Sealed Circular Plastic Connector With Removable Crimp Contacts

1. INTRODUCTION

1.1. Purpose

Testing was performed on the Tyco Electronics sealed circular plastic connector with removable crimp contacts to determine its conformance to the requirements of Product Specification 108-1579 Revision B.

1.2. Scope

This report covers the electrical, mechanical, and environmental performance of the sealed circular plastic connector with removable crimp contacts. Testing was performed at the Engineering Assurance Product Testing Laboratory between 18Feb97 and 16Jun97. The test file number for this testing is CTL 7970-003-002AR. This documentation is on file at and available from the Engineering Assurance Product Testing Laboratory.

1.3. Conclusion

The sealed circular plastic connector with removable crimp contacts listed in paragraph 1.5., conformed to the electrical, mechanical, and environmental performance requirements of Product Specification 108-1579 Revision B.

1.4. Product Description

The sealed circular plastic connector with removable crimp contacts are designed for use in electronic, electric power and control units where environmental protection is needed.

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	Connector Type	Connector Part Number	Connector Quantity	Contact Type	Contact Part Number	Wire AWG
1	Plug	213905-1	5	Pin	213841-2	8
	Receptacle	213890-2	5	Socket	213843-2	8
2	Plug	213905-1	10	Pin	213841-2	8
	Receptacle	213890-2	10	Socket	213843-2	8
	Plug	213905-1	10	Pin	213845-2	14
	Receptacle	213890-2	10	Socket	213847-2	14
3	Plug	213905-1	5	Pin	213841-2	8
	Receptacle	213890-2	5	Socket	213843-2	8
4	Plug	213905-1	5	Pin	213841-2	8
	Receptacle	213890-2	5	Socket	213843-2	8
	Plug	213905-1	5	Pin	213845-2	14
	Receptacle	213890-2	5	Socket	213847-2	14

Figure 1

* Trademark
| Indicates change

1.6. Qualification Test Sequence

Test or Examination	Test Group (a)			
	1	2	3	4
	Test Sequence (b)			
Examination of product	1,9	1,9	1,9	1,7
Termination resistance	3,7	2,7		2,6
Insulation resistance			2,6	
Dielectric withstanding voltage			3,7	
Temperature rise vs current		3,8		
Vibration	5	6(c)		
Physical shock	6			
Durability	4			
Contact retention			8	
Coupling torque	2			
Uncoupling torque	8			
Dust powder				4
Water jet splashing				5
Impact				3
Thermal shock			4	
Humidity/temperature cycling			5	
Temperature life		5		
Mixed flowing gas		4(d)		

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.
(d) Precondition specimens with 10 cycles durability.

Figure 2

2. SUMMARY OF TESTING

2.1. 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. Termination Resistance - Test Groups 1, 2 and 4

All low level contact resistance measurements, taken at 100 milliamperes maximum and 20 millivolts maximum open circuit voltage were less than 0.8 milliohm.

Test Group	Wire AWG	Condition	Termination Resistance			
			Min	Max	Mean	Std Dev
1	8	Initial	0.444	0.558	0.513	0.031
		Final	0.523	0.735	0.589	0.058
2	8	Initial	0.431	0.551	0.495	0.036
		Final	0.514	0.773	0.607	0.058
4	8	Initial	0.417	0.535	0.464	0.035
		Final	0.454	0.546	0.510	0.030
	14	Initial	1.213	1.321	1.257	0.034
		Final	1.244	1.338	1.292	0.027

NOTE *All values in milliohms.*

Figure 3

2.3. Insulation Resistance - Test Group 3

All insulation resistance measurements were greater than 5000 megohms.

2.4. Dielectric Withstanding Voltage - Test Group 3

No dielectric breakdown or flashover occurred.

2.5 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 and the correct derating factor value based on the specimens wiring configuration.

2.6. 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.

2.7. Physical 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.

2.8. Durability - Test Group 1

No physical damage occurred as a result of mating and unmating the specimens 500 times.

2.9. Contact Retention - Test Group 3

A force was applied to the mating end of the contact and increased until the contact was dislodged from the housing.

2.10. Coupling Torque - Test Group 1

All coupling torque measurements were greater than 1 inch-pound, and less than 15 inch-pounds.

2.11. Uncoupling Torque - Test Group 1

All uncoupling torque measurements were greater than 1 inch-pound, and less than 15 inch-pounds.

2.12. Dust Powder - Test Group 4

No evidence of physical damage was visible as a result of exposure to dust powder.

