AMPSEAL* Connectors

1. INTRODUCTION

1.1. Purpose

Testing was performed on AMPSEAL* Connectors to determine their conformance to the requirements of Product Specification 108-1329 Revision B.

1.2. Scope

This report covers the electrical, mechanical, and environmental performance of AMPSEAL Connectors. Testing was performed at the Engineering Assurance Product Testing Laboratory between 16Jun93 and 24Sep93. The test file number for this testing is CTL6933-035-003. This documentation is on file at and available from the Engineering Assurance Product Testing Laboratory.

1.3. Conclusion

The AMPSEAL Connectors listed in paragraph 1.5., conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-1329 Revision B.

1.4. Product Description

AMPSEAL Connectors are high density, general purpose, environmentally sealed connectors used for wire to PCB applications in the automotive, consumer, industrial, trucking, off-highway, construction, farming and marine markets.

1.5. Test Specimens

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

Test Group	Quantity	Part Number	Description
1	23	770520-1	Sn receptacles with 16 AWG wire
	23	770520-1	Sn receptacles with 20 AWG wire
	2	770669-2	Sn header assembly
	2	770680-2	Plug assembly
2	32	770520-3	Au receptacles with 16 AWG wire
	152	770520-3	Au receptacles
	8	1-770669-1	Au header assembly
	8	770680-1	Plug assembly
3	69	770520-1	Sn receptacles with 16 AWG wire
	69	770520-1	Sn receptacles with 20 AWG wire
	5	770669-2	Sn header assembly
	5	770680-2	Plug assembly
4	46	770520-1	Sn receptacles with 16 AWG wire
	2	770669-2	Sn header assembly
	2	770680-2	Plug assembly

Figure 1 (continued)

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| Indicates change

Test Group	Quantity	Part Number	Description
5	1	770680-2	Plug assembly
	6	770520-1	Sn receptacles with 16 AWG wire
	6	770520-1	Sn receptacles with 20 AWG wire
6	46	770520-1	Sn receptacles with 16 AWG wire
	1	770669-2	Sn header assembly
7	46	770520-1	Sn receptacles with 20 AWG wire
	4	770669-2	Sn header assembly
	4	770680-2	Plug assembly

Figure 1 (end)

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	4	5	6	7
	Test Sequence (b)						
Examination of product	1	1,11	1,7	1,5	1	1,3	1,12
Termination resistance, dry circuit	3,7	2,7,10					
Termination resistance, specified current				2,4			
Insulation resistance			2,5				3,6,10
Dielectric withstanding voltage			3,6				2,5,9
Temperature rise vs current		3,9					
Current cycling				3			
Solderability						2	
Crimp tensile	10				4		
Sinusoidal vibration	5						
Random vibration		8(c)					
Physical shock	6						
Durability	4	4					
Contact retention					3		
Contact insertion					2		
Mating force	2						
Unmating force	8						
Housing lock strength	9						
Immersion							4,8
Polarizing and keying feature strength							11
Temperature life		6					7
Mixed flowing gas		5					
Humidity/temperature cycling			4				

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 Test Specification 109-151.

Figure 2

2. SUMMARY OF TESTING

2.1. Examination of Product - All Test Groups

All specimens submitted for testing were selected from normal current production. They were inspected and accepted by the Product Assurance Department of the Automotive/Consumer Business Group.

2.2. Termination Resistance, Dry Circuit - Test Groups 1 and 2

All termination resistance measurements, taken at 50 milliamperes and 20 millivolts maximum open circuit voltage were less than 10 milliohms.

Test Group	Number of Data Points	Condition	Termination Resistance		
			Min	Max	Mean
1	46	Initial	1.63	2.65	2.19
		After mechanical	1.73	2.69	2.21
2	32	Initial	1.09	5.62	2.53
		After temperature life	0.41	7.38	2.99
		After vibration	1.09	3.49	2.35

NOTE *All values in milliohms.*

Figure 3

2.3. Termination Resistance, Specified Current - Test Group 4

All termination resistance measurements, taken at the specified current were less than 10 milliohms.

Test Group	Number of Data Points	Condition	Termination Resistance		
			Min	Max	Mean
4	46	Initial	1.73	2.39	2.04
		After current cycling	1.75	2.49	2.09

NOTE *All values in milliohms.*

Figure 4

2.4. Insulation Resistance - Test Groups 3 and 7

All insulation resistance measurements were greater than 100 megohms.

