Qualification of Low-Force Mezalok* 114 Position Socket Connector

1. INTRODUCTION

1.1 Purpose

Testing was performed on the TE Connectivity* Low-Force Mezalok 114 position (114 p) sockets to determine their conformance to selected requirements of Design Objective 108-160206, Rev. A.

1.2 Scope

This report covers the electrical, mechanical, and environmental performance of the Low-Force Mezalok 114 p sockets in 10mm & 18mm stack heights. Testing was performed at the Harrisburg Electrical Components Test Laboratory between 10/12/2020 and 3/1/2021. Documentation is on file and maintained at HECTL under test number EA20200400T.

1.3 Conclusion

The test specimens listed in paragraph 1.4 were subjected to the test sequence shown in paragraph 1.5 and conformed to the selected mechanical and environmental performance requirements of Design Objective 108-160206, Rev. A. No damage occurred that could be considered to affect product performance in any of the connectors during post-testing inspection.

1.4 Product Description

TE's Low-Force Mezalok connector is designed for stacking or mezzanine applications for rugged embedded computing. The connectors incorporate a dual-redundant Mini-Box contact system for a separable interface, and are available in 60, 114, and 320 positions with stack height options of 10, 12, 15, 17 and 18 mm. Mezalok connectors are shock and vibration resistant per VITA 47 and 72 HALT test requirements. The 114-position connector is compliant to VITA 61. Featuring a wide operating temperature range, excellent thermal stability, and data rates to 32+ Gb/s, these rugged and highly versatile connectors are ideal for high-speed embedded computing applications. Installation of Mezalok connectors is easily accomplished using standard BGA surface mount processes.

1.5 Test Specimens

The socket specimens were mounted to 60-1824227-1 rev A Socket PCBs, while the test pin header specimens were mounted to 60-1824222-1 rev A Pin Header PCBs. Specimens identified with the following part numbers were representative of normal production lots and used for test:

Table 1 – Test Specimens

Test Group #	Test Set #	Quantity	Part Number	Date Code	Description
1	**1**	4	2355825-1	2030	Low-Force Mezalok 114 p, 30 Au Socket, 10mm SH
1	**2**	4	2355825-9	2034	Low-Force Mezalok 114 p, 30 Au Socket, 18 mm SH
2	**3**	4	2355825-9	2034	Low-Force Mezalok 114 p, 30 Au Socket, 18 mm SH
3	**4**	4	2355825-9	2034	Low-Force Mezalok 114 p, 30 Au Socket, 18 mm SH
4	**5**	4	2355825-1	2030	Low-Force Mezalok 114 p, 30 Au Socket, 10mm SH
4	**6**	4	2355825-9	2034	Low-Force Mezalok 114 p, 30 Au Socket, 18 mm SH

