ANSI C136.41-2013 Dimming Receptacle

1. INTRODUCTION

1.1 Purpose

Testing was performed on the TE Connectivity ANSI C136.41-2013 Dimming Receptacle to determine its conformance to the requirements of Product Specification 108-32059, Rev A.

1.2 Scope

This report covers the electrical, mechanical and environmental performance of the TE Connectivity ANSI C136.41-2013 Dimming Receptacle. Testing was performed at the Harrisburg Electrical Components Test Laboratory between May 14, 2014 and December 11, 2014 and is maintained under EA20140239T and EA20140584T.

1.3 Conclusion

The TE Connectivity ANSI C136.41-2013 Dimming Receptacle specimens listed in paragraph 1.4 conformed to the electrical, mechanical and environmental performance requirements of Product Specification 108-32059, Rev A. Refer to paragraph 2 for a summary of test results. For Dimming Receptacle Signal Contact evaluation, please refer to Engineering Test Report 502-134107.

1.4 Product Description

The ANSI C136.41 compliant dimming receptacle and spring leaf contacts provide 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

The test specimens were representative of normal production lots, and the following part numbers were used for testing:

Table 1 – Submitted Specimens

Test Group	Test Set	QTY	Part Number	Description
1	1	10	2213362-4,Rev A	ANSI Dimming receptacle, 3 power & 4 Dimming contacts, 105C wire (14 AWG Power/18 AWG Signal)
		10	ALR-SC-10A	Shorting Cap
2	2	10	2213362-4,Rev A	ANSI Dimming receptacle, 3 power & 4 Dimming contacts, 105C wire (14 AWG Power/18 AWG Signal)
		10	ALR-SC-10A	Shorting Cap
3	3	10	2213362-4,Rev A	ANSI Dimming receptacle, 3 power & 4 Dimming contacts, 105C wire (14 AWG Power/18 AWG Signal)
		10	ALR-SC-10A	Shorting Cap
4	4	3	2213362-4,Rev A	ANSI Dimming receptacle, 3 power & 4 Dimming contacts, 105C wire (14 AWG Power/18 AWG Signal)
		3	ALR-SC-10A	Shorting Cap
5	5	3	2213362-4,Rev A	ANSI Dimming receptacle, 3 power & 4 Dimming contacts, 105C wire (14 AWG Power/18 AWG Signal)
		3	ALR-SC-10A	Shorting Cap
6	6	3	2213362-4,Rev A	ANSI Dimming receptacle, 3 power & 4 Dimming contacts, 105C wire (14 AWG Power/18 AWG Signal)
		3	ALR-SC-10A	Shorting Cap

1.6 Qualification Test Sequence

Refer to Table 2 for the qualification testing sequence performed on the specimens listed in Table 1.

Table 2 – Qualification Testing Sequence

Test or Examination	Test Groups					
	1	2	3	4	5	6
	Test Sequence (a)					
Initial Examination of Product	1	1	1	1	1	1
LLCR	2,6	2,5,7,9		2,4		
Insulation Resistance			2,7			
Dielectric Withstanding Voltage			3,6			
Current Cycling (Heating Test)					2(b)	
Temperature Rise vs. Current		3,10				
Contact Retention in Housing						2
Vibration	4	8(c)				
Mechanical Shock	5					
Durability	3					
Salt Spray				3		
Thermal Shock			4			
Humidity		4(b)	5			
Temperature Life		6				
Final Examination of Product	7	11	8	5	3	3

(a) Numbers indicate the sequence in which testes are performed.
(b) Preconditioned with 5 durability cycles.
(c) During vibration, the mated receptacle and shorting cap shall be energized at an 18°C temperature rise level and 100% connector current loading.

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

All specimens submitted for testing were representative of normal production lots. A Certificate of Conformance was issued by Product Assurance. Where specified, specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

2.2 Low Level Contact Resistance – Test Groups 1, 2 & 4

All low level contact resistance measurements taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage were less than 10 milliohms initially and had a change in resistance (ΔR) of less than 30 milliohms after testing. See Tables 3 through 5 for the summary results of low level contact resistance in milliohms.