2.5. Dielectric Withstanding Voltage - Test Groups 3 and 7

No dielectric breakdown or flashover occurred.

2.6. Temperature Rise vs Current - Test Group 2

All specimens had a temperature rise of less than 40˚C above ambient when energized at 17 amperes DC.

2.7. Current Cycling - Test Group 4

No physical damage occurred as a result of current cycling.

2.8. Solderability - Test Group 6

All solderable areas had a minimum of 95% solder coverage.

2.9. Crimp Tensile Test Groups 1 and 5

All crimp tensile values were greater than 150 N for 16 AWG wire and 80 N for 20 AWG wire.

2.10. Sinusoidal Vibration - Test Group 1

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

2.11. Random Vibration - Test Group 2

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

2.12. Physical Shock - Test Group 1

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

2.13. Durability - Test Groups 1 and 2

No physical damage occurred as a result of mating and unmating the specimens 10 times.

2.14. Contact Retention - Test Group 5

No physical damage occurred to either the contacts or the housing, and no contacts dislodged from the housing as a result of applying an axial load of 115 N to the contacts.

2.15. Contact Insertion - Test Group 5

The force required to insert each contact into its housing cavity was less than 10 N.

2.16. Mating Force - Test Group 1

All mating force measurements were less than 180 N.

2.17. Unmating Force - Test Group 1

All unmating force measurements were less than 100 N.

2.18. Housing Lock Strength - Test Group 1

Mated specimens did not unmate with a 160 N axial load applied.

2.19. Immersion - Test Group 7

Leakage current did not exceed 50 micro amperes while specimens were immersed in salt water.

2.20. Polarizing and Keying Feature Strength - Test Group 7

Specimens did not mate against the polarizing/keying feature with a 175 N force applied.

2.21. Temperature Life - Test Groups 2 and 7

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

2.22. Mixed Flowing Gas - Test Group 2

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

2.23. Humidity/temperature Cycling - Test Group 3

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

3. TEST METHODS

3.1. Examination of Product

Product drawings and inspection plans were used to examine the specimens visually and functionally.

3.2. Termination Resistance, Dry Circuit

Termination resistance measurements at low level current were made using a 4 terminal measuring technique (Figure 5). The test current was maintained at 50 milliamperes maximum with a 20 millivolt maximum open circuit voltage.

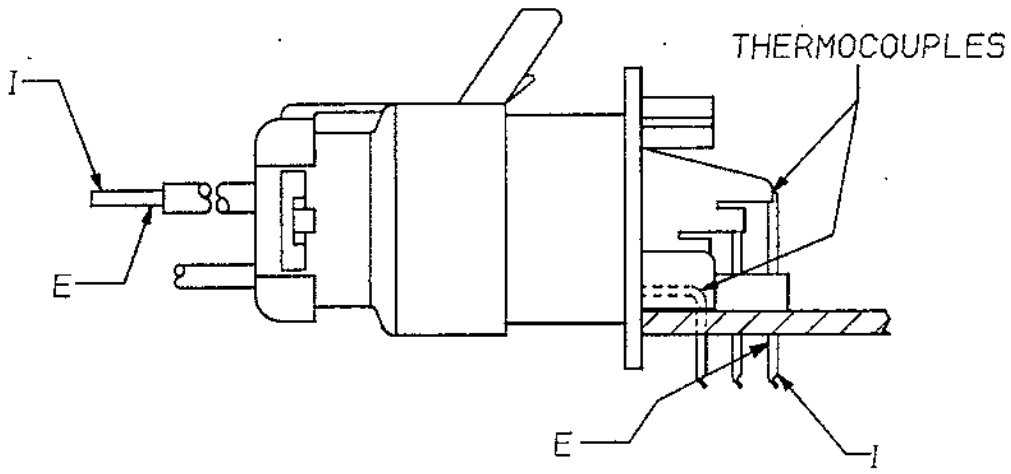

Figure 5
Typical Termination Resistance Measurement Points

3.3. Termination Resistance, Specified Current

Termination resistance measurements at specified current were made using a 4 terminal measuring technique (see Figure 5).

3.4. Insulation Resistance

Insulation resistance was measured between adjacent contacts of mated specimens. A test voltage of 500 volts DC was applied for 2 minutes before the resistance was measured.

