CFP2/4 Pluggable Host Receptacle and Cages

1. INTRODUCTION

1.1. Purpose

Testing was performed on the TE Connectivity CFP2 and CFP4 Receptacle to determine its conformance to the requirements of Product Specification 108-32103 Rev A.

1.2. Scope

This report covers the electrical, mechanical and environmental performance of the TE Connectivity CFP2 and CFP4 Receptacle. Testing was performed at the Harrisburg Electrical Components Test Laboratory between September 2017 to March 2018 and is on file under the following Test Reports: EA20170044T, EA20170591T, EA20170632T, EA20170713T, EA20180009T.

1.3. Conclusion

The TE Connectivity CFP2 and CFP4 Receptacles listed in paragraph 1.5 conformed to the electrical, mechanical and environmental requirements of Product Specification 108-32103 Rev A.

1.4. Product Description

The receptacle assembly features alignment posts and solder tails for mechanical retention to the pc board. The connector consists of a housing with 104 contact positions (CFP2) or 56 contact positions (CFP4) on 0.6mm centerline spacing. The receptacles have a mating slot to accept corresponding plugs designed to meet the requirements of the CFP2 and 4 Multi-Source Agreement (MSA).

1.5. Test Specimens

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

Table 1 – Specimen Identification

Test Group	Quantity	Part Number	Description
1	2	2274845-1	Connector Assembly, Receptacle, CFP2
	2	2274842	Hardware Kit, 1x1, CFP2 (Cover, Cage and Heatsink)
	2	N/A	Test Modules
2	2	2274845-1	Connector Assembly, Receptacle, CFP2
	2	2274842	Hardware Kit, 1x1, CFP2 (Cover, Cage and Heatsink)
	2	N/A	Test Modules
3	4	2274845-1	Connector Assembly, Receptacle, CFP2
	4	2274842	Hardware Kit, 1x1, CFP2 (Cover, Cage and Heatsink)
	4	N/A	Test Modules
4	2	2274845-1	Connector Assembly, Receptacle, CFP2
	2	2288229-1	Connector Assembly, Receptacle, CFP4
5	2	2274845-1	Connector Assembly, Receptacle, CFP2 mounted on test board with cover
	2	2274845-1	Connector Assembly, Receptacle, CFP2 mounted on test board
	2	2287075-1	1x2 Cage Assembly with diecast cover and heatsink
	2	60-1824707	Paddle Card Assembly with competitor plug and shop built module housing
6	5	2274845-1	Connector Assembly, Receptacle, CFP2
	5	2288229-1	Connector Assembly, Receptacle, CFP4
7	5	2274845-1	Connector Assembly, Receptacle, CFP2
	5	2288229-1	Connector Assembly, Receptacle, CFP4
8	7	2274845-1	Connector Assembly, Receptacle, CFP2
	7	2288229-1	Connector Assembly, Receptacle, CFP4
	5	2274842	1x1 Cage and Hardware Kit, CFP2
	5	2288226	1x1 Cage and Hardware Kit, CFP4
	1	2287075	1x2 Cage and Hardware Kit, CFP
	1	2289497	1x4 Cage and Hardware Kit, CFP4
	6	60-1824706-1 Rev A	Test PCB, CFP2 Receptacle
	7	60-1824707-1 Rev A	Test PCB, CFP2 Paddle card
	1	60-1824710-1 Rev A	Test PCB, CFP4 Receptacle, 1x4
	5	60-1824711-1 Rev A	Test PCB, CFP4 Receptacle, 1x1
	6	60-1824712-1 Rev A	Test PCB, CFP4 Paddle card
9	4	2274842	1x1 Cage and Hardware Kit, CFP2
	2	2287075	1x2 Cage and Hardware Kit, CFP
	4	2288226	1x1 Cage and Hardware Kit, CFP4
	2	2289497	1x4 Cage and Hardware Kit, CFP4
	6	60-1824706-1 Rev A	Test PCB, CFP2 Receptacle
	4	60-1824710-1 Rev A	Test PCB, CFP4 Receptacle, 1x4
	2	60-1824712-1 Rev A	Test PCB, CFP4 Paddle card

1.6. Qualification Test Sequence

Table 2 – Test Sequence

Test or Examination	Test Group								
	1	2	3	4	5	6	7	8	9
	Test Sequence (a)								
Initial examination of product	1	1	1	1	1	1	1	1	1
Low Level Contact Resistance	2,5,7,9	3,5,7,9	2,5,7,9		2,5,7,9				
Insulation Resistance				2,6					
Withstanding Voltage				3,7					
Random Vibration	6(f)				4				
Mechanical Shock	8				6				
Durability					3				
Durability (Preconditioning)	3(b)		3(b)						
Mating force								2(c)	
Unmating force								3	
Connector Solderability						2			
Resistance to reflow soldering heat							2		
Thermal shock				4					
Humidity/temperature cycling				5					
Temperature life 250 cycles		2,4,6,8							
Temperature life (Preconditioning)	4(e)		4(e)		8(e)				
Mixed flowing gas			6(d)						
Reseating			8						
Cage compliant pin insertion force									2
Cage compliant pin retention force									3
Final examination of product	10	10	10	8	10	3	3	4	4

(a) The numbers indicate sequence in which tests were performed
(b) Precondition specimens with 20 durability cycles
(c) Mate to blank transceivers (no components on cable connector pcb)
(d) LLCR after 7 days
(e) Precondition specimens with exposure to 90˚C for 360 hours
(f) Customer requested parameters

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 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

All low-level contact resistance measurements taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage were less than 80 milliohms initially and had a change in resistance (ΔR) of less than 10 milliohms after testing. The low-level contact resistance summary results are shown in Table 3 through Table 6.

Table 3 – Test Group 1 LLCR Summary Results (mΩ)

	Initial	Following Durability (Preconditioning) and Temp Life (Preconditioning) (Delta)	Following Vibration (Delta)	Following Mechanical Shock (Delta)
Min	4.10	-6.22	-7.32	-7.88
Max	35.64	7.56	1.15	1.34
Avg	25.10	1.18	-1.16	-1.26
STD	4.41	2.13	1.35	1.44
Nv	122	122	122	122

Table 4 – Test Group 2 LLCR Summary Results (mΩ)

	Initial	250 Hours	500 Hours	750 Hours	1000 Hours
	Initial from EA20170632T Specimen 301plug and receptacle	Specimen 0301 plug and receptacle	250 hours with plug 401	250 hours with plug 402	250 hours with plug 201
	Actual	Delta	Delta	Delta	Delta
Min	4.10	-6.75	-6.85	-8.06	-7.34
Max	35.64	8.21	1.21	6.48	0.87
Avg	25.10	0.48	-1.66	-1.11	-1.38
STD	4.41	2.18	1.53	2.56	1.42
Nv	122	122	122	122	122

Table 5 – Test Group 3 LLCR Summary Results (mΩ)

	Initial	Following Durability (Preconditioning) and Temp Life (Preconditioning) (Delta)	Following First 7 days MFG (Delta)	Following 14 days MFG (Delta)	Following Reseating (Delta)
Min	3.85	-5.23	-5.13	-5.03	-5.00
Max	32.79	1.86	2.22	2.30	1.83
Avg	23.53	0.31	0.19	0.21	0.24
STD	3.79	0.74	0.80	0.85	0.71
Nv	244	244	244	244	244

Table 6 – Test Group 5 LLCR Summary Results (mΩ)

	Initial	Following Durability (Delta)	Following Vibration (Delta)	Following Mechanical Shock (Delta)	Following Temperature Life (Delta)
Min	4.20	-8.72	-8.29	-9.02	-7.40
Max	36.76	0.62	0.47	-0.02	5.17
Avg	26.63	-2.40	-2.10	-2.50	-0.98
STD	4.58	-8.72	1.66	1.83	1.71
Nv	122	122	122	122	122

2.3 Insulation Resistance

All insulation resistance measurements were greater than 1,000 megaohms.