Table 3 – Test Set 1 - Low Level Contact Resistance (Milliohms)

	Initial (Actual)	Final (Delta)
Min	5.82	-0.73
Max	6.44	0.47
Avg	5.92	0.12
Std	0.12	0.22
N	30	30

Table 4 – Test Set 2 - Low Level Contact Resistance (Milliohms)

	Initial (Actual)	After Humidity (Delta)	After Temp Life (Delta)	Final (Delta)
Min	5.62	-0.03	-0.09	0.07
Max	6.07	3.13	0.79	3.20
Avg	5.82	0.31	0.25	0.70
Std	0.12	0.61	0.21	0.75
N	30	30	30	30

Table 5 – Test Set 4 - Low Level Contact Resistance (Milliohms)

	Initial (Actual)	Final (Delta)
Min	5.83	-0.060
Max	6.07	0.150
Avg	5.90	0.013
Std	0.07	0.062
N	9	9

2.3 Insulation Resistance – Test Group 3

All insulation resistance measurements were greater than 500 megohms.

2.4 Dielectric Withstanding Voltage – Test Group 3

No dielectric breakdown or flashover occurred.

2.5 Current Cycling – Test Group 5

Specimens did not exhibit visual evidence of damage as a result of 15 cycles of current cycling.

2.6 Temperature Rise vs Current – Test Group 2

All specimens had a temperature rise of less than 30 °C above ambient when tested using a maximum rated current of 15 amperes. Refer to Table 6 and Table 7 for initial and final T-Rise summaries, respectively.

Table 6 – Initial Temperature Rise vs. Current

Amperes	6	9	12	13	14	15
Min	1.44	2.26	3.13	4.20	5.27	6.53
Max	1.89	2.87	4.01	5.30	6.68	8.27
Ave	1.66	2.60	3.63	4.85	6.13	7.56
Std Dev	0.14	0.17	0.21	0.27	0.33	0.40
N	20	20	20	20	20	20

Table 7 – Final Temperature Rise vs. Current

Amperes	6	9	12	13	14	15
Min	1.54	2.37	3.26	4.28	5.40	6.55
Max	2.72	4.22	5.93	7.86	10.22	12.70
Ave	2.06	3.17	4.40	5.78	7.42	9.10
Std Dev	0.34	0.50	0.69	0.92	1.20	1.51
N	20	20	20	20	20	20

2.7 Contact Retention – Test Group 6

All specimens met the 10 pound minimum force without dislodging.

2.8 Vibration – Test Groups 1 & 2

No apparent physical damage occurred in Group 1 or 2 and no discontinuities of one microsecond or greater occurred during testing in Group 1.

2.9 Mechanical Shock – Test Group 1

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

2.10 Durability – Test Group 1

Specimens did not exhibit evidence of damage as a result of 25 durability cycles.

2.11 Salt Spray – Test Group 4

Specimen dimming caps showed visual evidence of water ingress. The junction box also showed evidence of water ingress through the cork gasket between the dimming receptacle and the junction box access panel. See Figure 1 for an image of the specimen following salt spray exposure. Low level contact resistance was taken prior to salt fog exposure and after salt fog exposure. The low level contact resistance measurements did not deviate by more than 1 milliohm from initial readings.

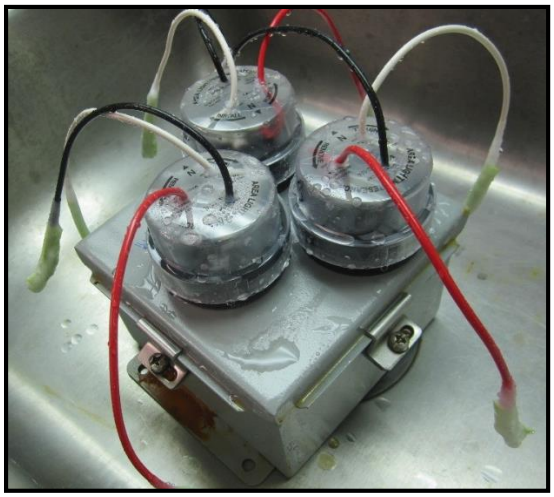

Figure 1 – Test Set 4 Following Salt Spray Exposure

2.12 Thermal Shock – Test Group 3

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

2.13 Humidity – Test Groups 2 & 3

No evidence of physical damage was visible as a result of exposure to steady state noncondensing humidity.

2.14 Temperature Life – Test Group 2

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

2.15 Final Examination – All Test Groups

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

3. TEST METHODS

3.1 Examination of Product

A Certification of Conformance was issued stating that all specimens in this test package have been produced, inspected, and accepted as conforming to product drawing requirements, and made using the same core manufacturing processes and technologies as production parts. Visual examinations were conducted in accordance with EIA-364-18B.

