**Evaluation of RAST 5 Positive Lock Housings with PA66 V0+GWT (TE RM: 2136700)**

## 1. INTRODUCTION

### 1.1. Purpose

Testing was performed on the TE Connectivity RAST 5 Positive Lock housings with PA66 UL94-V0+GWT Resin. For this report, results of testing were used to determine conformance to the requirements of Product Design Objective 108-143029 Rev C.

### 1.2. Scope

This report covers the electrical, mechanical, and environmental performance of the RAST 5 Positive Lock housings. Testing was performed at the Norwood Electrical Components Test Laboratory between August 9, 2017 and August 18, 2017 under EA20170469T. Detailed test data is on file and maintained at the Harrisburg Electrical Components Test Laboratory.

### 1.3. Conclusion

All specimens met the requirements found in Product Design Objective 108-143029, Rev C. Refer to section 2 for complete test results.

### 1.4. Test Specimens

Refer to Table 1 for the allocation and attributes of submitted test specimens.

**TABLE 1 – TEST SPECIMENS**

| Test Set | Qty | Part Number | Attributes |
|---|---|---|---|
| 2 | 2 | 521204 | 2 Position RAST 5 Housing, PA66 UL94-V0+GWT Resin |
| 4 | 1 | 521206 | 4 Position RAST 5 Housing, PA66 UL94-V0+GWT Resin |
| 6 | 1 | 521210 | 8 Position RAST 5 Housing, PA66 UL94-V0+GWT Resin |
| 8 | 3 | 521204 | 2 Position RAST 5 Housing, PA66 UL94-V0+GWT Resin |
| 10 | 2 | 521206 | 4 Position RAST 5 Housing, PA66 UL94-V0+GWT Resin |
| 12 | 2 | 521210 | 8 Position RAST 5 Housing, PA66 UL94-V0+GWT Resin |
| 14 | 4 | 521204 | 2 Position RAST 5 Housing, PA66 UL94-V0+GWT Resin |
| 16 | 3 | 521206 | 4 Position RAST 5 Housing, PA66 UL94-V0+GWT Resin |
| 18 | 5 | 521210 | 8 Position RAST 5 Housing, PA66 UL94-V0+GWT Resin |
| 2,4,6,8,10, 12,14,16,18 | 106 | 1217095-1 | Receptacle, 250 Series Posi-Lok, 16-12AWG, 1 per Position |

1.5. Test Sequence

Refer to Table 2 for the sequence of testing performed on the specimens listed in Table 1.

**TABLE 2 – PERFORMED TEST SEQUENCE**

| Test or Evaluation | Test Set | | |
|---|---|---|---|
| | 2, 4, 6 | 8, 10, 12 | 14, 16, 18 |
| | Test Sequence | | |
| Conditioning | 1 | 1 | 1 |
| Visual Examination | 2,10 | 2,5 | 2 |
| Insulation Resistance | 3,8 | | |
| Dielectric Withstanding Voltage | 4,9 | | |
| Thermal Shock | 5 | | |
| Humidity-Temperature Cycling | 6 | | |
| Low Temperature | 7 | | |
| Contact Insertion Force | | 3 | |
| Contact Retention Force | | 4 | |
| Dielectric Breakdown | | | 3 |

*Numbers indicate sequence in which tests were performed.*

1.6. Environmental Conditions

Unless otherwise stated, the following environmental conditions prevailed during testing:

Temperature: 15°C to 35°C
Relative Humidity: 20% to 80%
Barometric Pressure: 650 to 800 millimeters of mercury

## 2. SUMMARY OF TESTING

2.1. Conditioning (All Test Sets)

Specimens were subjected to room temperature and humidity for 24 hours prior to testing.

2.2. Initial Visual Inspection (All Test Sets)

Specimens did not exhibit any signs of damage or defect that would affect product performance.

2.3. Insulation Resistance (Test Sets 2, 4 & 6)

Initially, all specimens in Test Sets 2, 4 & 6 exceeded the 5000Megohm minimum requirement for initial insulation resistance found in Product Design Objective 108-143029, Rev C. The insulation resistance for all specimens was greater than 100 Gigohms.