2.4 Dielectric Withstand Voltage

No dielectric breakdown or flashover occurred.

2.5 Random Vibration

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

2.6 Mechanical Shock

No apparent physical damage or discontinuities of one microsecond or greater occurred during testing. The pulse velocity change was 132.0 inches per second.

2.7 Durability

No physical damage detrimental to product performance was observed following 200 cycles of durability.

2.8 Module Mating Force

Refer to Table 7 and Table 8 for mating force data in Newtons. All specimens met the requirements of 80 Newtons maximum for the CFP2 and 60 Newtons maximum for the CFP4.

Table 7 – CFP2 Transceiver Insertion Force Summary Results (N)

	Result
Minimum	19.49
Maximum	27.34
Mean	22.66
Std. Dev.	2.48
N	7

Table 8 – CFP4 Transceiver Insertion Force Summary Results (N

	Result
Minimum	12.54
Maximum	24.14
Mean	18.52
Std. Dev.	4.13
N	6

2.9 Module Unmating Force

Test was not performed due to problems with the TE fabricated module.

2.10 Solderability

2.10.1 Steam Age Pre-Conditioning

Some areas of staining were observed after the steam age pre-conditioning. Figure 1 is photographs typical of the specimens as received and Figure 2 is a photograph typical of the SMT contacts after the steam age pre-conditioning.

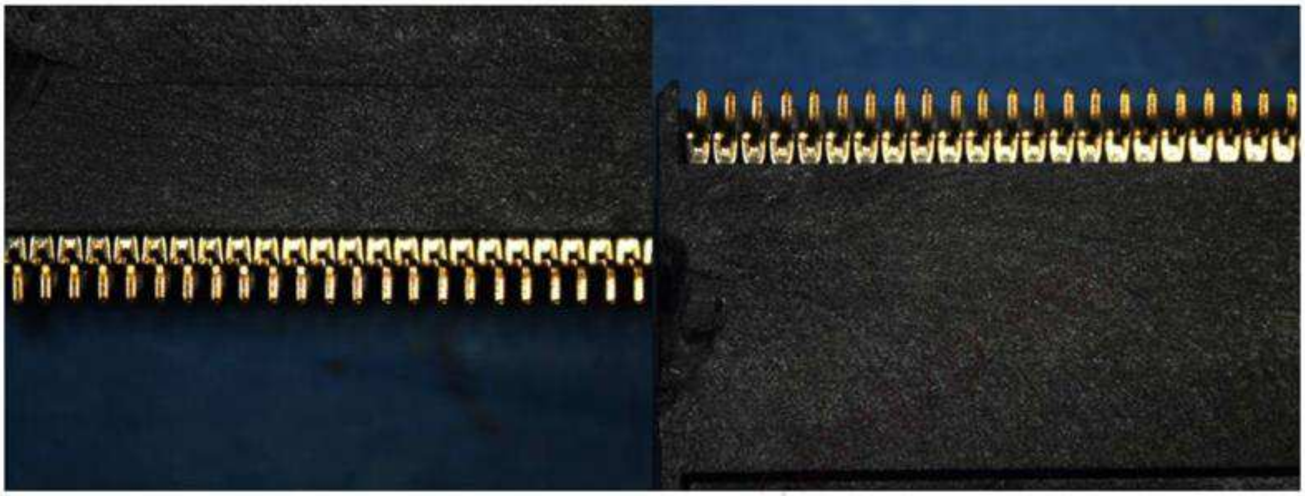


Figure 1 Typical SMT Contacts as Received

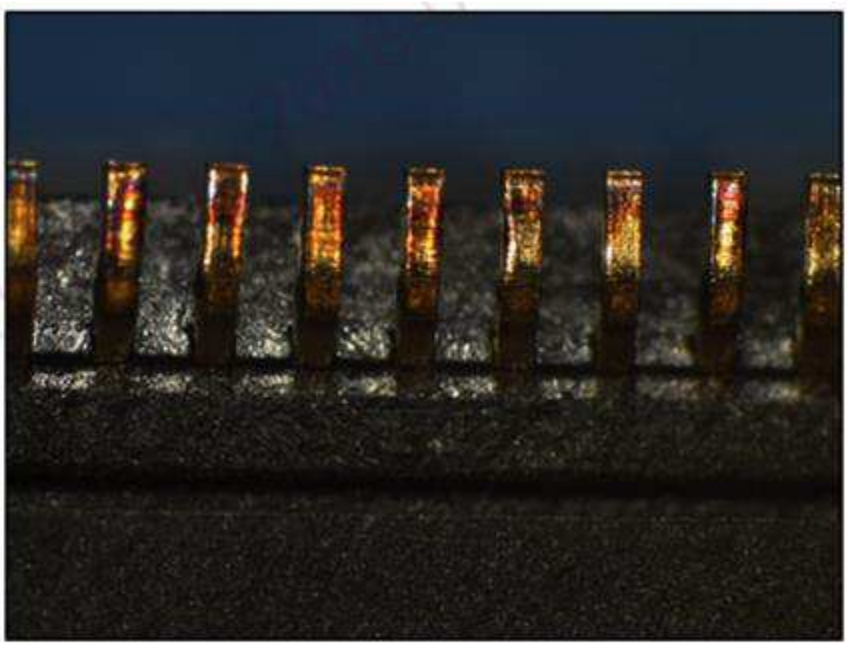


Figure 2 Typical SMT Contacts after Steam Age

2.10.2 Solder Testing

All specimens met the requirement of greater than 95% wetting of the critical surface areas. The critical area of solderability is defined in J-STD-002E. See Figure 3 for an illustration of the critical area of solderability and figure 4 for photographs typical of the tested specimens.

