AMPLIVAR 5-Serration Open Barrel Thru Type Splice Terminal

1. INTRODUCTION

1.1. Purpose

Testing was performed on the TE Connectivity (TE) AMPLIVAR 5-Serration Open Barrel Thru Type Splice Terminal to determine its conformance to the requirements of Product Specification 108-143150, Revision A

1.2. Scope

This report covers the electrical, mechanical, and environmental performance of AMPLIVAR 5-Serration Open Barrel Thru Type Splice Terminal that were submitted for testing. Testing was performed at the TE Shanghai Electrical Components Test Laboratory between February 10th, 2020 and July 15th, 2020. The test file number for this testing is **TP-20-00011**. This documentation is on file at and available from TE Shanghai Electrical Components Test Laboratory.

1.3. Conclusion

All part numbers listed in paragraph 1.5 conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-143150, Revision A.

1.4. Product Description

The AMPLIVAR 5-Serration Open Barrel Thru Type Splice Terminal is designed to splice unstrapped copper magnet wires together alone or along with stranded lead wire within a combined total range of 600 to 22,000 CMA.

1.5. Test Specimens

The test specimens were representative of normal production lots, and the following part numbers were used for testing (see).

Test Group	Quantity	Part Number	Description
1	10	42192-2 Rev W	Splice AMPLIVAR, Copper Magnet Wire Dia. 0.45mm, Total CMA 320
	10	42192-2 Rev W	Splice AMPLIVAR, Copper Magnet Wire Dia. 0.72mm, Total CMA 812
	10	42192-2 Rev W	Splice AMPLIVAR, Copper Magnet Wire Dia. 0.64mm + 18 AWG Lead wire Total CMA 2240
2	10	42192-2 Rev W	Splice AMPLIVAR, Copper Magnet Wire Dia. 0.45mm, Total CMA 320
	10	42192-2 Rev W	Splice AMPLIVAR, Copper Magnet Wire Dia. 0.72mm, Total CMA 812
	10	42192-2 Rev W	Splice AMPLIVAR, Copper Magnet Wire Dia. 0.64mm + 18 AWG Lead wire Total CMA 2240
3	10	42192-2 Rev W	Splice AMPLIVAR, Copper Magnet Wire Dia. 0.45mm, Total CMA 320
	10	42192-2 Rev W	Splice AMPLIVAR, Copper Magnet Wire Dia. 0.72mm, Total CMA 812
	10	42192-2 Rev W	Splice AMPLIVAR, Copper Magnet Wire Dia. 0.64mm + 18 AWG Lead wire Total CMA 2240

Figure 1

1.6. Qualification Test Sequence

Test or Examination	Test Groups (a)		
	1	2	3
	Test Sequence (b)		
Initial Examination of Product	1	1	1
Low Level Contact Resistance	2, 6, 9	2, 4	
Temperature Rise vs. Current	3, 10		
Current Cycling		3	
Vibration, Random	8		
Termination Tensile Strength			2
Thermal Shock	5		
Humidity Exposure	7		
Temperature Life	4		
Final Examination of Product	11	5	3

NOTE
(a) See Paragraph 1.5.
(b) Numbers indicate sequence which tests were performed.

Figure 2

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 – All Test Groups

A Certificate of Conformance stating that all specimens submitted for testing were representative of normal production lots and met the requirements of the applicable product drawing was provided. Where specified, specimens were visually examined, and no evidence of physical damage detrimental to product performance was observed.

2.2. Low Level Contact Resistance – Test Groups 1 and 2

All low-level contact resistance measurements recorded were less than the corresponding requirement listed in Figure 3 per wire size and material.

