Dryer Terminal Block Housing

1. INTRODUCTION

1.1 Purpose

Testing was performed on the TE Connectivity Dryer Terminal Block Housing to determine its conformance to the requirements of 108-61063 Rev C.

1.2 Scope

This report covers the electrical, mechanical, and environmental performance of the Dryer Terminal Block Housing. Testing was performed at the Harrisburg Electrical Components Test Laboratory between January 16, 2024 and February 23, 2024.

1.3 Conclusion

The specimens identified in paragraph 1.5, Table 1 conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-61063 Rev C.

1.4 Product Description

Each terminal block connector consists of a housing, three brass terminals, three screws and three nuts. The housing features mounting holes and three terminal slots. The terminals feature a locking lance, a wire barrel, an insulation support barrel and a tab for a screw and nut. The terminal used in this test report has a wire barrel design that covers a range of 12-16 AWG stranded copper wire. The tab end of the terminal will accept stranded copper household wire that is within a range of 6-10 AWG. These wires can be unterminated or can be terminated to a ring tongue terminal.

1.5 Test Specimens

Specimens identified with the following part numbers were used for this test. See Table 1 for test specimen identification information.

Table 1 – Specimen Identification

Test Set	Quantity	Part Number	Description
1,2	3 each	2238272-1	Terminal Block Housing for Dryer
	8 each	521843-1	Power Ring Sub Assembly Terminal, double ended on UL 1015 12AWG wire
	8 each	61866-1	Ring Terminal, double ended on High Temp 6AWG wire
	1 each	521843-1	Power Ring Sub Assembly Terminal, single ended on UL 1015 12AWG wire
	1 each	61866-1	Ring Terminal, single ended on High Temp 6AWG wire
3	3	2238272-1	Terminal Block Housing for Dryer
	9	521843-1	Power Ring Sub Assembly Terminal, double ended on UL 1015 12AWG wire
4	8	521843-1	Power Ring Sub Assembly Terminal (not crimped)
	7	61866-1	Ring Terminal, single ended on High Temp 6AWG wire
	1	61866-1	Ring Terminal, single ended on High Temp 6AWG wire (long)
	1	N/A	Long lead of High Temp 6AWG wire

1.6 Qualification Test Sequence

The specimens identified in paragraph 1.5, Table 1 were subjected to the sequences listed in Table 2.

Table 2 – Test Sequence

Test or Examination	Test Group			
	1	2	3	4
	Test Set			
	1	2	3	4
	Test Sequence (a)			
Examination of Product	1	1,9	1,8	1,5
Termination Resistance, Dry Circuit	3,5	2,7		2 ,4
Dielectric Withstanding Voltage			3,7	
Insulation Resistance			2,6	
Current Cycling				3
Temperature Rise Vs Current		3,8		
Vibration	4	6(b)		
Strength Of Housing	6			
Contact Insertion Force	2			
Contact Retention Force	7			
Crimp Tensile	8			
Thermal Shock			4	
Humidity-Temperature Cycling		4	5	
Temperature Life		5		

(a) The numbers indicate the sequence in which tests were performed.
(b) Vibration @18°C T-Rise (instead of monitoring for discontinuity)

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 – Groups 2, 3, 4

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

2.2 Termination Resistance, Dry Circuit (LLCR) – Groups 1, 2, 4

All Test Set 1 and 2 specimens were under the requirement of 1 milliohm maximum crimp resistance and 2 milliohms maximum total resistance. Approximately 0.4 milliohms of wire bulk resistance was subtracted for Test Sets 1 and 2. All Test Set 4 specimens were under the requirement of 2 milliohm maximum resistance. See Table 3 through Table 5 for summary LLCR data.

