
SMA Series Coaxial Connectors for Semi-Rigid Cable

1. SCOPE

1.1. Content

This specification contains performance requirements and qualification test procedures and production testing for AMP* Mil-B (crimp style) SMA series coaxial connectors. These connectors are intended for use on semi-rigid cables RG 405/U and RG 402/U and include plugs with or without center contacts and jacks of the straight panel, or bulkhead type and right angle plugs.

1.2 Definitions

For the purpose of this specification, the following definitions shall apply.

- A. Connector Assembly: A connector assembly consists of a mated plug and jack, terminated to their respective cable.
- B. Connector: A connector may be either a plug or a jack as described below.
 - 1. Plug: (Male) -- May contain a male inner contact or use the center conductor of the cable as an inner contact and a rotating, threaded collar for coupling purposes.
 - 2. Jack: (Female) -- Contains the female inner contact and external threads designed for mating with a plug.

1.3. Qualification

When tests are performed on the subject product line, the procedures specified in AMP 109 series specifications shall be used. All inspections shall be performed using the applicable inspection plan and product drawing.

2. APPLICABLE DOCUMENTS

The following documents constitute a part of this specification to the extent specified herein. In the event of conflict between requirements of this specification and the product drawing, the product drawing shall take precedence. In the event of conflict between the requirements of this specification and the referenced documents, this specification shall take precedence.

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2.1. AMP Specifications

- A. 109-1: General Requirements for Test Specifications
- B. 109 Series: Test Specifications as indicated in Figure 1.
(Comply with MIL-STD-202, MIL-STD-1344 and EIA RS-364, see Figure 5)

2.2. Military

- A. MIL-C-17: Cable, Coaxial, Radio Frequency
- B. MIL-I-17214: Indicator, Permeability, Low-Mu
- C. MIL-C-39012: Connectors, Coaxial, RF, General Specification For

3. REQUIREMENTS

3.1. Design and Construction

Connectors shall be of the design, construction and physical dimensions specified on the applicable product drawing.

3.2. Materials

The materials used in the construction of this product and the finish or plating shall be as specified on the AMP Product Drawing.

3.3. Ratings

- A. Nominal Impedance: 50 ohms
- B. Frequency Range: 0 - 18 GHz, 12.4 GHz for Rt. Angle
- C. Operating Temperature: -65 to +105°C
- D. Operating Voltage @ Sea Level: 500 VRMS (RG 402/U Cable)
335 VRMS (RG 405/U Cable)
- E. Operating Voltage @ 70,000 Feet: 125 VRMS (RG 402/U Cable)
85 VRMS (RG 405/U Cable)

3.4. Performance and Test Description

Connectors shall be designed to meet the electrical, mechanical and environmental performance requirements specified in Figure 1.

3.5. Test Requirements and Procedures Summary

Test Description	Requirement	Procedure
Examination of Product	Meets requirements of product drawing.	Visual, dimensional and functional per applicable inspection plan.

Figure 1 (cont)

