# Select Gold Standard Hermaphroditic Blade and Receptacle

## 1. INTRODUCTION

### 1.1 Purpose

Testing was performed on TE Connectivity* (TE) Select Gold Standard Hermaphroditic Blade and Receptacle connectors to determine their conformance to the requirements of Product Specification 108-2342 Rev E.

### 1.2 Scope

This report covers the electrical, mechanical, and environmental performance of the TE Select Gold Standard Hermaphroditic Blade and Receptacle connectors. Testing was performed at the TE Harrisburg Electrical Components Test Laboratory from 5-April-2016 to 30-June-2016. Detailed test data is on file and maintained at the Harrisburg Electrical Components Test Laboratory under test number EA20160073T.

### 1.3 Conclusion

The Select Gold Standard Hermaphroditic Blade and Receptacle connectors listed in paragraph 1.4 were tested to the mechanical, electrical and environmental requirements of Product Specification 108-2342 Rev E. The specimens met all of the requirements. See Paragraph 2 for results.

### 1.4 Product Description

Select gold hermaphroditic blade and receptacle connectors are suitable for harsh LED environments with reduced fretting corrosion. They reduce design time using the same connector for power, data or signal connections with 2, 4 or 6 positions and simplify assembly and service with either vertical or horizontal connections.

### 1.5 Test Specimens

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

The specimens as identified in Table 1 were submitted for testing.

**Table 1 – Test Specimens**

| Test Group | Test Set | Qty | Part number | Description |
|---|---|---|---|---|
| A | 1 | 20 | 2213614-1 | Select Gold Hermaphroditic Blade and Receptacle (2 Position) |
| | 2 | 20 | 2213614-2 | Select Gold Hermaphroditic Blade and Receptacle (4 Position) |
| | 3 | 20 | 2213614-3 | Select Gold Hermaphroditic Blade and Receptacle (6 Position) |
| | 1-3 | 60 | 60-1042640-1 Rev. A | PC Board |
| B | 4 | 20 | 2213614-1 | Select Gold Hermaphroditic Blade and Receptacle (2 Position) |
| | 5 | 20 | 2213614-2 | Select Gold Hermaphroditic Blade and Receptacle (4 Position) |
| | 6 | 20 | 2213614-3 | Select Gold Hermaphroditic Blade and Receptacle (6 Position) |
| | 4-6 | 60 | 60-1042640-1 Rev. A | PC Board |
| C | 7 | 10 | 2213614-3 | Select Gold Hermaphroditic Blade and Receptacle (6 Position) |
| D | 8 | 5 | 2213614-3 | Select Gold Hermaphroditic Blade and Receptacle (6 Position) |

### 1.6 Qualification Test Sequence

The test specimens referred to in paragraph 1.5 and Table 1 were tested according to the test sequence listed in Table 2.

**Table 2 – Test Sequence**

| Test or Examination | Test Group | | | |
|---|---|---|---|---|
| | 1 | 2 (a) | 3 | 4 |
| | Test Sequence (c) | | | |
| Initial Visual Examination | 1 | 1 | 1 | 1 |
| Low Level Contact Resistance | 3,7 | 2,5,7,9,11 | | |
| Insulation Resistance | | | 2,6 | |
| Withstanding Voltage | | | 3,7 | |
| Temperature Rise | | 3,12 | | |
| Resistance to Reflow Soldering Heat | | | | 2 |
| Random Vibration | 5 | 10(b) | | |
| Mechanical Shock | 6 | | | |
| Durability | 4 | | | |
| Mating Force | 2 | | | |
| Unmating Force | 8 | | | |
| Thermal Shock | | 8 | 4 | |
| Temperature / Humidity Cycling | | | 5 | |
| Temperature Life | | 6 | | |
| Mixed Flowing Gas | | 4 | | |
| Final Visual Examination | 9 | 13 | 8 | 3 |

(a) Half of the specimens are to be used for Initial Temperature Rise, the other half go through the remainder of the sequence.
(b) Energized to 18°C.
(c) Numbers indicate the sequence in 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 Visual Examination

The specimens were visually examined and no evidence of physical damage detrimental to the operation of the parts were observed.