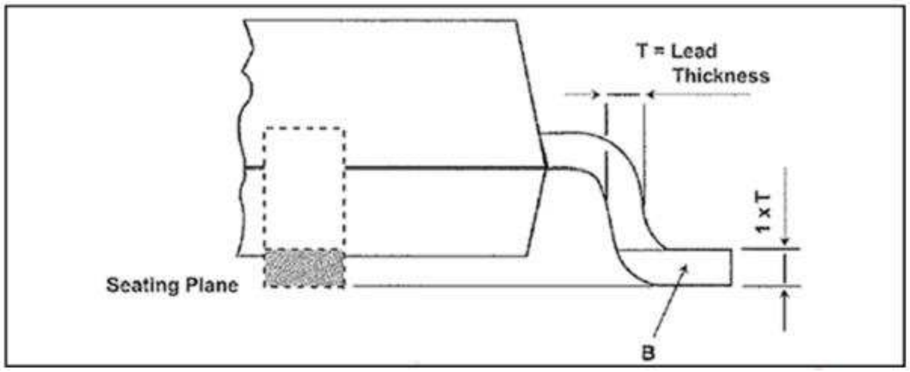


Figure 3 Critical Area of Solderability per J-STC-002D

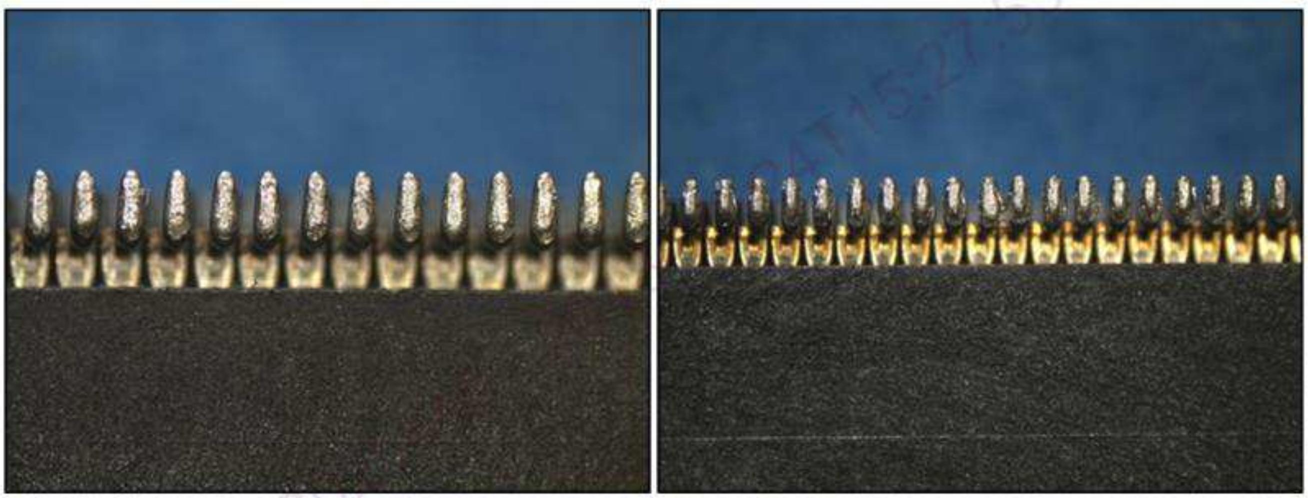
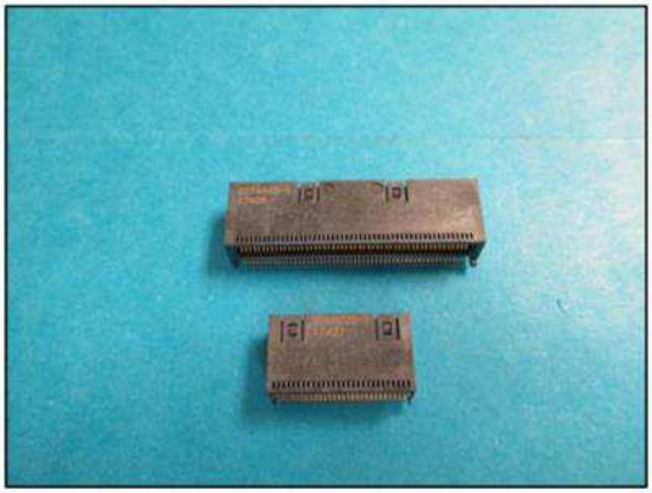


Figure 4 Typical SMT Contacts as Tested

2.11 Component Heat Resistance to Lead Free Soldering

2.11.1 Moisture Soak

There was no visual damage or defects as a result of the moisture soak preconditioning. See Figure 5 for a photograph typical of the specimens as received and Figure 6 for a photograph typical of the specimens after the moisture soak.



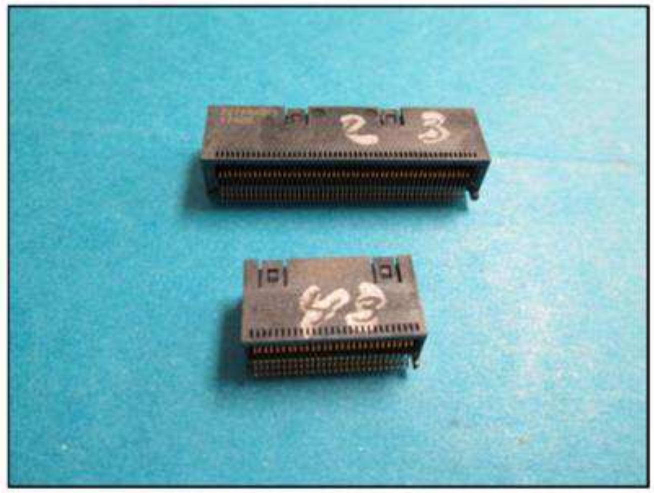


Figure 5 Typical Specimens as Received **Figure 6 After Moisture Soak**

2.11.2 Reflow Heat Exposure

There was no visual evidence of blistering, cracking, melting or significant discoloration observed on any specimen after the first reflow heat cycle exposure. There were no visible changes to any specimen after the second and third reflow heat exposures. Figure 5 above shows typical specimens as received, Figure 7 shows typical specimens after the first reflow heat exposure.

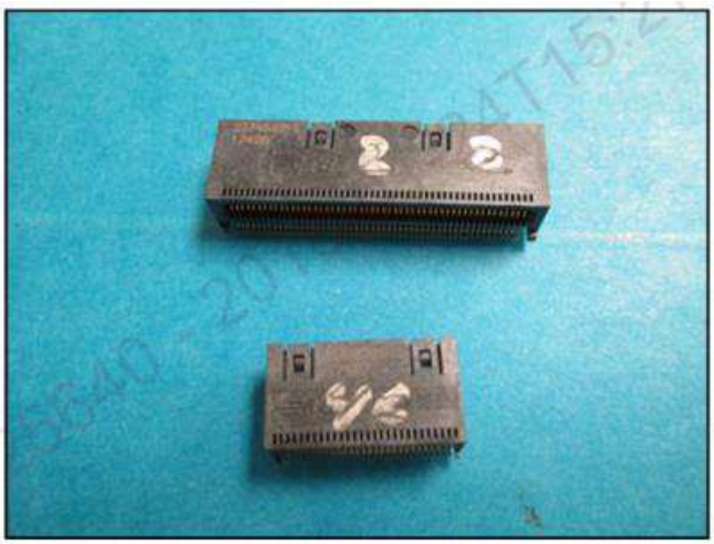


Figure 7 After First Reflow Heat Exposure

2.12 Thermal Shock

No visible damage detrimental to product performance was observed following exposure to 25 cycles of thermal shock.

2.13 Humidity-Temperature Cycling

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

2.14 Temperature Life

No evidence of physical damage to the receptacle was visible following exposure at 105˚C. The receptacle specimen was exposed for 1000 hours total. The plug was changed every 250 cycles.

2.15 Temperature Life (Preconditioning)

No evidence of physical damage to the receptacle was visible following exposure at 90˚C. The mated receptacle specimen was exposed for 360 hours.

2.16 Mixed Flowing Gas

No evidence of physical damage was visible as a result of exposure to mixed flowing gas. Copper corrosion rate (average) @ 17.9*µg/cm^2/day [EIA requirement 12-16].
*Corrosion rate exceeded range, possibly due to NO_2 calibration issue, post-test calibration check of the gas analyzers indicated T500 NO_2 analyzer was measuring ~40 ppb low

2.17 Reseating

No physical damage detrimental to product performance was observed following reseating.

2.18 Cage Compliant Pin Insertion Force

The cage press fit insertion force summary results are shown in Table 9 through Table 12.