Immediately following environmental exposure, all specimens in Test Sets 2, 4 & 6 exceeded the 5000 Megohm minimum requirement for final insulation resistance found in Product Design Objective 108-143029, Rev C. The insulation resistance for all specimens was greater than 20 Gigohms.

2.4. Dielectric Withstanding Voltage (Test Sets 2, 4 & 6)

Initially and after environmental exposure, all specimens in Test Sets 2, 4 & 6 met the 3000Vac dielectric withstanding voltage requirement found in Product Design Objective 108-143029, Rev C. No breakdown, flashover or leakage current greater than 0.5mA was detected.

2.5. Thermal Shock (Test Sets 2, 4 and 6)

Specimens did not exhibit any damage that would affect product performance as a result of thermal shock exposure as described in section 3.5.

2.6. Humidity-Temperature Cycling (Test Sets 2, 4 and 6)

Specimens did not exhibit any damage that would affect product performance as a result of humidity-temperature cycling exposure as described in section 3.6.

2.7. Low Temperature (Test Sets 2, 4 and 6)

Specimens did not exhibit any damage that would affect product performance as a result of low temperature exposure as described in section 3.7.

2.8. Contact Insertion Force (Test Sets 8, 10 and 12)

All specimens in Test Sets 8, 10 and 12 met the 13.35N maximum contact insertion force requirement found in Product Design Objective 108-143029, Rev C. Contact insertion force data is shown in Table 3.

**TABLE 3 – CONTACT INSERTION FORCE (N)**

| Statistic | Test Set | | |
|---|---|---|---|
| | 8 | 10 | 12 |
| Min | 5.18 | 6.01 | 6.19 |
| Max | 6.73 | 7.86 | 10.84 |
| Mean | 5.87 | 6.92 | 8.33 |
| Std Dev | 0.59 | 0.70 | 1.30 |
| N | 6 | 8 | 16 |

2.9. Contact Retention Force (Test Sets 8, 10 and 12)

All specimens in Test Sets 8, 10 and 12 met the 60N minimum contact retention force requirement found in Product Design Objective 108-143029, Rev C. Contact retention force data is shown in Table 4.

**TABLE 4 – CONTACT RETENTION FORCE (N)**

| Statistic | Test Set | | |
|---|---|---|---|
| | 8 | 10 | 12 |
| Min | 77.0 | 84.8 | 77.8 |
| Max | 89.7 | 102.5 | 119.7 |
| Mean | 84.4 | 92.0 | 91.9 |
| Std Dev | 5.0 | 6.1 | 9.2 |
| N | 6 | 8 | 16 |

2.10. Dielectric Breakdown (Test Sets 14, 16 and 18)

The dielectric breakdown voltage between adjacent positions of unmated test specimens is shown in Table 5 for Test Sets 14, 16 and 18 combined. The calculated values for minimum breakdown voltage, withstanding voltage and operating voltage per Test Standard 209-13, Rev B are also shown.

**TABLE 5 – DIELECTRIC BREAKDOWN VOLTAGE (VAC)**

| Statistic | Result |
|---|---|
| Min | 4087.9 |
| Max | 4882.1 |
| Mean | 4468.4 |
| Std Dev | 182.5 |
| N | 48 |
| Min Breakdown per 209-13 | 3909.2 |
| Withstanding Voltage per 209-13 | 2932 |
| Operating Voltage per 209-13 | 977 |

The dielectric breakdown voltage, plotted in Figure 1, appears to be “normal” as required by Test Standard 209-13, Rev B.

