Positive Lock Tab Gap Evaluation

1. INTRODUCTION

1.1 Purpose

Testing was performed on the TE Connectivity Positive Lock Terminals to evaluate the effect of a larger tab gap on temperature rise performance per UL 310, 9th Edition, October 17, 2014 and the test request.

1.2 Scope

This report covers the electrical performance of the Positive Lock Terminals using three different wire gages. Testing was performed at the Harrisburg Electrical Components Test Laboratory (HECTL) between October 29, 2019 and December 6, 2019. Detailed test data is on file and maintained at HECTL under EA20190399T.

1.3 Conclusion

Positive Lock Terminal specimens listed in paragraph 1.4 were tested according to the test sequence listed in paragraph 1.5. Refer to section 2 of this report for test results.

1.4 Test Specimens

Specimens identified with the following part numbers were used for this test. Refer to Table 1 for test specimen identification information.

Table 1 – Specimen Identification

Test Set	Quantity	Part Number	Description
1	14	63498-1 Rev M	Positive Lock Terminals on 16 AWG Wire
	7	60443-2 Rev AB7	.187 x .032” Electrical Test Tabs
2	14	63498-1 Rev M	Positive Lock Terminals on 18 AWG Wire
	7	60443-2 Rev AB7	.187 x .032” Electrical Test Tabs
3	14	63498-1 Rev M	Positive Lock Terminals on 20 AWG Wire
	7	60443-2 Rev AB7	.187 x .032” Electrical Test Tabs

1.5 Test Sequence

Specimens identified in Table 1 were subjected to the test sequence outlined in Table 2.

Table 2 – Test Sequence

Test or Examination	Test Set(s)
	1, 2, 3
	Test Sequence *(a)*
Millivolt Drop	1,4
Plot Temperature Rise Curve	2
Current Cycling Test	3

(a) Numbers indicate the sequence in which testing was 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%

2. SUMMARY OF TESTING

2.1 Millivolt Drop

Millivolt Drop measurements were taken initially and during current cycling after the 24th and 500th cycles. See Tables 3, 4, and 5 for millivolt drop test results.

Table 3 - Current Cycling Data Test Set 1, Millivolt Drop (Wire Bulk Removed)

Statistic	Initial Crimp	Initial Interface	Crimp 24th Cycle	Interface 24th Cycle	Crimp 500th Cycle	Interface 500th Cycle
Minimum	2.65	13.41	2.67	13.43	2.80	13.48
Maximum	4.54	17.62	4.66	17.96	7.04	19.39
Mean	3.30	14.66	3.30	14.74	3.69	15.20
Std. Dev.	0.47	1.26	0.50	1.32	1.08	1.70

Table 4 - Current Cycling Data Test Set 2, Millivolt Drop (Wire Bulk Removed)

Statistic	Initial Crimp	Initial Interface	Crimp 24th Cycle	Interface 24th Cycle	Crimp 500th Cycle	Interface 500th Cycle
Minimum	1.220	9.00	1.268	9.01	1.229	9.08
Maximum	2.624	14.41	2.686	14.66	2.620	15.28
Mean	2.049	10.25	2.071	10.30	1.998	10.48
Std. Dev.	0.43	1.36	0.42	1.42	0.43	1.62

Table 5 - Current Cycling Data Test Set 3, Millivolt Drop (Wire Bulk Removed)

Statistic	Initial Crimp	Initial Interface	Crimp 24th Cycle	Interface 24th Cycle	Crimp 500th Cycle	Interface 500th Cycle
Minimum	0.753	5.20	0.779	5.20	0.665	5.20
Maximum	2.405	6.31	2.402	6.35	2.535	6.47
Mean	1.434	5.60	1.453	5.63	1.403	5.67
Std. Dev.	0.53	0.39	.053	0.41	0.61	0.44

2.2 Plot Temperature Rise Curve

Refer to Figure 1 for the plots and equations used to determine the current levels to achieve a 30º T-Rise. See Table 6 for the actual current needed to achieve the 30º T-Rise.