3.2 Low Level Contact Resistance

All low level contact resistance measurements were taken using a 4 probe measurement technique on the power contacts only. The shorting cap was prepared by the requestor with 14 AWG wires extending past the shorting cap for measurements. See Figure 2 for a representative image of the testing setup.

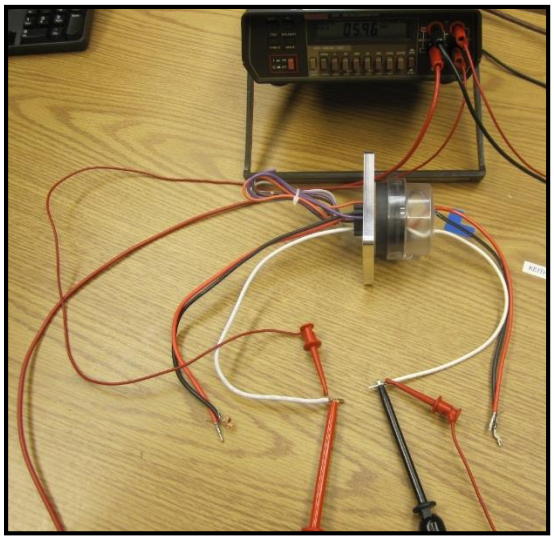

Figure 2 – Typical Low Level Contact Resistance Measurement Points

3.3 Insulation Resistance

Unmated specimens were tested between adjacent power contacts, between power and signal contacts, and between all contacts and the grounded mounting plate (vibration fixture). A potential of 500 V DC was applied and maintained for 1 minute or until stabilization occurred. All specimens were tested with a cork gasket, TEC P/N 2213469-1, between the receptacle housing and the vibration fixture. The same gasket was used on multiple specimens and replaced when visual evidence of wear was observed on the cork gasket.

3.4 Dielectric Withstanding Voltage

Unmated specimens were tested between adjacent power contacts, between power and signal contacts, and between power contacts and the grounded mounting plate (vibration fixture). A potential of 2500 V AC was applied and maintained for 1 minute while monitoring for dielectric breakdown or flashover. All specimens were tested with a cork gasket between the receptacle housing and the vibration fixture. The same gasket was used on multiple specimens and replaced when visual evidence of wear was observed on the cork gasket.

3.5 Current Cycling

All power contacts in each specimen had a 30 AWG Type T thermocouple attached to the contact at the intersection of the crimp barrel and the tongue. The specimen contacts were then inserted into the receptacle and the supplied shorting caps were mated to the receptacles. The specimens were preconditioned with 5 mating/unmating cycles. Each specimen was wired in a series circuit and all specimens were wired together in a series circuit. The specimens were connected to a data acquisition system to monitor the temperature of the power contacts.

The power contacts of each specimen were cycled on and off for 15 cycles of current cycling. Each cycle consisted of 20 consecutive hours energized at 15 amperes DC and 4 hours off. The temperatures of the power contacts were monitored and recorded at the end of the 20 hour and 4 hour sub-cycles. All specimen power contacts remained below a 30°C temperature rise.

3.6 Temperature Rise vs Current

Prior to temperature rise vs. current testing, a 30 AWG type T thermocouple lead that was approximately 36 inches long was beaded and welded to the tongue of the contact just past the crimp barrel, on the same side of the contact as the crimp barrel. The contact was then inserted into the housing. The Line and Load contacts of each specimen were then wired in a series circuit. All the specimens were then attached to the supports in the temperature rise enclosure and all specimens were wired together in a series circuit. See Figure 3 for an image of the testing setup. The specimens were energized at the current levels listed in Tables 6 and 7. The temperature rise of each energized contact was taken when 3 consecutive temperature measurements, taken at 5 minute intervals, did not deviate by more than 1°C. Refer to Figure 4 for an image of the thermocouple placement and Figure 5 for an illustration of the energized contacts.

