# 400 Form-Factor Pluggable (CDFP) Receptacle Connectors

## 1. INTRODUCTION

### 1.1 Purpose

Testing was performed on the TE Connectivity 400 Form-Factor Pluggable (CDFP) Receptacle to determine its conformance to the requirements of Product Specification 108-32065, Rev. C.

### 1.2 Scope

This report covers the electrical, mechanical, and environmental performance of the TE Connectivity 400 Form-Factor Pluggable (CDFP) Receptacle. Testing was performed at the Harrisburg Electrical Components Test Laboratory between February 10, 2015 and April 4, 2015 and is on file as EA20140458T Rev A.

### 1.3 Conclusion

The TE Connectivity 400 Form-Factor Pluggable (CDFP) Receptacle listed in paragraph 1.5 conformed to the electrical, mechanical and environmental performance requirements of Product Specification 108-32065, Rev C.

### 1.4 Product Description

The assembly features alignment posts and fasteners for mechanical retention to the pc board and to provide electromagnetic interference (EMI) suppression, panel ground features (panel ground Type 2 springs and Type 1 elastomeric gasket) to provide electrical contact to the bezel. In addition, the assembly has a locking latch and orientation keying for each mating module. The CDFP Connector Assembly is designed to be inserted into a bezel after being seated onto the pc board.

The connector consists of a housing with 120-position receptacle contacts and compliant pin contacts on 0.8 mm centerline spacing. The housing features alignment posts that provide stability for placement on the pc board. Each receptacle port has two card slots that accept a 1.0 ±0.1 mm thick integrated circuit card housed in the mating module.

### 1.5 Test Specimens

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

**Table 1 – Specimen Identification**

| Test Set | Quantity | Part Number | Description |
|---|---|---|---|
| 1, 2, 3, 4, 5, 6 | 4 each | 2274233-1 | Receptacle, Type 2, CDFP |
| | | 60-1824552-1 | CDFP Receptacle Test PCB |
| 1, 2, 3, 4, 5, 6 | 4 each | N/A | Plug, CDFP |
| | | 60-1824553-1 | CDFP Plug Test PCB, Upper |
| | | 60-1824554-1 | CDFP Plug Test PCB, Lower |

## 1.6 Qualification Test Sequence

The specimens identified in paragraph 1.4, Table 1 were subjected to the sequences listed in Table 2.

**Table 2 – Test Sequence**

| Test or Examination | Test Sets | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| | **Test Groups** | | | | | |
| | 1 | 2 | 3 | 4 | 5 | 6 |
| | **Test Sequence(a)** | | | | | |
| Initial Examination of Product | 1 | 1 | 1 | 1 | 1 | 1 |
| LLCR | 4(d), 6(d), 8(e), 11(d) | 2(d), 5(d) | 2(d), 5(d) | | | |
| Insulation Resistance | | | | 2,6 | | |
| Withstanding Voltage | | | | 3,7 | | |
| Random Vibration | 9 | | | | | |
| Mechanical Shock | 10 | | | | | |
| Durability, 100 Cycles Total | 7(b) | | | | | |
| Durability, Module, 50 Cycles | | | | | | 6(c), 11(c) |
| Mating Force | 2,13 | | | | | |
| Unmating Force | 3,12 | | | | | |
| Retention, Axial | | | | | | 2, 7, 12 |
| Retention, Perpendicular | | | | | | 3, 8, 13 |
| Latch Strength | | | | | | 4, 9, 14 |
| Cage Retention | | | | | | 5, 10 |
| Press-Fit Insertion Force | | | | | 2 | |
| Press-Fit Extraction Force | | | | | 3 | |
| Thermal Shock | | 3(f) | | 4 | | |
| Humidity – Temp Cycling | | 4 | | 5 | | |
| Temperature Life | 5 | | | | | |
| Mixed Flowing Gas | | | 3(d) | | | |
| Thermal Disturbance | | | 4 | | | |
| Final Examination of Product | 14 | 6 | 6 | 8 | 4 | 15 |

(a) The numbers indicate sequence in which tests were performed.
(b) Mate and unmate specimens for 40 cycles, measure LLCR (baseline), change transceivers and mate unmate for an additional 50 cycles.
(c) Precondition specimens with 25 durability cycles with latches engaged.
(d) Precondition specimens with 5 durability cycles with latches disengaged.
(e) Measure using original transceiver.
(f) Precondition specimens with 25 durability cycles with latches disengaged.

