Snap-Lug, Quick Disconnect Power Connector

1. INTRODUCTION

1.1 Purpose

Testing was performed on the TE Connectivity Snap-Lug, Quick Disconnect Power Connector, to determine its conformance to the requirements of Product Specification 108-32083, Rev A.

1.2 Scope

This report covers the electrical, mechanical, and environmental performance of the Snap-Lug, Quick Disconnect Power Connector. Testing was performed at the Harrisburg Electrical Components Test Laboratory between 8/25/2015 and 3/17/2016. Detailed test data is on file and maintained at the Tyco Electronics Harrisburg Electrical Components Test Laboratory under test file EA20150471T.

1.3 Conclusion

The SNAP-LUG, Quick Disconnect Power Connector, listed in paragraph 1.4, conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-32083, Rev A.

1.4 Test Specimens

The test specimens were representative of normal production lots, and specimens identified in Table 1 were used for test:

Table 1 – Test Specimens

Test Set	Test Group	Qty	Specimen Part Number	Test Assembly Part Number	Description
1	1	8	2828522-8, Rev 1	2828555-5 Rev 3 2828555-6 Rev 3	4/0 Socket Housing Assembly, Black Key
2	2	32	2828522-8, Rev 1	2828555-5 Rev 3 2828555-6 Rev 3	4/0 Socket Housing Assembly, Black Key
3	3	4	2828522-4, Rev 1	2828555-1 Rev 3 2828555-2 Rev 3	4/0 Socket Housing Assembly, Black Key
4	4	4	2828522-8, Rev 1	2828555-5 Rev 3 2828555-6 Rev 3	4/0 Socket Housing Assembly, Black Key
5	5	10	2828522-4, Rev 1	2828555-4 Rev 3	4/0 Socket Housing Assembly, Black Key
6	6	12	2828522-4, Rev 1	2828555-3 Rev 3 2828555-4 Rev 3	4/0 Socket Housing Assembly, Black Key
7	7	4	2828522-4, Rev 1	2828555-15 Rev 3	4/0 Socket Housing Assembly, Black Key
8	8	4	2828522-4, Rev 1	2828555-15 Rev 3	4/0 Socket Housing Assembly, Black Key
9	1	8	2226742-4, Rev 7	2828555-13 Rev 3 2828555-14 Rev 3	1/0 Socket Housing Assembly, Black Key
10	2*	4	2226742-4, Rev 7	2828555-13 Rev 3 2828555-14 Rev 3	1/0 Socket Housing Assembly, Black Key
11	2*	4	2226742-4, Rev 7	2828555-11 Rev 3 2828555-12 Rev 3	2/0 Socket Housing Assembly, Black Key
12	2*	4	2828522-8, Rev 1	2828555-9 Rev 3 2828555-10 Rev 3	3/0 Socket Housing Assembly, Black Key
13	4	4	2226742-4, Rev 7	2828555-13 Rev 3 2828555-14 Rev 3	1/0 Socket Housing Assembly, Black Key
1,2,4,6,7,8 9,10,11,12,13	1,2,4,6,7,8	88	2226744-8, Rev 3	-	Post Contact Kit, Silver Plated, Black Key
1,2,4,6,7,8 9,10,11,12,13	1,2,4,6,7,8	44	39-1824693-1, Rev A	-	Test Buss Bar

NOTE: * Test Sets 10, 11, and 12 were only subjected to initial examination, contact resistance, voltage drop, and temperature vs current.

1.5 Qualification Test Sequence

Specimens in Table 1 were subjected to the test sequences identified in Table 2.

Table 2 – Qualification Test Sequence

Test or Examination	Test Groups							
	1	2	3	4	5	6	7	8
	Test Sequence (a)							
Initial Examination of Product	1	1	1	1	1	1	1	1
Contact Resistance	2,7	2,5(b),9				2,4		
Voltage Drop	3,8	3,10		2,4				
Temperature Rise vs Current		4,11						
Dielectric Withstanding Voltage			2,5		2,4			
Current Cycling				3				
Random Vibration	5	8 (e)						
Mechanical Shock	6							
Durability	4						2	2
Crimp Tensile	9	12						
Connector Pull Test						3		
Thermal Shock			3 (d)					
Humidity-Temperature Cycling		6 (c)	4 (d)					
Temperature Life		7 (c)						
Fluid Immersion					3 (d)			
Sealing, Water							3	
Dust Proof								3
Final Examination of Product	10	13	6	5	5	5	4	4

NOTE: (a) Numbers indicate sequence in which tests were performed.
(b) Precondition with 50 cycles of durability.
(c) Specimens mated during exposure.
(d) Specimens unmated during exposure.
(e) Specimens were energized at 18°C T-Rise per 102-950.