Table 3 – LLCR Summary Data w/ Wire Resistance Removed (in milliohms) – Test Set 1

	Total Resistance		Crimp Resistance	
	Initial	After Vibration	Initial	After Vibration
Minimum	0.332	0.358	0.116	0.118
Maximum	0.394	0.421	0.173	0.205
Average	0.363	0.386	0.143	0.162
Std. Dev.	0.018	0.026	0.019	0.028

Table 4 – LLCR Summary Data w/ Wire Resistance Removed (in milliohms) – Test Set 2

	Total Resistance		Crimp Resistance	
	Initial	After Environments & Vibration	Initial	After Environments & Vibration
Minimum	0.325	0.328	0.110	0.127
Maximum	0.381	0.543	0.158	0.329
Average	0.356	0.395	0.139	0.179
Std. Dev.	0.020	0.067	0.013	0.069

Table 5 – LLCR Summary Data (in milliohms) – Test Set 4

	Initial	After Current Cycling
Minimum	0.157	0.157
Maximum	0.198	0.198
Average	0.179	0.177
Std. Dev.	0.012	0.012

2.3 Dielectric Withstanding Voltage – Group 3

All specimens showed no evidence of dielectric breakdown or flashover, and leakage current measurements did not exceed the maximum requirement of 5 mA.

2.4 Insulation Resistance – Group 3

All specimens exceeded the minimum requirement of 5000 megohms.

2.5 Current Cycling – Group 4

Specimens showed no visual damage detrimental to product performance as a result of current cycling.

2.6 Temperature Rise vs Current (T-Rise) – Group 2

All specimens were under the requirement of 50°C T-Rise at 32 amps. See Table 6 for T-Rise vs. Current data.

Table 6 – Temperature Rise Data @ 32 Amps

	Temperature Rise (°C)	
	Initial	Final
Minimum	19.33	19.79
Maximum	21.03	26.04
Average	20.41	21.28
Std. Dev.	0.48	1.98

2.7 Vibration – Groups 1, 2

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

All Test Set 2 specimens had no apparent physical damage occur during vibration testing.

2.8 Strength of Housing – Group 1

Specimens showed no visual damage detrimental to product performance as a result of strength of housing testing.

2.9 Contact Insertion Force – Group 1

All positions were below the maximum requirement of 12 pounds per contact. See Table 7 for a summary of the contact insertion force data.

Table 7 – Contact Insertion Force Data (lbs)

	Maximum Force
Minimum	5.63
Maximum	11.30
Average	8.71
Std. Dev.	1.70

2.10 Contact Retention Force – Group 1

All positions were above the minimum requirement of 30 lbs per contact. See Table 8 for a summary of the contact retention force data.

Table 8 – Contact Retention Force Data (lbs)

	Maximum Force
Minimum	64.51
Maximum	77.62
Average	70.22
Std. Dev.	4.80

2.11 Crimp Tensile – Group 1

All positions were above the minimum requirement of 70 lbs per contact. The method of failure for all specimens was the wire pulling out of the crimp. See Table 9 for a summary of the crimp tensile force data.

Table 9 – Crimp Tensile Force Data (lbs)

	Maximum Force
Minimum	119.35
Maximum	137.82
Average	130.79
Std. Dev.	6.08

2.12 Thermal Shock – Group 3

Specimens showed no visual damage detrimental to product performance as a result of exposure to thermal shock.

2.13 Humidity-Temperature Cycling – Groups 2, 3

Specimens showed no visual damage detrimental to product performance as a result of exposure to humidity-temperature cycling.

2.14 Temperature Life – Group 2

Specimens showed no visual damage detrimental to product performance as a result of exposure to temperature life.

2.15 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. Initial Examination of Product – Groups 1 thru 4

A C of C 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. Testing was performed in accordance with EIA-364-18 Rev B.

3.2 Termination Resistance, Dry Circuit (LLCR) – Group 1, 2, 4

Dry circuit termination resistance measurements were made using a four terminal measuring technique. The test current was maintained at 100 milliamperes maximum with a 20 millivolt maximum open circuit voltage. See Figure 1 for current and voltage application locations. See Figure 2 for images of the typical LLCR test setup for Test Sets 1 and 2. See Figure 3 for images of the typical LLCR test setup for Test Set 4. Testing was conducted in accordance with EIA-364-23 Rev D.