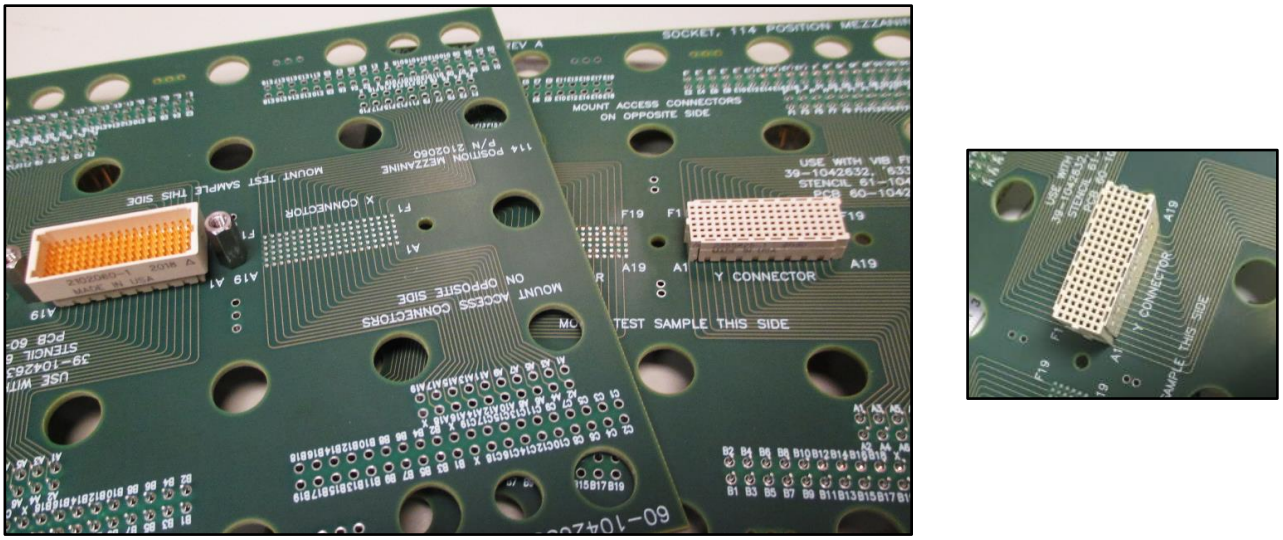

Figure 1 – Low-Force Mezalok 114p
Test Pin Header & 10mm Socket on L, and 18mm Socket on R

1.6 Qualification Test Sequence

Table 2 - Test Sequence

Test or Examination	Test Group (a)					
	1	1	2	3	6	6
	Test Set					
	1	2	3	4	5	6
	Test Sequence (b)					
Initial Examination of Product	1	1	1	1	1	1
Low level circuit resistance (LLCR)	3,8,11	3,8,11	2,5	2,5	2,4	2,4
Contact resistance	4,9,12	4,9,12	3,6	3,6	-	-
Durability	5	5	-	-	-	-
Random vibration	6	6	-	-	-	-
VITA 72 vibration	-	-	-	-	3	3
Mechanical Shock	7	7	-	-	-	-
Salt Spray	10	10				
Temperature life (125° C)	-	-	4	-	-	-
Thermal cycling (-55 to 125°C)	-	-	-	4	-	-
Mating Force	2	2	-	-	-	-
Unmating Force	13	13	-	-	-	-
Final Examination of Product	14	17	7	7	5	5

Note: *(a) See paragraph 1.5*
(b) Numbers indicate sequence which tests were performed.

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 1, 2, 3 & 6

All specimens submitted for testing were representative of normal production lots. Certificates of Conformance were issued by Product Assurance. Specimens were visually examined and showed no signs of damage or defects.

2.2 Low Level Contact Resistance – Groups 1, 2, 3 & 6

Test specimens did not exceed the maximum low level contact resistance requirement of 30 milliohms for 10mm stack height specimens and 35 milliohms for 18mm stack height specimens. All specimens had a change in resistance (ΔR) of less than 15 milliohms after testing.

2.3 Contact Resistance @ Rated Current – Groups 1, 2, & 3

Test specimens did not exceed the maximum low level contact resistance requirement of 30 milliohms for 10mm stack height specimens and 35 milliohms for 18mm stack height specimens. All specimens had a ΔR of less than 15 milliohms after testing.

2.4 Durability – Groups 1 & 2

Following durability, there was no indication of cracking, breaking or other damage.

2.5 Random Vibration – Groups 1 & 2

Following random vibration, there was no indication of cracking, breaking or other damage. No discontinuities of one microsecond or greater occurred during testing.

2.6 Random Vibration (VITA 72) – Group 6

Following random vibration, there was no indication of cracking, breaking or other damage. No discontinuities of one microsecond or greater occurred during testing.

2.7 Mechanical Shock – Groups 1 & 2

Following mechanical shock, there was no indication of cracking, breaking or other damage. No discontinuities of one microsecond or greater occurred during testing.

2.8 Salt Spray – Groups 1 & 2

The test specimens showed no signs of lifting of plated coating or exposure of basis material which would adversely affect performance.

2.9 Temperature Life – Group 2

No damage or defects were observed on any specimen after a 500 hr. temperature life exposure at 125°C

2.10 Temperature Cycling – Groups 1 & 2

Test specimens showed no signs of blistering, peeling, flaking, separation plating or other damage detrimental to the operation of the connectors as a result of Temperature Cycling exposure.

2.11 Mating Force – Groups 1 & 2

No evidence of defects detrimental to mechanical or electrical performance were visible as a result of mating the specimens.

2.12 Unmating Force – Groups 1 & 2

No evidence of defects detrimental to mechanical or electrical performance were visible as a result of unmating the specimens.

2.13 Final Examination of Product – Groups 1, 2, 3 & 6

All specimens submitted for testing were representative of normal production lots. Certificates of Conformance were issued by Product Assurance. Specimens were visually examined and showed no signs of damage or defects.