1.6 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 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 Contact Resistance - Groups 1, 2, 6

All contact resistance measurements were less than 0.100 milliohms initially and 0.200 milliohms after testing.

2.3 Voltage Drop - Groups 1, 2, 4

All voltage drop measurements were less than 35 millivolts initially and 60 millivolts after testing.

2.4 Temperature Rise vs Current - Group 2

All specimens had a temperature rise of less than 30°C above ambient when tested using a baseline rated current of 275 amperes and the correct derating factor value based on the specimens wiring configuration.

2.5 Dielectric Withstanding Voltage - Group 3

Specimens showed no signs of flashover or breakdown.

2.6 Current Cycling – Group 4

No evidence of physical damage detrimental to product performance was observed.

2.7 Random Vibration – Groups 1, 2

Following random vibration testing, no cracks, breaks, or loose parts on the specimens were visible. No discontinuities were detected in Test Group 1 during random vibration.

2.8 Mechanical Shock - Group 1

No discontinuities were detected during mechanical shock. Following mechanical shock testing, no cracks, breaks, or loose parts on the specimens were visible. Pulse Velocity Change: 85.9 Inches/Second.

2.9 Durability - Group 1, 7, 8

No physical damage occurred to the specimens as a result of mating and unmating the specimens 500 times.

2.10 Crimp Tensile - Group 1, 2

Specimens met the minimum requirements for crimp tensile.

2.11 Connector Pull Test - Group 6

No physical damage occurred to the specimens as a result of connector pull testing.

2.12 Thermal Shock - Group 3

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

2.13 Humidity-Temperature Cycling - Group 3

No evidence of physical damage was visible as a result of exposure to humidity-temperature cycling.

2.14 Temperature Life - Group 2

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

2.15 Fluid Immersion - Group 5

No evidence of physical damage was visible as a result of exposure to fluid immersion.

2.16 Sealing, Water – Group 7

The sealed mating surface of the specimens showed no signs of water ingress.

2.17 Dust Proof – Group 7

Specimens showed no signs of dust ingress. The latching and release mechanisms functioned properly.

2.18 Final Examination of Product - All 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.

3.2 Contact Resistance

Contact Resistance was conducted in accordance with EIA-364-06C. Contact resistance was measured from a point on the conductor 1/16 inch from the wire receiving end of the crimp barrel to a point on the bus bar 1/4 inch from the keying ring (Figure 1). A test current of 10.0 amperes with a maximum open circuit voltage of 1.0 volts was used.

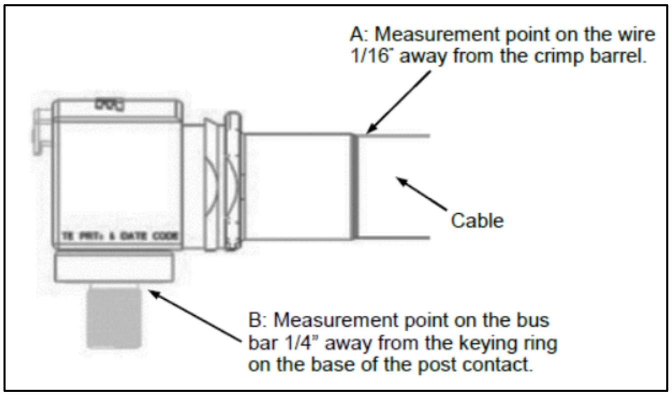

Figure 1 – Contact Resistance Measurement Points

3.3 Voltage Drop

Voltage drop was conducted in accordance with EIA-364-06C. The series circuit was energized with the specified test current, as listed in Tables 1 through 8 in Appendix B, until thermal stability was achieved Thermal stability is defined as three consecutive readings taken at 5 minute intervals that did not differ by more than ±1˚C for each specimen. Upon reaching thermal stability, temperatures were recorded and voltage drops were measured using a hand probe technique. Voltage drop measurement points were from a point on the conductor 1/16 inch from the wire receiving end of the crimp barrel to a point on the bus bar 1/4 inch from the keying ring (Figure 1).

