MILITARY SPECIFICATION

CONNECTOR, COAXIAL, RADIO FREQUENCY FOR COAXIAL, STRIP OR MICROSTRIP TRANSMISSION LINE

GENERAL SPECIFICATION FOR

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the general requirements and tests for radio frequency connectors used with coaxial, strip, or microstrip transmission line devices.

1.2 Classification. Connectors shall be of the following types and part numbers, as specified (see 3.1).

1.2.1 Part number. Each connector shall be marked with the complete part number. The part number shall be as shown in the following example:

M83517/	1	3	1	001
Basic specification number	Specification sheet number	Material (see 1.2.2)	Finish (see 1.2.3)	Number from specification (see 3.1)

1.2.2 Material. The material of the connector body shall be designated by the numbers 0, 1, 3, 4, and 5 as follows:

0 - Brass
1 - Phosphor bronze
3 - Corrosion resistant steel
4 - Copper beryllium
5 - Copper alloy

1.2.3 Finish. The finish of the connector body shall be designated by the numbers 1 through 5 as follows:

1 - Passivated
2 - Gold
3 - Gold plated body and passivated coupling nut
4 - Silver
5 - Nickel

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. Unless otherwise specified, the following specifications and standards of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Air Force Acquisition Logistics Division, Electronic Support Division, (AFALD/PTSP), Gentile AF Station, Ohio 45444 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

FSC 5935

SPECIFICATIONS

FEDERAL

L-P-389	-	Plastic Molding Material, FEP Flurocarbon, Molding and Extrusion.
L-P-403	-	Plastic Molding Material, Polytetrafluoroethylene (TFE-Flurocarbon).
QQ-B-613	-	Brass, Leaded and Non Leaded. Flat Products (Plate, Bar, Sheet, and Strip).
QQ-B-626	-	Brass, Leaded and Non Leaded: Rod, Shapes, Forgings, and Flat Products with Finished Edges (Bar and Strip).
QQ-B-750	-	Bronze, Phosphor, Bar, Plate, Rod, Sheet, Strip, Flat Wire, and Structural and Special Shaped Sections.
QQ-C-530	-	Copper-Beryllium Alloy Bar, Rod, and Wire (Copper Alloy Number 172 and 173).
QQ-C-533	-	Copper-Beryllium Alloy Strip (Copper Alloy Numbers 170 and 172).
QQ-S-763	-	Steel Bars, Wire, Shapes, and Forgings, Corrosion-Resisting.
ZZ-R-765	-	Rubber, Silicone

MILITARY

MIL-F-14072	-	Finishes for Ground Electronic Equipment.
MIL-I-17214	-	Indicator, Permeability; Low-Mu (Go-no-go).
MIL-C-39012	-	Connectors, Coaxial, Radiofrequency.
MIL-G-45204	-	Gold Plating, Electrodeposited.
MIL-C-55330	-	Connector, Preparation for Delivery of.

(See supplement 1 for applicable specification sheets.)

STANDARDS

MILITARY

MIL-STD-105	-	Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-130	-	Identification Marking of U.S. Military Property.
MIL-STD-202	-	Test Methods for Electronic and Electrical Component Parts.
MIL-STD-1344	-	Test Methods for Electrical Connectors.
MIL-STD-45662	-	Calibration, System Requirements.

(Copies of specifications, standards, drawings, and publications required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DoD adopted shall be the issue listed in the current DoDISS are the supplement thereto, if applicable.

AMERICAN NATIONAL STANDARDS INSTITUTE, INC.

IEEE-287 - Precision Coaxial Connector

ANSI B46.1-1962 - Surface Texture

ANSI Y14.5 - Dimensioning and Tolerances

(Application for copies should be addressed to the American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.)

ASTM A 484-80 - Steel Product, Wrought, Stainless and Heat Resistive

ASTM A 582-75 - Free Machining, Stainless Steel and Heat Resisting Steel Bars, Hot Rolled or Cold Finished

(Application for copies should be addressed to the American Society For Testing and Materials, 1916 Race St. Philadelphia, PA 19103.)

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 Specification sheets. The individual item requirements shall be as specified herein and in accordance with the applicable specification sheet. In the event of any conflict between the requirements of this specification and the specification sheet, the latter shall govern.

