# Connector, Miniature Rectangular (MR)

## 1. INTRODUCTION

### 1.1. Purpose

Testing was performed on the AMP* Miniature Rectangular Connector to determine its conformance to the requirements of AMP Product Specification 108-1022 Rev. E.

### 1.2. Scope

This report covers the electrical, mechanical, and environmental performance of the Miniature Rectangular Connector manufactured by the Consumer/Commercial Business Group. The testing was performed between October 1994 and October 1996.

### 1.3. Conclusion

The Miniature Rectangular Connector, listed in paragraph 1.5, meet the electrical, mechanical, and environmental performance requirements of AMP Product Specification 108-1022 Rev E.

### 1.4. Product Description

The AMP Miniature Rectangular (MR) Connector is a grouping of multiple-lead connections that is used in wire-to-wire applications. The connector consists of a pin and socket contact which can house up to 36 contact positions and accepts 26 to 18 AWG wire sizes.

### 1.5. Test Samples

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

| Test Group | Quantity | Part Nbr | Description |
|---|---|---|---|
| 1 | 5 | 1-640526-0 | 36 position socket housing |
| | 5 | 1-640516-0 | 36 position pin housing |
| | 180 | 641294-1 | skt contact(Pb Sn)terminated w/18AWG |
| | 180 | 350967-1 | pin contact(Pb Sn)terminated w/18AWG |
| | 5 | 1-640521-0 | 9 position socket housing |
| | 5 | 1-640511-0 | 9 position pin housing |
| | 45 | 641294-1 | skt contact(Pb Sn)terminated w/18AWG |
| | 45 | 350967-1 | pin contact(Pb Sn)terminated w/18AWG |
| 2 | 3 | 1-640526-0 | 36 position socket housing |
| | 3 | 1-640516-0 | 36 position pin housing |
| | 108 | 641294-1 | skt contact(Pb Sn)terminated w/18AWG |
| | 108 | 350967-1 | pin contact(Pb Sn)terminated w/18AWG |
| 3 | 5 | 1-640521-0 | 9 position socket housing |
| | 5 | 1-640511-0 | 9 position pin housing |
| | 45 | 641294-1 | skt contact(Pb Sn)terminated w/18AWG |
| | 45 | 350967-1 | pin contact(Pb Sn)terminated w/18AWG |
| 4 | 4 | 1-640514-0 | 10 position pin housing |
| | 40 | 350967-1 | pin contact (Pb Sn) |
| | 4 | 1-640522-0 | 10 position socket housing |
| | 40 | 641294-1 | skt contact (Pb Sn) |



* Trademark
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| | | | |
|---|---|---|---|
| 5 | 20 | 641294-1 | skt contact (Pb Sn) terminated w/18AWG |
| | 20 | 641294-1 | skt contact (Pb Sn) terminated w/20AWG |
| | 20 | 641294-1 | skt contact (Pb Sn) terminated w/22AWG |
| | 20 | 641294-1 | skt contact (Pb Sn) terminated w/24AWG |
| | 20 | 641294-1 | skt contact (Pb Sn) terminated w/26AWG |
| 5 | 20 | 350967-1 | pin contact (Pb Sn) terminated w/18AWG |
| | 20 | 350967-1 | pin contact (Pb Sn) terminated w/20AWG |
| | 20 | 350967-1 | pin contact (Pb Sn) terminated w/22AWG |
| | 20 | 350967-1 | pin contact (Pb Sn) terminated w/24AWG |
| | 20 | 350967-1 | pin contact (Pb Sn) terminated w/26AWG |

1.6. Qualification Test Sequence

| Test or Examination | Test Groups | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| | Test Sequence (a) | | | | |
| Examination of Product | 1,9 | 1,9 | 1,8 | 1,4 | 1,3 |
| Termination Resistance, Dry Circuit | 3,7 | 2,7 | | | |
| Insulation Resistance | | | 2,6 | | |
| Dielectric Withstanding Voltage | | | 3,7 | | |
| Temperature Rise vs Current | | 3,8 | | | |
| Vibration | 5 | 6(b) | | | |
| Physical Shock | 6 | | | | |
| Mating Force | 2 | | | | |
| Unmating Force | 8 | | | | |
| Contact Insertion Force | | | | 2 | |
| Contact Retention Force | | | | 3 | |
| Crimp Tensile | | | | | 2 |
| Durability | 4 | | | | |
| Thermal Shock | | | 4 | | |
| Temperature-Humidity Cycling | | 4(c) | 5 | | |
| Temperature Life | | 5 | | | |

**NOTE**

(a) *Numbers indicate sequence in which tests are performed.*
(b) *Discontinuities shall not be measured. Energize at the 18 °C level for 100% loaded/energized as determined in AMP Specification 109-151.*
(c) *Precondition samples with 10 cycles durability.*

## 2. SUMMARY OF TESTING

2.1. Examination of Product - All Groups

All samples submitted for testing were selected from normal current production lots. They were inspected and accepted by the Product Assurance Department of the Commercial Products Business Unit.