3.4 Temperature Rise vs Current

T-Rise vs Current was conducted in accordance with EIA-364-70C. The series circuit was energized with the currents as listed in Table 3. Specimens remained at each current level until thermal stability was achieved. Upon reaching thermal stability, temperatures were recorded. Once thermal stability was reached the current was increased to the next current increment. Thermal stability is defined as three consecutive readings taken at 5 minute intervals that did not differ by more than ±1˚C for each specimen.

Table 3 – Temperature vs Current Test Currents

Test Set	AWG	Current Increments (DC)						
1	4/0	250	275	300	325	350	375	-
10	1/0	100	125	150	175	200	225	250
11	2/0	150	175	200	225	250	275	300
12	3/0	200	225	250	275	300	325	350

3.5 Dielectric Withstanding Voltage

Dielectric withstanding voltage testing was conducted in accordance with EIA-364-20E. Specimens were prepared by wrapping the entire surface of the housing in conductive foil (Figure 2). A test potential of 1500 volts AC was applied between the socket contact and the foil (Figure 3). The voltage was applied at a rate of 500 volts per second. This potential was applied for one minute and then returned to zero.

Figure 2 – DWV Sample Prep

Figure 3 – DWV Test Setup

3.6 Current Cycling

Current Cycling was conducted in accordance with SAE AS7928B. Specimens were exposed to 50 cycles of current cycling. One cycle consisted of the series circuit energized at 125% of rated current for 30 minutes, followed by 15 minutes of no current. Temperatures were monitored during current cycling.

3.7 Random Vibration

3.7.1 Random Vibration, Test Group 1

Random vibration was conducted in accordance with MIL-STD-810G, Method 514.7. The parameters of this test condition are specified by a random vibration spectrum with excitation frequency bounds of 20 and 500 Hertz (Hz). The power spectral density (PSD) is flat at 0.04 G^2/Hz from 20 Hz to the upper bound frequency of 500 Hz. The root-mean square amplitude of the excitation was 4.5 GRMS. The test specimens were subjected to this test for 1 hour in each of the three mutually perpendicular axes, for a total test time of 3 hours per test specimen. The test specimens were monitored for discontinuities of 1 microsecond or greater using an energizing current of 100 milliamperes.