3.2 Qualification. Connectors furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 4.4 and 6.4).

3.3 Material. Material shall be as specified herein (see table I). If materials other than those specified are used, the contractor shall certify to the qualifying activity that the substitute material enables the connectors to meet the requirements of this specification. Acceptance or approval of any constituent material shall not be construed as a guaranty of the acceptance of the product. When a definite material is not specified, a material shall be used which will enable the connector to meet the requirements of this specification.

TABLE I. Materials.

Component material	Applicable specification
Brass -	QQ-B-626
Phosphor bronze - - - - - - - - - - - - - - - - - -	QQ-B-750
Copper Beryllium- - - - - - - - - - - - - - - - - -	QQ-C-530
Copper Beryllium- - - - - - - - - - - - - - - - - -	QQ-C-533
Steel -	ASTM-A-582
Steel-corrosion resisting - - - - - - - - - - - - -	QQ-S-763
TFE fluorocarbon- - - - - - - - - - - - - - - - - -	L-P-403
FEP fluorocarbon- - - - - - - - - - - - - - - - - -	L-P-389
Silicon rubber- - - - - - - - - - - - - - - - - - -	ZZ-R-765

3.3.1 Finish. Unless otherwise specified (see 6.2), center contacts shall be gold-plated to a minimum thickness of .00005-inch in accordance with MIL-G-45204, type II, class 1. Silver shall not be used as an underplate. All other metal parts shall be finished so as to provide a connector which meets the corrosion requirements of this specification.

3.3.2 Dissimilar metals. Dissimilar metals between which an electromotive couple may exist shall not be placed in contact with each other. Reference is made to MIL-F-14072 for definition of dissimilar metals.

3.3.3 Nonmagnetic materials. All parts (except hermetic sealed connectors) shall be made from materials which are classified as nonmagnetic (see 3.8).

3.3.4 Spring members. Unless otherwise specified (see 3.1), center contact spring members shall be made of copper beryllium.

3.4 Design and construction. Connectors shall be of the design, construction and physical dimensions in accordance with ANSI Y14.5 and as specified (see 3.1).

3.5 Force to engage/disengage. When tested as specified in 4.6.2, the torque necessary to completely couple or uncouple the connectors shall not exceed that specified (see 3.1). Also the longtitudinal force necessary to initiate the engaging or disengaging cycle shall not exceed that specified (see 3.1).

3.6 Coupling proof torque. When tested as specified in 4.6.3, the coupling mechanism (threaded types) shall not be dislodged, and the connector shall meet the requirements of 3.5. The interface dimensions of the connector shall remain as specified (see 3.1 and 3.4).

3.7 Contact gaging. When connectors are tested as specified in 4.6.4, the contact dimensions shall be gaged as specified (see 3.1), and the contact dimensions shall stay within the specified tolerance (see 3.1).

3.8 Permeability of nonmagnetic materials. When connectors (except hermetic-sealed) are tested as specified in 4.6.5, the permeability (Mu) shall not be greater than 2.0.

3.9 Seal (see 6.6 for definitions).

3.9.1 Hermetic-sealed connectors. When connectors are tested as specified in 4.6.6.1, the leakage rate shall not exceed that specified (see 3.1).

3.9.2 Pressurized and weatherproof connectors. When connectors are tested as specified in 4.6.6.2, there shall be no leakage as detected by escaping air bubbles.

3.10 Insulation resistance. When connectors are tested as specified in 4.6.7, the insulation resistance shall not be less than that specified (see 3.1).

3.11 Center contact retention (where applicable see 3.1).

3.11.1 Axial force. When connectors are tested as specified in 4.6.8.1, the center contacts shall withstand the axial force specified (see 3.1). The center contact shall meet the applicable mating dimensions (see 3.1).

3.11.2 Torque. When connectors are tested as specified in 4.6.8.2, there shall be no rotation of the center contact (see 3.1).

3.12 Dielectric withstanding voltage. When connectors are tested as specified in 4.6.9, there shall be no evidence of breakdown or flashover.

3.13 Corrosion. When connectors are tested in 4.6.10, there shall be no exposure of the base metal on the interface or mating surface, and they shall meet the requirements of 3.5.

3.14 Voltage standing wave ratio (VSWR). When connectors are tested as specified in 4.6.11, the VSWR shall not exceed that specified over the frequency range specified (see 3.1).

3.15 Radio frequency (RF) transmission loss. When connectors are tested as specified in 4.6.12, the transmission loss shall not exceed that specified (see 3.1).

3.16 Radio frequency (RF) leakage. When connectors are tested as specified in 4.6.13, the total leakage shall not excceed that specified (see 3.1).