2.13. Water Jet Splashing - Test Group 4

No evidence of physical damage was visible as a result of exposure to water jet splashing.

2.14. Impact - Test Group 4

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

2.15. Thermal Shock - Test Group 3

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

2.16. Humidity/temperature Cycling - Test Group 3

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

2.17. Temperature Life - Test Group 2

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

2.18. 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.

3. TEST METHODS

3.1. Examination of Product

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

3.2. Termination Resistance

Termination resistance measurements were made using a 4 terminal measuring technique (Figure 4). The test current was maintained at 100 milliamperes maximum with a 20 millivolt maximum open circuit voltage.

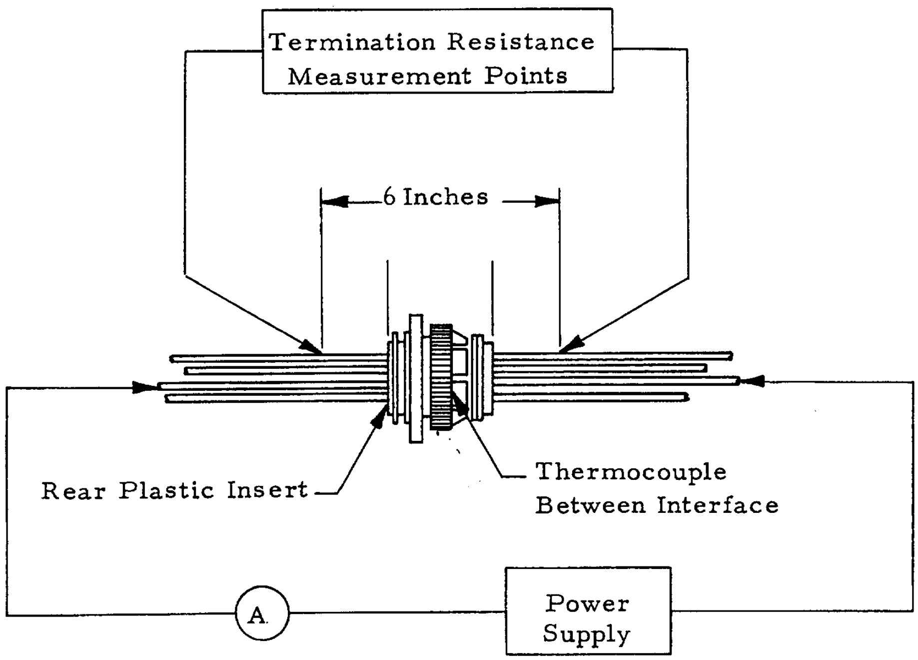

Figure 4
Termination Resistance Measurement Points

3.3. 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.

3.4. Dielectric Withstanding Voltage

A test potential of 1500 volts AC was applied between the adjacent contacts of mated specimens. This potential was applied for 1 minute and then returned to zero.

3.5. Temperature Rise vs Current

A. Initial Testing

Temperature rise measurements were recorded on 1 energized contact position in each mated specimen with 1 single circuit per specimen energized (1 of 3), 67% of the contacts per specimen energized (2 of 3), and 100% of the contacts per specimen energized (3 of 3). Specimens on both minimum (14 AWG) and maximum (8 AWG) wire size were tested. For each level of percent connector loading, the required number of circuits in each specimen were wired in series, then wired in series with all other specimens of the same wire size to form a continuous series test circuit. This test circuit was subjected to incremental AC current levels, with each current level maintained until thermal stability had been achieved. Temperature measurements of the crimp area of the selected energized contact position in each specimen were recorded, along with a measurement of the room ambient temperature. Temperature rise values were calculated as the difference between the measured specimen temperature and the measured room ambient temperature. The series test circuit was then energized at the next incremental current level, and the measurement process repeated. The incremental current levels were increased until a minimum average temperature rise of 30˚C had been achieved.

B. Final Testing

Temperature rise measurements were recorded on each energized contact position in each mated specimen with 1 single circuit per specimen energized. Specimens on maximum wire size were tested. One circuit in each specimen was wired in series with all other specimens to form a continuous series test circuit. This test circuit was subjected to incremental AC current levels, with each current level maintained until thermal stability had been achieved. Temperature measurements of the crimp area of the selected energized contact position in each specimen were recorded, along with a measurement of the room ambient temperature. Temperature rise values were calculated as the difference between the measured specimen temperature and the measured room ambient temperature. The series test circuit was then energized at the next incremental current level, and the measurement process repeated. The incremental current levels were increased until a minimum average temperature rise of 30˚C had been achieved. The entire process was repeated until all contact positions in all specimens were tested.