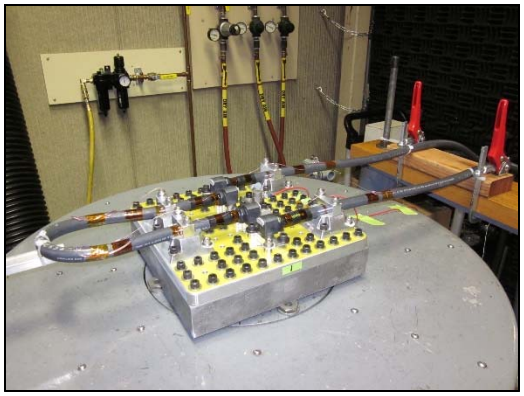

Figure 4 – Vibration, TG1, Vertical Axis

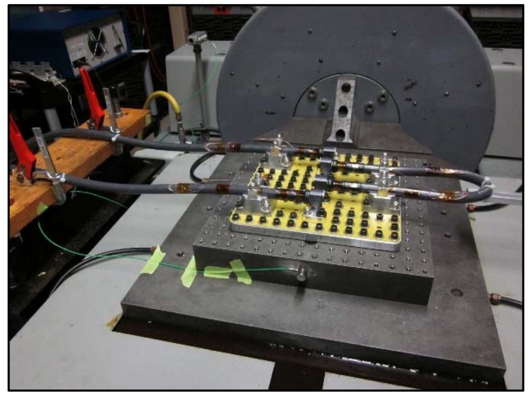

Figure 5 – Vibration, TG1, Transverse Axis

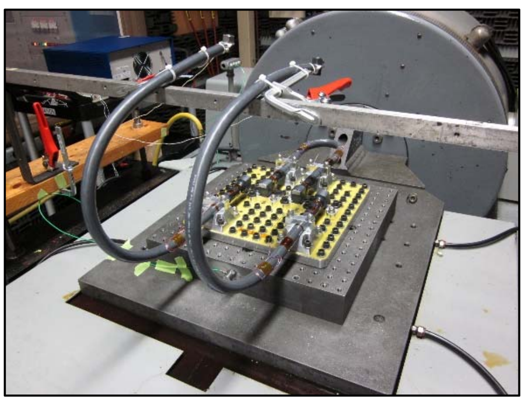

Figure 6 – Vibration, TG1, Longitudinal Axis

3.7.2 Random Vibration, Test Group 2

Random vibration was conducted in accordance with EIA-364-28F, test condition VI, test condition letter D. The parameters of this test condition are specified by a random vibration spectrum with excitation frequency bounds of 50 and 2000 Hertz (Hz). The power spectral density (PSD) at 50 Hz is 0.025 G^2/Hz. The spectrum slopes up at 6 dB per octave to a PSD of 0.1 G^2/Hz at 100 Hz. The spectrum is flat at 0.1 G^2/Hz from 100 Hz to the upper bound frequency of 2000 Hz. The root-mean square amplitude of the excitation was 13.89 GRMS. The test specimens were subjected to this test for 1.5 hours in each of the three mutually perpendicular axes, for a total test time of 4.5 hours per test specimen. The test specimens were energized with a dc current of 300 amperes during testing.

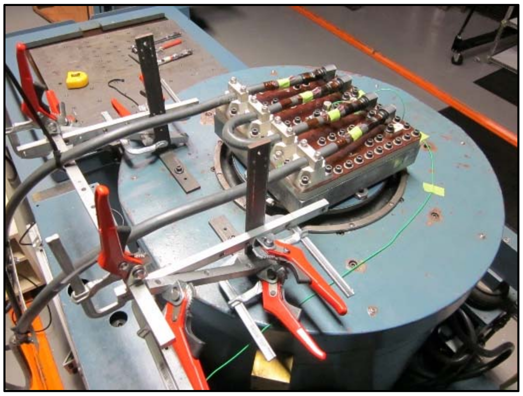

Figure 7 – Vibration, TG2, Vertical Axis

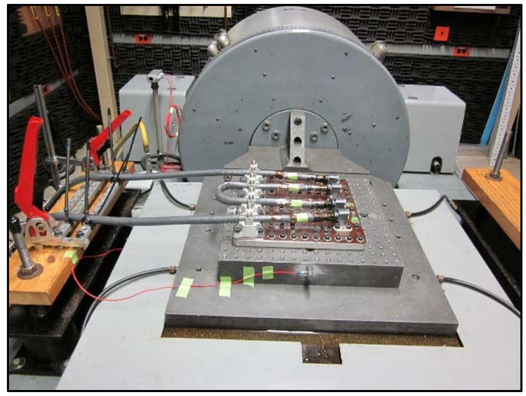

Figure 8 – Vibration, TG2, Transverse Axis

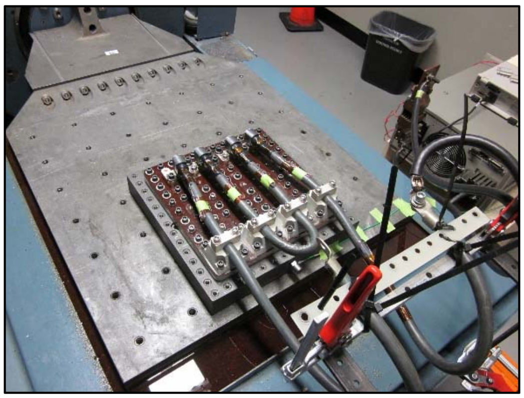

Figure 9 – Vibration, TG1, Longitudinal Axis

3.8 Mechanical Shock, Half-sine

Mechanical shock was conducted in accordance with MIL-STD-810G, Method 516.7. The parameters of this test condition are a half-sine waveform with an acceleration amplitude of 40 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.

