AMP*

QUALIFICATION TEST REPORT

Circular Metal Connector (CMC)

501-105 Rev. 0

Product Specification:	108-10040, Rev. 0
CTL No.:	CTL4955-012-010
Date:	January 22, 1990
Classification:	Unrestricted
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CORPORATE TEST LABORATORY

Qualification Test Report
Circular Metal Connector (CMC)

1. Introduction

1.1 Purpose

Testing was performed on AMP's Circular Metal Connector to determine if it meets the requirements of AMP Product Specification 108-10040, Rev. 0.

1.2 Scope

This report covers the electrical, mechanical, and environmental performance of the Circular Metal Connector, manufactured by the Interconnection Component Division of the Interconnection Component Group. The testing was performed between October 30, 1989 and December 8, 1989. Supplemental testing was performed under the following test numbers: CTL4955-003, CTL4955-005, and CTL4955-010-009.

1.3 Conclusion

The Circular Metal Connector meets the electrical, mechanical, and environmental performance requirements of AMP Product Specification 108-10040, Rev. 0.

1.4 Product Description

Circular Metal Connectors consist of a black Thermoplastic insert with an outer shell and coupling ring of Aluminum alloy, Zinc plated. Their retaining rings are stainless steel. The connectors are available for uses with the following contacts: Series 1 Multimate, Series 20 DM and 20 DF, Series 3 Power, and Series 4 Power/Multimate. The connectors are available in Shell Sizes 14 for Series 1 only, and in Shell Sizes 22 and 28 for all Series (1, 2, 3, & 4).

1.5 Test Samples

The test samples were randomly selected from current production, and the following part numbers were used for test:

Test Group	Quantity	Part Number	Description
1,2,3,4,5	9	208715-1	CMC Recp 14- 7
1,2,3,4	8	208714-1	CMC Plug 14- 7
5	1	208714-2	CMC Plug 14- 7
1,2,3,4	8	208489-1	CMC Recp 22-16
1,2,3,4	8	208488-1	CMC Plug 22-16
1,2,3,4	8	208491-1	CMC Recp 22-28
1,2,3,4	8	208490-1	CMC Plug 22-28
1,2,3,4,5	9	208495-1	CMC Recp 22- 3
1,2,3,4	8	208494-1	CMC Plug 22- 3
5	1	208494-3	CMC Plug 22- 3
1,2,3,4,5	9	208471-1	CMC Recp 28-37
1,2,3,4	8	208470-1	CMC Plug 28-37
5	1	208470-3	CMC Plug 28-37
1,2,3,4	8	208477-1	CMC Recp 28-63
1,2,3,4	8	208476-1	CMC Plug 28-63
1,2,3,4,5	9	208483-1	CMC Recp 28- 7
1,2,3,4	8	208482-1	CMC Plug 28- 7
5	1	208482-3	CMC Plug 28- 7
1,2,3,4,5	9	208481-1	CMC Recp 28-22M
1,2,3,4	8	208480-1	CMC Plug 28-22M
5	1	208480-3	CMC Plug 28-22M
5	1	208489-1	CMC Recp 22-16
5	1	208488-3	CMC Plug 22-16

1.6 Qualification Test Sequence

Test or Examination	Test Groups 1	2	3	4	5
Examination of Product	1,9	1,5	1,11	1,6	1,5
Termination Resistance, Dry Circuit	2,8	2,4	3,8	2,5	
Dielectric Withstanding Voltage			7		
Insulation Resistance			6		4
Shell Resistance				4	
Vibration	6				
Physical Shock	7				
Contact Retention			9		
Durability	4				
Maintenance Aging			2		
Retention, Plastic/Insert			10		
Torque	3,5				
Thermal Shock			4		
Humidity-Temperature Cycling			5		
Industrial Mixed Flowing Gas				3	
Temperature Life		3			
Dust Power					2
Water Splashing					3

The numbers indicate sequence in which tests were performed.

