Rapid Lock Quick Connect/Disconnect Bus Bar Power Qualification Test Specification

1. INTRODUCTION

1.1. Purpose

Testing was performed on the Rapid Lock Quick Connect/Disconnect Bus Bar Power Connector System to determine its conformance to the requirements of Product Specification 108-64019.

1.2. Scope

This report covers the electrical, mechanical, and environmental performance of the Rapid Lock Quick Connect/Disconnect Bus Bar Power Connector System. Testing was performed at the TE Connectivity Shanghai Electrical Component Testing Laboratory between 04 Oct 2013 and 15 Feb. 2014.

1.3. Conclusion

The Rapid Lock Quick Bus Bar Power Connector System conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-64019.

1.4. Test Specimens

Test specimens were representative of normal production lots. Specimens identified with Rapid Lock Quick Bus Bar Power Socket and Pin conn. #8, #6, #2, #12mm. Manufacturer: TE Connectivity Switzerland.

1.5. Environmental Conditions

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

- Temperature: 25±10°C
- Relative Humidity: 50±25% RH

| Indicates Change

1.6. Qualification Test Sequence

Test or Examination	Test Group			
	1	2	3	4
Initial examination of product	1	1	1	1
Low level contact resistance	2,5,7	4,7,9,13	3,6,8,10	2,6,8(c),12
Contact resistance at rated current				10
Insulation resistance		2,10		
Withstanding voltage		3,11		
Temperature rise vs. current test				4,9
Vibration, random			9	
Mechanical shock			7	
Durability	3(a)	5	4(a)	3(a)
Mating force			2	
Unmating force			11	
Thermal shock		6		
Humidity-temperature cycling		8		
Temperature life	4		5(b)	5(b)
Mixed flowing gas				7(d)
Reseating	6	12		11
Final examination of product	8	14	12	13

NOTE

(a) Durability (preconditioning)
(b) Temperature life (preconditioning)
(c) LLCR after MFG 7days, and LLCR after MFG 14 days
(d) MFG-Class IIA. ½ samples mated 14days; ½ samples unmated 7days, and then mated for final 7days.

Figure 1

2. SUMMARY OF TESTING

2.1. Initial Examination of Product - All Test Groups

All specimens submitted for testing were representative of normal production lots. A Certificate of Conformance was issued by Product Assurance. Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

2.2. Low Level Contact Resistance – All Test Groups

All low level contact resistance measurements, taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage were as below specification for mated Rapid Lock connector.

Conn. Size	Crimp Size	LLCR /milliohm Max.	Test result
#8	#12	0.5	0.430
	#8	0.5	0.250
	#6	0.5	0.234
#4	#8	0.3	0.211
	#6	0.3	0.210
	#4	0.3	0.140
#2	#4	0.2	0.142
	#2	0.2	0.110
	#0	0.2	0.150
	#1/0	0.2	0.090
12mm	95mm²	0.1	0.023

Figure 2. Rapid Lock power LLCR

2.3. Contact Resistance at Rated Current - Test Group 4

All contact resistance at rated current measurements #8: 50A; #4: 110A; #2: 150A; #12mm: 250A, meet the contact resistance specification as below, initial and end of life.

Conn. Size	Crimp Size	CR Specification	Test result
#8	#12	0.5	0.430
	#8	0.5	0.250
	#6	0.5	0.234
#4	#8	0.3	0.211
	#6	0.3	0.210
	#4	0.3	0.140
#2	#4	0.2	0.142
	#2	0.2	0.110
	#0	0.2	0.150
	#1/0	0.2	0.090
12mm	95mm²	0.1	0.023

Figure 3. Rapid Lock power Contact Resistance

2.4. Insulation Resistance - Test Group 2

All insulation resistance measurements were greater than 5000 megohms.

2.5. Withstanding Voltage - Test Group 2

No dielectric breakdown or flashover occurred.

2.6. Temperature Rise vs Current - Test Group 4

All specimens had a temperature rise of less than 30°C above ambient when tested using a baseline rated current of #8: 50A; #4: 110A; #2: 150A; #12mm: 250A, for Rapid Lock Power Connector, initial and final temperature rise.

2.7. Vibration - Test Group 3

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

2.8. Mechanical Shock - Test Group 3

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

2.9. Durability (preconditioning) - Test Groups 1, 3, and 4

No physical damage occurred as a result of mating and unmating the specimens 5 cycles.

2.10. Durability - Test Groups 2

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

2.11. Mating Force - Test Group 3

All average mating force measurements were less than 150 N per connector.

2.12. Unmating Force - Test Group 3

All unmating force measurements were more than 20 N per connector.