3. TEST METHODS

3.1 Examination of Product

Initial examination of all specimens was performed per TE Connectivity Specification 108-160206, Rev. A. 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 Low Level Contact Resistance

Low level contact resistance measurements at low level current were taken per TE Connectivity Specification 108-160206, Rev. A using a four terminal measuring technique (Figure 1). The test current was maintained at 100 milliamperes maximum with a 20 millivolt maximum open circuit voltage.

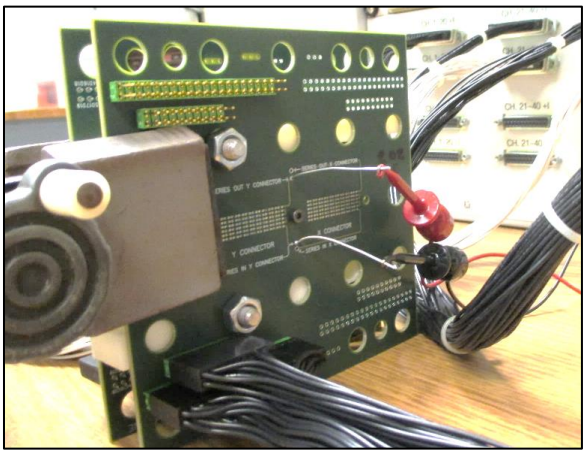

Figure 1 – Low Level Contact Resistance Measurement Points

3.3 Contact Resistance @ 1.5 Amps

Contact resistance measurements at rated current were taken per TE Connectivity Specification 108-160206, Rev. A using a four terminal measuring technique (Figure 2). The test current was maintained at 1.5 amperes with a 20-volt maximum open circuit voltage.

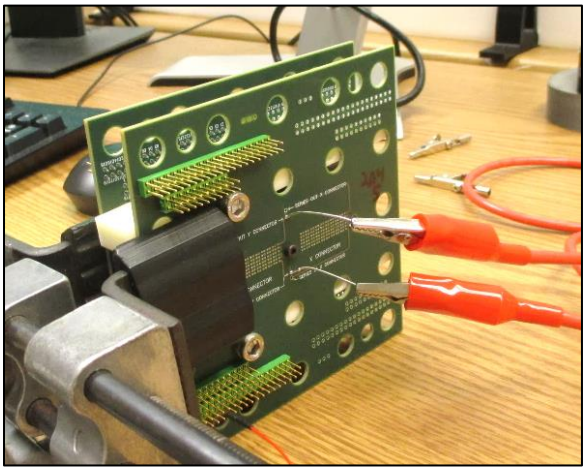

Figure 2 – Contact Resistance @ 1.5 A Measurement Points

3.4 Vibration, Random

The mated test specimens were subjected to a random vibration test as stated in TE Connectivity Specification 108-160206, Rev. A. See Figures 3 through 7 for vibration profile run and vibration setup photographs.

The parameters of this test condition are specified by a random vibration spectrum, with excitation frequency bounds of 5 and 2000 hertz. The spectrum sloped up at 3 dB per octave to a PSD of 0.1 G^2/Hz from 5 - 100 Hz. The spectrum stayed flat at 0.1 G^2/Hz from 100 to 1000 Hz. The spectrum then sloped down at 6 dB/octave from 1000 to 2000 Hz. The root-mean square amplitude of the excitation was 12.0 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 one microsecond or greater using a current of 100 milliamperes DC.