3.5. Dielectric Withstanding Voltage

A test potential of 1000 volts AC was applied between adjacent contacts of mated specimens. This potential was applied for 1 minute and then returned to zero.

3.6. Temperature Rise vs Current

Specimen temperatures were measured while energized at specified currents. Thermocouples were attached to measure specimen temperatures. Specimen temperatures were subtracted from the ambient temperature to determine the temperature rise. When 3 readings taken at 5 minute intervals were the same, the readings were recorded.

3.7. Current Cycling

Specimens were subjected to 125% of rated current for 500 cycles consisting of current ON for 45 minutes and current OFF for 15 minutes.

3.8. Solderability

Specimen contact solder tails were subjected to a solderability test. The soldertails were immersed in a mildly activated rosin flux for 5 to 10 seconds, allowed to drain for 10 to 60 seconds, then held over molten solder without contact for 2 seconds. The solder tails were then immersed in the molten solder at a rate of approximately 25.4 mm per second, held for 3 to 5 seconds, then withdrawn. After cleaning in isopropyl alcohol, the specimens were visually examined for solder coverage. The solder used for testing was 60/40 tin lead composition maintained at a temperature of 245˚C.

3.9. Crimp Tensile

The force load was applied to each specimen using a tensile/compression device with the rate of travel at 25.4 mm per minute.

3.10. Sinusoidal Vibration

Mated specimens were subjected to sinusoidal vibration, having a simple harmonic motion with an amplitude of 1.5 mm double amplitude. The vibration frequency was varied uniformly between the limits of 10 and 500 Hz and returned to 10 Hz in 15 minutes. This cycle was performed 64 times in each of 3 mutually perpendicular planes for a total vibration time of 48 hours. Specimens were monitored for discontinuities of 1 microsecond or greater using a current of 100 milliamperes DC.

3.11. Random Vibration

Mated specimens were subjected to a random vibration test, specified by a random vibration spectrum, with excitation frequency bounds of 10 and 500 Hz. The Power Spectral Density (PSD) was flat at 0.2 G^2/Hz from 10 to 500 Hz. The root-mean square amplitude of the excitation was 10 GRMS.

3.12. Physical Shock

Mated specimens were subjected to a physical 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.

3.13. Durability

Specimens were mated and unmated 10 times at a maximum rate of 600 cycles per hour.

3.14. Contact Retention

An axial load of 115 N was applied to each contact, with the Wedge Lock in the locked position, and held for 60 seconds. The force was applied in a direction to cause removal of the contacts from the housing.

3.15. Contact Insertion

The force required to insert the contact/wire into the housing was measured.

3.16. Mating Force

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

3.17. Unmating Force

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

3.18. Housing Lock Strength

An axial load of 160 N was applied to mated specimens in a manner which would cause the specimen lacking latches to disengage.

3.19. Immersion

Mated specimens were immersed in a 5% salt water solution for 1 hour. All adjacent circuits were paralleled. A polarization voltage of 48 volts DC was applied to monitor the leakage current.

3.20. Polarizing and Keying Feature Strength

An axial force of 175 N was applied to the plug half of the specimen in an attempt to mate it to a receptacle backwards.

3.21. Temperature Life

Mated tin plated specimens were exposed to a temperature of 100˚C for 500 hours. Mated gold plated specimens were exposed to a temperature of 155˚C for 100 hours.

3.22. Mixed Flowing Gas

Mated specimens were exposed for 20 days to a mixed flowing gas Class II exposure. Class II exposure is defined as a temperature of 30˚C and a relative humidity of 70% with the pollutants of Cl_2 at 10 ppb, NO_2 at 200 ppb, and H_2S at 10 ppb.

3.23. Humidity/temperature Cycling

Mated specimens were exposed to 10 humidity/temperature cycles of the following:

- Hold at 23 ± 5˚C and 45 to 75% Relative Humidity (RH) for 4 hours.
- Raise chamber temperature to 55 ± 2˚C at 95 to 99% RH within 0.5 hour.
- Hold at 55 ± 2˚C and 95 to 99% RH for 10 hours.
- Lower chamber temperature to -40 ± 2˚C within 2.5 hours.
- Hold at -40 ± 2˚C for 2 hours.
- Raise chamber temperature to 125 ± 2˚C within 1.5 hours.
- Hold at 125 ± 2˚C for 2 hours.
- Recover to 23 ± 5˚C within 1.5 hours.