutually perpendicular directions, so that the motion was applied for a total period of 3 hours on each test specimen.

3.8.1 Vibration – Test Group A

An electrical load of was applied and maintained at 100 milliamperes maximum to the test specimens and was monitored for discontinuities of 1 microsecond or longer.

3.8.2 Vibration – Test Group B

All test specimens were energized at an approximate current of 19.3 amps for an 18 °C temperature rise, while being subjected to sinusoidal vibration testing.

Note: Specimens were unmated prior to testing in order to attach the vibration fixtures to the specimens.

3.9 Mechanical Shock – Test Group A

The test specimens were subjected to a Mechanical Shock test in accordance with Test Procedure EIA-364-27C, Test Condition H and the product specification. 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 milliseconds. Three shocks in each direction were applied along the three mutually perpendicular axes of the test specimen, for a total of 18 shocks. An electrical load of was applied and maintained at 100 milliamperes maximum to the test specimens and was also monitored for discontinuities of 1 microsecond or longer.

3.10 Durability – Test Group A

Specimens were subjected to a durability test in accordance with EIA 364-9D and the product specification. Specimens were subjected to 25 mating and un-mating cycles at a maximum rate of 120 cycles per hour by hand.

3.11 Salt Spray – Test Group D

Specimens were subjected to salt spray test in accordance with IEC 60512-11-6 Edition 1.0 2002-02 and the product specification. The specimens were placed in the chamber on horizontal racks with the mating interface on a horizontal axis. The chamber was operated for a period of 240hrs. Upon completion of the test the specimens were rinsed in warm tap water and lightly brushed as needed to remove salt deposits for 5 minutes maximum then placed in an air-circulating oven for 16hrs @ 38C to dry. 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: 22 PSI.
- Brine Solution pH Range: 6.5 to 7.2.
- Specific Gravity Range: 1.027 to 1.035.
- Collection rate: 0.5 to 3ml per hour.

3.12 Thermal Shock – Test Group C

Specimens were subjected to a thermal shock environment in accordance with Test Procedure EIA 364-32G, Method A and the product specification. Unmated specimens were subjected to 25 cycles between -40°C and 65°C with 30-minute dwells at temperature extremes with 1 minute transitions between temperatures.

3.13 Humidity – Test Group, B, C

Specimens were subjected to a humidity environment in accordance with UL 773 5th Edition, Section 23 and the product specification. Specimens from Test Set 2 were preconditioned with 5 durability cycles before testing. Mated specimens were subjected to 96 ±2% Relative Humidity at 50 ±2°C for 168 hours.

3.14 Temperature Life – Test Group B

Specimens were subjected to a temperature life environment in accordance with Test Procedure EIA 364-17C, Method A and the product specification. Mated specimens were subjected to 100°C for 500 hours.

3.15 Temperature Life – IP – Test Groups G1, G2

Specimens were subjected to a temperature life environment in accordance with Test Procedure EIA 364-17C, Method A and the product specification. Mated specimens were subjected to 65°C for 240 hours.

3.16 Ingress Protection 6X (Dust) – Test Group G1

The specimens were subjected to a dust test in accordance with IP6X paragraph 13.4 of IEC 60529, Edition 2.2 2013-08 and the product specification. Specimens were prepared for IP6X testing by drilling a hole in the side of the IP box, inserting a vacuum line and sealing the line with silicone. The specimens were placed into the talcum dust chamber and the specimen vacuum lines were attached to the vacuum manifold. The specimens were then placed into the talcum dust chamber. A vacuum was applied to the specimens through the vacuum lines at a pressure not exceeding 2.0 kPa. This pressure was maintained for the entirety of the test. The dust chamber was then started and run for 8 hours. The vacuum pump and dust chamber were left to sit for a minimum of one hour before the specimens were removed for inspection.

3.17 Ingress Protection X6 (Water Spray) – Test Group G2

The specimens were subjected to an IPX6 water spray test in accordance with IEC 60529, Edition 2.2 2013-08. Specimens were prepared by applying two layers of aluminum duct tape around the seal of the aluminum IP box each specimen was attached to. The specimen was sprayed from all directions 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 water delivery rate was 100 l/min ±5%. After testing, the exterior of the specimen was wiped dry and the specimen was unmated, opened and visually inspected for water ingress.

3.18 Final Examination of Product – All Test Sets

Specimens were subjected to a visual examination in accordance with EIA 364-18B and the product specification. Specimens were visually examined with an unaided eye.