Current, Resistance and Crimp Tensile Strength Specifications

Wire Size		Current and Resistance Specifications			Tensile Strength Specs [lbs]
		Copper			
AWG	CMA	Current (amps)		Low Level Resistance* (mΩ max)	Copper
		T-Rise	Cycled		
32	64	0.5	1.5	36.0	0.7
31	79	1.0	2.0	26.0	1.0
30	100	1.5	3.5	23.0	1.4
29	128	2.0	4.5	18.0	2.1
28	159	2.5	5.0	14.4	2.8
27	202	3.0	6.0	10.0	3.5
26	258	3.5	7.5	9.1	4.2
25	320	4.0	8.0	7.2	5.6
24	404	5.0	9.5	5.7	7.0
23	511	5.5	11.0	4.6	9.1
22	640	6.5	12.5	4.3	11.2
21	812	7.0	14.0	3.5	14.7
20	1024	8.0	16.0	2.7	18.2
19	1289	9.0	18.0	2.2	23.1
18	1624	10.0	20.0	2.0	29.4
17	2052	11.0	22.0	1.8	37.1
16	2581	14.0	28.0	1.6	46.2
15	3260	16.0	32.0	1.4	58.8
14	4109	18.5	37.0	1.2	99.0

**Resistance measurement includes crimp + 1.5 inches of wire.*

Figure 3

2.3. Temperature Rise Vs. Current – Test Group 1

All specimens had values of less than 30°C for temperature rise vs. current measurements at their respective current levels, initially and finally. Refer to Figure 3 for the listing of T-rise currents per wire size and material.

2.4. Current Cycling – Test Group 2

No evidence of physical damage detrimental to product performance was observed during or after current cycling. Low level contact resistance measurements were taken initially, and after every 5,000 cycles. Refer to Figure 3 for the listing of cycled currents per wire size and material.

2.5. Vibration, random – Test Group 1

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

2.6. Termination tensile strength – Test Group 3

All termination tensile strength measurements recorded were greater than the corresponding requirement listed in Figure 3 per wire size and material.

2.7. Thermal Shock – Test Group 1

No evidence of physical damage detrimental to product performance was observed.

2.8. Humidity Exposure – Test Group 1

No evidence of physical damage detrimental to product performance was observed.

2.9. Temperature Life – Test Group 1

No evidence of physical damage detrimental to product performance was observed.

2.10. Final Examination of Product – All Test Groups

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

3. TEST METHODS

3.1. Initial Examination of Product

A Certificate of Conformance 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

Low level contact resistance measurements were taken at a current level of 100 milliamperes maximum and 20 millivolts maximum open circuit voltage. Measurements were taken from the center of the AMPLIVAR Splice to a point on the magnet wire that was 1.5 inches from the center of the splice. Figure 4 illustrates the measurement points.

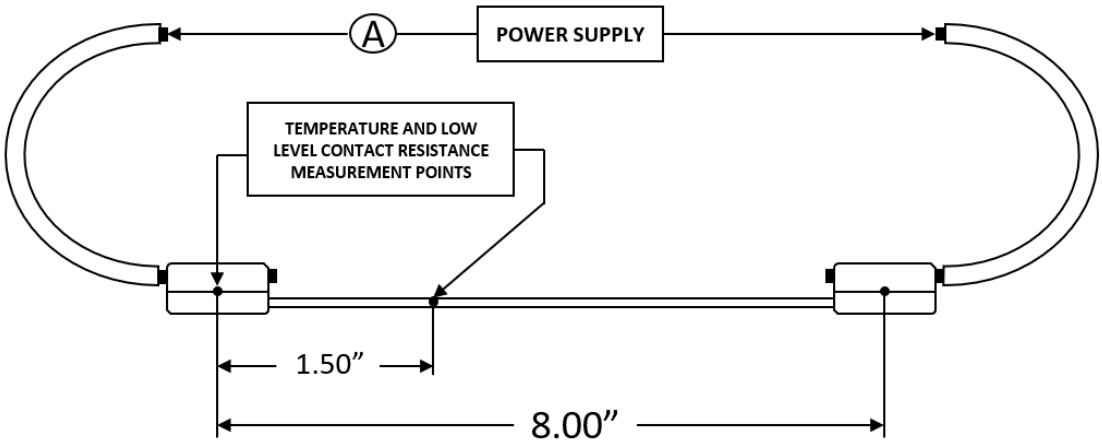


Figure 4: Temperature and Low Level Contact Resistance Measurement Points

3.3. Temperature Rise vs. Current

Infrared temperature measurement points were coated with Equate powder, 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 a 34/80 mm close up lens attached to the standard optics (24°) lens to image the test specimens. ThermaCAM* Researcher 2001 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 temperature. The test specimens were placed a temperature rise enclosure. Refer to Figure 5 for an image of the typical test setup.