Table 9 – CFP2 1x1 Cage Press Fit Insertion Force Results (N)

	Cage Press Fit Insertion Force	Per Pin 18 Pins
Minimum	621.23	34.51
Maximum	824.22	45.79
Mean	722.28	40.13
Std. Dev.	83.05	4.61
N	4	4

Table 10 – CFP2 1x2 Cage Press Fit Insertion Force Results (N)

	Cage Press Fit Insertion Force	Per Pin 32 Pins
Minimum	1048.29	32.76
Maximum	1216.44	38.01
Mean	1132.37	35.39
Std. Dev.	118.90	3.72
N	2	2

Table 11 – CFP4 1x1 Cage Press Fit Insertion Force Results (N)

	Cage Press Fit Insertion Force	Per Pin 15 Pins
Minimum	333.50	22.23
Maximum	429.28	22.65
Mean	362.23	23.10
Std. Dev.	45.01	28.62
N	4	4

Table 12 – CFP4 1x4 Cage Press Fit Insertion Force Results (N)

	Cage Press Fit Insertion Force	Per Pin 49 Pins
Minimum	643.68	13.14
Maximum	662.28	13.52
Mean	652.98	13.33
Std. Dev.	13.15	0.27
N	2	2

2.19 Cage Compliant Pin Extraction Force

The cage press fit extraction force results ae shown in Table 13 through Table 16.

Table 13 – CFP2 1x1 Cage Press Fit Extraction Force Results (N)

	Cage Press Fit Extraction Force	Per Pin 18 Pins
Minimum	630.03	35.00
Maximum	982.36	54.58
Mean	848.27	47.13
Std. Dev.	152.17	8.45
N	4	4

Table 14 – CFP2 1x2 Cage Press Fit Extraction Force Results (N)

	Cage Press Fit Extraction Force	Per Pin 32 Pins
Minimum	716.65	22.40
Maximum	884.45	27.64
Mean	800.55	25.02
Std. Dev.	118.66	3.71
N	2	2

Table 15 – CFP4 1x1 Cage Press Fit Extraction Force Results (N)

	Cage Press Fit Extraction Force	Per Pin 15 Pins
Minimum	328.77	21.92
Maximum	490.68	32.71
Mean	397.59	26.51
Std. Dev.	68.24	4.55
N	4	4

Table 16 – CFP4 1x4 Cage Press Fit Extraction Force Results (N)

	Cage Press Fit Extraction Force	Per Pin 49 Pins
Minimum	555.49	11.34
Maximum	623.31	12.72
Mean	589.40	12.03
Std. Dev.	47.96	0.98
N	2	2

2.19 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

Specimens were visually examined with the unaided eye for signs of physical damage detrimental to product performance. Testing was performed in accordance with EIA-364-18 Rev B.

3.2 Low Level Contact Resistance

Low level contact resistance measurements at low level current were made using the four-terminal measuring technique. The test current was maintained at 100 milliamperes maximum with a 20-millivolt maximum open circuit voltage. Positive current and positive voltage was applied to the paddle card bus. Negative current and negative voltage probes were applied vie the discrete headers of the printed circuit board. Mated specimens were seated an additional 0.13mm from the latching position of TE fabricated test modules and held in place by the vibration fixture with the card stop in place. See Figure 15. Testing was performed in accordance with EIA-364-23 Rev C.

3.3 Insulation Resistance

Insulation resistance was measured between adjacent signal contacts of mated specimens. A test voltage of 300 volts DC was applied for two minutes before the resistance was measured. Testing was performed in accordance with EIA-364-21 Rev E.

3.4 Withstanding Voltage

A test potential of 300 volts AC was applied between adjacent contacts, signal to signal and signal to ground, of mated specimens. A total of 64 positions were tested. This potential was applied for one minute and then returned to zero. Testing was performed in accordance with EIA 364-20 Rev E, Condition 1.

3.5 Vibration, Random

3.5.1 Customer Requested Parameters

The test specimens were subjected to a random vibration test in accordance with specification EIA-364-28 rev F, test condition “V”, test condition letter “C”. The card stop test fixture was used as part of the vibration test setup. 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 0.015 G^2/Hz. The spectrum slopes up at 6dB per octave to a PSD of 0.06 G^2/Hz at 100 Hz. The spectrum is flat at the upper bound frequency of 2000 Hz. The root-mean square amplitude of the excitation was 9.26 GRMS. The test specimens were subjected to this test for 2 hours in each of the three mutually perpendicular axes, for a total test time of 6 hours per test specimen. The test specimens were monitored for discontinuities of 1 microsecond or greater using an energizing current of 100 milliamperes. Refer to Figure 6 for images of the typical test setup.

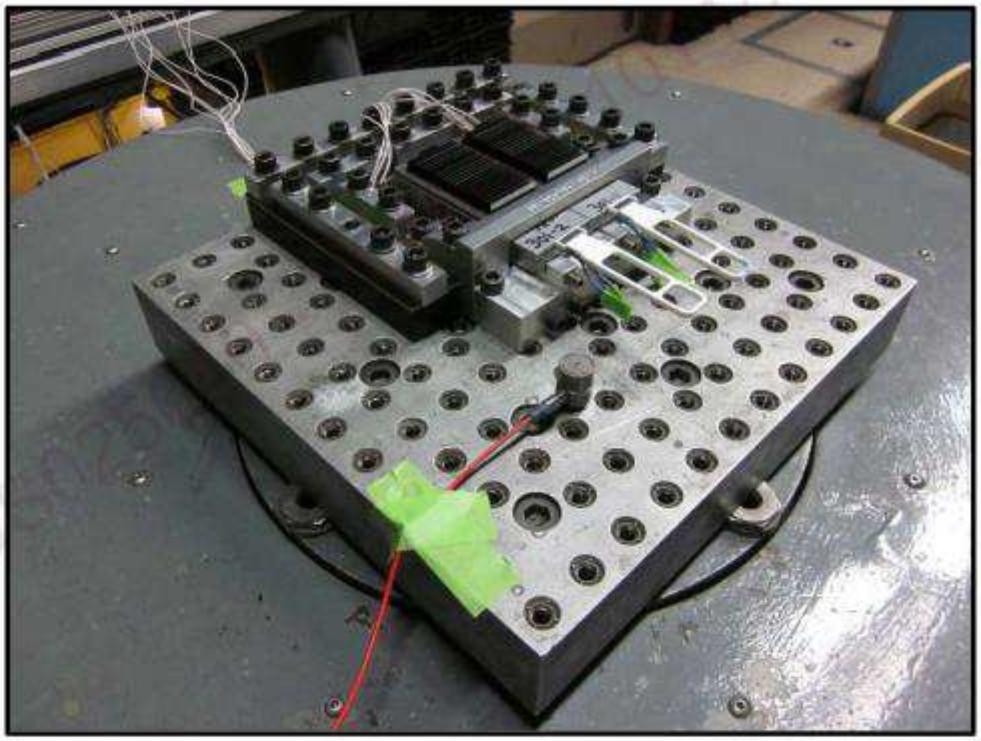


Figure 6 Vibration Setup Typical

3.5.2 Per Product Specification Parameters

The test specimens were subjected to a random vibration test as stated in TE Connectivity Specification 108-32103, in accordance with specification EIA-364-28 Rev F, test condition VII, test condition letter D. The card stop test fixture was used as part of the vibration test setup. The parameters of this test condition are specified by a random vibration spectrum with excitation frequency bounds of 20 and 500 Hertz (Hz). The spectrum remains flat at 0.02 G2/Hz from 20 Hz to the upper bound frequency of 500 Hz. The root-mean square amplitude of the excitation was 3.10 GRMS. The test specimens were subjected to this test for 15 minutes in each of the three mutually perpendicular axes, for a total test time of 45 minutes per test specimen. The test specimens were monitored for discontinuities of 1 microsecond or greater using an energizing current of 100 milliamperes.