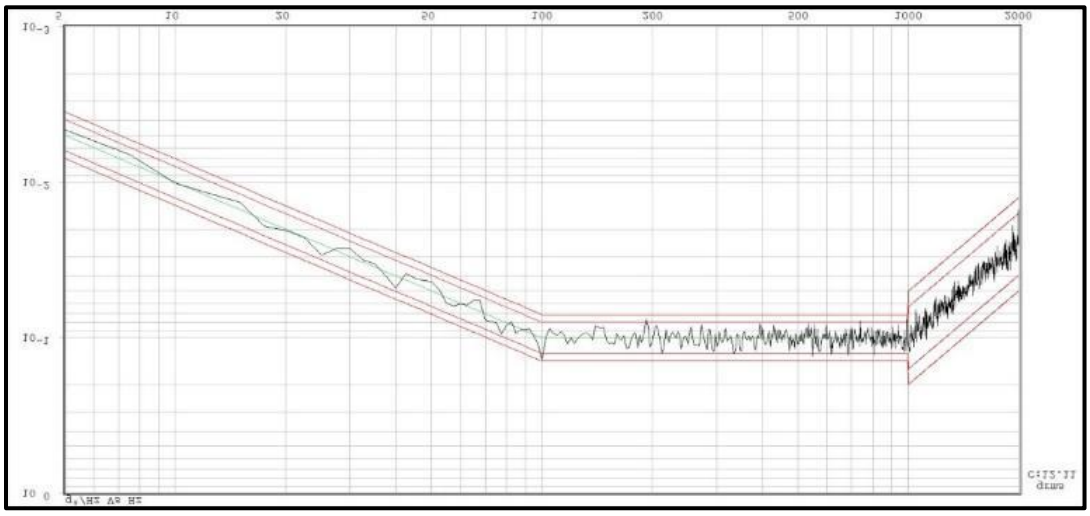

Figure 3 – Vibration Profile Run

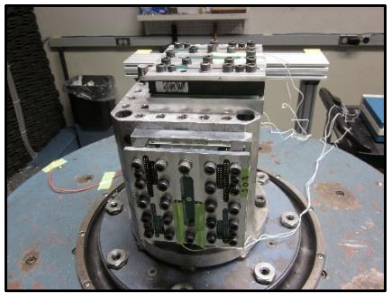

Figure 4 – Vibration Setup

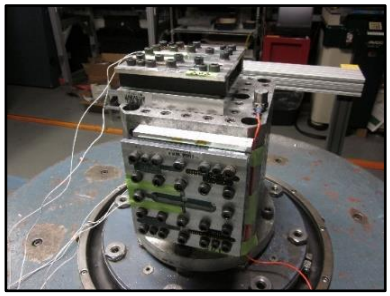

Figure 5 – Vibration Setup

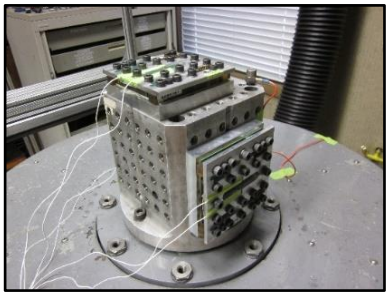

Figure 6 – Vibration Setup

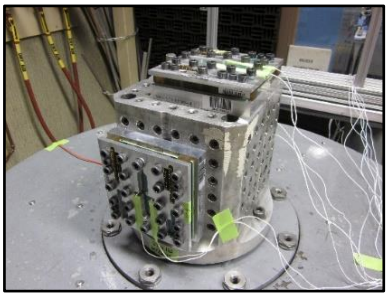

Figure 7 – Vibration Setup

3.5 Vibration, Random (VITA 72)

The test specimens were subjected to a random vibration test as stated in TE Connectivity Specification 108-160206, Rev. A. Vibration testing was completed using provided fixture from requestor. See Figures 8 through 10 for vibration setup photographs.

Rugged L3 Random Vibration Profile

The parameters of this test condition are specified by a random vibration spectrum with excitation frequency bounds of 5 and 2000 Hertz (Hz). The power spectral density (PSD) at 5 Hz is 0.002 G^2/Hz. The spectrum slopes up to a PSD of 0.04 G^2/Hz at 15 Hz. The spectrum is flat at 0.04 G^2/Hz from 15 Hz to 150 Hz. The spectrum then slopes up to a PSD of 0.1 G^2/Hz at 300 Hz. The spectrum is flat at 0.1 G^2/Hz from 300 Hz to 1000 Hz. The spectrum then slopes down to a PSD of 0.025 G^2/Hz at the upper bound frequency of 2000 Hz. The root-mean square amplitude of the excitation was 11.7 GRMS.

The test specimen was subjected to this test for 1 hour in each of the three mutually perpendicular axes, for a total test time of 3 hours. The test specimen was monitored for discontinuities of 1 microsecond or greater using an energizing current of 100 milliamperes.

Rugged L3 Random Vibration Profile Plus 3dB Profile

The parameters of this test condition are specified by a random vibration spectrum with excitation frequency bounds of 5 and 2000 Hertz (Hz). The power spectral density (PSD) at 5 Hz is 0.004 G^2/Hz. The spectrum slopes up to a PSD of 0.08 G^2/Hz at 15 Hz. The spectrum is flat at 0.08 G^2/Hz from 15 Hz to 150 Hz. The spectrum then slopes up to a PSD of 0.2 G^2/Hz at 300 Hz. The spectrum is flat at 0.2 G^2/Hz from 300 Hz to 1000 Hz. The spectrum then slopes down to a PSD of 0.050 G^2/Hz at the upper bound frequency of 2000 Hz. The root-mean square amplitude of the excitation was 16.49 GRMS.