3.17 Connector durability. When connectors are tested as specified in 4.6.14, they shall show no evidence of severe mechanical damage and the coupling device shall remain functional. Connectors shall meet the applicable requirements of 3.5 and 3.7.

3.18 Contact resistance. When connectors are tested as specified in 4.6.15, the contact resistance shall be as specified (see 3.1).

3.19 Thermal shock. After testing as specified in 4.6.16, there shall be no evidence of visual mechanical damage to the connector and it shall meet the dielectric withstanding voltage requirement (see 3.12), and the contact resistance specified for the center contact shall not be exceeded (see 3.18), and meet the VSWR requirements (see 3.14).

3.20 Moisture resistance. When connectors are tested as specified in 4.6.17, there shall be no evidence of damage. They shall withstand the dielectric withstanding voltage specified (see 3.12), and the insulation resistance shall not be less than that specified (see 3.1 and 3.10).

3.21 Radio frequency (RF) high potential withstanding voltage. When connectors are tested as specified in 4.6.18, there shall be no breakdown or flashover (see 3.1).

3.22 Coupling mechanism retention force. When tested as specified in 4.6.19, the coupling mechanism shall not be dislodged from the connector and shall be capable of meeting the requirements of 3.5 immediately after the test (see 3.1).

3.23 Marking. Connectors and associated fittings shall be permanently and legibly marked in accordance with the general marking requirements of MIL-STD-130 with the military part number (see 1.2.1) and the manufacturer's federal supply code. The marking location is optional; when practicable, a location should be picked that will least likely be covered by installation (see 4.6.1).

3.24 Workmanship. Connectors and associated fittings shall be processed in such a manner as to be uniform in quality and shall be free from sharp edges, burrs, and other defects that will affect life, serviceability or appearance.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality and quantity to permit performance of the required inspection shall be established and maintained by the contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with MIL-STD-45662.

4.2 Classification of inspections. The inspections specified herein are classified as follows:

a. Qualification inspection (see 4.4).

b. Quality conformance inspection (see 4.5).

4.3 Inspection conditions. Unless otherwise specified herein, all inspections shall be performed in accordance with the test condition in the "GENERAL REQUIREMENTS" of MIL-STD-202 and MIL-STD-1344. For each test of threaded coupling connectors where the test is performed on mated pairs, the pair shall be torqued to the specified value (see 3.1).

4.4 Qualification inspection. Qualification inspection shall be performed at a laboratory acceptable to the Government (see 6.4) on sample units produced with equipment and procedures normally used in production.

4.4.1 Sample size. Nine connectors of the same part number with its mating connector shall be subjected to qualification inspection.

4.4.2 Group qualification. For group qualification of all series of connectors covered by this specification, see 3.1. The government reserves the right to authorize performance of any or all qualification inspection on additional types in the group that are considered necessary for qualification with each group.

4.4.3 Inspection routine. The sample shall be subjected to the inspections specified in table II. All sample units shall be subjected to the inspection of group I. The sample shall then be divided into three groups consisting of three connectors each (see 1.2). The sample units shall then be subjected to the inspection for their particular group.

4.4.4 Failures. One or more failures shall be cause for refusal to grant qualification approval.

4.4.5 Retention of qualification. To retain qualification, the supplier shall forward a report at 12 or 36 month intervals to the qualifying activity. The qualifying activity shall establish the initial reporting date. Initial retention of qualification shall be at a 12 month interval; subsequent retention of qualification at a 36 month interval. The report shall consist of:

a. A summary of the results of the tests performed for inspection of product for delivery, groups A and B, indicating as a minimum the number of lots that have passed and the number that have failed. The results of tests of all reworked lots shall be identified and accounted for.

b. A summary of the results of tests performed for qualification verification inspection, group C, including the number and mode of failures. The summary shall include results of all qualification verification inspection tests performed and completed during the 12 or 36 month period. If the summary of the test results indicates nonconformance with specification requirements, and corrective action acceptable to the qualifying activity has not been taken, action may be taken to remove the failing product from the qualified products list.

Failure to submit the report within 60 days after the end of each 12 or 36 month period may result in loss of qualification for the product. In addition to the periodic submission of inspection data, the supplier shall immediately notify the qualifying activity at any time during the 12 or 36 month period that the inspection data indicates failure of the qualified product to meet the requirements of this specification.