A certification of conformance was issued stating that the specimens in the test package were produced, inspected, and accepted as conforming to product drawing requirements and made using the same core manufacturing processes and technologies as production parts.

## 2.2 Low Level Contact Resistance

### 2.2.1 Low Level Contact Resistance – Test Group 1

The specimens met the performance requirements listed in Product Specification 108-2342 Rev E for low level contact resistance. See Table 3 for more a summary of the test results.

The specimens in Test Group 1 had a maximum low level contact resistance of 3.18 milliohms, meeting the 18 milliohms maximum initial requirement. The specimens had a maximum delta resistance of 0.85 milliohms, meeting the Δ5 milliohm maximum requirement.

**Table 3 – Low Level Contact Resistance Test Results for Test Group 1 in Milliohms**

| Test Set | Test Set 1 | | Tet Set 2 | | Test Set 3 | |
|---|---|---|---|---|---|---|
| | 2 Position | | 4 Position | | 6 Position | |
| Reading | Initial | Final | Initial | Final | Initial | Final |
| | Actual | Delta | Actual | Delta | Actual | Delta |
| Minimum | 2.43 | -0.38 | 2.33 | -1.29 | 2.32 | -0.86 |
| Maximum | 3.18 | 0.85 | 3.70 | 0.29 | 3.39 | 0.11 |
| Average | 2.72 | 0.07 | 2.59 | -0.14 | 2.78 | -0.24 |
| Std Dev | 0.19 | 0.33 | 0.27 | 0.29 | 0.21 | 0.21 |
| N | 20 | 20 | 40 | 40 | 60 | 60 |

### 2.2.2 Low Level Contact Resistance – Test Group 2

The specimens met the performance requirements listed in Product Specification 108-2342 Rev E for low level contact resistance. See Table 4 for more a summary of the test results.

The specimens in Test Group 2 had a maximum low level contact resistance of 2.93 milliohms, meeting the 18 milliohms maximum initial requirement. The specimens had a maximum delta resistance of 4.43 milliohms, meeting the Δ5 milliohm maximum requirement.

**Table 4 – Low Level Contact Resistance Test Results for Test Group 2 in Milliohms**

| Test Set | Test Set 4 | | | | | Tet Set 5 | | | | | Test Set 6 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 Position | | | | | 4 Position | | | | | 6 Position | | | | |
| Reading | Initial | After MFG | After Temp Life | After Thermal Shock | Final | Initial | After MFG | After Temp Life | After Thermal Shock | Final | Initial | After MFG | After Temp Life | After Thermal Shock | Final |
| | Actual | Delta | Delta | Delta | Delta | Actual | Delta | Delta | Delta | Delta | Actual | Delta | Delta | Delta | Delta |
| Minimum | 2.33 | -0.17 | 0.48 | 0.12 | 0.20 | 2.23 | -0.42 | 0.20 | 0.04 | 0.04 | 2.33 | -0.47 | -0.40 | -0.40 | -0.27 |
| Maximum | 2.93 | 1.00 | 4.34 | 2.83 | 3.99 | 2.75 | 0.07 | 2.03 | 4.11 | 2.94 | 2.98 | 0.13 | 2.65 | 4.43 | 1.90 |
| Average | 2.57 | 0.08 | 2.31 | 1.18 | 1.23 | 2.45 | -0.11 | 1.10 | 0.88 | 0.96 | 2.55 | -0.08 | 0.27 | 0.50 | 0.67 |
| Std Dev | 0.15 | 0.40 | 1.41 | 0.94 | 1.08 | 0.13 | 0.16 | 0.62 | 1.00 | 0.71 | 0.14 | 0.14 | 0.69 | 1.18 | 0.57 |
| N | 20 | 10 | 10 | 10 | 10 | 40 | 20 | 20 | 20 | 20 | 60 | 30 | 30 | 30 | 30 |

## 2.3 Insulation Resistance.

The specimens met the performance requirements listed in Product Specification 108-2342 Rev E for insulation resistance.