2. Summary of Testing

2.1 Examination of Product - All Groups

All samples submitted for testing were selected from normal production lots. They were inspected and accepted by the Product Assurance Department of the Interconnection Component Group.

2.2 Termination Resistance - Groups 2, 3, 4

All termination resistance measurements, taken at 100 milliamperes dc. and 50 millivolts open circuit voltage, were less than the specification requirements.

Test Group	Shell Size	Contact Size	Wire Size	Condition	Spec. Max.	Measured Max.
1	14- 7	#16	#22	Initial	9.50	2.36
	22- 3	# 8	#12		1.25	0.26
	22-16	#16	#22		9.50	2.52
	22-28	#20	#24		14.00	4.14
	28- 7	# 8	#12		1.25	0.26
	28-22m	# 8	#12		1.25	0.26
	28-22m	#16	#22		9.50	3.57
	28-37	#16	#22		9.50	2.47
	28-63	#20	#24		14.00	5.05
1	14- 7	#16	#22	After Mechanical	9.50	3.34
	22- 3	# 8	#12		1.25	0.48
	22-16	#16	#22		9.50	3.19
	22-28	#20	#24		14.00	4.81
	28- 7	# 8	#12		1.25	1.07
	28-22m	# 8	#12		1.25	0.55
	28-22m	#16	#22		9.50	3.91
	28-37	#16	#22		9.50	3.04
	28-63	#20	#24		14.00	6.37
2	14- 7	#16	#22	Initial	9.50	2.27
	22-16	#16	#22		9.50	2.93
	22-28	#20	#24		14.00	3.59
	28-22	#16	#22		9.50	3.37
	28-37	#16	#22		9.50	2.66
	28-63	#20	#24		14.00	4.35
2	14- 7	#16	#22	After Temp Life	9.50	2.17
	22-16	#16	#22		9.50	2.73
	22-28	#20	#24		14.00	3.59
	28-22	#16	#22		9.50	3.47
	28-37	#16	#22		9.50	3.16
	28-63	#20	#24		14.00	4.45
3	14- 7	#16	#22	Initial	9.50	1.47
	22-16	#16	#22		9.50	2.63
	22-28	#20	#24		14.00	3.29
	28-22	#16	#22		9.50	2.37
	28-37	#16	#22		9.50	2.66
	28-63	#20	#24		14.00	4.35
3	14- 7	#16	#22	After Humidity	9.50	1.67
	22-16	#16	#22		9.50	2.43
	22-28	#20	#24		14.00	3.59
	28-22	#16	#22		9.50	2.07
	28-37	#16	#22		9.50	2.66
	28-63	#20	#24		14.00	4.45

Test Group	Shell Size	Contact Size	Wire Size	Condition	Spec. Max.	Measured Max.
4	14- 7	#16	#22	Initial	9.50	1.97
	22- 3	# 8	#12		1.25	0.22
	22-16	#16	#22		9.50	2.83
	22-28	#20	#24		14.00	3.59
	28- 7	# 8	#12		1.25	0.41
	28-22m	# 8	#12		1.25	0.42
	28-22m	#16	#22		9.50	3.87
	28-37	#16	#22		9.50	3.26
	28-63	#20	#24		14.00	5.15
4	14- 7	#16	#22	After IMFG	9.50	2.27
	22- 3	# 8	#12		1.25	0.24
	22-16	#16	#22		9.50	3.03
	22-28	#20	#24		14.00	3.80
	28- 7	# 8	#12		1.25	0.41
	28-22m	# 8	#12		1.25	0.46
	28-22m	#16	#22		9.50	3.87
	28-37	#16	#22		9.50	3.26
	28-63	#20	#24		14.00	4.45

All values in milliohms
All values have bulk resistance subtracted

2.3 Dielectric Withstanding Voltage - Group 3

There was no dielectric breakdown or flashover between adjacent contacts, when a test voltage of 1500 Vac was applied for one minute.