## 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 - Groups 1,2,3

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 20 milliohms after testing.

| Test Group | Number of Data points | Condition | Low Level Contact Resistance Min | Max | Mean |
|---|---|---|---|---|---|
| 1 | 320 | Initial | 28.04 | 67.78 | 48.43 |
| | 320 | After Mechanical (ΔR) | -3.64 | 5.76 | 0.59 |
| 2 | 320 | Initial | 28.11 | 67.54 | 48.52 |
| | 320 | After Temp Humidity (ΔR) | -6.43 | 2.97 | 0.74 |
| 3 | 320 | Initial | 27.87 | 67.66 | 48.45 |
| | 320 | After Mixed Gas (ΔR) | -10.03 | 12.34 | 0.44 |

All values in milliohms

### 2.3 Insulation Resistance - Group 4

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

### 2.4 Dielectric Withstanding Voltage - Group 4

No dielectric breakdown or flashover occurred.

### 2.5 Vibration - Group 1

No discontinuities were detected during vibration. Following vibration, no cracks, breaks, or loose parts on the specimens were visible.

### 2.6 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. The pulse velocity change was 79.3 inches/second.

### 2.7 Durability - Group 1

No physical damage occurred to the specimens as a result of mating and unmating the specimens 100 times.

### 2.8 Durability, 50 Cycles – Group 6

No physical damage occurred to the specimens as a result of mating and unmating the specimens 50 times.

### 2.9 Mating Force - Group 1

All mating force measurements were less than 150 N [33.7 lbf].

### 2.10 Unmating Force - Group 1

All unmating force measurements were less than 75 N [16.9 lbf].

### 2.11 Retention, Axial - Group 6

No damage detrimental to product performance was visible due to axial retention testing. The plug did not unmate from the receptacle.

### 2.12 Retention, Perpendicular - Group 6

No damage detrimental to product performance was visible due to perpendicular retention testing. The plug did not unmate from the receptacle.

### 2.13 Latch Strength - Group 6

No damage detrimental to product performance was visible due to latch strength testing. The plug did not unmate from the receptacle.

### 2.14 Cage Retention - Group 6

No damage detrimental to product performance was visible due to cage retention testing.

### 2.15 Press-Fit Insertion Force - Group 5

The per pin force was obtained by dividing the connector force by 140. For specimen 1 and specimen 2 the connector force was divided by 138. All forces were below the maximum requirement of 24.5 N [5.5 lbf] per pin.

### 2.16 Press-Fit Extraction Force - Group 5

All forces were above the minimum requirement of 93.4 N [21.0 lbf].

### 2.17 Thermal Shock - Groups 2, 4

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

### 2.18 Humidity-Temperature Cycling - Groups 2, 4

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

### 2.19 Temperature Life - Group 1

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

### 2.20 Mixed Flowing Gas - Group 3

No evidence of physical damage was visible as a result of exposure to the pollutants of mixed flowing gas. The average copper corrosion rate was 22 $\mu g/cm^2/day$.

### 2.21 Thermal Disturbance - Group 3

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

### 2.22 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 Low Level Contact Resistance

Low level contact resistance measurements at low level current 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. The positive current and positive voltage leads were connected to the access header on the receptacle test PCB and the negative current and negative voltage leads were connected to the test PCB inside of the test plug assembly.

### 3.3 Insulation Resistance

Insulation resistance was measured between adjacent contacts of unmated specimens. A test voltage of 500 volts DC was applied for two minutes before the resistance was measured.

### 3.4 Dielectric Withstanding Voltage

A test potential of 300 volts AC was applied between the adjacent contacts of unmated specimens. This potential was applied for one minute and then returned to zero.

## 3.5 Random Vibration

The test specimens were subjected to a random vibration test as stated in TE Connectivity Specification 108-32065, Rev. B, in accordance with specification EIA-364-28F, test condition "VII", test condition letter "D". See Figure 1 for vibration setup photographs. 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 $G^2/Hz$ 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.