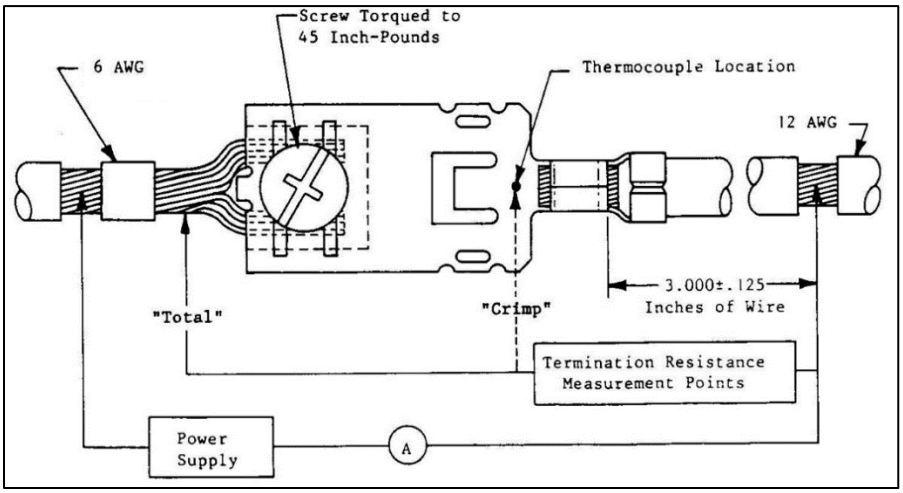

Figure 1 – LLCR Current and Voltage Application

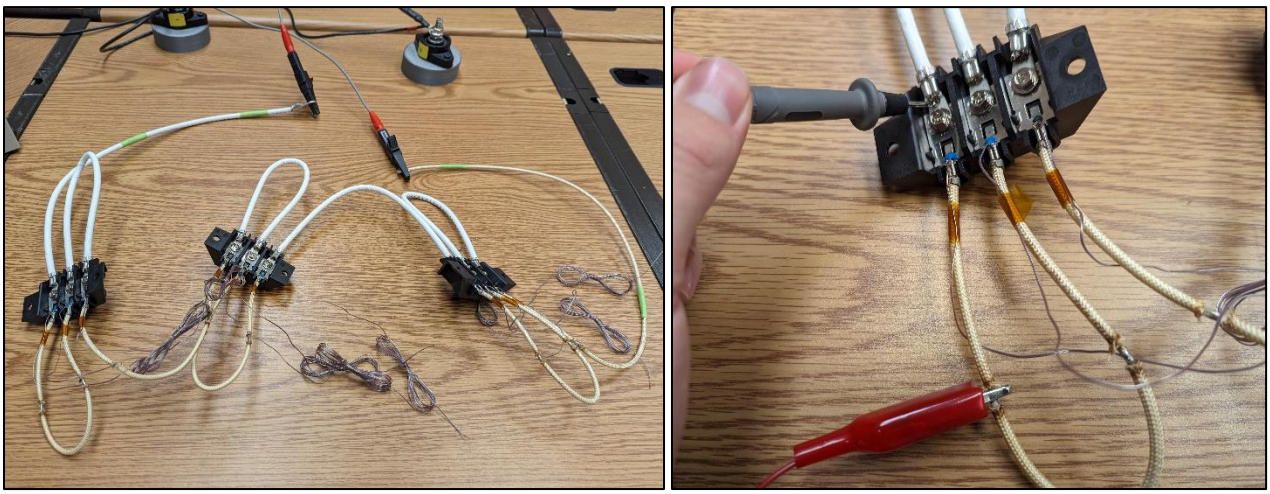

Figure 2 – Typical LLCR Test Setup – Test Sets 1 and 2

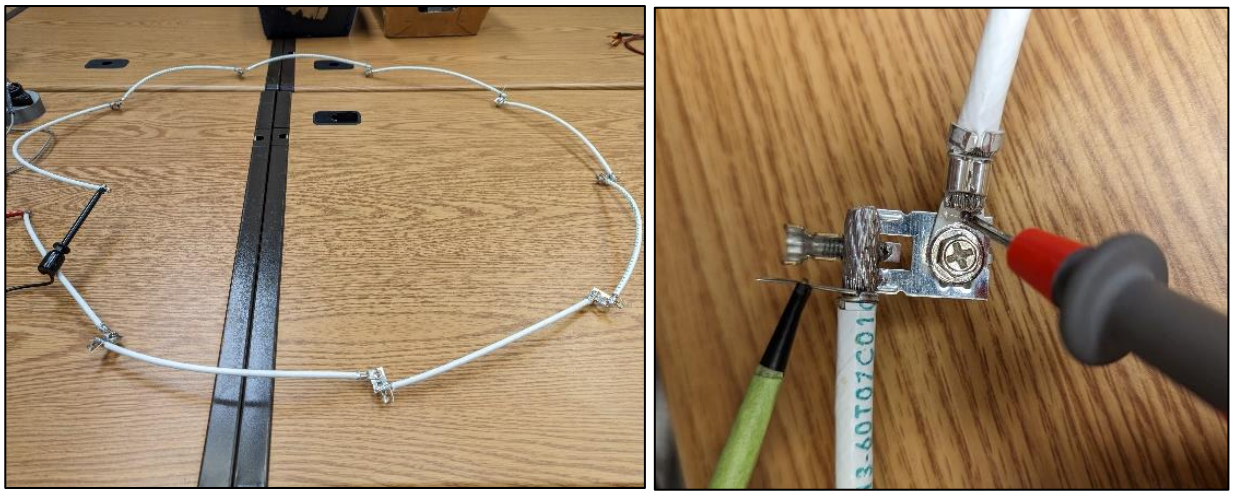

Figure 3 – Typical LLCR Test Setup – Test Set 4

3.3 Dielectric Withstanding Voltage (DWV) – Group 3

The wire was stripped back to allow voltage to be applied to the contacts. Specimens were subjected to 1500 VAC between adjacent contacts for a duration of 1 minute. Voltage was increased at a rate of 500 volts per second until the specified voltage was reached. See Figure 4 