2.4 Insulation Resistance - Groups 3, 5

All insulation resistance measurements were greater than the specification requirement of 5000 megohms.

2.5 Vibration - Group 1

During vibration testing, there were no discontinuities of the contacts greater than one microsecond. Following vibration, there were no cracks, breaks or loose parts on the connector assemblies.

2.6 Physical Shock - Group 1

During physical shock testing, there were no discontinuities of the contacts greater than one microsecond. Following physical shock, there were no cracks, breaks or loose parts on the connector assemblies.

2.7 Shell Resistance - Group 4

All shell resistance measurements were less than 50 milliohms.

Shell Size	Contact Type	Resistance
14- 7	III+	34.28
28- 7	XII	30.04
22- 3	XII	29.96
22-16	III+	30.41
22-28	20DF	30.96
28-37	III+	32.48
28-63	20DF	31.61
28-22m	XII/III+	30.82

All values in milliohms

2.8 Contact Retention - Group 3

No contacts dislodged from the housings, as a result of applying 7 pounds axial load to the #20 contacts, 10 pounds to the #16 contacts, and 25 pounds to the #8 contacts. There was no physical damage to either the contacts or the housing.

2.9 Durability - Group 1

There was no physical damage to the samples, as a result of mating and unmating the connector 500 times.

2.10 Maintenance Aging - Group 3

There was no physical damage to the connectors or contact locking devices, after inserting and extracting each contact 5 times.

2.11 Retention, Plastic Insert - Group 3

The plastic inserts did not dislodge from their shells, when an axial load of 100 pounds was applied to #28 Shells, 75 pounds to #22 Shells, and 40 pounds to #14 Shells.

2.12 Torque - Group 1

All torque values, required to open and close each coupling ring, were within specification limits.

Shell Size	Open Min.	Open Max.	Close Min.	Close Max.	Limits Min.	Limits Max.
Initial						
#14	1.75	1.75	1.94	1.94	1.00	30.00
#22	4.37	4.62	2.00	5.62	2.00	50.00
#28	7.25	10.50	9.62	17.56	3.00	70.00
After Durability						
#14	1.37	1.37	2.50	2.50	1.00	30.00
#22	5.31	12.50	5.62	18.12	2.00	50.00
#28	3.12	20.94	10.31	39.68	3.00	70.00

All values in inch pounds

2.13 Thermal Shock - Group 3

There was no evidence of physical damage to either the contacts or the connector, as a result of thermal shock.

2.14 Humidity-Temperature Cycling - Group 3

There was no evidence of physical damage to either the contacts or the connector, as a result of exposure to humidity-temperature cycling.

2.15 Industrial Mixed Flowing Gas - Group 4

There was no evidence of physical damage to either the contacts or the connector, as a result of exposure to the pollutants of industrial mixed flowing gas.

2.16 Temperature Life - Group 2

There was no evidence of physical damage to either the contacts or the connector, as a result of exposure to a temperature of 125°C for 300 hours.

2.17 Dust, Powder - Group 5

After eight hours of dust exposure (talcum powder), there was no evidence of penetration of powder that would effect the mechanical properties of the connector.

2.18 Water, Splashing - Group 5

After a 10 minute exposure, the water did not interfere with the satisfactory operation of the connector, and the water did not enter the cable or accumulate near the cable ends.

3. Test Methods

3.1 Examination of Product

The product drawings and inspection plans were used to examine the samples. They were examined visually and functionally.

3.2 Termination Resistance, Low Level

Termination resistance measurements at low level current were made, using a four terminal measuring technique (Figure 1). The test current was maintained at 100 milliamperes dc, with an open circuit voltage of 50 millivolts dc.