The test specimen was 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. After each test specimen had run this profile for one hour in each of the three mutually perpendicular axes, the specimen was subjected to this profile for another twelve hours, in the Z axis only. The test specimens were monitored for discontinuities of 1 microsecond or greater using an energizing current of 100 milliamperes.

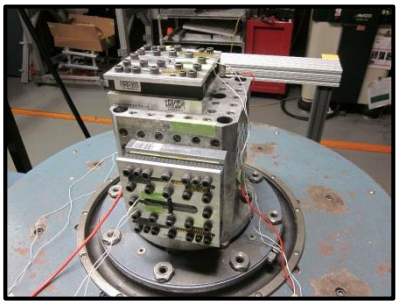

Figure 8 – Vibration Test Setup

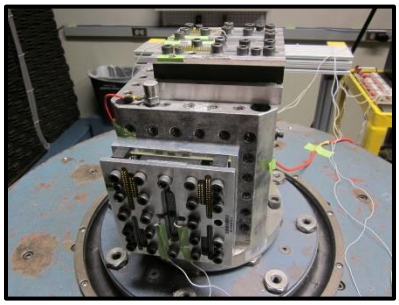

Figure 9 – Vibration Test Setup

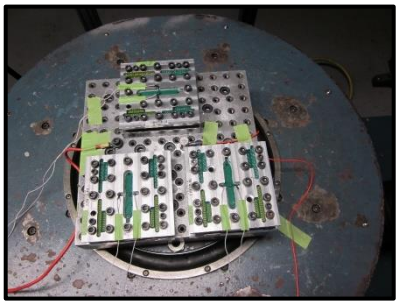

Figure 10 – Vibration Test Setup

3.6 Mechanical Shock, Sawtooth

The mated test specimens were subjected to a mechanical shock test as stated in TE Connectivity Specification 108-160206, Rev. A. See Figures 11 through 15 for shock profile run and shock setup photographs.

The parameters of this test condition are a saw-tooth waveform with an acceleration amplitude of 100 gravity units (g's peak) and a duration of 6 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 one microsecond or greater using a current of 100 milliamperes.