for images of the typical DWV test setup. Testing was performed in accordance with EIA-364-20 Rev F.

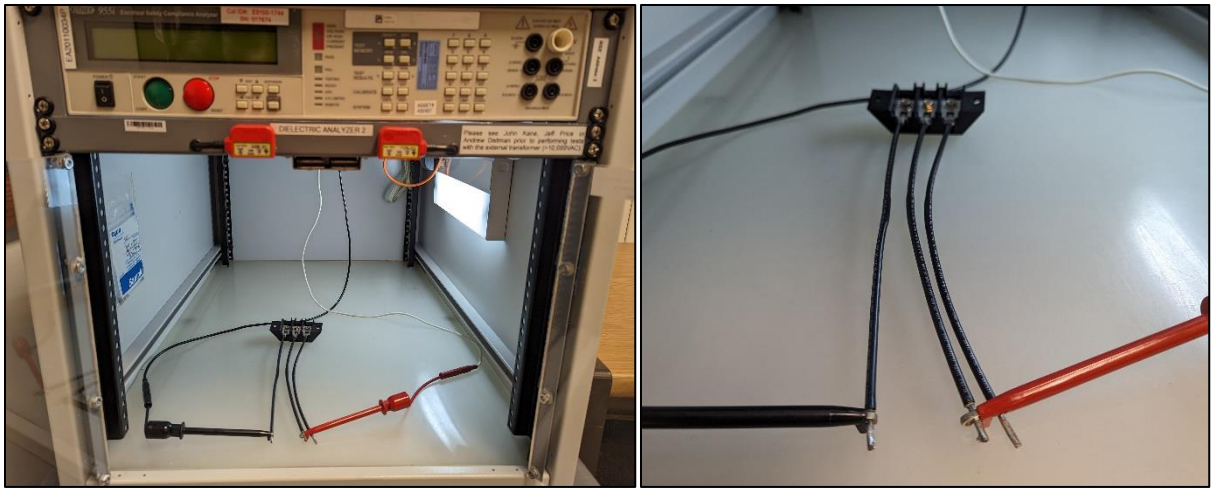

Figure 4 – Typical IR & DWV Test Setup

3.4 Insulation Resistance (IR) – Group 3

The wire was stripped back to allow voltage to be applied to the contacts. Specimens were subjected to 500 VDC between adjacent contacts for a duration of 2 minutes. Voltage was increased at a rate of 500 volts per second until the specified voltage was reached. See Figure 4 (above) for images of the typical IR test setup. Testing was performed in accordance with EIA-364-21 Rev F.

