SHUR-PLUG* and SHUR-PLUG* Receptacles

1. INTRODUCTION

1.1. Purpose

Testing was performed on .180 inch diameter SHUR-PLUG* and SHUR-PLUG* Receptacles to determine their conformance to the requirements of Product Specification 108-1899 Revision A.

1.2. Scope

This report covers the electrical, mechanical, and environmental performance of SHUR-PLUG and SHUR-PLUG Receptacles. Testing was performed at the Engineering Assurance Product Testing Laboratory between 12Apr99 and 28May08. The test file number for this testing is EA20080587T. This documentation is on file at and available from the Engineering Assurance Product Testing Laboratory.

1.3. Conclusion

The SHUR-PLUG and SHUR-PLUG Receptacles listed in paragraph 1.5., conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-1899 Revision A.

1.4. Product Description

The .180 inch diameter SHUR-PLUG is only available as a straight contact while SHUR-PLUG receptacles are available in straight and right angle versions.

1.5. Test Specimens

Test specimens were representative of normal production lots. Specimens identified with the following part numbers were used for test:

Part Number	Description
42531-1	.180 inch diameter SHUR-PLUG receptacle with 16 AWG wire
42865-3	.180 inch diameter SHUR-PLUG with 10 AWG wire
60660-1	.180 inch diameter SHUR-PLUG with 14 AWG wire
60798-4	.180 inch diameter SHUR-PLUG receptacle with 14 AWG wire
505038-1	.180 inch diameter SHUR-PLUG with 16 AWG wire
1217074-2	.180 inch diameter SHUR-PLUG receptacle with 8 AWG wire
1217070-1	.180 inch diameter SHUR-PLUG receptacle with 8 AWG wire

Figure 1

* Trademark
| Indicates change

1.6. Environmental Conditions

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

- Temperature: 15 to 35˚C
- Relative Humidity: 25 to 75%

1.7. Qualification Test Sequence

Test or Examination	Test Group (a)		
	1	2	3
	Test Sequence (b)		
Initial examination of product	1	1	1
LLCR		2,7	
Contact resistance, specified current	3,7		
Temperature rise vs current		3,8	
Crimp tensile			2
Sinusoidal vibration	5	6(c)	
Mechanical shock	6		
Durability	4		
Mating force	2		
Unmating force	8		
Humidity/temperature cycling		4(d)	
Temperature life		5	
Final examination of product	9	9	

NOTE

(a) See paragraph 1.5.
(b) Numbers indicate sequence in which tests are performed.
(c) Discontinuities shall not be measured. Energize at 18˚C level for 100% loadings per Quality Specification 102-950.
(d) Precondition specimens with 6 durability cycles.

Figure 2

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 (C of C) was issued by Product Assurance. Specimens were visually examined and no evidence of physical damage detrimental to product performance was observed.

2.2. Contact Resistance - Test Groups 1 and 2

A. Low Level Contact Resistance (LLCR) - Test Group 2

All LLCR measurements, taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage were less than 4 milliohms initially and had a change in resistance (ΔR) of less than 4 milliohms after testing.

Test Group	Number of Data Points	Condition	Termination Resistance		
			Min	Max	Mean
1	21	Initial	0.52	0.56	0.54
	21	After mechanical (ΔR)	-0.01	0.18	0.06
2	21	Initial	0.49	0.58	0.52
	21	After vibration (ΔR)	0.12	0.87	0.25

NOTE *All values in milliohms.*

Figure 3

B. Contact Resistance, Specified Current - Test Group 1

All contact resistance measurements, taken at 1 ampere maximum and 1 volt maximum open circuit voltage were less than 4 milliohms initially and had a change in resistance (ΔR) of less than 4 milliohms after testing.

2.3. Temperature Rise vs Current - Test Group 2

All specimens had a temperature rise of less than 30˚C above ambient when tested using a baseline rated current of 30 amperes and the correct derating factor value based on the specimens wiring configuration.

2.4. Crimp Tensile - Test Group 3

All crimp tensile were greater than those shown in Figure 4.

Wire Size (AWG)	Crimp Tensile (Pounds Minimum)
18	20
16	30
14	50
12	70
10	80
8	57

Figure 4

2.5. Sinusoidal Vibration - Test Groups 1 and 2

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

2.6. Mechanical Shock - Test Group 1

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

2.7. Durability - Test Group 1

No physical damage occurred as a result of manually mating and unmating the specimens 6 times.

2.8. Mating Force - Test Group 1

All mating force measurements were less than 17 pounds.

2.9. Unmating Force - Test Group 1

All unmating force measurements were greater than 5.7 pounds.

2.10. Humidity/temperature Cycling - Test Group 2

No evidence of physical damage was visible as a result of exposure to humidity/temperature cycling.