2.2. Contact Termination Resistance, Dry Circuit - Groups 1, 2

All contact termination resistance measurements, taken at 100 milliamperes DC and 20 millivolts open circuit voltage, were less than 5 milliohms maximum initial and the maximum change in resistance (ΔR) was less than 5 milliohms from initial.

| Test Group | Nbr of Data points | Condition | Min | Max | Mean |
|---|---|---|---|---|---|
| 1 | 60 | Initial | 3.04 | 3.86 | 3.218 |
| | 60 | After Mechanical(ΔR) | -0.52 | +0.38 | +0.077 |
| 2 | 30 | Initial | 2.98 | 3.25 | 3.150 |
| | 30 | After Current Verif.(ΔR) | -0.01 | +1.01 | +0.373 |

All values in milliohms

2.3. Dielectric Withstanding Voltage - Group 3

No dielectric breakdown or flashover occurred when a test voltage was applied between adjacent contacts of mated samples.

2.4. Insulation Resistance - Group 3

Initial insulation resistance measurements were greater than 1500 megohms. Final insulation resistance measurements were greater than 100 megohms.

2.5. Temperature Rise vs Current - Group 2

All samples, during initial and final testing had a temperature rise of less than 30°C above ambient when a specified current of 9.43 amperes DC was applied to a single circuit terminated to 18 AWG.

2.6. Vibration - Group 1

No discontinuities of the contacts were detected during vibration. Following vibration, no cracks, breaks, or loose parts on the connector assemblies were visible.

2.7. Physical Shock - Group 1

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

2.8. Mating Force - Group 1

All mating force measurements were less than 1 pounds per contact.

2.9. Unmating Force - Group 1

All unmating force measurements were greater than .25 pounds per contact.

2.10. Contact Insertion Force - Group 4

The force required to insert each contact into its housing cavity was less than 1.75 lbs per contact.

2.11. Contact Retention - Group 4

No physical damage occurred to either the contacts or the housing, and no contacts dislodged from the housings as a result of supplying an axial load of 10 pounds to the contacts.

2.12. Crimp Tensile - Group 5

All tensile values were greater than 5.0 pounds for samples crimped on AWG 26 wire, 9.5 pounds for samples crimped on AWG 24 wire, 15.0 pounds for samples crimped on AWG 22 wire, 25.0 pounds for samples crimped on AWG 20 wire, 35.0 pounds for samples crimped on AWG 18 wire.

2.13. Durability - Group 1

No physical damage occurred to the samples as a result of mating and unmating the connector 25 times.

2.14. Thermal Shock - Group 3

No evidence of physical damage to either the contacts or the connector was visible as a result of thermal shock.

2.15. Temperature-Humidity Cycling - Group 2, 3

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

2.16. Temperature Life - Group 2

No evidence of physical damage to either the contacts or the connector was visible as a result of exposure to an elevated temperature.

## 3. TEST METHODS

3.1. Examination of Product

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 20 millivolts DC.

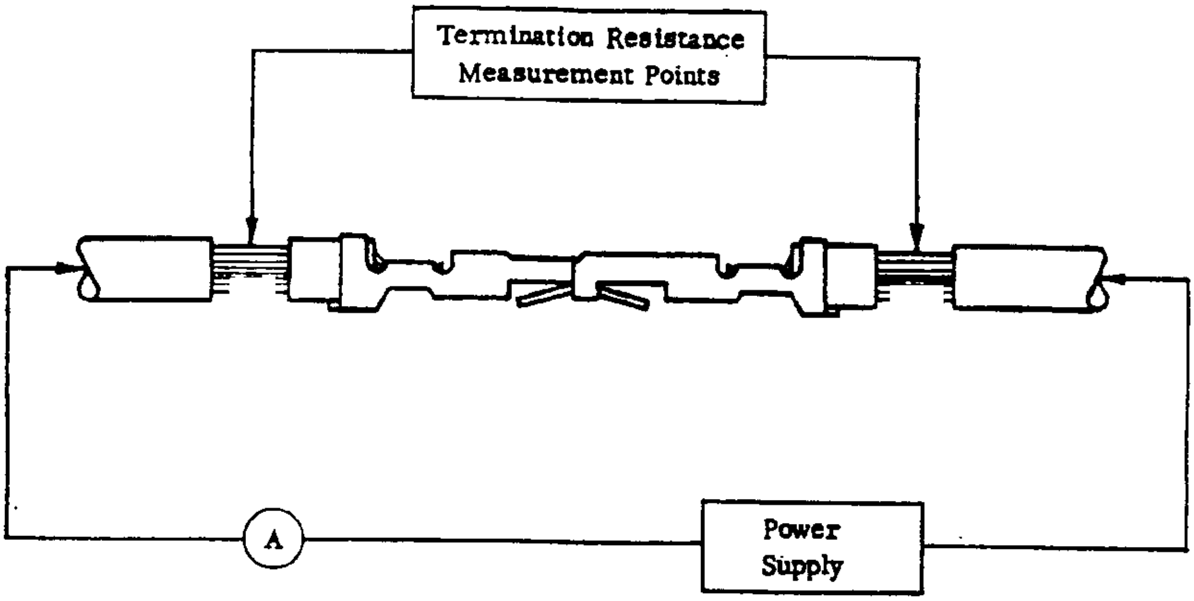



Figure 1
Typical Termination Resistance Measurement Points

3.3. Dielectric Withstanding Voltage

A test potential of 2500 volts AC was applied between the adjacent contacts with leakage current set at 1.3 milliamps. This potential was applied at a rate of 500 volts AC per second and held 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. Temperature Rise vs Specified Current