3.5 Current Cycling – Group 4

Specimens were subjected to 500 current cycles. Each cycle consisted of 45 minutes at 40 amps, followed by 15 minutes at no load. See Figure 5 for an image of the typical test setup. Testing was conducted in accordance with EIA-364-55 Rev B.

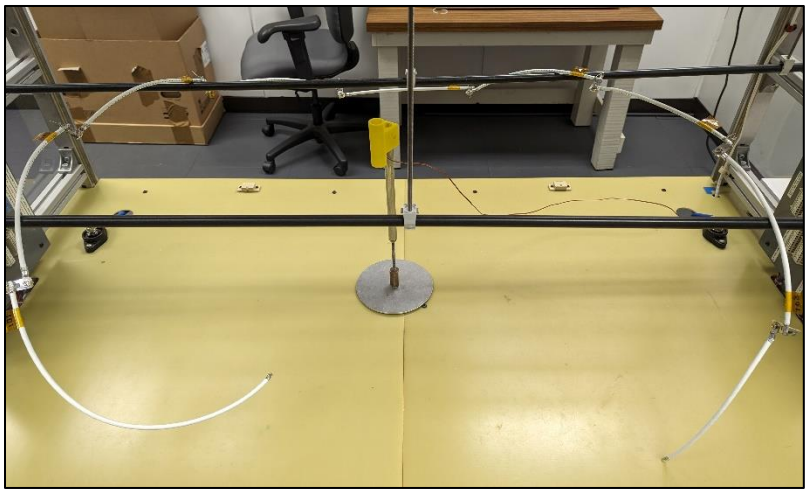

Figure 5 – Typical Current Cycling Test Setup

3.6 Temperature Rise vs Current – Group 2

Type T thermocouple leads were placed on the terminals using epoxy as shown in Figure 6. Temperature measurements were recorded when the specimens reached stability at each current level. The temperature is considered to be stable when the temperature rise of 3 consecutive readings taken at 5 minute intervals does not differ by more than 1°C. The ambient temperature was then subtracted from this measured temperature to obtain the temperature rise. See Figure 6 for an image of the typical T-Rise test setup. Testing was performed in accordance with EIA-364-70 Rev D.

Figure 6 – Thermocouple Location and Typical T-Rise Test Setup

3.7 Vibration – Group 1, 2

Test specimens were subjected to a sinusoidal vibration test in accordance with EIA-364-28 Rev F, test condition I.

Test specimens were subjected to a simple harmonic motion having an amplitude of 0.06-inch double amplitude (maximum total excursion). The vibration frequency was varied uniformly between the approximate limits of 10 to 55 Hertz (Hz). The entire frequency range of 10 to 55 Hz and return to 10 Hz was traversed in approximately 1 minute. The motion was applied for a period of 2 hours in each of the three mutually perpendicular axes, so the motion was applied for a total period of approximately 6 hours.

Test Set 1 specimens had an electrical load applied and maintained at a maximum of 100 milliamperes to all series wired test specimens and was monitored for discontinuities of 1 microsecond or longer. Test Set 2 specimens were energized at 30 amps to achieve an approximate 18°C T-rise. The typical sinusoidal vibration profile is shown in Figure 7. Typical vibration test setups are shown in Figures 8 through 10.