Test Description	Requirement	Procedure																								
ELECTRICAL																										
Termination Resistance, Specified Current	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th colspan="2" style="text-align: center;">MILLIOHMS MAXIMUM</th> </tr> <tr> <th></th> <th style="text-align: center;">Initial</th> <th style="text-align: center;">After Test</th> </tr> </thead> <tbody> <tr> <td>Inner Contact (Rt. Angle)</td> <td style="text-align: center;">3.0 4.0</td> <td style="text-align: center;">4.0 6.0</td> </tr> <tr> <td>Outer Contact</td> <td style="text-align: center;">2.0</td> <td style="text-align: center;">N/A</td> </tr> <tr> <td>Shield to Body</td> <td style="text-align: center;">0.5</td> <td style="text-align: center;">N/A</td> </tr> </tbody> </table>		MILLIOHMS MAXIMUM			Initial	After Test	Inner Contact (Rt. Angle)	3.0 4.0	4.0 6.0	Outer Contact	2.0	N/A	Shield to Body	0.5	N/A	Measure potential drop of mated contacts at 1 ampere DC, see Figure 3, AMP Spec 109-25, calculate resistance.									
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Dielectric Withstanding Voltage	1000 Vac for RG-405/U, 1500 Vac for RG-402/U dielectric withstanding voltage, one minute hold. No breakdown or flash-over.	Test between center and outer contacts of unmated connector assemblies; AMP Spec 109-29-1.																								
Insulation Resistance	5000 megohms minimum initial. 200 megohms minimum 5 minutes after Temperature - Humidity Cycling	Test between center and outer contact of unmated connector assembly, AMP Spec 109-28-4.																								
Permeability	2 Mu maximum	Measure magnetic permeability with an indicator conforming to MIL-I-17214.																								
Voltage Standing Wave Ratio	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Cable Type</th> <th>Connector Type</th> <th>VSWR Max.</th> </tr> </thead> <tbody> <tr> <td>405</td> <td>Non-cap</td> <td>1.07+.008F (GHz)</td> </tr> <tr> <td>402</td> <td>Non-cap</td> <td>1.05+.008F (GHz)</td> </tr> <tr> <td>405</td> <td>Captive</td> <td>1.07+.01F (GHz)</td> </tr> <tr> <td>402</td> <td>Captive</td> <td>1.05+.01F (GHz)</td> </tr> <tr> <td>402</td> <td>No C.Con</td> <td>1.035+.005F (GHz)</td> </tr> <tr> <td>405</td> <td>Rt.Angle</td> <td>1.10+.01F (GHz)</td> </tr> <tr> <td>402</td> <td>Rt.Angle</td> <td>1.10+.01F (GHz)</td> </tr> </tbody> </table>	Cable Type	Connector Type	VSWR Max.	405	Non-cap	1.07+.008F (GHz)	402	Non-cap	1.05+.008F (GHz)	405	Captive	1.07+.01F (GHz)	402	Captive	1.05+.01F (GHz)	402	No C.Con	1.035+.005F (GHz)	405	Rt.Angle	1.10+.01F (GHz)	402	Rt.Angle	1.10+.01F (GHz)	Measure VSWR between 0.5 and 18 GHz in accordance with MIL-C-39012, Paragraph 4.6.12, as applicable. For Rt. Angle, test from .5 to 12.4 GHz.
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Altitude/Corona	250 volts rms minimum at 5 picocoulombs maximum discharge, except RG-402/U with center contact is 375 volts rms minimum.	Test corona at 70,000 feet simulated altitude in accordance with AMP Spec 109-40.																								

Figure 1 (cont)

Test Description	Requirement	Procedure
R.F. High Potential	670 volts rms 5 MHz for 1 minute, except RG-402/U with center contact is 1000 volts. No dielectric breakdown or flashover.	Test between center and outer contacts of unmated connectors; AMP Spec 109-29-1, except at 5 MHz AC.
R.F. Leakage	Connector leakage cable to cable shall not exceed -90 dB minimum, except with no center contact -60 dB minimum.	Measure RF Leakage in accordance with MIL-C-39012 between 2 and 3 GHz.
R.F. Insertion Loss	$.03 \sqrt{F(\text{GHz})} \text{ dB}$ maximum at 6 GHz. $.05 \sqrt{F(\text{GHz})} \text{ dB}$ for Rt. Angle.	Measure RF Insertion Loss in accordance with MIL-C-39012 at 6 GHz.
MECHANICAL		
Vibration	No discontinuities greater than 1 microsecond. (a)	Subject mated connectors to 20 G's, 10-2000 Hz with 100 ma current applied, see Figure 4; AMP Spec 109-21-4.
Physical Shock	No discontinuities greater than 1 microsecond. (a)	Subject mated connector to 100 G's sawtooth in 6 milliseconds; 3 shocks in each direction applied along the 3 mutually perpendicular planes total 18 shocks; see Figure 4; AMP Spec 109-26-9.
Force to Engage/Disengage	2 inch pounds maximum	Connectors shall be fully engaged and disengaged with a standard mating part while measuring the force required. Connectors are fully engaged when referenced planes coincide.
Mating Characteristics	.037 inch gage 2 pounds maximum insertion force.	Jacks only: Precondition by inserting a .0375 inch gage 3 times to a .050 to .045 inch minimum depth.
	.0355 inch gage 2 ounces minimum withdrawal force.	Measure force to insert a .037 inch gage to .050 to .075 inch depth. Insert a .0355 inch gage to .050 to .075 inch depth and measure force to withdraw.