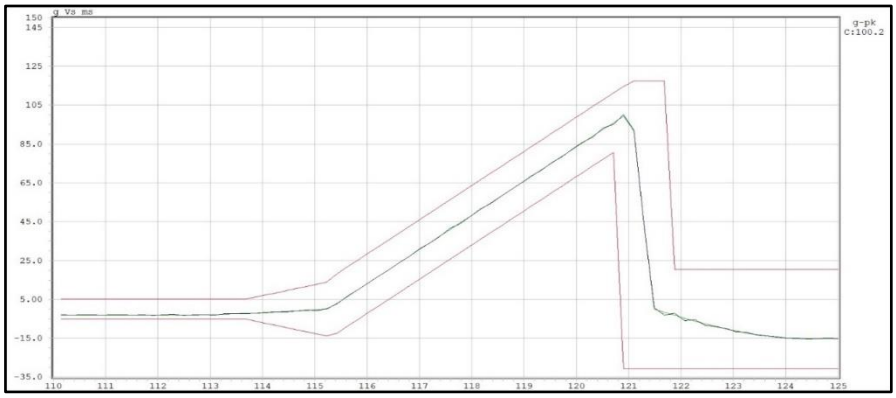

Figure 11 – Shock Profile Run

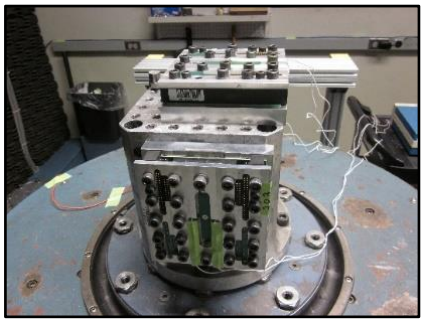

Figure 12 – Shock Setup

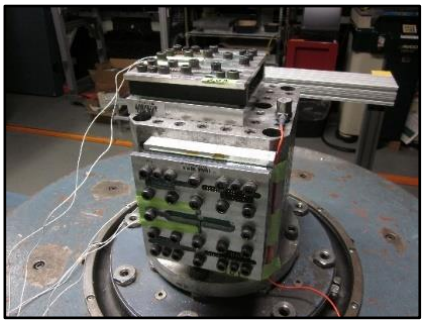

Figure 13 – Shock Setup

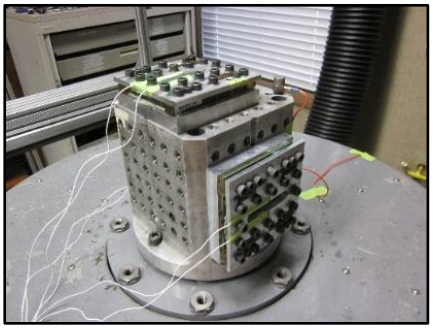

Figure 14 – Shock Setup

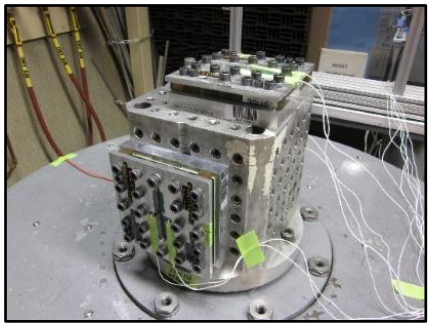

Figure 15 – Shock Setup

3.7 Durability

Per TE Connectivity Specification 108-160206, Rev. A test method, specimens were mated and unmated 500 times at a maximum rate of 475 cycles per hour. (Figure 16)

Figure 16 – Durability Cycling Setup

3.8 Mating Force

Per TE Connectivity Specification 108-160206, Rev. A, the force required to mate individual specimens was measured using a tensile/compression device with the rate of travel at 6.35 mm/minute. A free-floating x-y table as shown in Figure 17 was used for the mating force test. Maximum mating force was calculated using 50 gram force times the number of contacts.

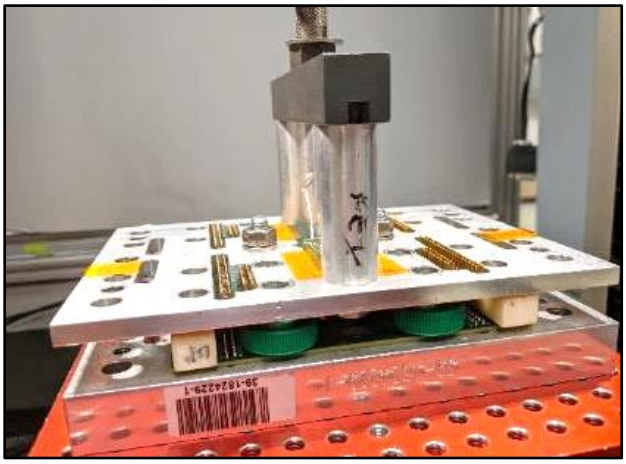

Figure 17 – Mating Force Setup

3.9 Unmating Force

Per TE Connectivity Specification 108-160206, Rev. A test method, the force required to unmate individual specimens was measured using a tensile/compression device with the rate of travel at 3.65 mm/minute and a free-floating x-y table as shown in Figure 18. Minimum mating force was calculated using 7.0 gram force times the number of contacts.

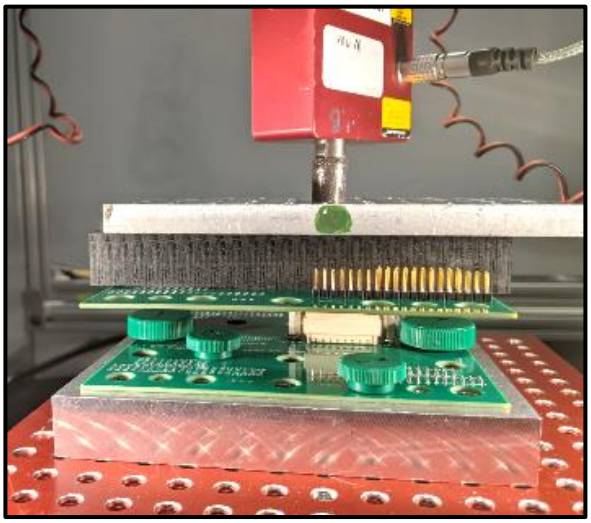

Figure 18 – Unmating Force Setup

3.10 Salt Spray

Per TE Connectivity Specification 108-160206, Rev. A test method, a specimen enclosure containing the specimens was placed in the chamber on horizontal racks by the test requestor. The enclosure had four 3/8" drain holes in the bottom (one in each corner). See Figure 19 & Figure 20 for views of the salt spray setup. The chamber was operated for a total of 48 hrs. See Table 3 for chamber collection data.