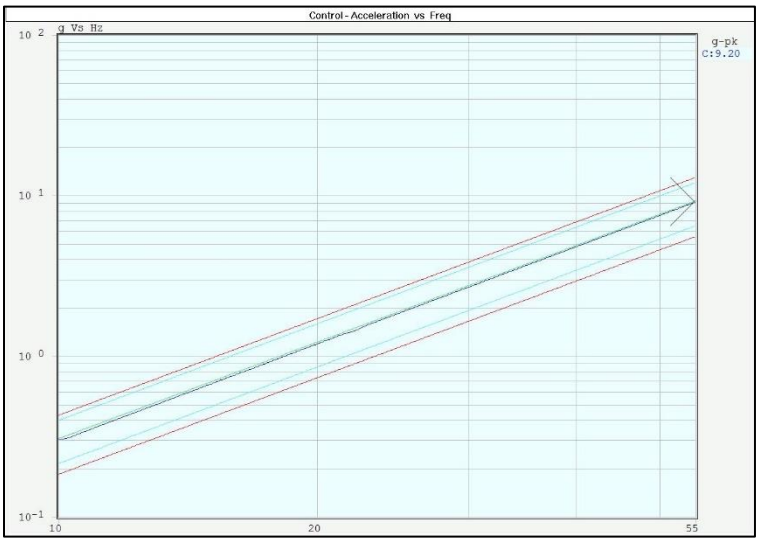

Figure 7 – Typical Sinusoidal Vibration Profile

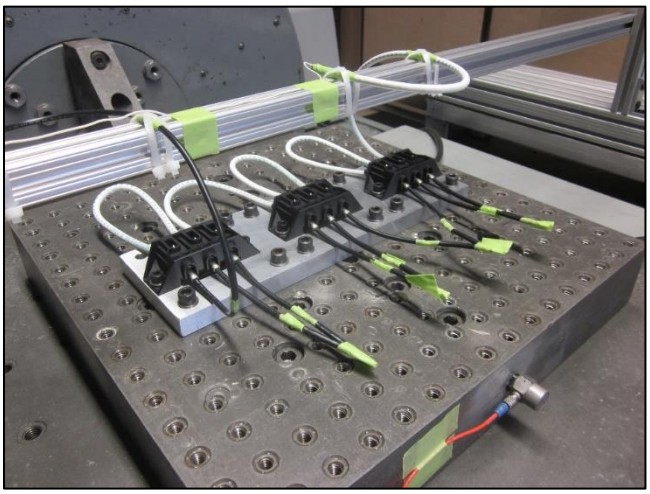

Figure 8 – Typical Sinusoidal Vibration Test Setup - Longitudinal Axis

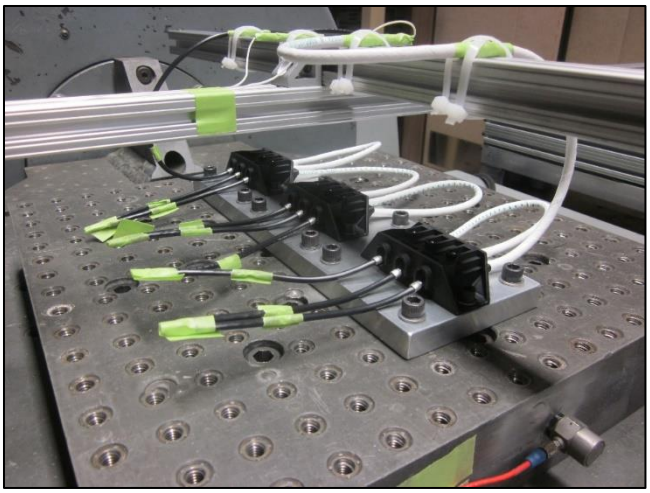

Figure 9 – Typical Sinusoidal Vibration Test Setup - Lateral Axis

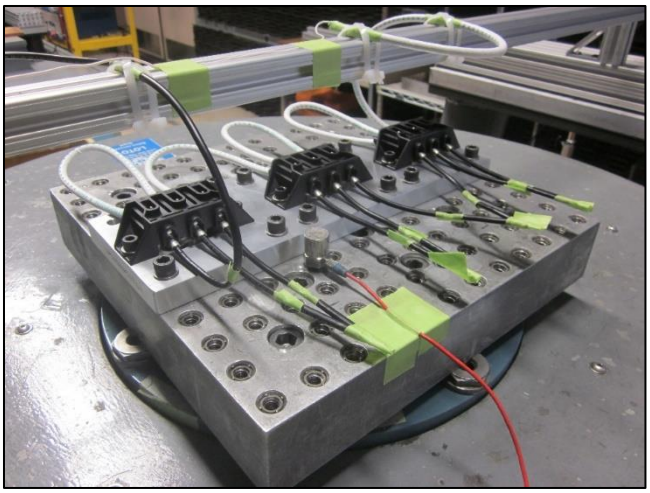

Figure 10 – Typical Sinusoidal Vibration Test Setup - Vertical Axis

3.8 Strength of Housing – Group 1

The screws that secured the two contacts were torqued to 50 in-lbs using a torque wrench. The housing and screws were visually inspected for damage. Testing was performed in accordance with 108-61063 Rev C.