All initial and final insulation resistance readings were well above the 1 Megohm minimum requirement.

### 2.4 Withstanding Voltage

The specimens met the performance requirements listed in Product Specification 108-2342 Rev E for withstanding voltage.

Specimens displayed no breakdown or flashover when the specimens were subjected to 1500 VAC for one minute for both initial and final withstanding voltage testing.

### 2.5 Temperature Rise

The specimens met the performance requirements listed in Product Specification 108-2342 Rev E for temperature rise.

#### 2.5.1 Temperature Rise – Initial

Specimens had a temperature rise less than the 30°C maximum requirement at 6 Amperes.

#### 2.5.2 Temperature Rise – Final

Specimens had a temperature rise less than the 30°C maximum requirement at 6 Amperes.

### 2.6 Resistance to Reflow Soldering Heat

The specimens met the performance requirements listed in Product Specification 108-2342 Rev E. No visual evidence of melting, blistering, cracking or other damage was observed on any specimen as a result of the reflow heat exposure.

### 2.7 Random Vibration

The specimens met the performance requirements listed in Product Specification 108-2342 Rev E, having no apparent physical damage or discontinuities of one microsecond or greater occurred during testing.

### 2.8 Mechanical Shock

The specimens met the performance requirements listed in Product Specification 108-2342 Rev E, having no apparent physical damage or discontinuities of one microsecond or greater occurred during testing.

### 2.9 Durability

After mating and unmating the specimens 10 times by hand, no evidence of physical damage detrimental to the operation of the part was observed.

### 2.10 Mating Force

The specimens met the performance requirements listed in Product Specification 108-2342 Rev E (Figure 7) for mating force.

### 2.11 Unmating Force

The specimens met the performance requirements listed in Product Specification 108-2342 Rev E (Figure 7) for unmating force.

### 2.12 Thermal Shock

The specimens were visually examined and no evidence of physical damage detrimental to the operation of the parts were observed.

### 2.13 Temperature / Humidity Cycling

The specimens were visually examined and no evidence of physical damage detrimental to the operation of the parts were observed.

### 2.14 Temperature Life

The specimens were visually examined and no evidence of physical damage detrimental to the operation of the parts were observed.

### 2.15 Mixed Flowing Gas

The specimens were visually examined and no evidence of physical damage detrimental to the operation of the parts were observed.

Copper corrosion rate (Average) = 18.33 $\mu g/cm^2/day$

### 2.16 Final Visual Examination

The specimens were visually examined and no evidence of physical damage detrimental to the operation of the parts were observed.

## 3. TEST METHODS

### 3.1. Initial Examination of Product

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.

### 3.2 Low Level Contact Resistance

The specimens were subjected to a low level contact resistance test in accordance with test procedure EIA-364-23C and Product Specification 108-2342 Rev E. See Figure 2 for a representative image of the test setup.

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.