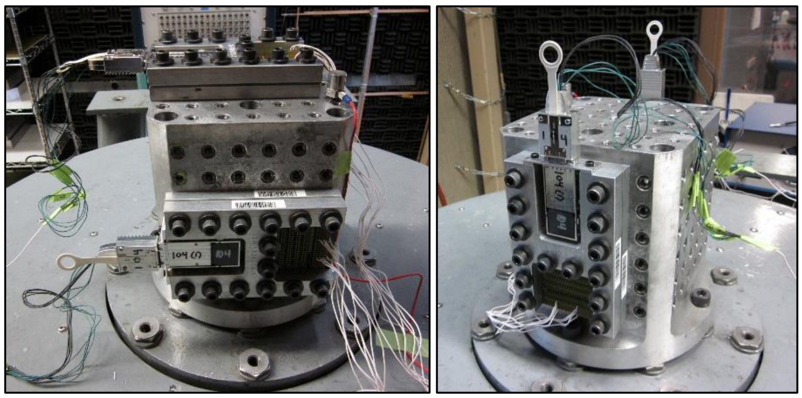

**Figure 1 – Typical Vibration and Mechanical Shock Test Setup**

## 3.6 Mechanical Shock

The test specimens were subjected to a mechanical shock test as stated in TE Connectivity Specification 108-32065, Rev. B, in accordance with specification EIA-364-27C, test condition "H". See Figure 1 above 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.

## 3.7 Durability, 100 Cycles Total

Specimens were mated and unmated 100 times at a maximum rate of 300 cycles per hour with the latches disengaged.

## 3.8 Durability, 50 Cycles

Specimens were mated and unmated 50 times at a maximum rate of 300 cycles per hour with the latches disengaged.

## 3.9 Mating Force

The PCB was bolted to a 90° fixture attached to a free floating x/y table. The x/y table was attached to the base of the tensile/compression machine. The plug specimen was manually started into the cage. A slotted plate fixture was attached to the movable crosshead of the tensile/compression machine and manually aligned with the plug. Force was applied in a downward direction at a rate of 0.25 in/min until the plug was fully mated to the receptacle. The latches were disengaged during testing. Refer to Figure 2 for images of the typical test setup.

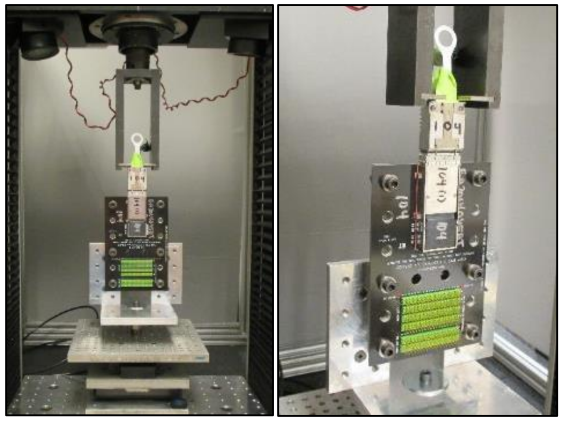


**Figure 2 – Typical Mating Force Test Setup**

### 3.10 Unmating Force

The PCB was bolted to a 90° fixture attached to a free floating x/y table. The x/y table was attached to the base of the tensile/compression machine. The plug was clamped in a parallel vise attached to the movable crosshead of the tensile/compression machine. Force was applied in an upward direction at a rate of 0.25 in/min until the plug was fully unmated from the receptacle. The latches were disengaged during testing. Refer to Figure 3 for images of the typical test setup.