3.9 Contact Insertion Force

The housing was held at approximately 23° in an adjustable angle vise mounted on a free-floating x/y and rotational table at the base of the tensile/compression machine. The wire was gripped in a chuck attached to the moveable crosshead of the tensile/compression machine. Force was applied in an upward direction at a rate of 0.25 in/min until the contact was fully inserted. See Figure 11 for images of the typical test setup. Testing was performed in accordance with EIA-364-05 Rev C.

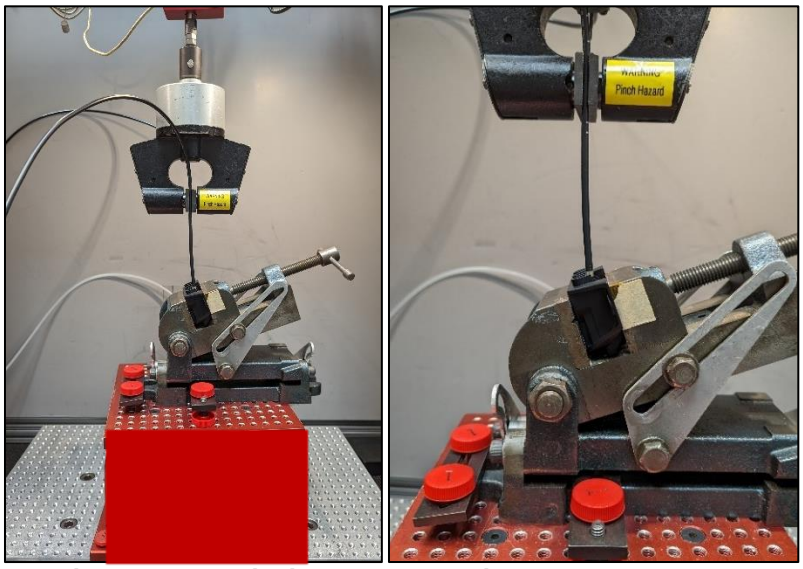

Figure 11 – Typical Contact Insertion Force Test Setup

3.10 Contact Retention Force

The housing was held on a right-angle plate mounted on a free-floating x/y and rotational table at the base of the tensile/compression machine. The wire was held by air jaws attached to the moveable crosshead of the tensile/compression machine. Force was applied in an upward direction at a rate of 25.4 mm/min until the contact retention mechanism failed. See Figure 12 for images of the typical test setup. Testing was performed in accordance with EIA-364-29 Rev E.

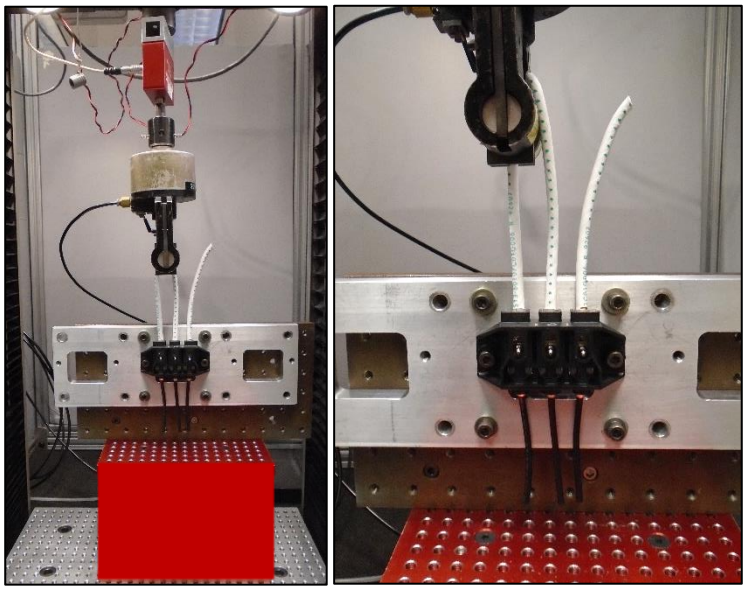

Figure 12 – Typical Contact Retention Force Test Setup

3.11 Crimp Tensile

The contact was held in a slotted plate mounted on a free-floating x/y and rotational table at the base of the tensile/compression machine. The wire was held by air jaws attached to the moveable crosshead of the tensile/compression machine. Force was applied in an upward direction at a rate of 1 in/min until the crimp failed. See Figure 13 for images of the typical test setup. Testing was performed in accordance with EIA-364-08 Rev C.