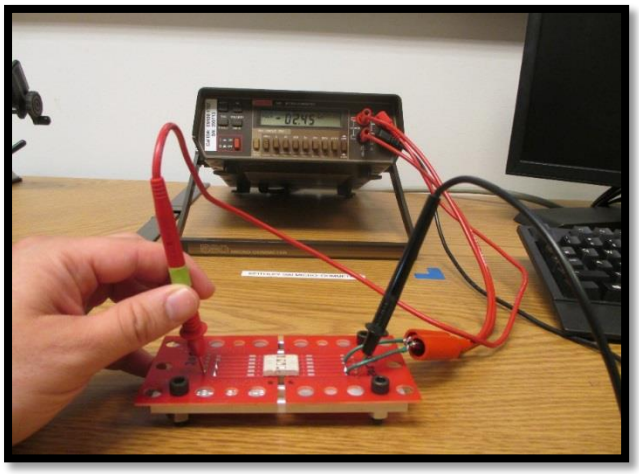

**Figure 2 – Low Level Contact Resistance Test Setup**

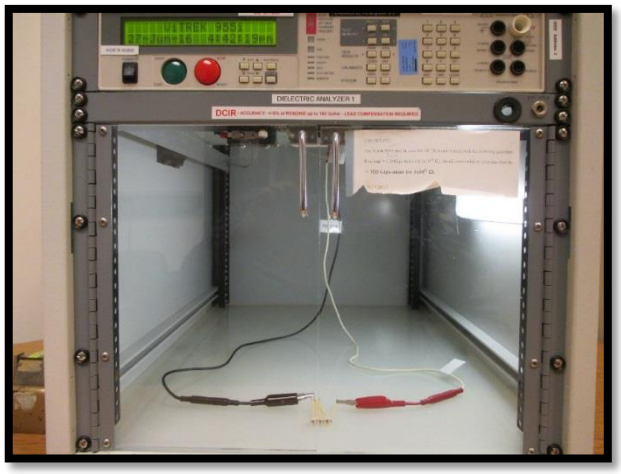


**Figure 3 – IR and Withstanding Voltage Test Setup**

### 3.3 Insulation Resistance.

Insulation resistance was conducted as stated in Product Specification 108-2342 Rev E and in accordance with test procedure EIA 364-21E. See Figure 3 for a representative image of the test setup.

A test potential of 500 VDC was applied to adjacent contacts on an unmated specimen for two minutes with insulation resistance measurements recorded immediately after.

### 3.4 Withstanding Voltage

Dielectric withstanding voltage was conducted as stated in Product Specification 108-2342 Rev E and in accordance with EIA 364-20D. See Figure 3 for a representative image of the test setup.

Test leads were connected to adjacent contacts with the test voltage increased from zero to 1500 VAC at a rate of 500 volts per second. The 1500 VAC was held for one minute and the maximum leakage current recorded.

### 3.5 Temperature Rise

Temperature rise was conducted as stated in Product Specification 108-2342 Rev E and in accordance with EIA 364-70C, Method 1. See Figure 4 for a representative image of the test setup.

The infrared temperature measurement point, i.e. contacts of the specimen, were coated with Equate powder, and used as an emissivity correction coating. The emissivity correction coating has a known value which is 0.95. Raising and knowing the emittance value allows for accurate temperature measurements. The infrared camera was used with the standard optics (50 mm lens) to image the test specimens.

ExaminIR thermal imaging processing system was used for data analysis. The area tool software feature was used to determine maximum temperature of the exposed contacts. The area tool software feature allows a shape, which can be sized, to be placed on an area of interest. The pixels inside the shape are analyzed giving minimum, maximum, average, and standard deviation measurements of the target temperature.

The test specimens were placed in the temperature rise enclosure and measurements were taken after temperature stabilization. The contacts were connected in series through the traces on the PCB.

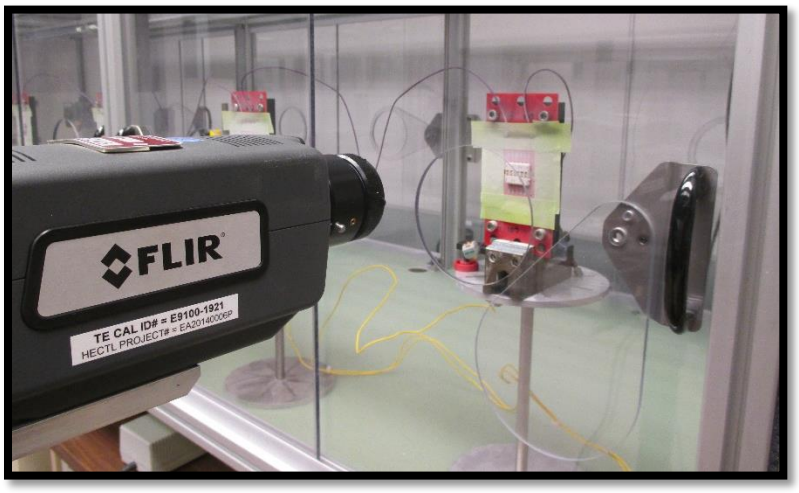


**Figure 4 – Temperature Rise Test Setup**

### 3.6 Resistance to Reflow Soldering Heat

Resistance to reflow soldering heat was conducted as stated in Product Specification 108-2342 Rev E and in accordance with TEC 109-201, Method A, Condition B.