3.6. Vibration, Sinusoidal

Mated specimens were subjected to sinusoidal vibration, having a simple harmonic motion with an amplitude of 0.06 inch, double amplitude. The vibration frequency was varied uniformly between the limits of 10 and 2000 Hz and returned to 10 Hz in 20 minutes. This cycle was performed 12 times in each of 3 mutually perpendicular planes for a total vibration time of 12 hours. Specimens were monitored for discontinuities of 1 microsecond or greater using a current of 100 milliamperes DC.

3.7. 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.

3.8. Durability

Specimens were manually mated and unmated 500 times at a maximum rate of 600 cycles per hour.

3.9. Contact Retention

Force was gradually applied to the mating end of each pin at a maximum rate of .5 inch per minute and increased until the contact dislodged from the housing. Maximum force was recorded.

3.10. Coupling Torque

Receptacle connector was secured to a test fixture attached to a torque measurement cell. The corresponding plug connector was mated to the receptacle at a maximum rate of 45 degrees of rotation per second. The maximum torque required to fully mate the connector pair was recorded.

3.11. Uncoupling Torque

Receptacle connector was secured to a test fixture attached to a torque measurement cell. The corresponding plug connector was unmated from the receptacle at a maximum rate of 45 degrees of rotation per second. The maximum torque required to fully unmate the connector pair was recorded.

3.12. Dust Powder

Mated specimens were placed in a dust chamber and subjected to 8 hours of exposure to blowing talcum powder.

3.13. Water Jet Splashing

Mated specimens were sprayed from all practical directions by a stream of water approximately 40 mm in diameter flowing at a rate of 3.3 gallons per second for a period of 3 minutes.

3.14. Impact

Specimens were securely fastened to the test fixture such that the specimen can hang freely and rest against the vertical face of a steel striking plate a distance of 32 inches from the wire clamping fixture. The specimen was extended its full length from the test fixture to a horizontal position and allowed to fall freely by pendulum action to strike the steel plate. Each specimen was dropped 8 times with the radial orientation of the specimen turned 45 degrees prior to each drop.

3.15. Thermal Shock

Mated specimens were subjected to 5 cycles of thermal shock with each cycle consisting of 60 minute dwells at -55 and 125˚C. The transition between temperatures was less than 5 minutes.

3.16. 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 twice while maintaining high humidity (Figure 5).

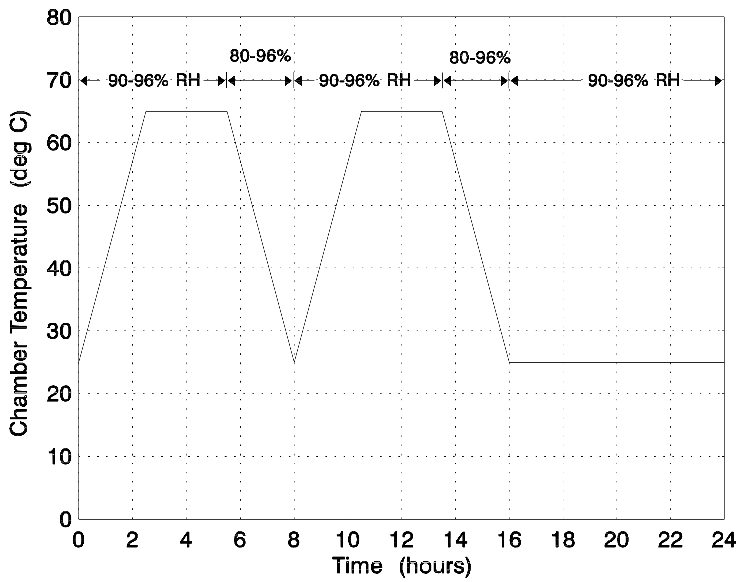

Figure 5
Humidity-Temperature Cycling Profile

3.17. Temperature Life

Mated specimens were exposed to a temperature of 125˚C for 1000 hours. Specimens were preconditioned with 10 cycles of durability.

3.18. Mixed Flowing Gas, Class III

Mated specimens were exposed for 20 days to a mixed flowing gas Class III exposure. Class III exposure is defined as a temperature of 30˚C and a relative humidity of 75% with the pollutants of Cl_2 at 20 ppb, NO_2 at 200 ppb, and H_2S at 100 ppb. Specimens were preconditioned with 10 cycles of durability.