2.11. Temperature Life - Test Group 2

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

2.12. 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 C o f 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. Contact Resistance

A. LLCR

Termination resistance measurements at low level current were made using a 4 terminal measuring technique. Resistance was measured, on the wire, at 1 inch back from the wire crimp of a terminal to the same point on the mating terminal. A wire bulk resistance adjustment value was determined and subtracted from all resistance measurements. The test current was maintained at 100 milliamperes maximum with a 20 millivolt maximum open circuit voltage.

B. Contact Resistance, Specified Current

Termination resistance measurements at specified current were made using a 4 terminal measuring technique. Resistance was measured, on the wire, at 1 inch back from the wire crimp of a terminal to the same point on the mating terminal. A wire bulk resistance adjustment value was determined and subtracted from all resistance measurements. The test current was maintained at 1 ampere maximum with a 1 volt maximum open circuit voltage.

3.3. Temperature Rise vs Current

Temperature rise curves were produced by measuring individual contact temperatures at 5 different current levels. These measurements were plotted to produce a temperature rise vs current curve. Thermocouples were attached to individual contacts to measure their temperatures. The ambient temperature was then subtracted from this measured temperature to find the temperature rise. When the temperature rise of 3 consecutive readings taken at 5 minute intervals did not differ by more than 1˚C, the temperature measurement was recorded.

3.4. Crimp Tensile

The force load was applied using a tensile/compression device with a free floating fixture and a rate of travel of 1 inch per minute.

3.5. Sinusoidal Vibration

Mated specimens were subjected to sinusoidal vibration, having a simple harmonic motion with an amplitude of .06 inch double amplitude. The vibration frequency was varied uniformly between the limits of 10 and 55 Hz and returned to 10 Hz in 1 minute. This cycle was performed 120 times in each of 2 mutually perpendicular planes for a total vibration time of 4 hours. The mating axis was not tested. One end of the test specimens was mounted to the vibrating surface while the other end was secured to a non-vibrating support leaving a minimum of 8 inches of unsupported cable in between. Test group 1 specimens were monitored for discontinuities of 1 microsecond or greater using a current of 100 milliamperes DC. Test group 2 specimens were energized at 32 amperes.

3.6 Mechanical Shock, Half-sine

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. 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.

3.7. Durability

Specimens were manually mated and unmated 6 times.

3.8. 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 1 inch per minute.

3.9. 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 1 inch per minute.

3.10. Humidity/temperature Cycling

Unmated specimens were exposed to 10 humidity/temperature cycles. Each cycle lasted 24 hours and consisted of cycling the temperature between 25 and 65˚C twice while maintaining high humidity (Figure 5). Specimens were preconditioned with 6 durability cycles.

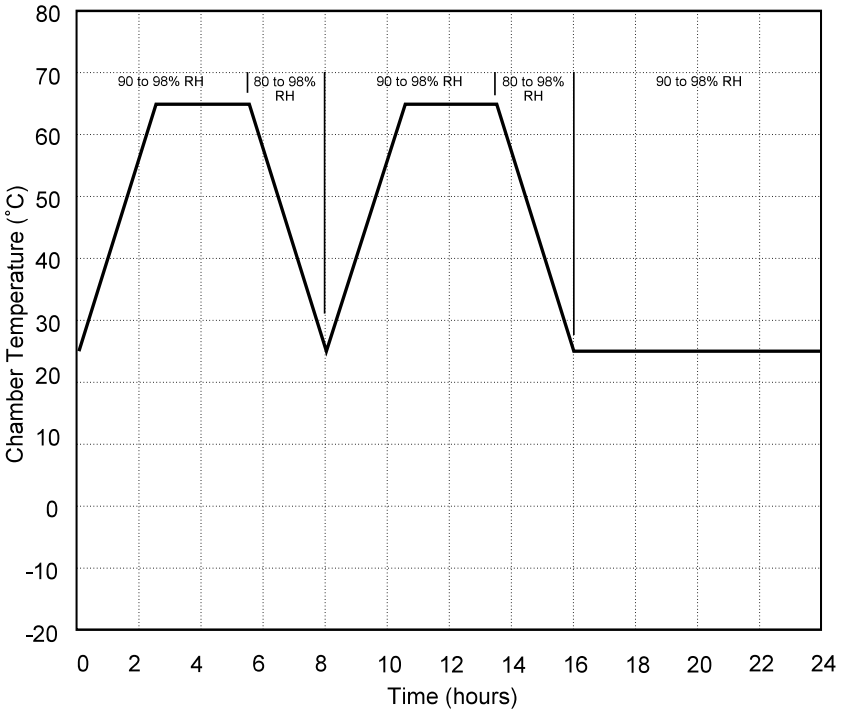

Figure 5
Typical Humidity/Temperature Cycling Profile

3.11. Temperature Life

Mated specimens were exposed to a temperature of 105˚C for 500 hours.

3.12. Final Examination of Product

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