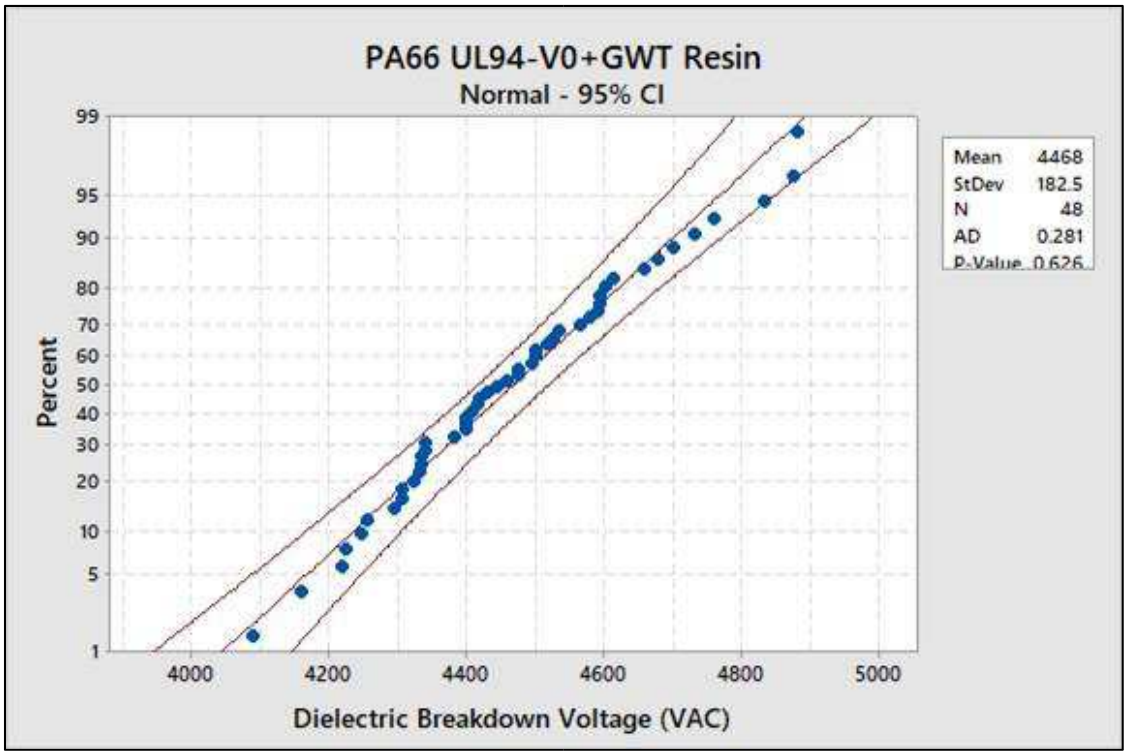


**Figure 1 – Breakdown Voltage Probability Plot**

**2.11 Final Visual Inspection (All Test Sets)**

Specimens did not exhibit any signs of damage or defect that would affect product performance.

## 3. TEST PROCEDURES

### 3.1. Conditioning

Specimens were removed from packaging and subjected to room temperature (23°C) and humidity (35-50%RH) for 24 hours prior to testing.

### 3.2. Initial Visual Inspection

Prior to testing, specimens were visually examined according to EIA-364-18B for any signs of damage or defect that would affect product performance.

### 3.3. Insulation Resistance

Testing was performed according to EIA-364-21E. Connections were made across adjacent contacts of unmated connectors. Measurements were recorded after a test voltage of 500Vdc was applied for a period of 2 minutes. Refer to Figure 2 for a view of the test setup.