Prior to the reflow heat exposure, all specimens were measured for critical dimensions by the submitting test technician. After the dimensional measurements the specimens were placed in a temperature/humidity chamber and subjected to the conditions of 85°C and a relative humidity of 85%, for a period of 168 hours. The specimens were contained in a non-reactive mesh basket as not to be touching or overlapping each other for the entire exposure time. Upon completion of the moisture soak pre-conditioning, the specimens were removed and allowed to sit at ambient conditions for at least 15 minutes and prior to 4 hours were subjected to three reflow heat cycles.

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. The temperature on top of a setup specimen was monitored in order to enable temperature profiling. A temperature of 259°C was measured during the profile setup/verification. The specimens and substrates were allowed to cool to ambient temperatures and then run back through the oven a total of 3 times. After the reflow heat exposure, the specimens were returned to the responsible test technician for final measurements.

### 3.7 Random Vibration

Random vibration was performed as stated in Product Specification 108-2342 Rev E, in accordance with specification EIA-364-28F, test condition “VII”, test condition letter “E”. See Figure 5 and Figure 6 for representative images of the 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 0.05 $G^2$/Hz from 20 Hz to the upper bound frequency of 500 Hz. The root-mean square amplitude of the excitation was 4.90 g’s rms. 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 in Test Group 1 were monitored for discontinuities of 1 microsecond or longer. Specimens in Test Group 2 were energized with the specified dc current during testing listed in Table 5.

**Table 5 – Test Group 2 Random Vibration DC Current Levels in Amperes**

| Test Set | Specified Current Applied |
|---|---|
| 4 | 6.0 |
| 5 | 6.0 |
| 6 | 5.4 |

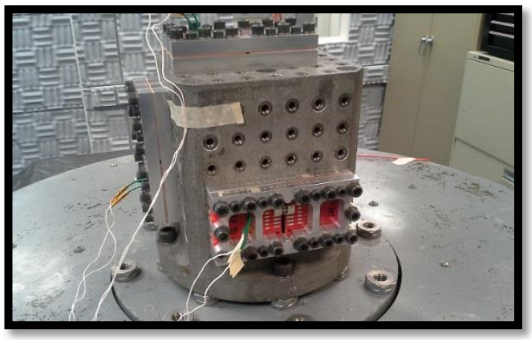

**Figure 5 – Random Vibration and Mechanical Shock Test Setup**

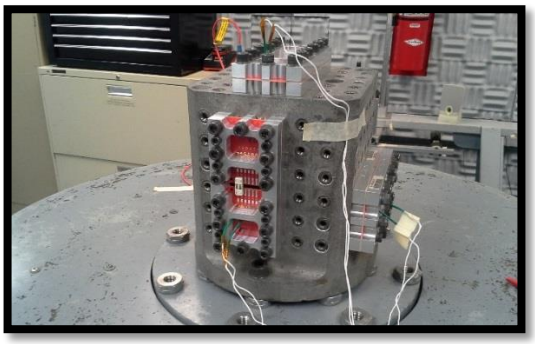

**Figure 6 – Random Vibration and Mechanical Shock Test Setup**

### 3.8 Mechanical Shock

Mechanical shock was performed as stated in Product Specification 108-2342 Rev E, in accordance with specification EIA-364-27C, Test Condition “H”. See Figure 5 and Figure 6 for representative images of the test setup.

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 longer.

### 3.9 Durability

Specimens were subjected to durability as stated in Product Specification 108-2342 Rev E and in accordance with test procedure EIA 364-9C.

Specimens were mated and unmated for 10 cycles by hand.

### 3.10 Mating Force

Mating force was performed with a tensile / compression machine as stated in Product Specification 108-2342 Rev E and in accordance with specification EIA-364-13E. See Figure 7 and Figure 8 for representative images of the test setup.