Upon completion of the test the specimen enclosure containing the specimens was removed from the chamber and allowed to dry at room ambient conditions until picked up by the requestor. 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: 1.031 to 1.038.
- Collection rate: .5 to 3ml per hour.

Table 3 – Collection Data

DATE	TECHNICIAN	TOTAL HOURS	AIR PRESSURE	COLLECTION				PH		SPECIFIC GRAVITY		SOLUTION TEMP (°C)		COMMENTS
				TOTAL (ml)		RATE (ml/hr)								
				L	R	L	R	L	R	L	R	L	R	
2/23/2021	ZUVICH	48	22	75	55	1.56	1.15	6.91	6.9	1.036	1.036	23.5	23.2	2/16/21 to 2/18/21

Figure 19– Test specimen in salt spray enclosure

Figure 20 – Salt spray enclosure inside salt chamber

3.11 Thermal Shock

Per TE Connectivity Specification 108-160206, Rev. A test method mated specimens were subjected to 2000 cycles of between -55 and 125°C with 30 minute dwells at temperature extremes and 1 minute maximum transition between temperatures. See Figures 23 & 24 for temperature profile.

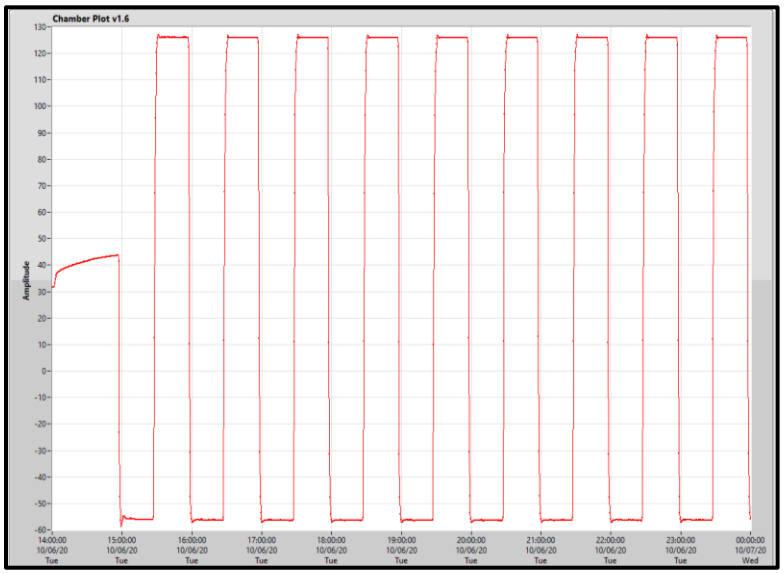

Figure 23 - Temperature profile, Start

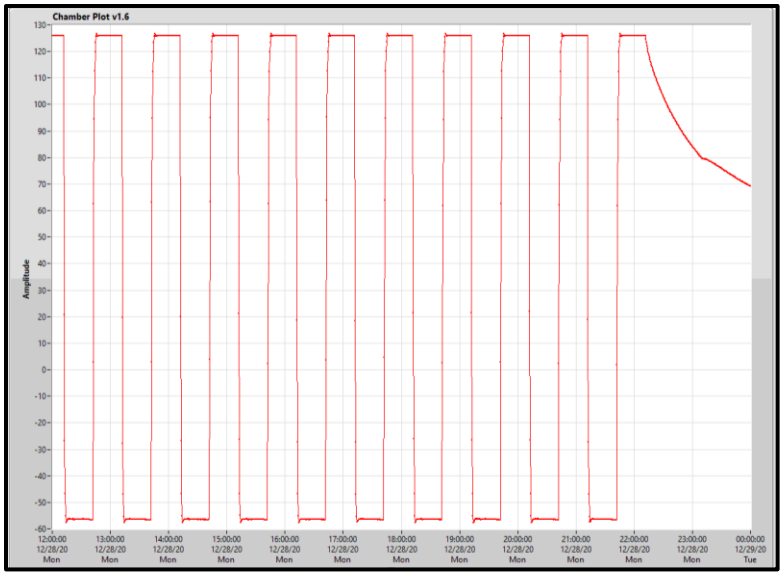

Figure 24 - Temperature profile, End

3.12 Temperature Life

Per TE Connectivity Specification 108-160206, Rev. A test method subjected mated specimens to 125°C for 500 hours. See Figure 25 & Figure 26 for temperature profile.