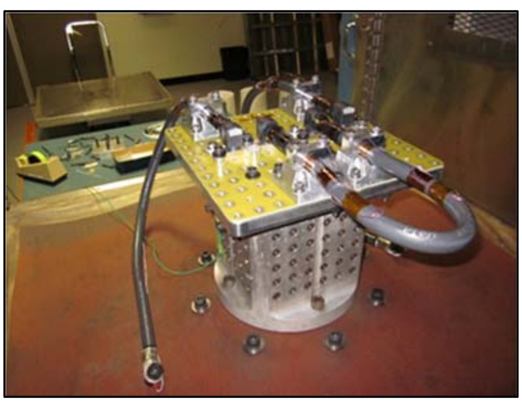

Figure 10 – Shock, TG1, Vertical Axis

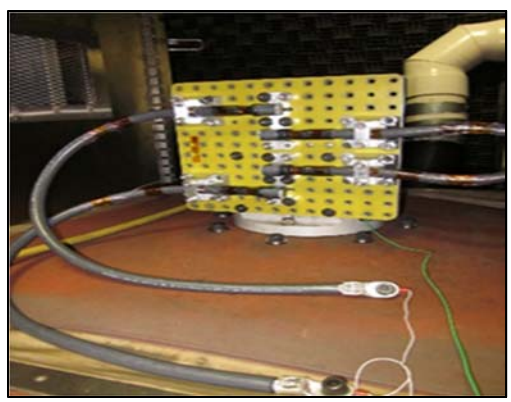

Figure 11 – Shock, TG1, Transverse Axis

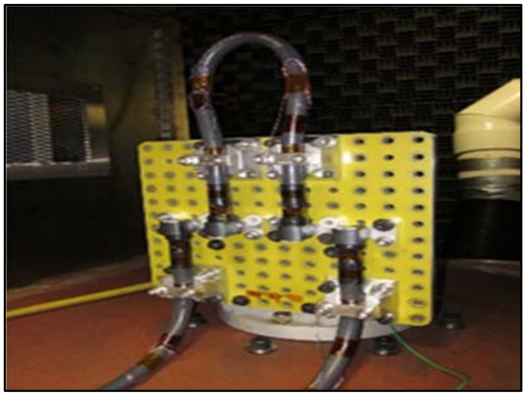

Figure 12 – Shock, TG1, Longitudinal Axis

3.9 Durability

Durability was conducted in accordance with EIA-364-9C. Specimens were manually mated and unmated 500 times at a maximum rate of 200 cycles per hour.

3.10 Crimp Tensile

Crimp tensile was conducted in accordance with Product Specification 108-32083, Rev A. Specimens were mounted to the tensile/compression machine as seen in Figure 13. An axial force was applied at a rate of 1 inch per minute. Force was applied until a failure of the Snap-Lug crimp occurred. The maximum force was recorded.

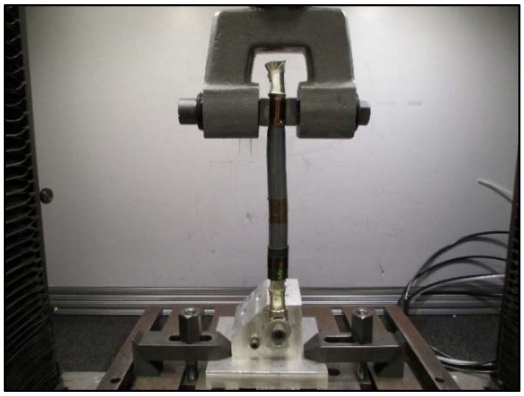

Figure 13 - Crimp Tensile Test Set Up

3.11 Connector Pull Test

Connector pull testing was conducted in accordance with Product Specification 108-32083, Rev A. Specimens were mounted to the tensile/compression machine in each of three configurations (Figure 14 through 20). A force of 125 pounds was applied at 0.5 inches per minute. Upon completion of testing specimens were evaluated for damage.