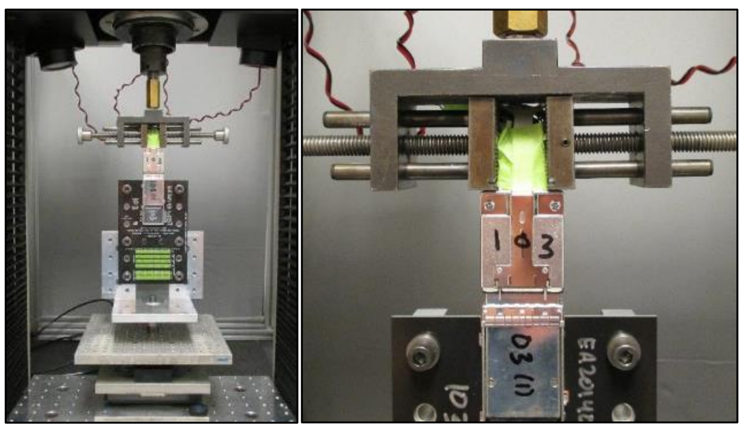


**Figure 3 – Typical Unmating Force Test Setup**

### 3.11 Retention, Axial

The PCB was bolted to a 90° fixture attached to a free floating x/y table. The x/y table was attached to the base of the tensile/compression machine. The plug was clamped in a parallel vise attached to the movable crosshead of the tensile/compression machine. Force was applied in an upward direction at a rate of 0.25 in/min until 90 Newtons was achieved and held for 10 seconds, then returned to the starting position. The latches were engaged during testing and the cage retention screws were installed. Refer to Figure 4 for images of the typical test setup.

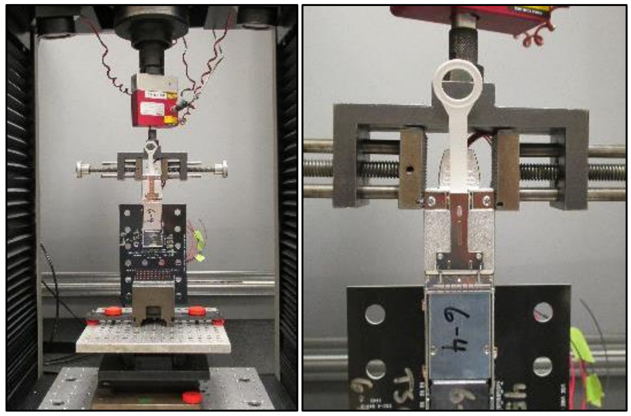

**Figure 4 – Typical Axial Retention Test Setup**

### 3.12 Retention, Perpendicular

The PCB was held in a vise attached to a free floating x/y table. The x/y table was attached to the base of the tensile/compression machine. The plug was clamped in a parallel vise attached to the movable crosshead of the tensile/compression machine. Force was applied in an upward direction at a rate of 0.25 in/min until 45 Newtons was achieved and held for 10 seconds, then returned to the starting position. The latches were engaged during testing and the cage retention screws were installed. The force was applied in all four perpendicular directions. Refer to Figure 5 for images of the typical test setup.