**Note**: This data reflects the second mating of the test specimens. All specimens were mated manually in order to mount them on the PCB during the surface mounting operation prior to this mating force test.

#### 3.10.1 Mating Force – Vertical

One half of the connector was secured to a mill table attached to the base of the tensile/compression machine using hold downs. The other half of the connector was secured to a fixture mounted to the load cell of the tensile/compression crosshead. The crosshead was lowered at a rate of 0.50 inches/min until the specimen was fully mated and the peak force was recorded.

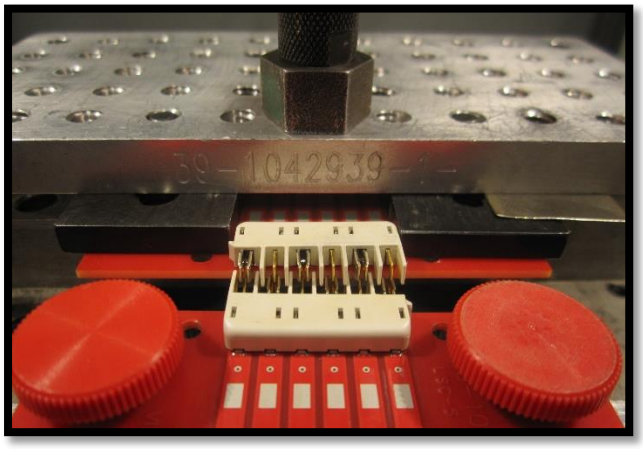

**Figure 7 – Mating Force – Vertical Test Setup**

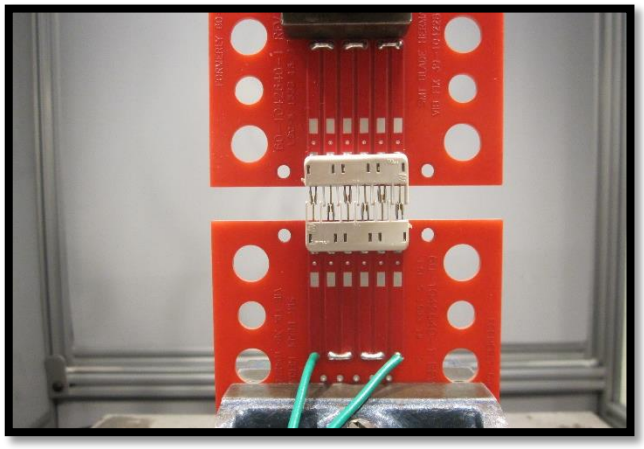

**Figure 8 – Mating Force – Horizontal Test Setup**

### 3.10.2 Mating Force – Horizontal

One half of the connector was held in a vice secured to a mill table attached to the base of the tensile/compression machine using hold downs. The other half of the connector was held in air-jaws mounted to the load cell of the tensile/compression crosshead. The crosshead was lowered at a rate of 0.50 inches/min until the specimen was fully mated and the peak force was recorded.

## 3.11 Unmating Force

Unmating force was performed with a tensile / compression machine as stated in Product Specification 108-2342 Rev E and in accordance with specification EIA-364-13E. See Figure 9 and Figure 10 for representative images of the test setup.

**Note**: This data reflects the second unmating of the test specimens. All specimens were mated manually in order to mount them on the PCB during the surface mounting operation prior to this force test.

### 3.11.1 Unmating Force – Vertical

One half of the connector was secured to a mill table attached to the base of the tensile/compression machine using hold downs. The other half of the connector was secured to a fixture mounted to the load cell of the tensile/compression crosshead. The crosshead was raised at a rate of 0.50 inches/min until the specimen was fully unmated and the peak force was recorded.