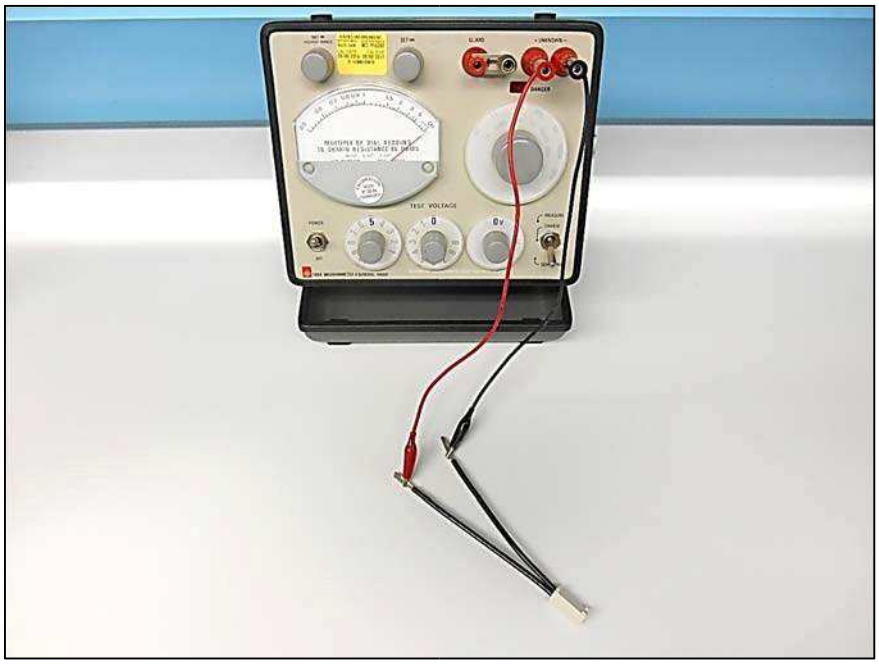

**FIGURE 2 – INSULATION RESISTANCE TEST SETUP**

3.4. Dielectric Withstanding Voltage

Testing was performed according to EIA-364-20E by applying 3000VAC volts across adjacent contacts of unmated connectors for a period of 60 seconds. Refer to Figure 3 for a view of the test setup.


**Figure 3 – DWV Test Setup**

3.5. Thermal Shock

Testing was performed in accordance with EIA-364-32G, Method A, Condition VIII, Duration A-1. Unmated specimens were subjected to 25 cycles of thermal shock between the temperatures of -40°C and 105°C. The time at each temperature was 30 minutes. Refer to Figure 4 for a view of the test setup.

**FIGURE 4 – THERMAL SHOCK TEST SETUP**

3.6. Humidity-Temperature Cycling

Testing was performed in accordance with EIA-364-31E, Method IV using modified temperature ramp and dwell times. Unmated test specimens were subjected to 10 cycles (100 hours) of humidity with temperature cycling between the temperature range of 25°C to 55°C, and humidity range of 80-98%RH. Step 7a (cold exposure) was omitted. Testing was stopped after the step 6 of the 10th cycle in order to perform final electrical measurements. The temperature/humidity profile for 1 cycle is shown in Figure 5. A view of the test setup is shown in Figure 6.

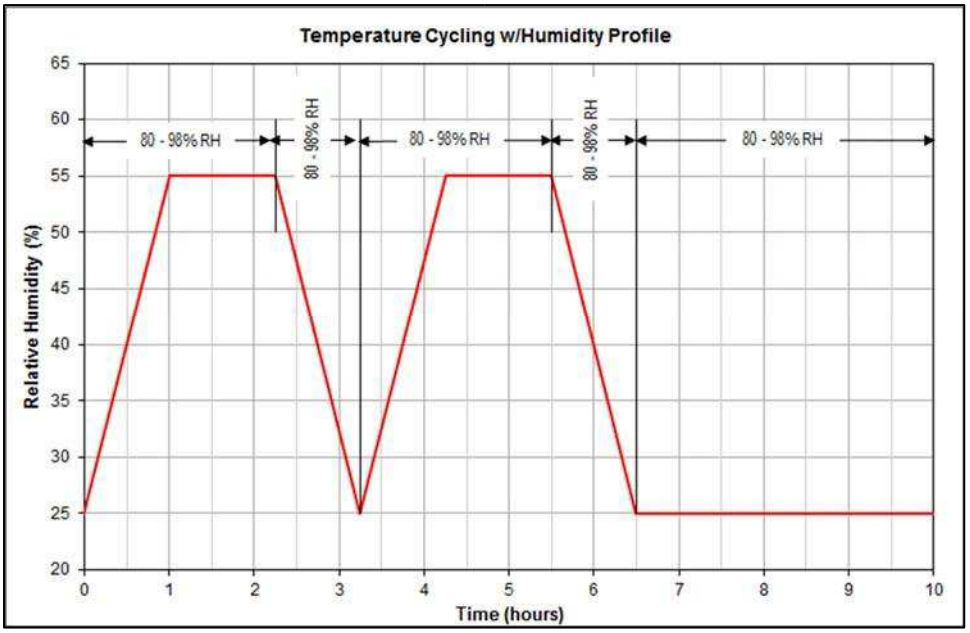


**Figure 5 – Temperature/Humidity Profile**

**FIGURE 6 – HUMIDITY TEST SETUP**

3.7. Low Temperature

Unmated test specimens were placed in an oven and subjected to -40°C for 2 hours immediately following humidity exposure. Refer to Figure 7 for a view of the test setup.