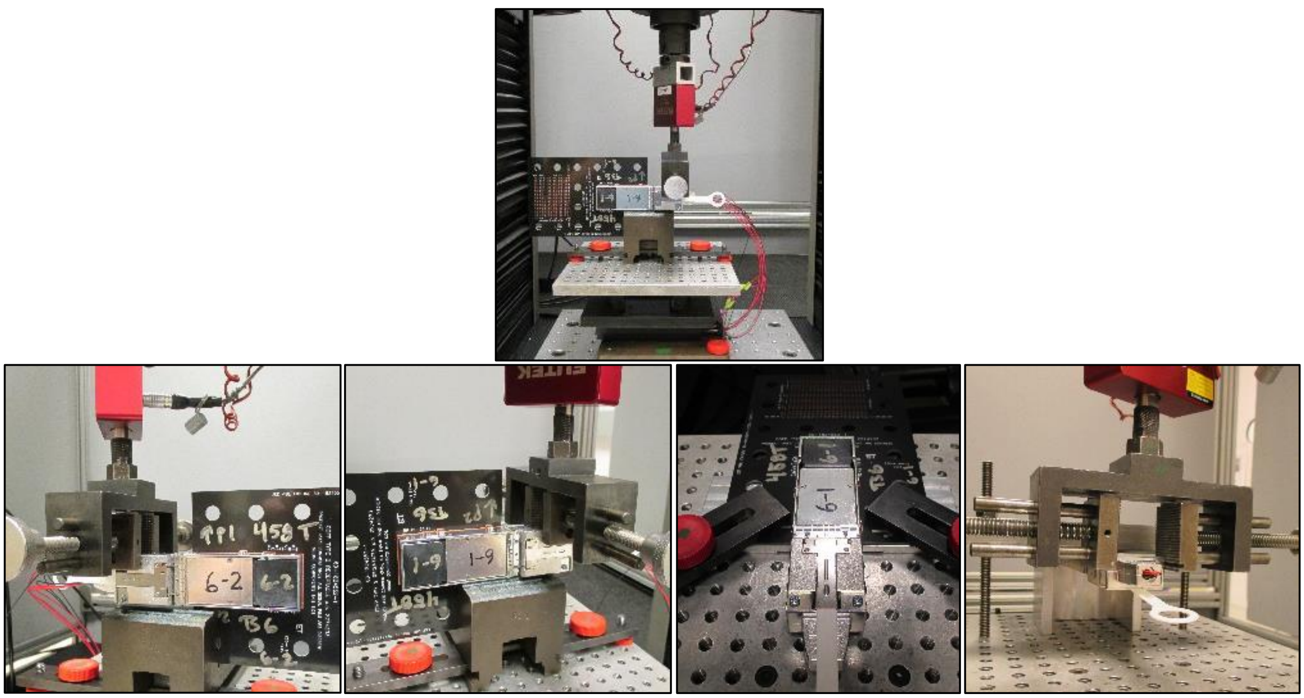

**Figure 5 – Typical Perpendicular Retention Test Setup**

### 3.13 Latch Strength

The PCB was held in a vise attached to a free floating x/y table. The x/y table was attached to the base of the tensile/compression machine. The plug was clamped in a parallel vise attached to the movable crosshead of the tensile/compression machine. Force was applied in an upward direction at a rate of 0.25 in/min until 100 Newtons was achieved and held for 10 seconds, then returned to the starting position. The latches were engaged during testing and the cage retention screws were installed. Refer to Figure 6 for images of the typical test setup.

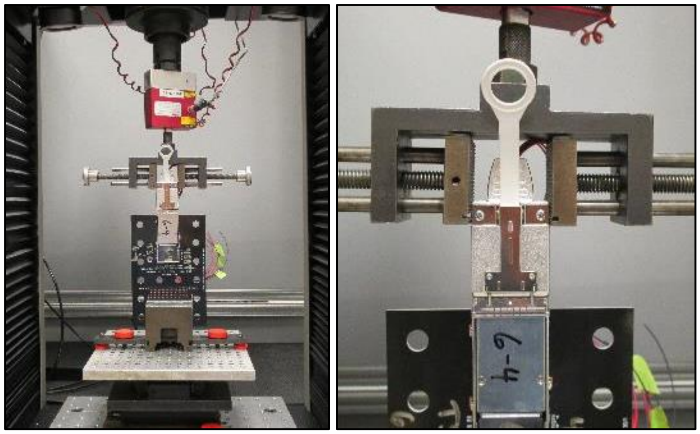

**Figure 6 – Typical Latch Strength Test Setup**

### 3.14 Cage Retention

The PCB was clamped to a free floating x/y table. The x/y table was attached to the base of the tensile/compression machine. The cage was clamped in a parallel vise attached to the movable crosshead of the tensile/compression machine. Force was applied in an upward direction at a rate of 0.25 in/min until 114 Newtons was achieved and held for 10 seconds, then returned to the starting position. The cage retention screws were installed during testing. Refer to Figure 7 for images of the typical test setup.