3.6 Mechanical Shock

The test specimens were subjected to a mechanical shock test in accordance with specification EIA-364-27 Rev C, test condition “A”. The card stop test fixture was used as part of the shock test setup. See Figure 7 for shock setup photographs. The parameters of this test condition are a half-sine waveform with an acceleration amplitude of 50 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.

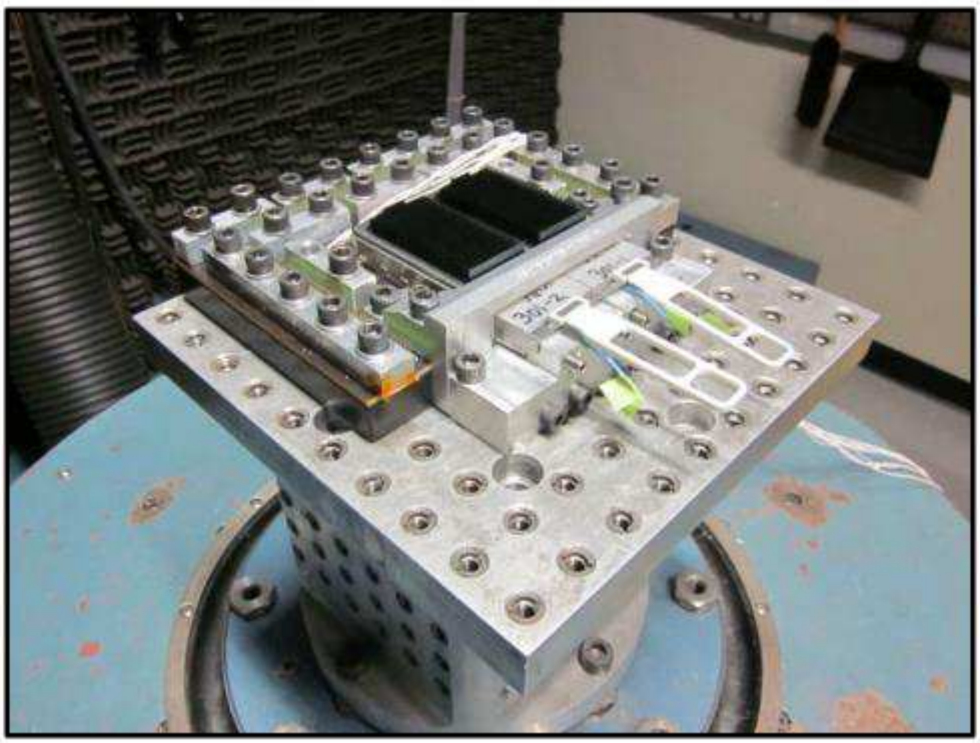


Figure 7 Mechanical Shock Setup Typical

3.7 Durability

Specimens were mated and unmated by hand for 200 cycles. Testing was conducted in accordance with EIA-364-9C.

3.8 Module Mating Force

The receptacle assembly mounted to the test circuit board was held vertically in a vise mounted to the base of the tensile compression device. The transceiver module was placed in the cage assembly. A probe was placed on top and held in a Jacob's chuck attached to the moveable crosshead of the tensile compression device. The crosshead was actuated in a downward direction at a rate of 0.5 inches per minute until the connector was mated. The maximum force was recorded. Refer to Figure 8 for images of the typical test setup. Testing was performed in accordance with EIA-364-13 Rev E.

Figure 8 – Transceiver Insertion Force Test Setup

3.9 Module Unmating Force

Test was not performed due to problems with the TE fabricated module.

3.10 Solderability

3.10.1 Steam Age Pre-Conditioning

The specimens were suspended in a closed container, 2 inches above boiling de-ionized water using a stainless-steel holder. The specimen surfaces were exposed to this steam environment for 8 hours. Placement was in a manner that none of the specimens touched each other or overlapped in any way, and they were at least 10 millimeters from the walls of the unit. Within 72 hours the specimens were subjected to Solderability testing as described in paragraph 3.8.2. See Figure 9 for a photograph of the specimens in the steam age unit prior to closing the lid.

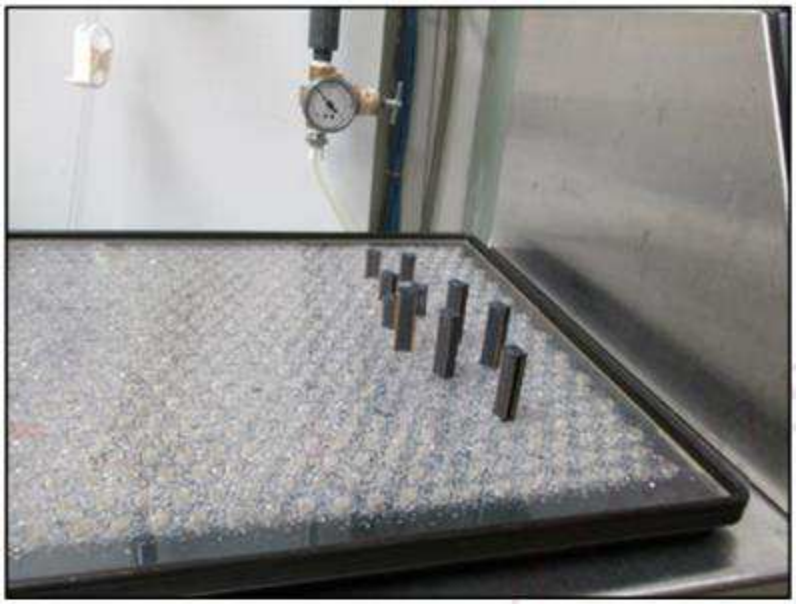


Figure 9 Test Specimens in Steam Age Unit

3.10.2 Solder Testing

Prior to testing, specimens were prepared by removing the locating studs. This was done to enable the specimens to sit flush on the ceramic substrate. A solder paste with a composition of 96.5% Sn, 3.0% Ag, 0.5% Cu (SAC305), RMA, with a mesh of -325 +500 was then placed onto a stencil with pad geometry, opening and thickness that was appropriate for the specimens being tested. The stencil was supplied with the specimens. The solder paste was printed onto a 4x6 inch ceramic substrate. The screen was removed and the specimens were placed onto the solder paste print under appropriate magnification. Care was taken to ensure that the specimens were not contaminated in any way and were tested in the “as received” condition. The specimens and ceramic substrate were placed on a conveyor belt through a convection oven. The specimens were exposed to 60-120 seconds between the temperatures of 150˚C and 180˚C and to 30-60 seconds between the temperatures of 230˚ and 260˚C as specified in J-STD-002. The temperature on the ceramic substrate, at a point close to the specimen was monitored to enable temperature profiling. All specimens were examined using a microscope for solder wetting. Figure 10 illustrates the temperature profile. Figure 11 is a photograph of the connector in solder paste.