Contact temperature was measured, while energized at the specified current of 9.43 amperes DC. Thermocouples were attached to the contacts to measure their temperatures. This temperature was then subtracted from the ambient temperature to find the temperature rise. When three readings at five minute intervals were within ±1.0°C, the readings were recorded. The initial temperature rise vs current test was performed to establish the rating factor for loading conditions and wire sizes. The final temperature rise vs current test was performed to establish the current rating for a mated, single circuit contact terminated with the maximum wire.

3.6. Vibration, Sine

Mated connectors were subjected to sinusoidal vibration, having a simple harmonic motion with an amplitude of 0.03 inch (0.06 inch maximum total excursion).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 three mutually perpendicular planes, for a total vibration time of 6 hours (2 hours each plane). Group 1 connectors were monitored for discontinuities equal to or greater than one microsecond, using a current of 100 milliamperes DC in the monitoring circuit. All group 2 connectors were energized during the entire vibration test with 3.75 amps, which produced an 18°C t-rise. Discontinuity was not monitored.

3.7. Physical Shock

Mated connectors were subjected to a physical shock test, having a half-sine shock pulse 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 equal to or greater than one microsecond, using a current of 100 milliamperes DC in the monitoring circuit.

3.8. Mating Force

The force required to mate individual, fully loaded connectors was measured using a tensile/compression device with a crosshead speed of 0.5 inch/minute and a free floating fixture. The force per contact was then calculated.

3.9. Unmating Force

The force required to unmate individual connectors(latch disengaged) was measured using a tensile/compression device with a crosshead speed of 0.5 inch/minute and a free floating fixture. The force per contact was then calculated.

3.10. Contact Insertion

Contact Insertion force was measured by applying an increasing force to each contact until the contact was properly seated in the housing. The force per contact was calculated.

3.11. Contact Retention

An axial load of 10 pounds was applied to each contact and held for 60 seconds. The force was applied in a direction to cause removal of the contacts from the housing.

3.12. Crimp Tensile

An axial load was applied (at a crosshead rate of 1.0 inches per minute) to each sample in a direction as to pull the wire out of the contact crimp.

3.13. Durability

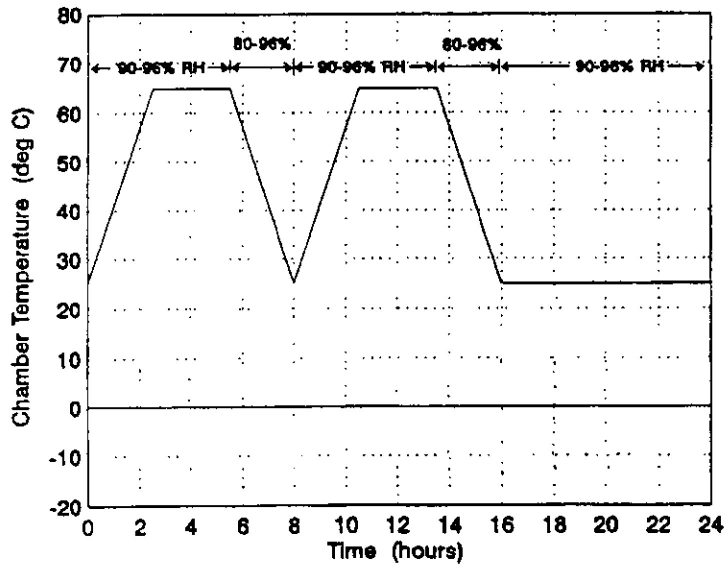
Connectors were mated and unmated (cycled) by hand 25 times at a rate not exceeding 10 cycles per minute.

3.14. Thermal Shock

Mated connectors were subjected to 25 cycles of temperature extremes with each cycle consisting of 30 minutes at each temperature extreme. The temperature extremes were -55°C and 85°C. The transition between temperatures was less than one minute.

3.15. Humidity-Temperature Cycling

Mated connectors were conditioned in a dry oven at 50°C for a period of 24 hours prior to starting the first temperature/humidity cycle. Mated connectors were exposed to 10 cycles of humidity-temperature cycling. Each cycle lasted 24 hours and consisted of cycling twice between 25°C and 65°C as shown in the following graph:




3.16. Temperature Life

Mated samples were exposed to a temperature of 85°C for 300 hours.

## 4. VALIDATION

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