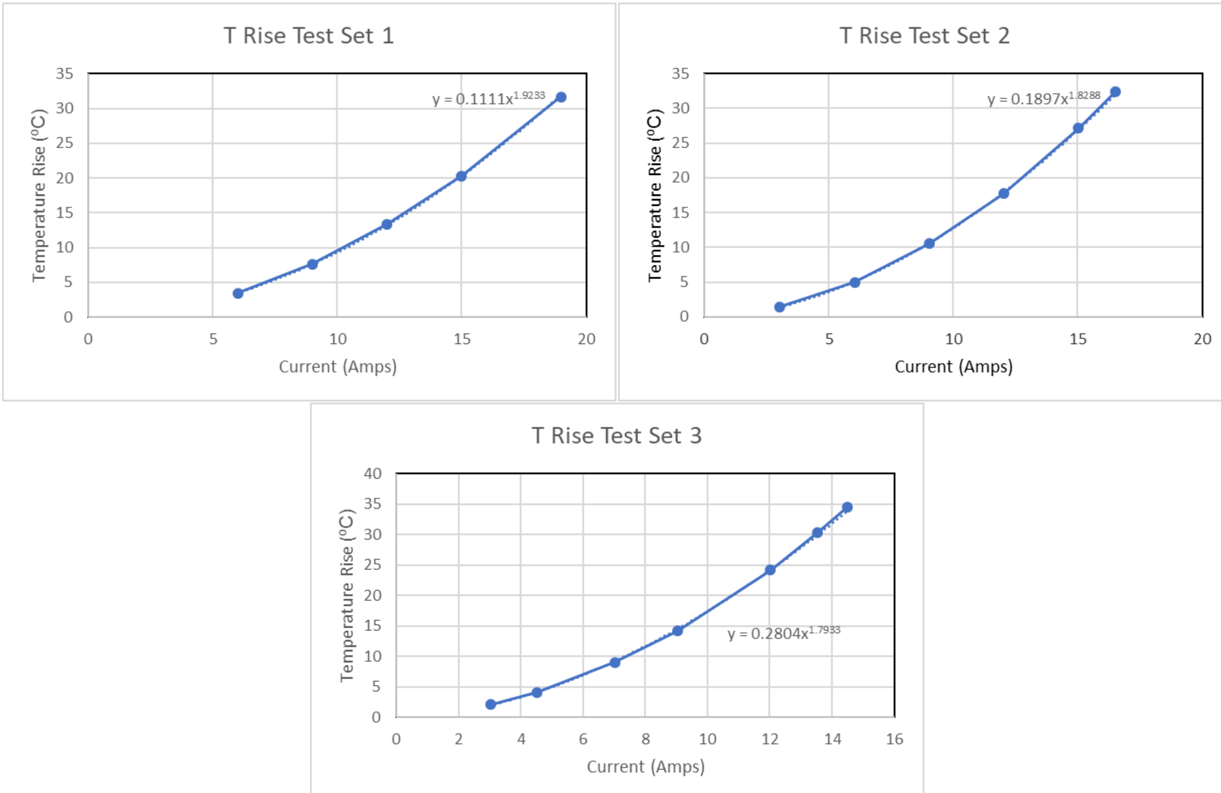

Figure 1 – Temperature Rise Curves for Three Test Sets

Table 6 – Calculated 30ºC T-Rise

Test Set	Calculated current to achieve a 30ºC T-Rise
1	18.4 Amps
2	15.9 Amps
3	13.5 Amps

2.3 Current Cycling

No evidence of physical damage was visible as a result of current cycling. A total of 500 cycles of current cycling were completed on each test set. Data was obtained for the initial, 24th, and 500th cycles.

3. TEST METHODS

3.1 Millivolt Drop

Millivolt drop measurements were taken during the current cycling for each test set. These measurements were taken at both the crimp and the interface areas of each specimen (See Figure 2). One testing lead was placed on the crimp area and the other was placed in the window that was cut in the wire approximately three inches back from the contact for the crimp measurement. The other lead was placed on the test tab in front of the contact for the interface measurement. Millivolt measurements were than recorded. Measurements were taken initially and after both 24 and 500 cycles of current cycling. Specimens in Test Set 1 were energized at 20 amps, Test Set 2 at 14 amps, and Test Set 3 at 8 amps during the testing. Refer to Figure 2 for diagram of lead placement. Testing was done in accordance with UL310 Section A2.

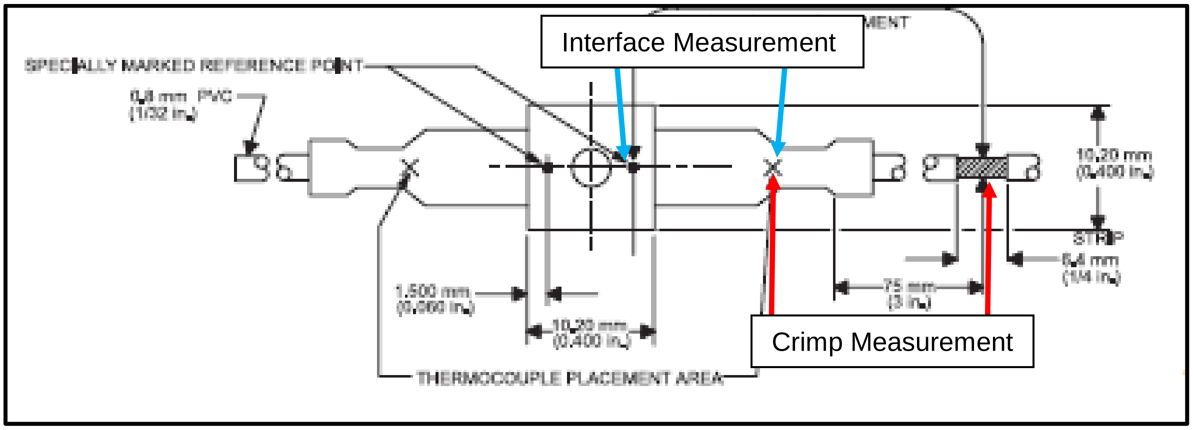

Figure 2 – Diagram of Lead Placement for Millivolt Drop

3.2 Temperature Rise Curve

Thermocouples were installed on each specimen in the crimp area. Specimens were placed into a draft free enclosure. Each specimen was subjected to a minimum of five current level values to achieve at least an average 30ºC temperature rise. When the temperature rise of three consecutive reading taken did not differ by more than 1ºC, the temperature measurement was recorded. These measurements were then used to calculate a curve to determine the exact current to apply to get an average of 30ºC temperature rise across all specimens in the test set. See Figure 3 for temperature rise test setup.