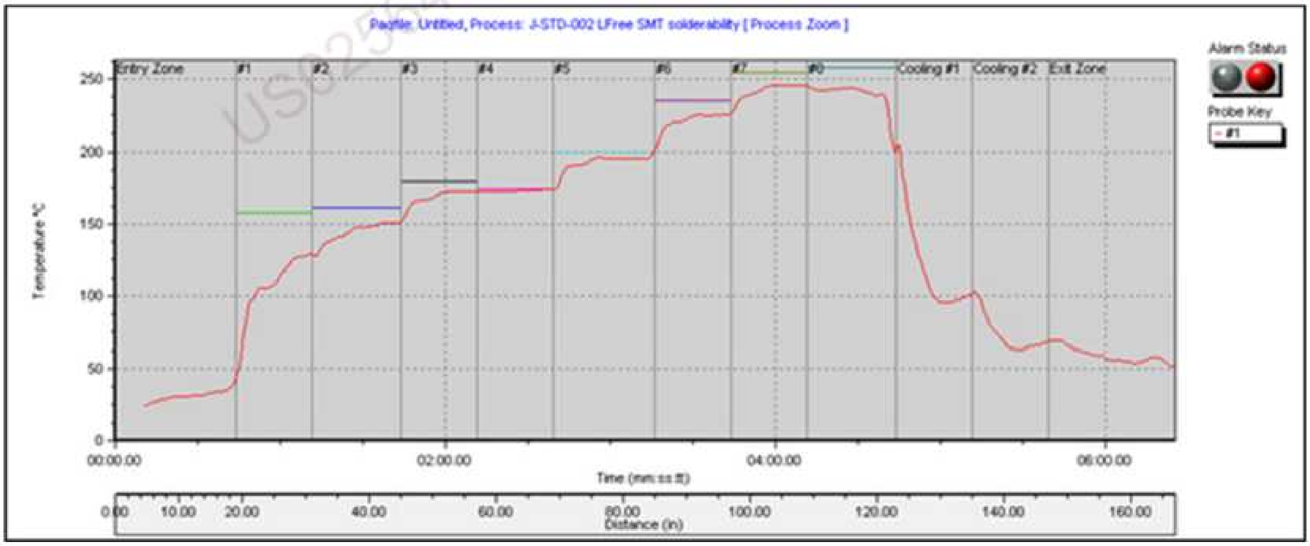


Figure 10 Temperature Profile

Figure 11 Specimen in Solder Paste

3.11 Component Heat Resistance to Lead Free Reflow Soldering Testing

3.11.1 Moisture Soak

Specimens were placed in a clean, dry shallow container in such a manner that they did not overlap or touch and were exposed to 85˚C at 85% relative humidity for 168 hours. Within 15 minutes to 4 hours after removal from the moisture soak, the specimens were subjected to the heat exposure described below.

3.11.2 Reflow Exposure

The specimens were placed on 4 x 6 x 0.0395-inch ceramic substrates and placed on a conveyor belt through a convection air oven. The specimens were exposed to temperatures between 150˚C and 200˚C for 60 to 180 seconds and between the temperatures of 255˚C and 260˚C for 20 to 40 seconds and above liquidus (217˚C) for 60 to 150 seconds as specified in specification TEC-109-201. The temperature on top of the specimen was monitored to enable temperature profiling. Figure 12 is the temperature profile and Figure 13 shows the reflow results. Thermocouple #1 was placed on the top of the component and thermocouple #2 was in the contact area on the ceramic substrate. The specimens and substrates were allowed to cool to ambient temperatures and then run back through the oven a total of 3 times.

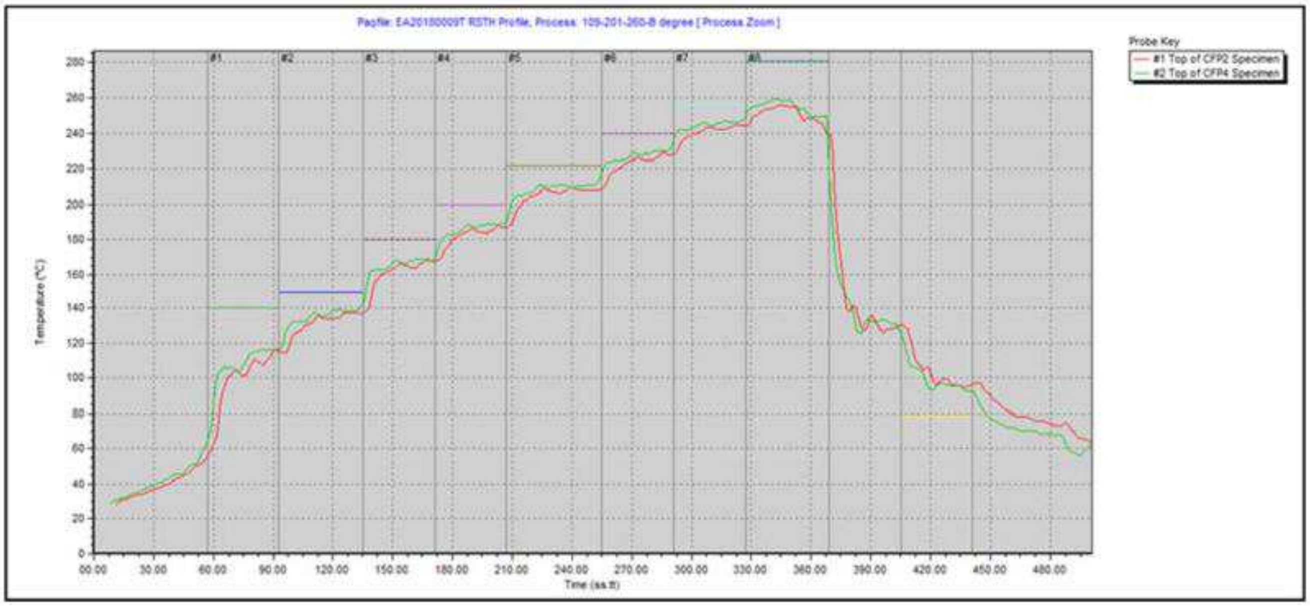
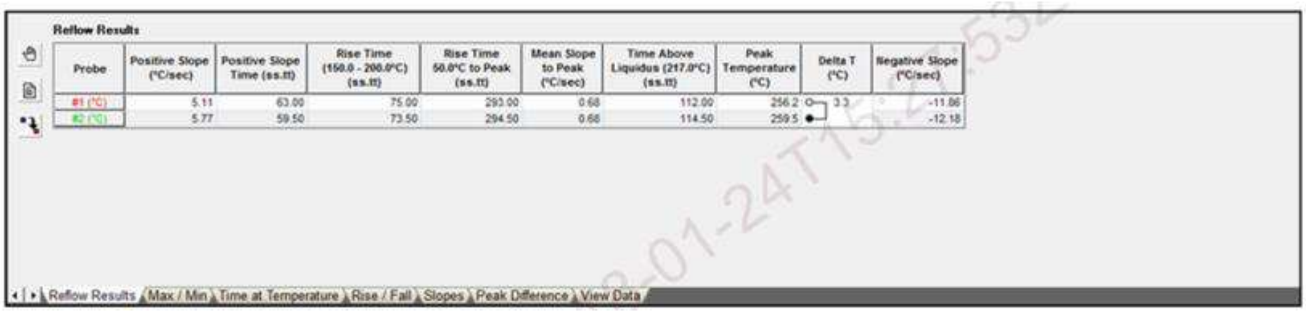


Figure 12 Temperature Profile



Reflow Results

Probe	Positive Slope (°C/sec)	Positive Slope Time (ss.tt)	Rise Time (150.0 - 200.0°C) (ss.tt)	Rise Time 50.0°C to Peak (ss.tt)	Mean Slope to Peak (°C/sec)	Time Above Liquidus (217.0°C) (ss.tt)	Peak Temperature (°C)	Delta T (°C)	Negative Slope (°C/sec)
#1 (°C)	5.11	63.00	75.00	293.00	0.68	112.00	256.2	3.3	-11.86
#2 (°C)	5.77	59.50	73.50	294.50	0.68	114.50	259.5		-12.18

Figure 13 Reflow Results

3.12 Thermal Shock

Mated specimens were subjected to 25 cycles of thermal shock with each cycle consisting of 30 minute dwells at -55 and 105˚C. The transition between temperatures was less than one minute. Testing was done in accordance with EIA 364-32 Rev G, Method A, Test Condition VII.