Figure 5

Test Photos:

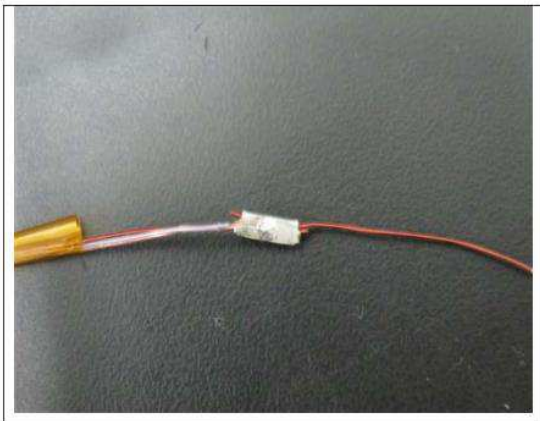


Fig.1: Typical thermocouple location

Fig.2: Typical test setup

3.4. Current Cycling

Testing consisted of 10,000 cycles of current cycling, with each cycle having current on for 3 minutes and current off for 3 minutes. Low level contact resistance measurements were taken after 5000 cycles and at the completion of the 10,000 cycles.

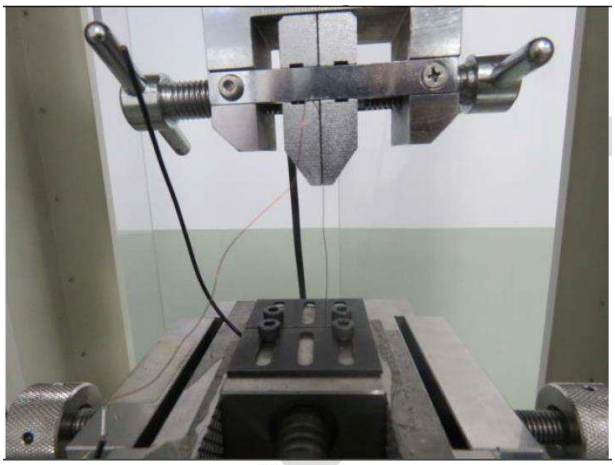
3.5. Vibration, random

The test specimens were subjected to a random vibration test. 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 3 hours in each of the three mutually perpendicular axes, for a total test time of 9 hours per test specimen. The test specimens were monitored for discontinuities of 1 microsecond or greater using an energizing current of 100 milliamperes.

3.6. Termination Tensile Strength

A floating XY table was secured to the base of the tensile machine. A slotted plate fixture was fastened to the XY table. A mandrel was attached to the crosshead of the tensile machine. The magnet wire of each test specimen was placed in the clamp and the crimp was held in the slotted plate. The crosshead was then raised at a speed of 25mm per minute until failure. A photo of the test setup for test sets Figure 6 below.

Figure 6



Test setup

3.7. Thermal Shock

Test specimens were subjected to fifty cycles of thermal shock testing from -65°C to 150°C with 30-minute dwells at each extreme.

3.8. Humidity Exposure

Specimens were subjected to 40°C at 90-95% relative humidity for 96 hours in an environmental chamber.

3.9. Temperature Life

Specimens were subjected to 150°C for 96 hours in an air circulating oven.

3.10. Final Examination of Product

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

4. REVISION HISTORY.

Revision	Change Description
A	Initial Release
A1	Test samples table (Figure 1) and Current Cycling Test Figure 5 updated