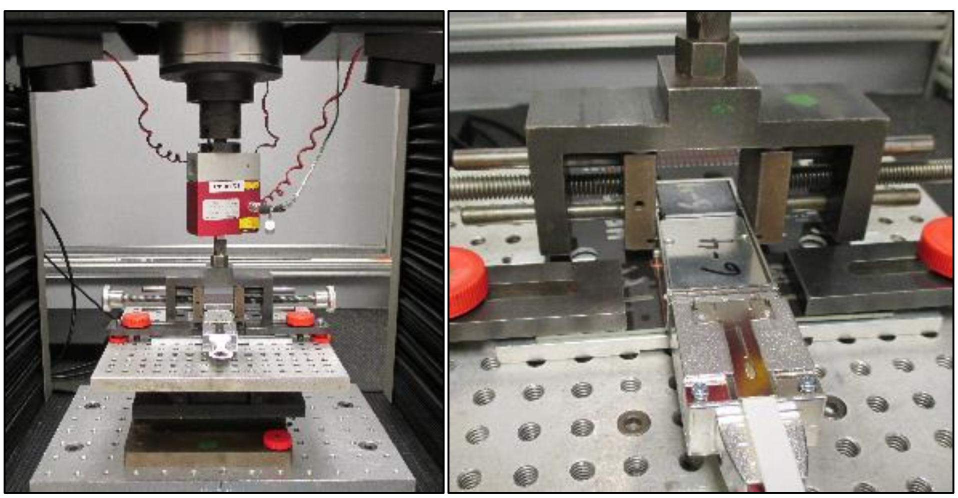

**Figure 7 – Typical Cage Retention Test Setup**

### 3.15 Press-Fit Insertion Force

The compliant pin tails were started into the plated through holes of the test PCB. Several compliant pins on each specimen had to be manually aligned. The PCB was placed on a mill table attached to the base of the tensile/compression machine. A second PCB was placed underneath to prevent the alignment pins from stubbing on the mill table. A requester supplied fixture was placed on top of the specimen. A probe was attached to the moveable crosshead of the tensile/compression machine and manually aligned with the specimen. Force was applied in a downward direction at a rate of 0.2 inches/minute until the specimen was fully seated to the PCB. Refer to Figure 8 for an image of the typical test setup.

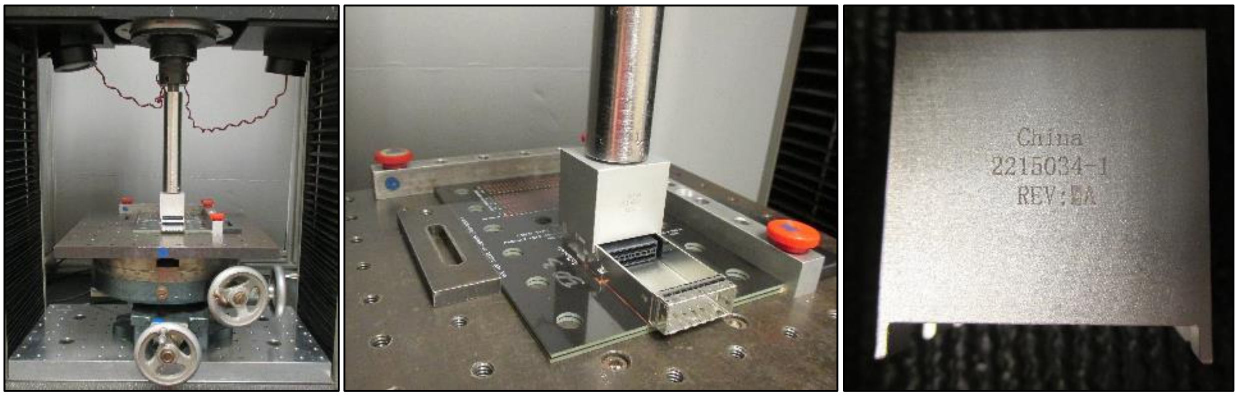


**Figure 8 – Typical Press-Fit Insertion Force Test Setup**

### 3.16 Press-Fit Extraction Force

The PCB was clamped to a mill table attached to the base of the tensile/compression machine. A requester supplied fixture was inserted into the specimen and clamped in a drill chuck attached to the moveable crosshead of the tensile/compression machine. Force was applied in an upward direction at a rate of 0.2 in/min until the specimen was removed from the PCB. Refer to Figure 9 for images of the typical test setup.