Figure 1 (cont)

Test Description	Requirement	Procedure
Cable Retention	No loss of electrical continuity or evidence of physical damage at the following forces: (a) RG - 405/U 30 pounds retention 16 inch oz. torque RG-402/U 60 pounds retention 55 inch oz. torque	Apply a tensile load of the amount specified between connector and cable for 30 seconds and check for electrical discontinuity. Then apply a torque of the amount specified at 1 cable diameter from the connector in both directions then recheck continuity.
Durability	No physical damage (a)	Mate and unmate connector assemblies for 500 cycles; AMP Spec 109-27.
Coupling Nut Retention	Coupling nut shall not loosen or dislodge from plug body.	Apply a tensile load of 60 pounds between coupling nut and plug body for 1 minute. During the minute, rotate nut 2 revolutions in each direction.
Center Contact Retention	The center contact shall not be displaced from the specified interface dimensions.	A 6-pound force shall be applied to the center contact for 5 seconds minimum in each direction.
Coupling Proof Torque	Coupling mechanism shall not dislodge from body.	Connectors shall be mated and coupling nut tightened to 15 inch-pounds for 1 minute then released.
ENVIRONMENTAL		
Thermal Shock	No physical damage (a).	Subject mated connectors to 5 cycles between -65° and +115°C; AMP Spec 109-22.

Figure 1 (cont)

Test Description	Requirement	Procedure
Temperature-Humidity Cycling	No physical damage (a).	Subject mated connectors to 10 temperature-humidity cycles between 25° and 65°C at 95% RH; AMP Spec 109-23, Method III, Cond B, with cold shock at -10°C; however no vibration. Measure Insulation Resistance within 5 minutes after removing from chamber.
Corrosion, Salt Spray	No base metal exposure on any mating or interface surface of the connectors.	Subject unmated uncabled connectors to 5% salt concentration for 48 hours; AMP Spec 109-24, Cond B.
Leakage	No air bubbles around seal area during pressurized immersion.	Mount connector in hole (specified on AMP IS sheet) cut in end of small air chamber. Install seal and cap mating end. Pressurize chamber to 30 psi and submerge in water for .5 to 2 minutes.

(a) Shall show no evidence of damage, cracking, or chipping.

Figure 1 (end)

3.6. Connector Tests and Sequences

Test or Examination	Test Group (a)						
	1	2	3	4	5	6	7
	Test Sequence (b)						
Examination of Product	1	1	1	1	1	1	1
Termination Resistance, Specified Current(c)			8-11-13-16			8	
Dielectric Withstanding Voltage			9-15-19				
Insulation Resistance (d)	7	7	7-18	7	7	7	7
Permeability	6	6	6	6	6	6	6
Voltage Standing Wave Ratio		8					
Altitude Corona			20				
R.F. High Potential			21				
R.F. Leakage				8			
R.F. Insertion Loss					8		
Vibration			10				
Physical Shock			12				
Force to Engage/Disengage	3-5-1	3-5-10	3-5-24	3-5	3-5	3-5	3-5
Mating Characteristics	2	2-11	2	2	2	2	2
Cable Retention			22				
Durability		9					
Coupling Nut Retention			23				
Center Contact Retention (e)	8						
Coupling Proof Torque	4	4	4	4	4	4	4
Thermal Shock			14				
Temperature - Humidity Cycling			17				
Corrosion, Salt Spray	9						
Leakage (f)							8

(a) See Paragraph 4.1.A.