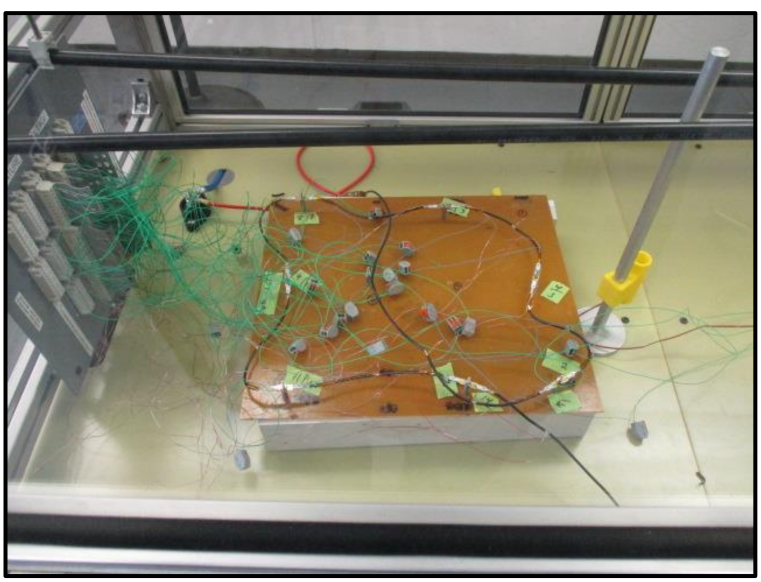

Figure 3 – Temperature Rise Test Setup

3.3 Current Cycling

Testing consisted of 500 cycles of current cycling using the same setup as Temperature Rise Curve test, with each cycle having current ON for 45 minutes and current OFF for 15 minutes. The test current was 20 amperes DC for Test Set 1, 14 Amperes DC for Test Set 2, and 8 amperes DC for Test Set 3. The millivolt drop and temperature was recorded at the end of each ON step of the cycle. Testing was performed in accordance to UL310, paragraph 6.5.3. Refer to Figure 4 for test setup.

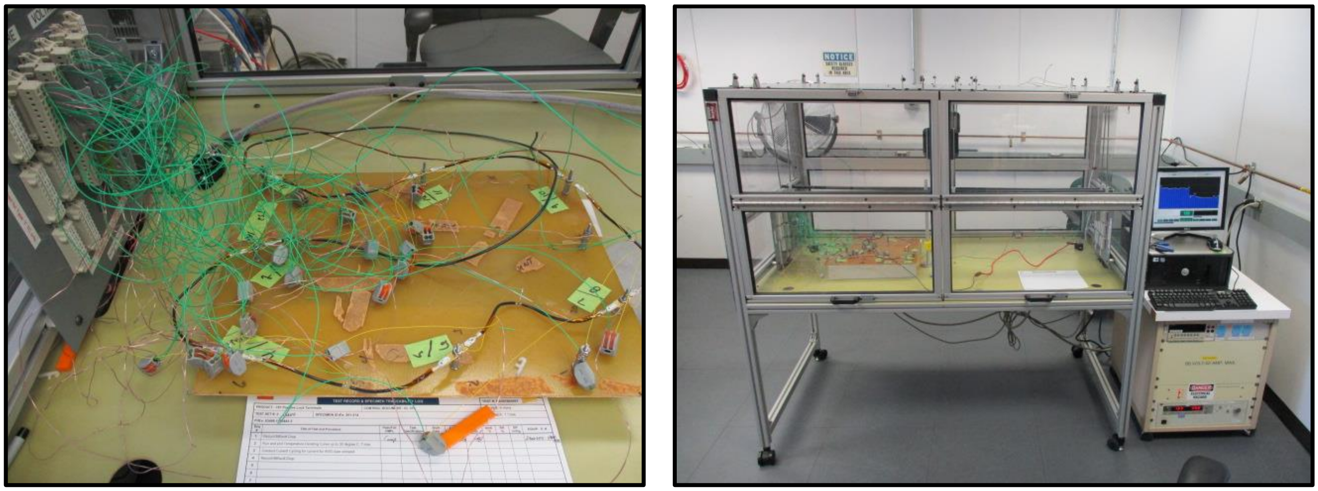

Figure 4 – Current Cycling Test Setup