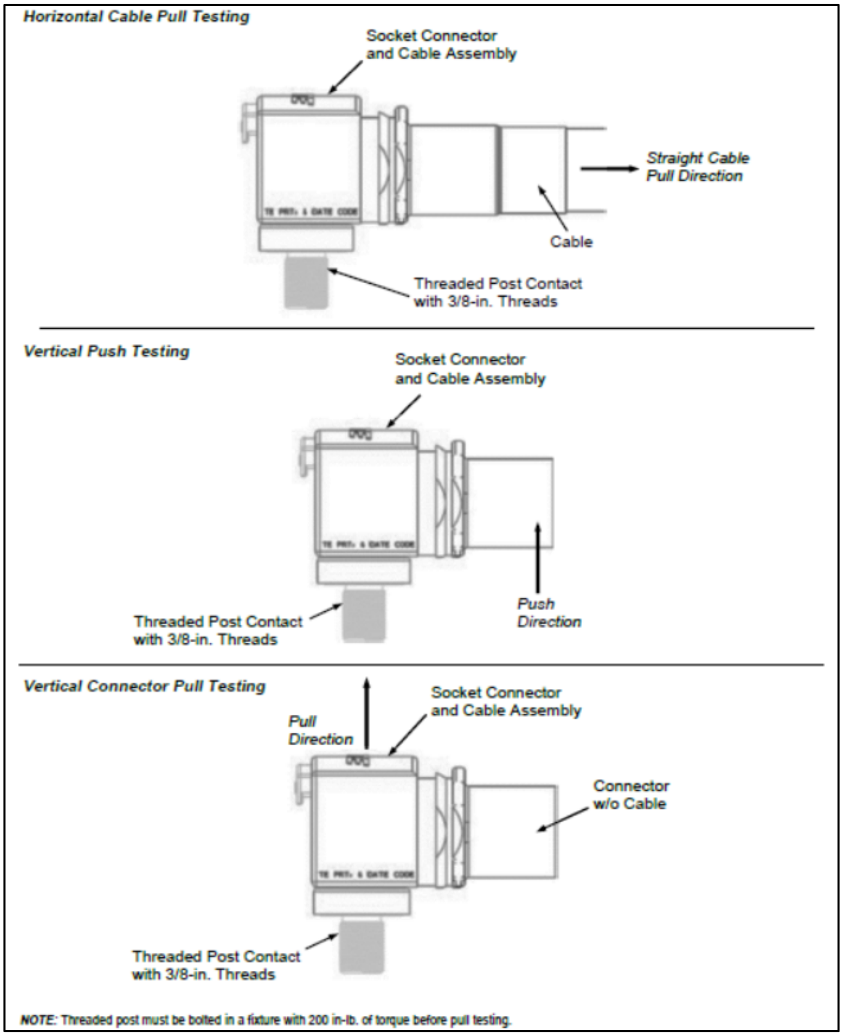

Figure 14 – Connector Pull Test Configurations

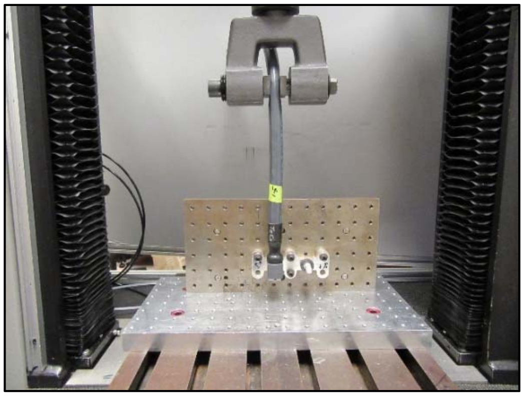

Figure 15 – Horizontal Pull

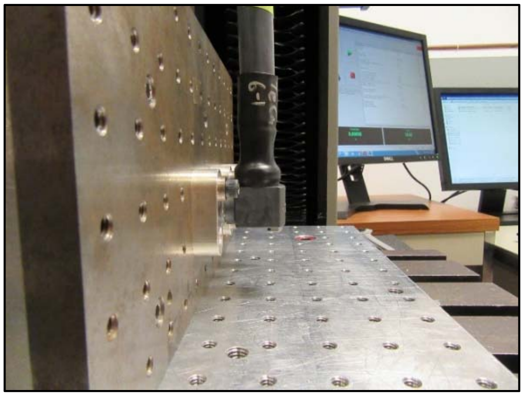

Figure 16 – Horizontal Pull

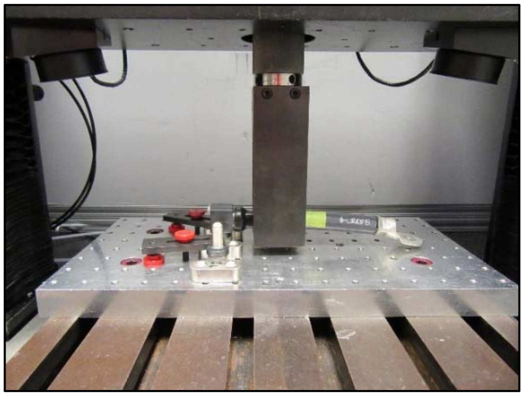

Figure 17 – Vertical Push

Figure 18 – Vertical Push

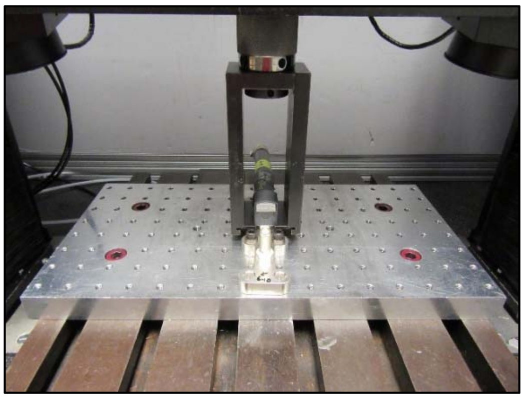

Figure 19 – Vertical Pull

Figure 20 – Vertical Pull

3.12 Thermal Shock

Thermal shock was conducted in accordance with EIA-364-32G. Specimens were subjected to 5 cycles between
-65°C and 150°C with 30 minute dwells at each extreme. Transfer time was 1 minute maximum.

3.13 Humidity-Temperature Cycling

Humidity-Temperature cycling was conducted in accordance with EIA-364-31D, Method IV. Specimens were subjected to 10 cycles (10 days) between 25°C and 65°C at 80 to 100% RH. Optional cold shocks were not performed.

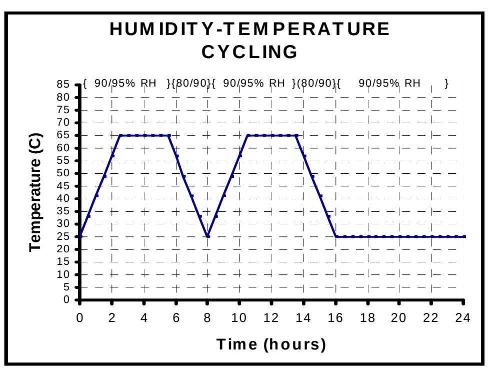

Figure 21 – Typical Humidity-Temperature Cycling Profile

3.14 Temperature Life

Temperature Life was conducted in accordance with EIA-364-17C. Specimens were subjected to 150°C for 1000 hours.

3.15 Fluid Immersion

Fluid Immersion was conducted in accordance with EIA-364-10F. See Table 4 for testing fluids and exposure parameters.

Table 4 – Fluid Immersion Test Parameters

Specimens	Fluid	Preconditioning		Step 1 Immersion		Step 2 Drainage	Step 3 Oven Cure		Number of Cycles
		Time (Min)	Temp (°C)	Time (Min)	Temp (°C)	Free air (Hrs)	Time (Hrs)	Temp (°C)	