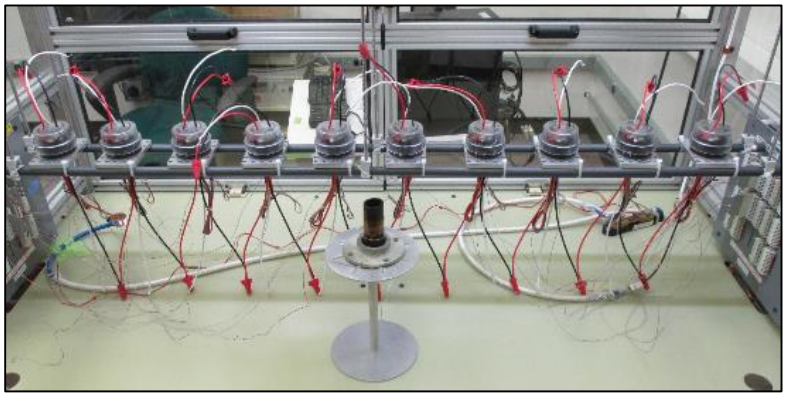

Figure 3 – Temperature Rise vs. Current Setup

Figure 4 – Thermocouple Placement

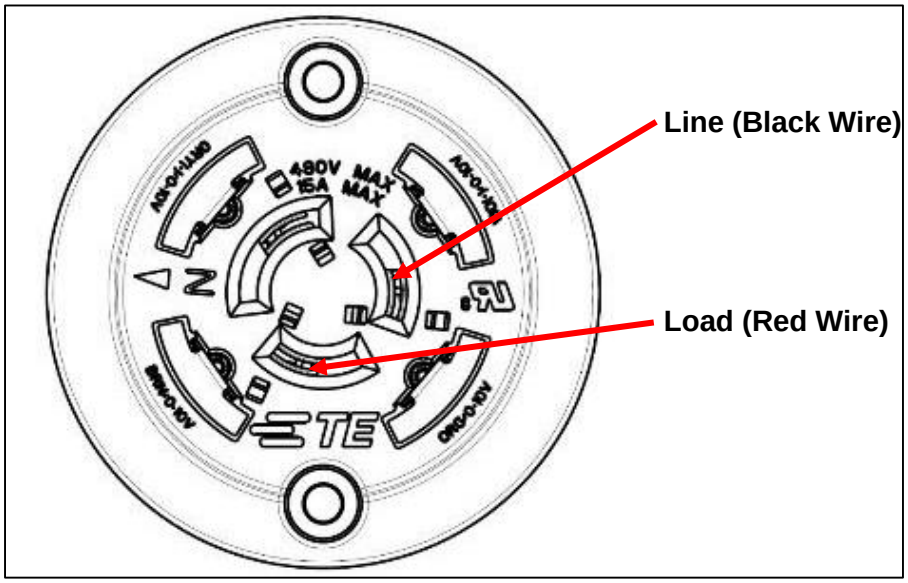

Figure 5 – Energized Contacts

3.7 Contact Retention

During contact retention testing, the specimens were mounted to the vibration fixture (P/N 39-1824450-1). The vibration fixture was secured to a floating X-Y table at the base of the tensile testing machine. The specimens were supported above the X-Y table on standoffs to prevent the receptacle from contacting the table. The wire lead was held in a vice mounted to the load cell on the crosshead of the tensile machine. The crosshead was raised at a rate of 1.0 in/min. See Figure 6 for an image of the test setup.

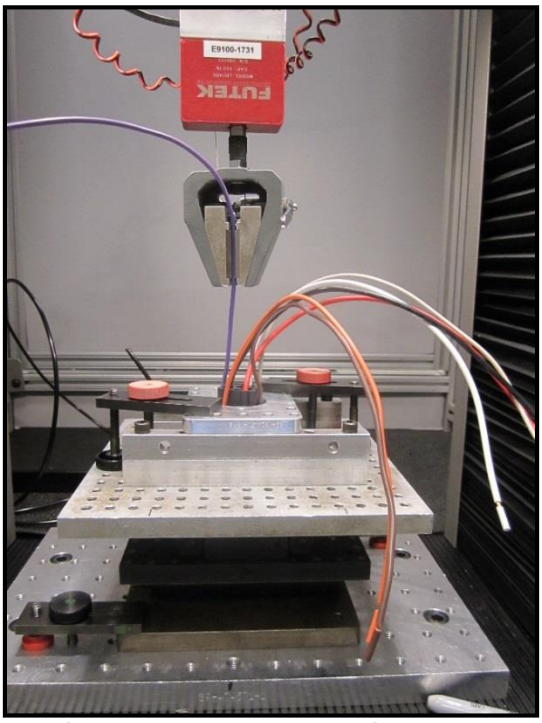

Figure 6 – Contact Retention Setup

3.8 Vibration

The test specimens were subjected to a sinusoidal vibration test. See Figures 7 thru 9 for vibration setup photographs. The 7 lead wires were zip tied 1 inch behind the rear face of the connection housing to provide strain-relief and secured to the vibration table within 6 inches from the rear face of the connector.