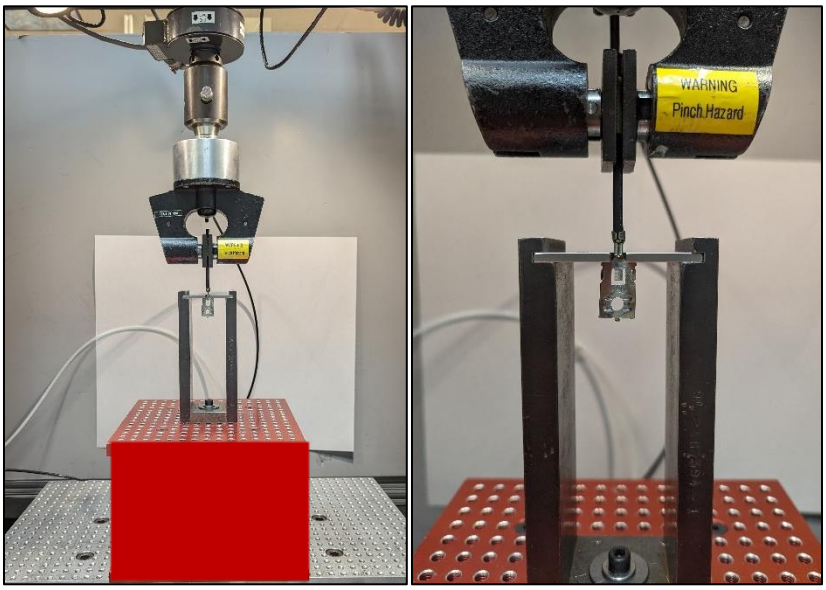

Figure 13 – Typical Crimp Tensile Force Test Setup

3.12 Thermal Shock

Testing was performed in accordance with EIA-364-32 Rev H, method A.

Mated specimens were subjected to 25 cycles of thermal shock from -40°C to 125°C. The dwell time at each temperature extreme was half an hour.

3.13 Humidity-Temperature Cycling

Mated specimens were exposed to 10 cycles of humidity-temperature cycling. Each cycle lasted 24 hours and consisted of cycling the temperature between 25°C and 65°C twice while maintaining high humidity. During five of the first nine cycles, the specimens were exposed to a cold shock at –10°C for 3 hours (Figure 14). Testing was performed in accordance with EIA-364-31 Rev F, Method IV.

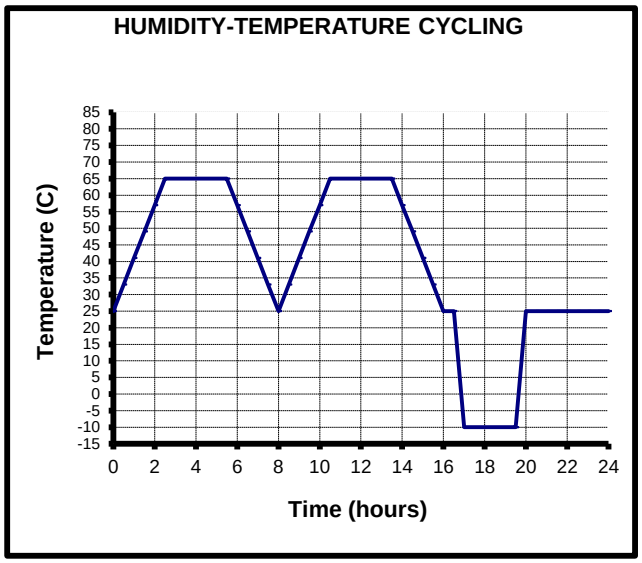

Figure 14 – Typical Humidity-Temperature Cycling Profile

3.14 Temperature Life

Mated specimens were subjected to 150°C for a duration of 24 hours in an air circulating oven. Testing was performed in accordance with EIA-364-17 Rev C.

3.15 Final Examination of Product

Specimens were visually examined with an unaided eye. Testing was performed in accordance with EIA-364-18 Rev B.