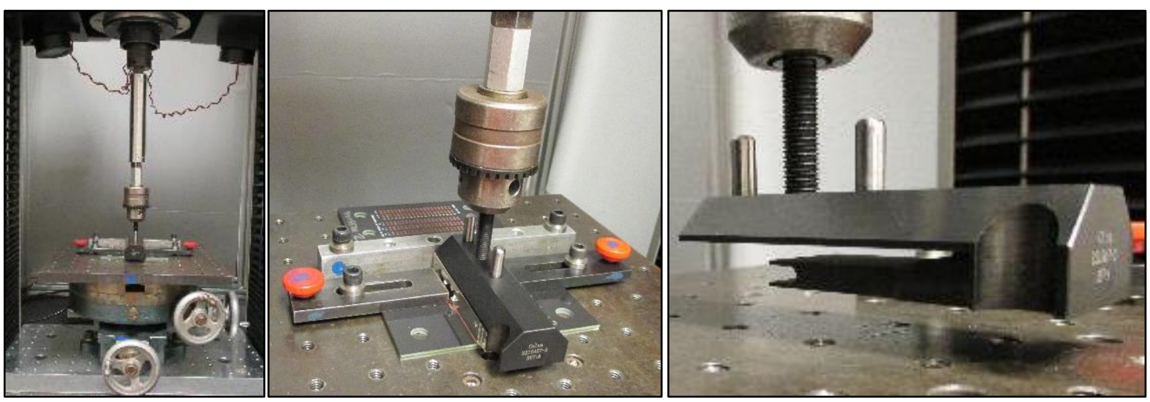

**Figure 9 – Typical Press-Fit Extraction Test Setup**

### 3.17 Thermal Shock

Unmated specimens were subjected to 10 cycles of thermal shock with each cycle consisting of 30 minute dwells at -55 and 85°C. The transition between temperatures was less than one minute.

### 3.18 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. Refer to Figure 10 for an illustration of the profile.

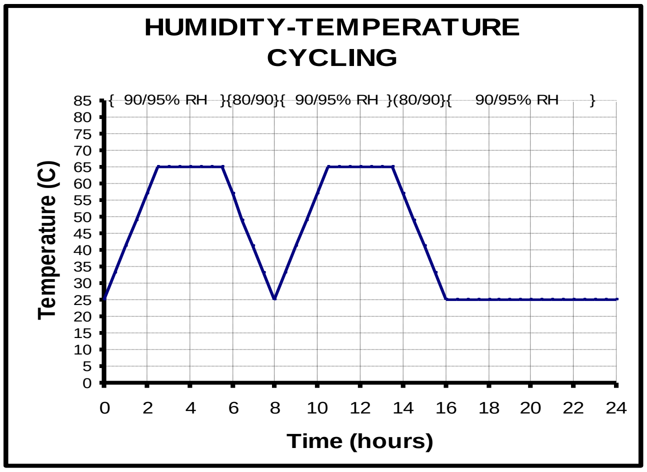


**Figure 10 – Typical Humidity-Temperature Cycling Profile**

### 3.19 Temperature Life

Mated specimens were exposed to a temperature of 85°C for 500 hours.

### 3.20 Mixed Flowing Gas, Class IIA

All specimens were subjected to a 4 gas environment in accordance with EIA-364-65B, Class IIA. An exception was taken as the time the coupons were placed in the chamber was allowed to be 2-7 days per IEC 68-2-60 and Bellcore GR-1217-CORE. The test parameters are listed in Table 10. The connectors were exposed for 20 days total, ten days unmated with only receptacle exposed followed by ten days of mated exposure.

**Table 10 – MFG Test Parameters**

| Environment | IIA |
|---|---|
| Temperature (°C) | **30** |
| Relative Humidity (% ) | **70** |
| Chlorine (Cl2) Concentration (ppb) | **10 $\pm$ 3** |
| Hydrogen Sulfide (H2S) Concentration (ppb) | **10 $\pm$ 3** |
| Nitrogen Dioxide (NO2) Concentration (ppb) | **200 $\pm$ 50** |
| Sulfur Dioxide (SO2) Concentration (ppb) | **100 $\pm$ 20** |
| Exposure Period | **20 days** |

### 3.21 Thermal Disturbance

Mated specimens were exposed to 10 temperature cycles between 15±3°C and 85±3°C. The ramp time was a minimum of 2°C per minute with 30 minute dwells at temperature extremes. The humidity was not controlled.

### 3.22 Final Examination of Product

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