3.13 Humidity-Temperature Cycling

Mated specimens were exposed to 10 cycles (10 days) of humidity-temperature cycling. Each cycle lasted 24 hours and consisted of cycling the temperature between 25˚C and 65˚C twice while maintaining humidity at 80 to 100% Relative Humidity. (Figure 14). Testing was done in accordance with EIA-364-31 Rev D, Method IV.

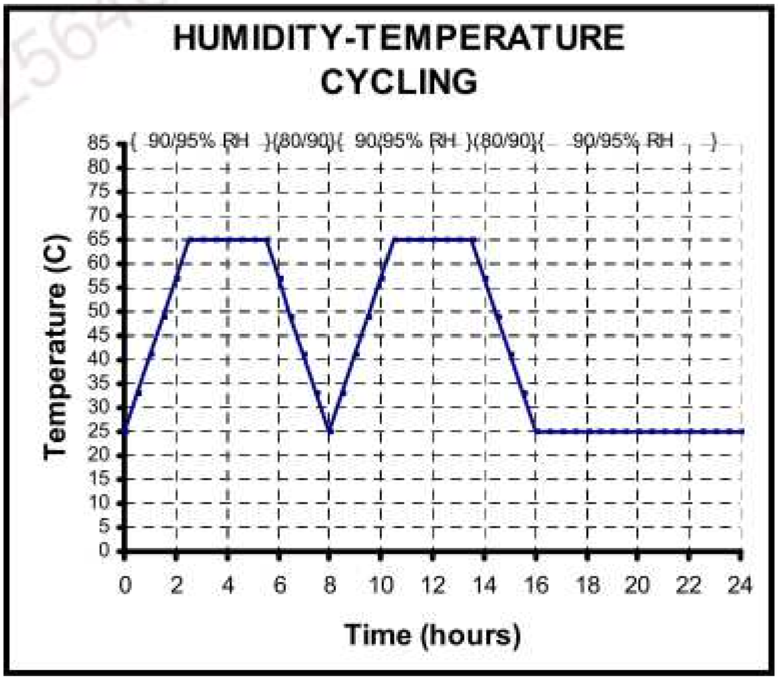


Figure 14-Typical Humidity-Temperature Cycling Profile

3.14 Temperature Life

Mated specimens were exposed to a temperature of 105˚C for 1000 hours. Testing was done in accordance with EIA-364-17, Method A, Condition 4. Every 250 hours the plug assembly was switched with a new specimen. Due to instability with the plug module, mated specimens were seated an additional 0.13mm from the latching position of TE fabricated test modules and held in place by the vibration fixture with the card stop in place. See Figure 15.

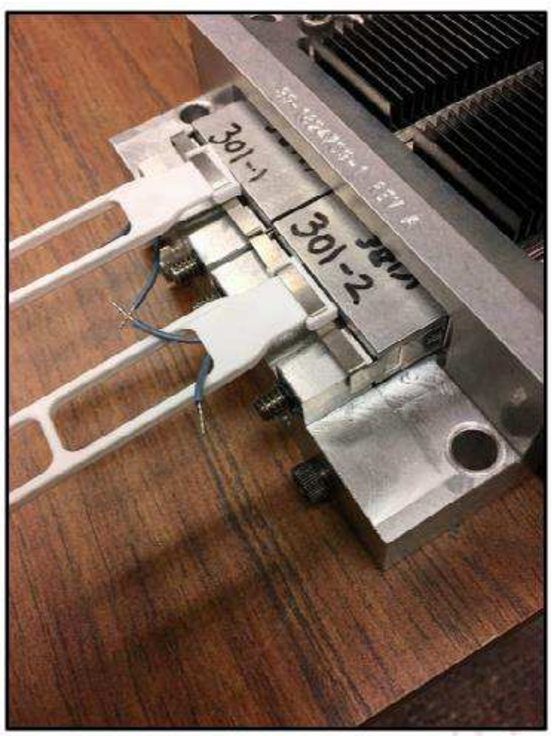


Figure 15 Vibration Fixture with Card Stop

3.15 Mixed Flowing Gas, Class IIA

Specimens were subjected to a 4-gas environment in accordance with EIA 364-65 Rev B, Class IIA for 14 days. One half of the specimens (receptacles only) unmated for 7 days followed by 7 days mated. The remaining one-half of the specimens mated for 14 days. They were removed from the chamber for LLCR measurements at 7 days. Refer to Table 9 for the MFG test parameters.

Table9 – MFG Test Parameters

Environment	IIA
Temperature (˚C)	30±1
Relative Humidity (%)	70±2
Chlorine (Cl_2) Concentration (ppb)	10±3
Hydrogen Sulfide (H_2S) Concentration (ppb)	10±5
Nitrogen Dioxide (NO_2) Concentration (ppb)	200±50
Sulfur Dioxide (SO_2) Concentration (ppb)	100±20
Exposure Period	14 days

3.16 Reseating

The specimens were cycled by hand for 1 cycle.

3.17 Cage Compliant Pin Insertion Force

The test board was placed on the mill table at the base of the tensile compressive device. A cage with the appropriate press fit fixture was placed inside the cage an on top of the cage to properly press the cage on. A flat bottom fixture was attached to the moveable crosshead of the tensile compression device (Figure 16). The crosshead was actuated in a downward direction at 0.5 inches per minute until the cage was inserted. The maximum force was recorded. Testing was performed in accordance with EIA-364-05 Rev B.