(b) Numbers indicate sequence in which tests are performed.

(c) Test Group 6 Sequence 8 measure inner contact, outer contact, and shield to body. Test Group 3 Sequences 8, 11, 13, and 16 measure inner contact resistance only.

(d) Test Group 3 Sequence 18 measures Insulation Resistance within 5 minutes after Temperature Humidity Cycling.

(e) Applies only to captive contact designs.

(f) Test Group 7 performed on pressurized connectors only.

Figure 2

4. QUALITY ASSURANCE PROVISIONS

4.1. Qualification Testing

A. Sample Selection

Connectors shall be prepared in accordance with applicable Instruction Sheets. They shall be selected at random from current production. Test Group 1 shall consist of 3 unmated, uncabled connector pairs. Test Groups 2, 4, and 5 consist of 3 connector pairs each, which shall be cabled during R.F. testing. Test Groups 3 and 6 shall consist of 3 connector pairs with each connector crimped to a 12 inch length of cable. Cable used for testing shall be RG-402/U and RG-405/U, which conform to MIL-C-17.

B. Test Sequence

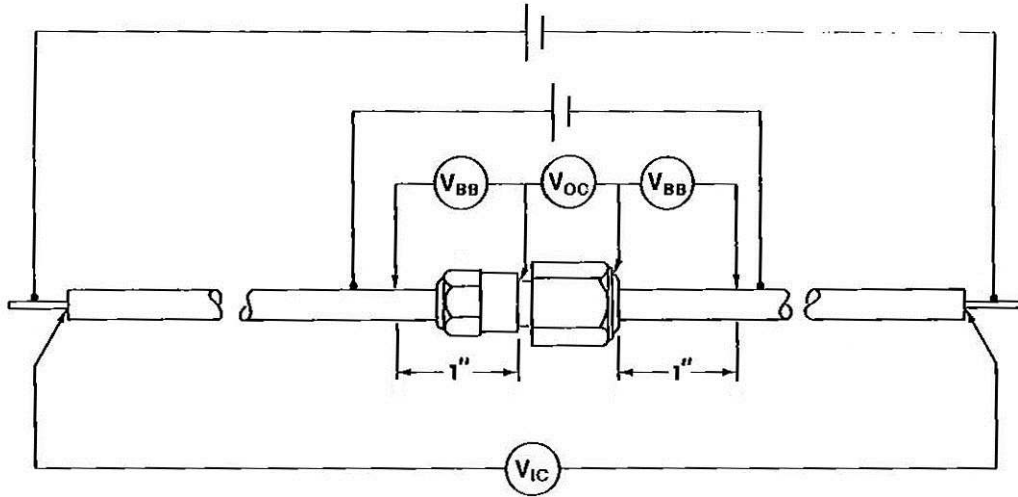
Qualification inspection shall be verified by testing samples as specified in Figure 2.

C. Acceptance

- (1) All samples tested in accordance with this specification shall meet the stated requirement.
- (2) Failures attributed to equipment, test setup, or operator deficiencies shall not disqualify the product. When product failure occurs, corrective action shall be taken.

4.2. Quality Conformance Inspection

The applicable AMP inspection plan will specify the sampling acceptable quality level to be used. Dimensional and functional requirements shall be in accordance with the applicable product drawing and this specification.



- NOTE: (a) V_{BB} is shield to body measurement.
 V_{OC} is outer contact measurement.
 V_{IC} is inner contact measurement.
- (b) Measure at 1 ampere DC.
- (c) Also measure 3 feet of wire, calculate milliohms per inch. Measure distance between probes on center contact measurement and subtract the length of the center contacts, then multiply by milliohms per inch and subtract this value from measurement to obtain actual contact resistance. For shield to body, subtract 1 unit of milliohm per inch to obtain actual contact resistance.