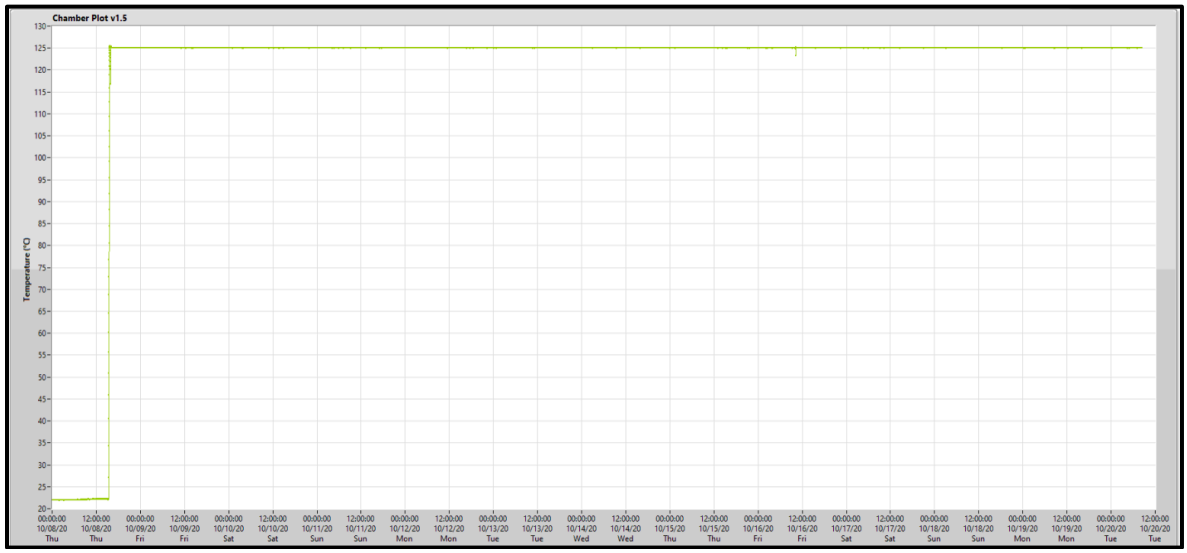

Figure 25 - Temperature Profile of First 250 hrs

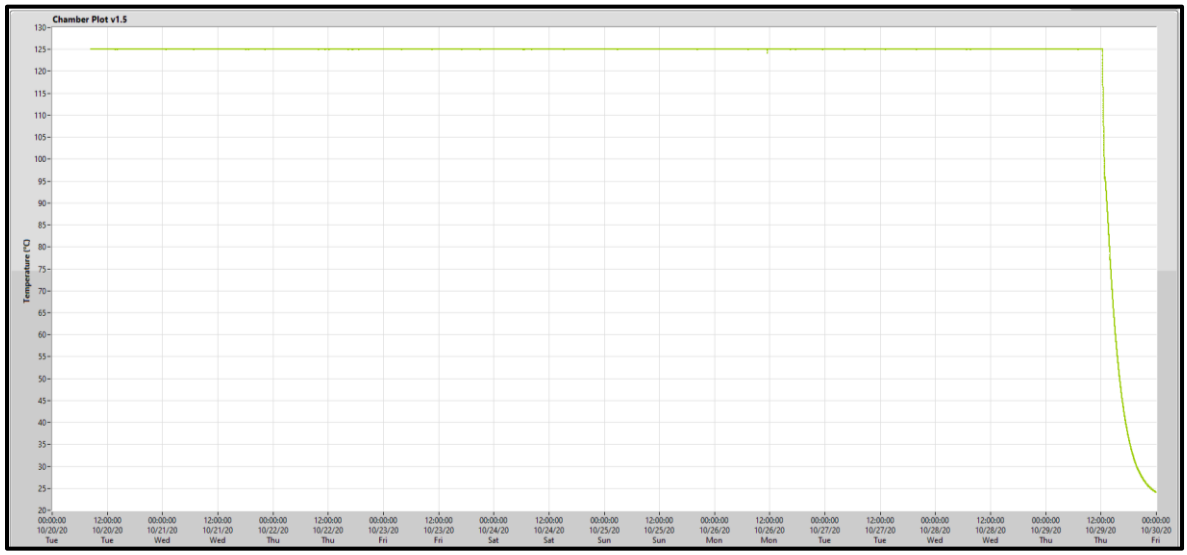

Figure 26 - Temperature Profile of Last 250 hrs

3.13 Final Examination of Product

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