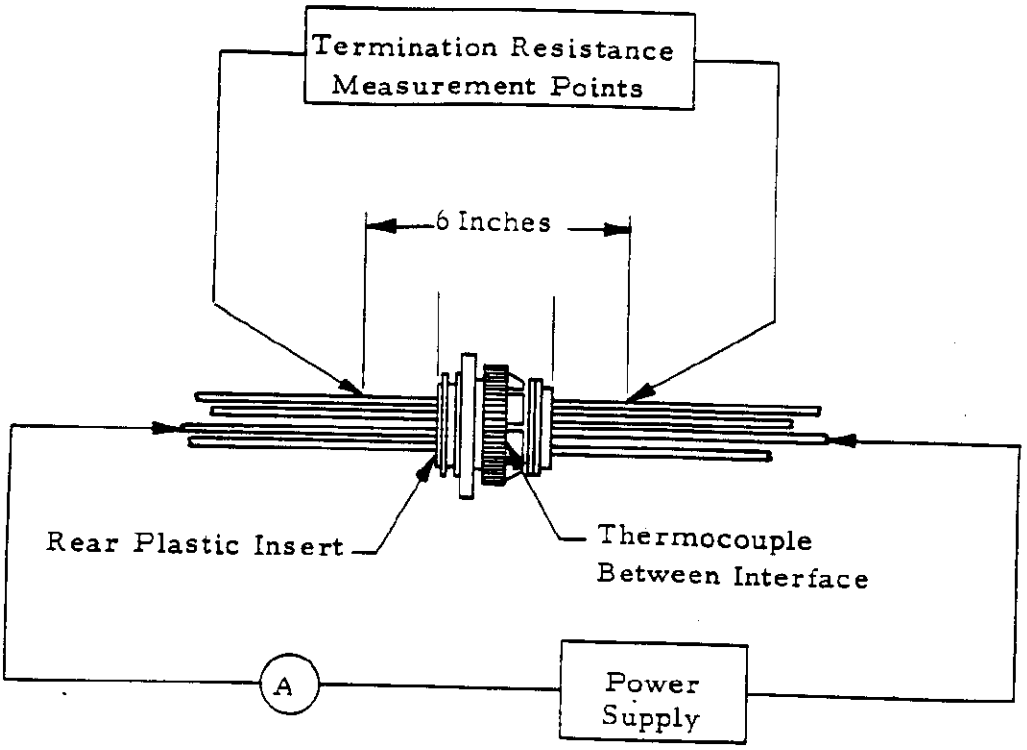


Figure 1
Typical Termination Resistance Measurement Points

3.3 Dielectric Withstanding Voltage

A test potential of 1500 vac was applied between the adjacent contacts. This potential was applied for one minute and then returned to zero.

3.4 Insulation Resistance

Insulation resistance was measured between adjacent contacts, using a test voltage of 500 volts dc. This voltage was applied for one minute before the resistance was measured.

3.5 Vibration, Sine

Mated connectors were subjected to sinusoidal vibration having a simple harmonic motion with an amplitude of 0.06 inch, double amplitude. The vibration frequency was varied logarithmically 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 three mutually perpendicular planes for a total vibration time of 12 hours. Connectors were monitored for discontinuities greater than one microsecond, using a current of 100 milliamperes in the monitoring circuit.

3.6 Physical Shock

Mated connectors 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 three mutually perpendicular planes for a total of 18 shocks. The connectors were monitored for discontinuities greater than one microsecond, using a current of 100 milliamperes in the monitoring circuit.

3.7 Shell Resistance

Shell resistance was measured at low level current, using a four terminal measuring technique. The test current was maintained at 100 milliamperes dc. The measurement was taken between the rear of the plug to the receptacles square flange.

3.8 Contact Retention

An axial load was applied to each contact and held for 60 seconds. The force was applied in a direction so as to cause removal of the contacts from the housing.

3.9 Durability

Connectors were mated and unmated 500 times, at a rate not exceeding 200 per hour.

3.10 Maintenance Aging

All contacts were inserted and extracted from their housing five times, using the appropriate tooling.

3.11 Retention, Plastic Insert

An axial load was applied to each plastic insert in a direction such as to displace the insert from the metal shell.