2.13. Reseating - Test Group 1, 2, and 4

No physical damage occurred after mating/unmating manually samples for three cycles.

2.14. Thermal Shock - Test Group 2

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

2.15. Humidity-temperature Cycling - Test Group 2

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

2.16. Temperature Life (preconditioning) - Test Groups 3, 4

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

2.17. Temperature Life - Test Group 1

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

2.18. Mixed Flowing Gas - Test Group 4

No evidence of physical damage was visible as a result of exposure to the pollutants of mixed flowing gas.

2.19. 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 made using a 4 terminal measuring technique. The test current was maintained at 100 milliamperes maximum with a 20 millivolt maximum open circuit voltage.

3.3. Contact Resistance at Rated Current

Contact resistance measurements at rated current were made using a 4 terminal measuring technique. The test specimens were energized at the rated current in accordance with Design Specification 108-64019 and EIA-364-06.

3.4. Insulation Resistance

Insulation resistance was measured between adjacent contacts of mated specimens. A test voltage of 500 volts DC was applied for one minute before the resistance was measured, in accordance with EIA-364-21.

3.5. Withstanding Voltage

A test potential of 750 volts AC for power contacts was applied between adjacent mated specimens. This potential was applied for 1 minute and then returned to zero, in accordance with EIA-364-20.

3.6. Temperature Rise vs Current

Temperature rise was measured on 5 unstressed and stressed specimens using infrared imaging. Temperature rise curves were established for specimens with a single circuit energized. All contacts were energized at 5 different current levels. The specimens were allowed to stabilize before the temperature was measured. The specimens were imaged using standard optics after applying an emissivity correction coating (Micatin™ foot powder). The emittance of the emissivity correction factor is 0.93. Raising this emittance value allows for accurate temperature measurements. ThermaCAM™ Researcher 2001 thermal image processing was used for data analysis. The software has a temperature box measurement feature to determine maximum temperature of the contact. This software feature allows a measurement of the area inside the box when placed on an area of interest. The specimens were placed in the stable air environment of a temperature rise enclosure. In accordance with EIA-364-70.

3.7. Vibration

Mated specimens were subjected to a random vibration test, specified by a random vibration spectrum, in accordance with EIA-364-28, condition V, letter C. This was performed for 120 minutes in each of 3 mutually perpendicular planes. Specimens were monitored for discontinuities of 1 microsecond.

3.8. Mechanical Shock

Mated specimens were subjected to a mechanical shock test having a half-sine waveform of 50 gravity units (g peak) and a duration of 11 milliseconds, in accordance with EIA-364-27, condition A. Three shocks in each direction were applied along the 3 mutually perpendicular planes for a total of 18 shocks. Specimens were monitored for discontinuities of 1 microsecond or greater using a current of 100 milliamperes DC.

3.9. Durability (preconditioning)

Specimens were mated and unmated 5 cycles at a maximum rate of 500 cycles per hour.

3.10. Durability

Specimens were mated and unmated 50 cycles at a maximum rate of 500 cycles per hour.

3.11. Mating Force

The force required to mate individual specimens was measured using a tensile/compression device with a free floating fixture and a rate of travel of 12.7 mm [.5 in] per minute.

3.12. Unmating Force

The force required to unmate individual specimens was measured using a tensile/compression device with a free floating fixture and a rate of travel of 12.7 mm [.5 in] per minute.

3.13. Reseating

Specimens were mated and unmated 3 cycles manually.

3.14. Thermal Shock

Mated specimens were subjected to 25 cycles of thermal shock between -65°C and 105°C, in accordance with EIA-364-32, method A, condition II.

3.15. 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 while maintaining high humidity, in accordance with EIA-364-31, method III, condition B.

3.16. Temperature Life (preconditioning)

Mated specimens were exposed to a temperature of 105°C for 72 hours in accordance with EIA-364-17, method A; temperature and duration per EIA-364-1000 table 9, 60℃ for 10 years.

3.17. Temperature Life

Mated specimens were exposed to a temperature of 105°C for 1000 hours in accordance with EIA-364-17, method A, condition 4.

3.18. Mixed Flowing Gas, Class IIA

Specimens were exposed for 14 days to a mixed flowing gas Class IIA exposure. Class IIA exposure is defined as a temperature of 30±1°C and a relative humidity of 70±2% with the pollutants of Cl2 at 10 ±3 ppb, NO2 at 200±50 ppb, H2S at 10±5 ppb and SO2 at 100±20 ppb, in accordance with EIA-364-65, class IIA. ½ subject samples mated for 336 hours (14days); ½ subject samples unmated 168 hours (7days), and then mated for final 168 hours (7days).

3.19. Final Examination of Product

Specimens were visually examined for evidence of physical damage detrimental to product performance.