**Figure 7 – Low Temperature Test Setup**

3.8. Contact Insertion Force

The housing was placed on the base of the force tester. The wire was placed into a pin vise attached to a load cell with 25mm of wire exposed. The contact was aligned over the housing opening and pushed downward at a rate of 25 mm/minute until the contact was fully inserted. Refer to Figure 8 for a view of the test setup.

**FIGURE 8 – CONTACT INSERTION FORCE TEST SETUP**

3.9. Contact Retention Force

Testing was performed according to EIA-364-29C, Method C. The housing was placed under the lip of a vise mounted to a free-floating table. The wire was placed into a clamp fixture attached to a load cell. The wire was pulled upward at a rate of 25 mm/minute until the contact was released from the housing. Refer to Figure 9 for a view of the test setup.

**Figure 9 – Contact Retention Force Test Setup**

3.10. Dielectric Breakdown

Testing and calculations were performed according to Test Standard 209-13, Rev B. A voltage was applied between adjacent positions of an unmated housing at a rate of 500 V/sec until breakdown occurred. The peak voltage was recorded and the minimum, rated and operating voltages were calculated. Refer to Figure 10 for a view of the test setup.

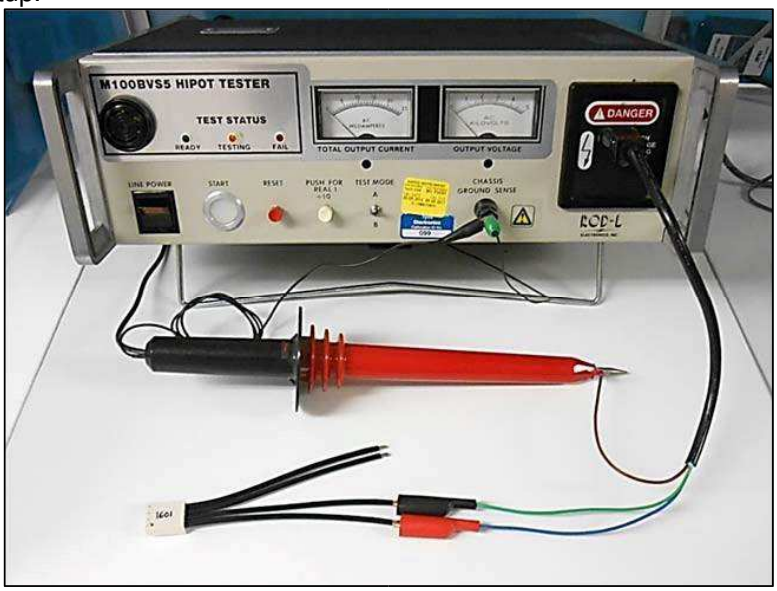


**FIGURE 10 – DIELECTRIC BREAKDOWN TEST SETUP**

Per Test Standard 209-13, Rev B, the minimum breakdown voltage with a one-sided tolerance factor (K) for normal distribution with P=0.99 and 95% confidence level is calculated using the formula x – Ks, where x = mean, K = 2.863 (from k factor table for N=50), s = standard deviation.

Per Test Standard 209-13, Rev B, the rated withstanding voltage is 3/4 of the minimum breakdown voltage and is calculated using the formula 3/4 * (x – Ks).

Per Test Standard 209-13, Rev B, the rated operating voltage is 1/3 of the rated withstanding voltage and is calculated using the formula 1/3 * 3/4 * (x – Ks).

### 3.11. Final Visual Inspection

At the completion of testing, specimens were visually examined according to EIA-364-18B for any signs of damage or defect that would affect product performance.
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