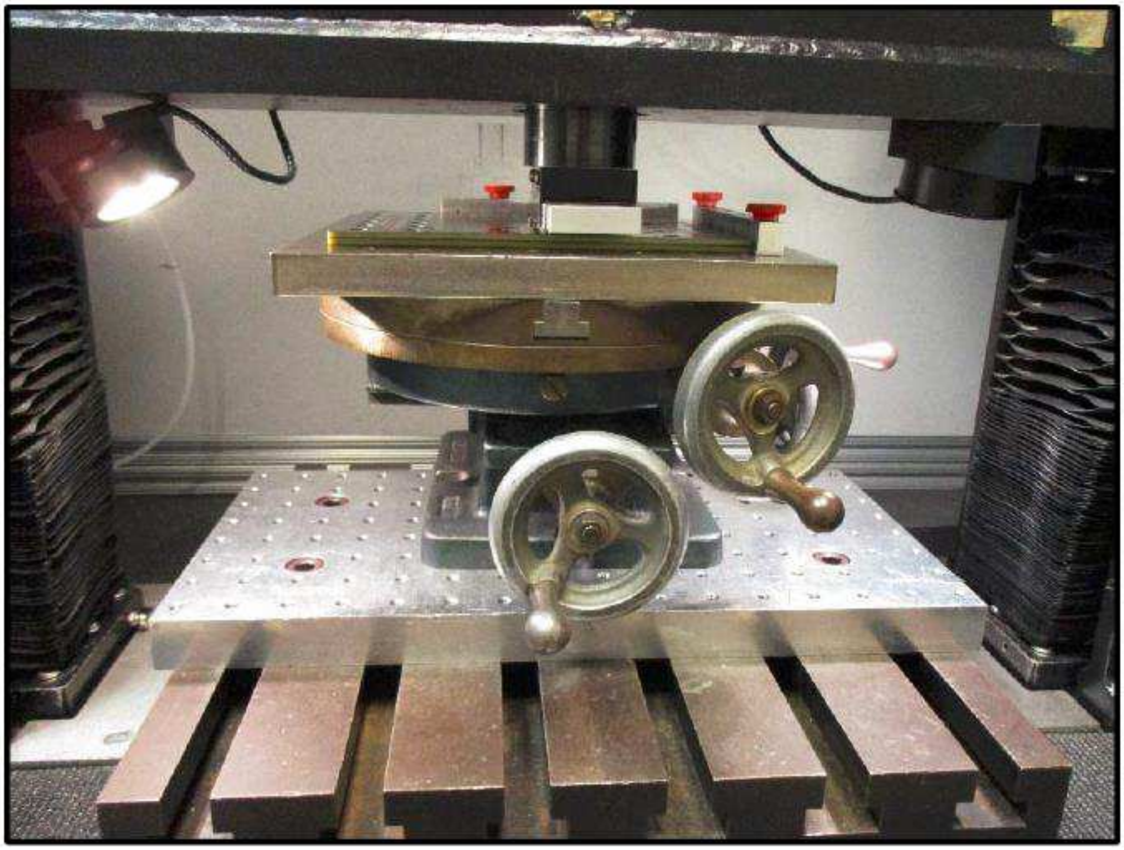


Figure 16 – Cage Compliant Pin Insertion Force Test Setup

3.18 Cage Compliant Pin Extraction Force

A plug housing assembly lid was prepared by drilling a hole in the center. A nut was held in the underside of the lid. A bolt was placed in the nut and attached to a slotted plate. The slotted plate was attached to the moveable crosshead of the tensile compression device. The test board was held to the Mill table at the base of the tensile compression device (Figure 17). The crosshead was actuated in an upward direction at 0.5 inches per minute until the cage was removed from the board. The maximum force was recorded. Testing was performed in accordance with EIA-3640-05 Rev B.

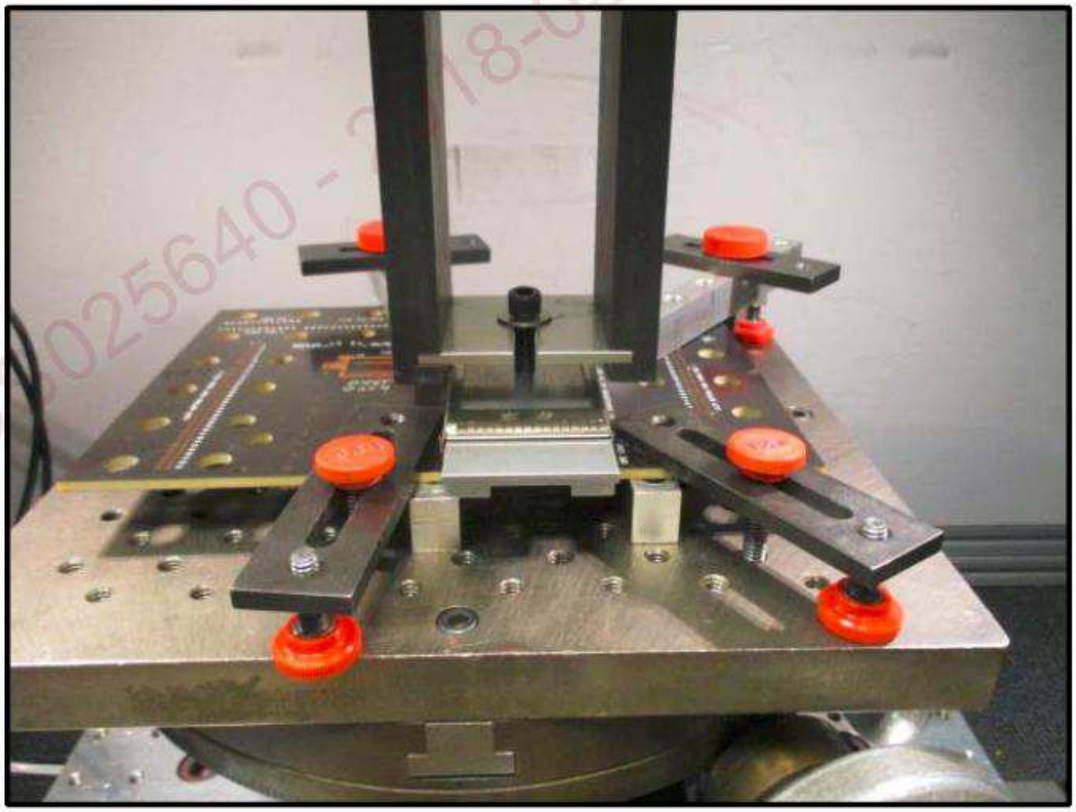


Figure 17 – Cage Compliant Pin Extraction Force Test Setup

3.19 Final Examination of Product

Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed. Testing was performed in accordance with EIA364-18 Rev B.

4.0 Equipment

4.1 Calibration Statement

All test and measurement equipment requiring calibration is calibrated and traceable to the International System of Units (SI).

4.2 Equipment List

Equipment Name	Calibration Number
Weather Station	E9100-2033
Barometric Pressure Transmitter	E9100-2060
Automated LLCR Station	E9100-1455
Automated LLCR Station	E4997-0390
Chamber	E9100-1754, 1985, 1742, 1277, 1545

Oven	E9100-1215, 1216, 1180, 1280, 1874, 1542, 1607
Control Accelerometer	E9100-1878, 1959, 1001
Charge Amplifier	E9100-1243, 1304, 1305, 1962
Vibration Controller	E9100-1306, 1790, 1987
Vibration Table and Amplifier	EM-1029, EM-1104, X0085-045
Discontinuity Monitor	E9100-1928, 1969, 1971, 1708
Channels Monitored	1,2,3,4,6,7,8,9,21,22,23,24
Base Plate	99-466632, 99-466854-1
Test Fixtures	39-1824708-1 Rev A, 39-1824709-1 Rev A, 39-1824713-1 Rev A, 39-1824714-1 Rev A
Card Stop Fixture	39-1937557-1
Cube	39-468210
Clamping Bars	N/A
Dielectric Analyzer	E9100-1754
Load Frame	E9100-1722, 1505
Load Cell	E9100-1749, 2072, 1726
Scale	E4997-0471
Teledyne API Model T700 Dynamic Gas Dilution Calibrator	E9100-1844
DataPaq Temperature Acquisition	E9100-1853
Temp/Humidity Indicator	E9100-2066
Valsala Temp/Humidity Transmitter HMT 330	E9100-1841
Steam Age Unit	E9100-1670
Stencil P/N 61-1824772-1 Rev A	N/A
Mettler Model XP56	E9100-1872
Cl_2 (Air Sentry II IMS Monitor, S/N: 67629)	N/A*
Cl_2 (Air Sentry II IMS Monitor, S/N: 67632)	N/A*
SO_2 & H_2S (Teledyne API Model T101, S/N 381	N/A*
NO_2 (Teledyne API Model T500U, S/N 135	N/A*

*Gas Analyzer verified before each use per appropriate primary gas standard (Teledyne API T700)