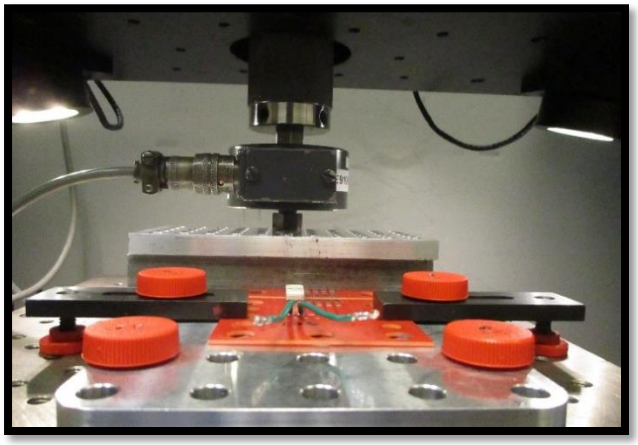

**Figure 9 – Unmating Force – Vertical Test Setup**

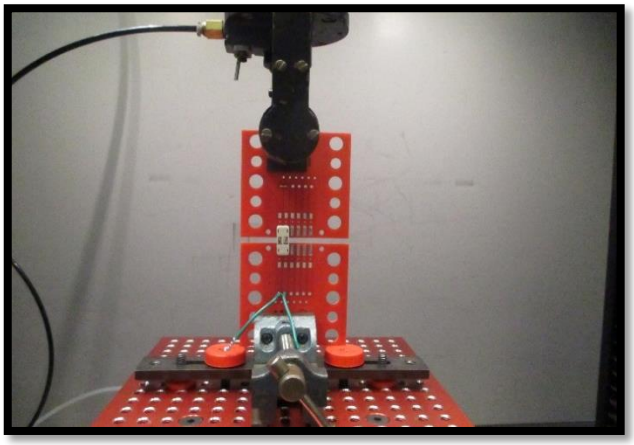

**Figure 10 – Mating Force – Horizontal Test Setup**

### 3.11.2 Unmating Force – Horizontal

One half of the connector was held in a vice secured to a XYR floating table rigidly attached to the base of the tensile/compression machine. The other half of the connector was held in air-jaws mounted to the load cell of the tensile/compression crosshead. The crosshead was lowered at a rate of 0.50 inches/min until the specimen was fully mated and the peak force was recorded.

## 3.12 Thermal Shock

Unmated specimens were subjected to thermal shock as stated in Product Specification 108-2342 Rev E and in accordance with test procedure EIA 364-32G, Test Condition VII.

Unmated specimens were subjected to 250 cycles between -40°C and 105°C with 30 minute dwells at temperature extremes and 1 minute transition between temperatures.

### 3.13 Temperature / Humidity Cycling

Unmated specimens were subjected to temperature / humidity cycling as stated in Product Specification 108-2342 Rev E and in accordance with test procedure EIA 364-31D, Method III.

Unmated specimens were subjected to ten 24-hour cycles between 25°C and 65°C at 80 to 100% relative humidity.

### 3.14 Temperature Life

Mated specimens were subjected to temperature life as stated in Product Specification 108-2342 Rev E and in accordance with test procedure EIA 364-17C, Method A.

Mated specimens were subjected to 130°C for 500 hours.

### 3.15 Mixed Flowing Gas

Mated specimens were subjected to a 4 gas environment as stated in Product Specification 108-2342 Rev E and in accordance with test procedure EIA 364-65B, Class 2a.

The specimens were exposed for 14 days. See Table 6 for the MFG test parameters.

**Table 6 – MFG Test Parameters**

| Environment | **2a** |
|---|---|
| Temperature ($^0$C) | **30** |
| Relative Humidity (% ) | **70** |
| Chlorine (Cl2) Concentration (ppb) | **10±3** |
| Hydrogen Sulfide (H2S) Concentration (ppb) | **10±5** |
| Nitrogen Dioxide (NO2) Concentration (ppb) | **200±50** |
| Sulfur Dioxide (SO2) Concentration (ppb) | **100±20** |
| Exposure Period | **14 days** |

### 3.16 Final Visual Examination

The specimens were visually examined in accordance with test procedure EIA-364-18B and Product Specification 108-2342 Rev E for evidence of physical damage that would be detrimental to the operation of the parts.