3.12 Torque

The force to couple and uncouple the connector halves was measured by applying rotational torque to the coupling ring.

3.13 Thermal Shock

Mated connectors were subjected to five cycles of temperature extremes, with each cycle consisting of 30 minutes at each temperature. The temperature extremes were -55°C and 125°C. The transition between temperatures was less than one minute.

3.14 Humidity-Temperature Cycling

Mated connectors 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 the relative humidity was held at 95%.

3.15 Industrial Mixed Flowing Gas, Class III

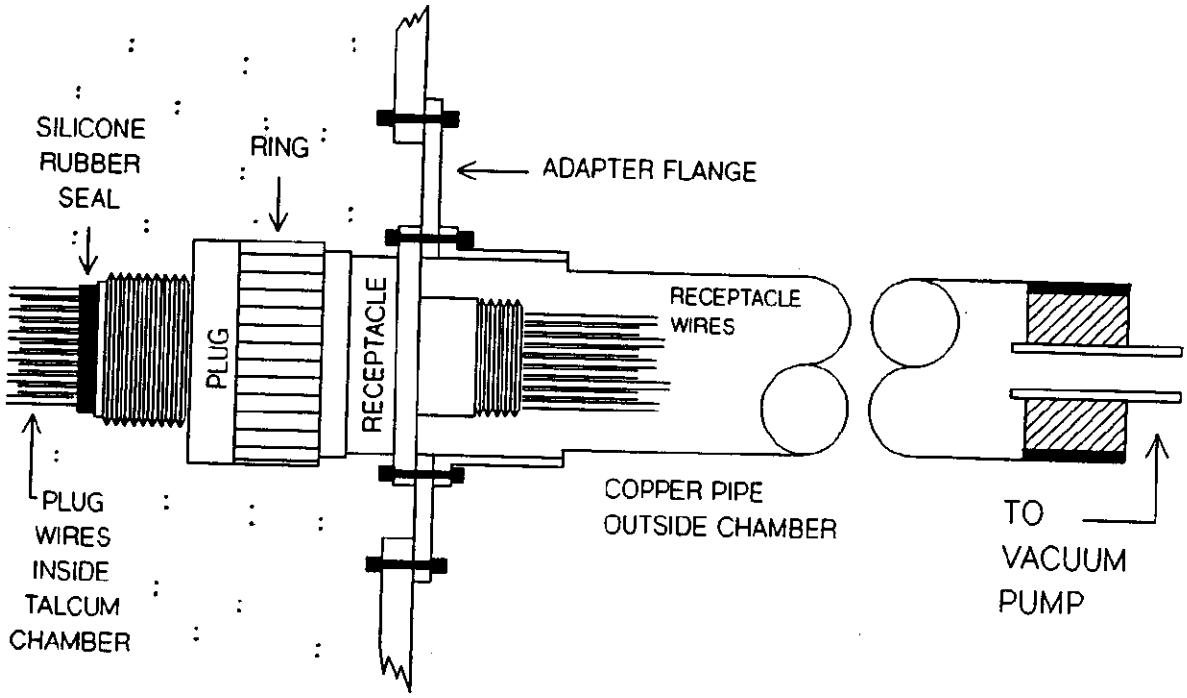
Mated connectors were exposed for 20 days in the industrial mixed flowing gas chamber. Class III exposure is defined as a temperature of 30°C and a relative humidity of 75%. Pollutants are Cl_2 at 20 ppb, NO_2 at 200 ppb and H_2S at 100 ppb.

3.16 Temperature Life

Mated samples were subjected to 300 hours at an elevated temperature of 125°C.