Figure 3

Resistance Measurement Points

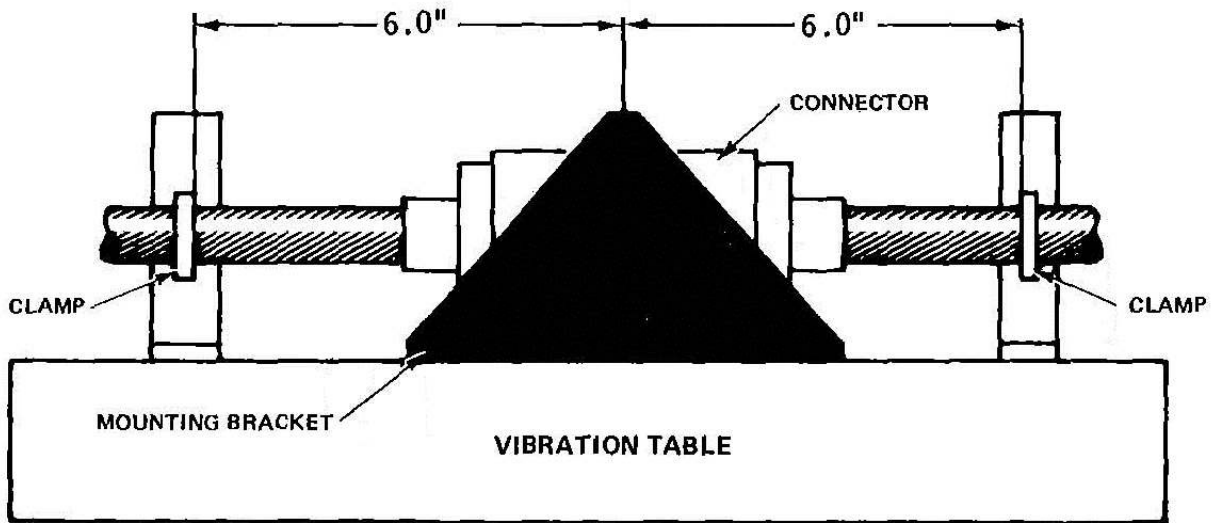


Figure 4

Vibration and Physical Shock Mounting

AMP Test Spec No	Title	Commercial Reference	Military Reference
109-21	Vibration Test Procedure for Electrical Connectors	EIA RS-364, TP-28	MIL-STD-1344, Method 2005 MIL-STD-202, Method 201 MIL-STD-202, Method 204
109-22	Thermal Shock Test Procedure for Electrical Connectors	EIA RS-364, TP-32	MIL-STD-1344, Method 1003 MIL-STD-1344, Method 1010 MIL-STD-202, Method 107
109-23	Humidity Test Procedure for Electrical Connectors	EIA RS-364, TP-31	MIL-STD-1344, Method 1002 MIL-STD-202, Method 103 MIL-STD-202, Method 106
109-24	Salt Spray Corrosion Test Procedure for Electrical Connectors	EIA RS-364, TP-26 ASTM B 117-64	MIL-STD-1344, Method 1001 MIL-STD-202, Method 101
109-25	Rated Current Termination Resistance Test Procedure for Electrical Connectors	EIA RS-364, TP-6 IPC-3.1	MIL-STD-1344, Method 3004
109-26	Mechanical Shock, Specified Pulse Test Procedure for Electrical Connectors	EIA RS-364, TP-27	MIL-STD-1344, Method 2004 MIL-STD-202, Method 213
109-27	Durability Test Procedure for Electrical Connectors	EIA RS-364, TP-9	MIL-STD-1344, Method 2016
109-28	Insulation Resistance Test Procedure for Electrical Connectors	EIA RS-364, TP-21	MIL-STD-1344, Method 3003 MIL-STD-202, Method 302
109-29	Withstanding Voltage Test Procedure for Electrical Connectors	EIA RS-364, TP-20	MIL-STD-1344, Method 3001 MIL-STD-202, Method 301
109-40	Corona, Test Procedure for	EIA RS-364, TP-44	

Figure 5