The test specimens were subjected to a simple harmonic motion having an amplitude of 0.250 inch double amplitude (maximum total excursion). The vibration frequency was varied uniformly between the approximate limits of 5 to 55 Hertz (Hz). The entire frequency range of 5 to 55 Hz and return to 5 Hz was traversed at approximately 1 octave/minute. The motion was applied for a period of 1 hour in each of the three mutually perpendicular axes, so the motion was applied for a total period of approximately 3 hours.

The test specimens were monitored for discontinuities of 1 microsecond or greater using an energizing current of 100 milliamperes in Test Group 1. An energizing current of 16.5 amperes was applied during vibration in Test Group 2.

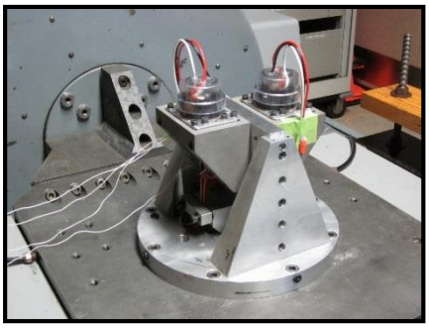

Figure 7 – Vibration/Shock Setup

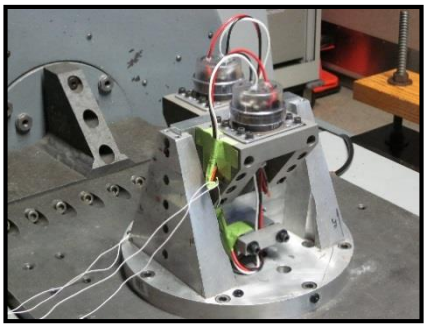

Figure 8 – Vibration/Shock Setup

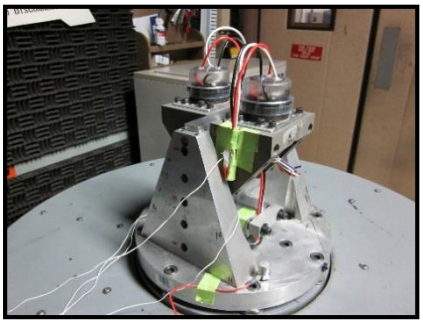

Figure 9 – Vibration/Shock Setup

3.9 Mechanical Shock

The test specimens were subjected to a mechanical shock test. See Figures 7 thru 9 for shock setup photographs.

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 specimens, for a total of eighteen shocks.

The test specimens were monitored for discontinuities of 1 microsecond or greater using an energizing current of 100 milliamperes.

3.10 Durability

Specimens were mated and unmated (full motion of connector including twist lock) 25 times by hand at a rate not exceeding 120 cycles per hour.

3.11 Salt Spray

Prior to salt spray exposure, the specimen wire leads were sealed with tape then dielectric wax. The specimens were then placed into the supplied exterior junction box for testing. The receptacles were mounted to the junction box with the cork gaskets between the receptacle housing and the junction box. The dimming cap was then placed onto the receptacle and the junction box access panel was secured to the junction box. The junction box was placed in a level position in the salt spray chamber.

The salt mist was a solution of 5±1% salt to 95% parts by weight deionized water. The chamber was maintained at approximately 35 °C. The chamber was allowed to run continuously for 240 hours (10 days). At completion of testing the specimens were allowed to rest in the chamber for an hour before removal. The specimens were then washed with tap water for approximately 5 minutes to remove any collected salt from the junction box. The specimens were then gently dried with paper towels. The junction box was allowed to dry before the access panel was removed for specimen examination.

3.12 Thermal Shock

Mated specimens were exposed to 25 cycles of thermal shock between -40°C and 65°C at each extreme. Specimens were maintained at each extreme for 30 minutes and no more than 1 minute between extremes.

3.13 Humidity

Mated specimens were subjected to 96% non-condensing humidity for 168 hours at a temperature of 50°C. DWV testing was initiated within 10 minutes of removal from the chamber.

3.14 Temperature Life

Mated specimens were exposed to a temperature of 100°C for 500 hours.

3.15 Final Examination

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