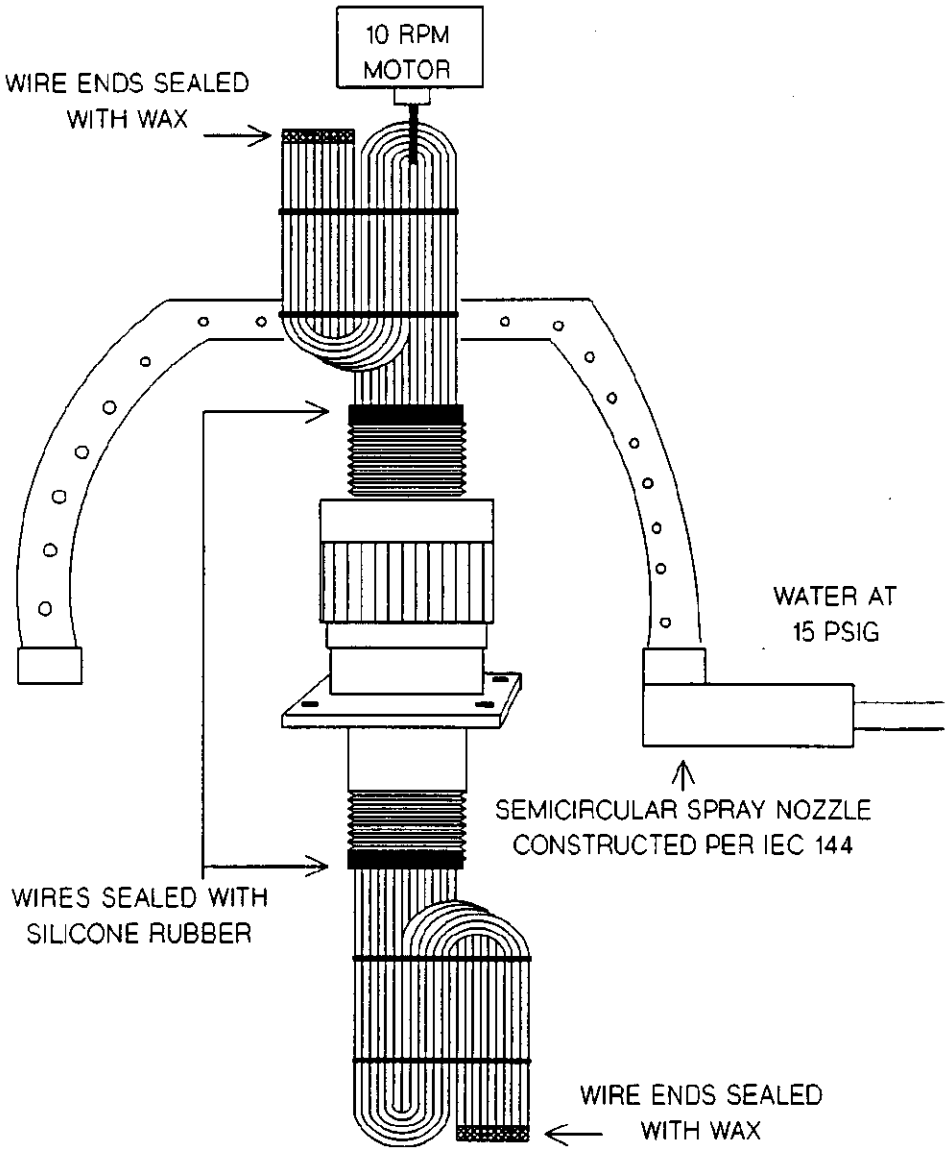
3.17 Dust, Powder

Samples were mounted to the side of the dust chamber. The plug wires were sealed with silicone rubber to prevent talcum from entering the connector along the wires. A low vacuum, equivalent to 20 centimeters of water, was applied to a pipe containing the receptacle wires. To enter the connector under test, talcum would have to go through any gaps existing between the plug and ring, or ring and receptacle. Each sample was tested for six hours.



3.18 Water Splashing

Samples were suspended vertically from a hook, which was attached to a 10 RPM motor. Water and spray nozzles were attached to a ring stand so as to create a 160° arc of water. The connector was rotated for a total of ten minutes.



4. Validation

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