5-1, 5-2	Hydraulic Fluid MIL-PRF-5606			5	85 ±3	1	6	100	7
5-3, 5-4	Lubricating Oil MIL-PRF-7808			5	120 ±3	1	6	125	7
5-5, 5-6	Gasoline ASTM-D-4814			5	25 ±3	24			5
5-7, 5-8	Diesel Fuel			5	25 ±3	24			5
5-9, 5-10	Coolant MIL-PRF-87252	30	175	1 ±0.1	Ambient	1			1

Figure 22 – Typical Fluid Immersion Setup

Figure 23 – Typical Fluid Immersion Setup

3.16 Sealing, Water

Water immersion testing was conducted in accordance with paragraph 14.2.7 of IEC 60529, Edition 2.2, 2013-08. Specimens were subjected to immersion testing in water containing a ultra-violet tracer at a depth of 1m for 30 minutes. Upon completion of testing, specimens were dried at an elevated temperature of 38°C for approximately 24 hours. Once dry, the specimens were unmated and evaluated with an ultra-violet light (UV-A) for signs of water ingress.

Figure 24 – 1m Test Vessel

Figure 25 – Orientation During Drying

3.17 Dust Proof

Dust testing was conducted in accordance with paragraph 14.2.7 of IEC 60529, Edition 2.2, 2013-08. Specimens were placed in the talcum dust chamber. The pressure inside the connector was subjected to depression of 2 kPa maximum. Specimens were subjected to dust exposure for 8 hours. Upon completion of testing specimens were unmated and examined for dust ingress. Specimens were also examined to ensure the latching and release mechanisms functioned properly.

Figure 26 – Specimens in Dust Chamber

3.18 Final Examination of Product

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