In the event that no production occurred during the reporting period, a report shall be submitted certifying that the company still has the capabilities and facilities necessary to produce the item. If during 3 consecutive reporting periods there has been no production, the manufacturer may be required, at the discretion of the qualifying activity, to submit a representative product from each group, as defined by 4.4.2 to testing in accordance with the qualification inspection requirements.

TABLE II. Qualification inspection.

Inspection	Requirement paragraph	Method paragraph
Group I		
Visual and mechanical inspection		
Material	3.3	4.6.1
Finish	3.3.1	4.6.1
Dissimilar metals	3.3.2	4.6.1
Design and construction (dimensions)	3.4	4.6.1
Marking	3.23	4.6.1
Force to engage/disengage	3.5	4.6.2
Coupling proof torque	3.6	4.6.3
Design and construction	3.4	4.6.1
Force to engage/disengage	3.5	4.6.2
Contact gaging	3.7	4.6.4
Permeability of nonmagnetic materials	3.8	4.6.5
Workmanship	3.24	4.6.1
Seal	3.9	4.6.6
Hermetic sealed connectors	3.9.1	4.6.6.1
Pressurized and weatherproof connectors	3.9.2	4.6.6.2
Insulation resistance	3.10	4.6.7
Group II 1/		
Center contact retention	3.11	4.6.8
Axial force	3.11.1	4.6.8.1
Torque	3.11.2	4.6.8.2
Dielectric withstanding voltage	3.12	4.6.9
Corrosion	3.13	4.6.10
Force to engage/disengage	3.5	4.6.2
Group III		
VSWR	3.14	4.6.11
RF transmission loss	3.15	4.6.12
RF leakage	3.16	4.6.13
Connector durability	3.17	4.6.14
Force to engage/disengage	3.5	4.6.2
Contact gaging	3.7	4.6.4
Group IV		
Contact resistance	3.18	4.6.15
Thermal shock	3.19	4.6.16
Dielectric withstanding voltage	3.12	4.6.9
Contact resistance	3.18	4.6.15
VSWR	3.14	4.6.11
Moisture resistance	3.20	4.6.17
Dielectric withstanding voltage	3.12	4.6.9
Insulation resistance	3.10	4.6.7
RF high potential withstanding voltage	3.21	4.6.18
Coupling mechanism retention force	3.22	4.6.19
Force to engage/disengage	3.5	4.6.2

1/ SEE 3.1

4.4.6 Extension of qualification. Manufacturers who have products listed on QPL-39012 and produce connectors of the same series in accordance with this specification, may apply to the qualifying activity for extension of qualification to this specification, provided the interfacial coupling, materials, and plating of the connectors are identical, and the connector successfully meets the requirements of groups I, II, and III of table II.

4.5 Quality conformance inspection.

4.5.1 Inspection of product for delivery. Inspection of product for delivery shall consist of groups A and B inspection.

4.5.1.1 Inspection lot. An inspection lot shall consist of all the connectors and associated fitting comprised of identical piece parts produced under essentially the same conditions and offered for inspection at one time.

4.5.1.1.1 Group A inspection. Group A inspection shall consist of the inspections specified in table III, and shall be made on the same set of sample units, in the order shown.

TABLE III. Group A inspection.

Inspection	Requirement paragraph	Method paragraph	AQL (% defective) Major	Minor
Visual and mechanical inspection				
Material - - - - - - - - - - - -	3.3	4.6.1	.65	2.5
Finish 1/- - - - - - - - - - - -	3.3.1	4.6.1		
Dissimilar metals- - - - - - -	3.3.2	4.6.1		
Design and construction- - - -	3.4	4.6.1		
Marking- - - - - - - - - - - - - -	3.23	4.6.1		
Workmanship- - - - - - - - - - -	3.24	4.6.1		
Seal - - - - - - - - - - - - - - -	3.9	4.6.6		
Hermetic seal connectors - -	3.9.1	4.6.6.1		
Pressurized and weatherproof	3.9.2	4.6.6.2		
Dielectric withstanding voltage-	3.12	4.6.9		

1/ Verification of finish may be accomplished using the manufacturer's process controls providing these controls are clearly equal to or more stringent than the requirements of this specification.

4.5.1.1.1.1 Sampling plan. Statistical sampling and inspection shall be in accordance with MIL-STD-105 for general inspection level II. The acceptable quality level (AQL) shall be as specified in table III. Major and minor defects shall be as defined in MIL-STD-105.

4.5.1.1.1.2 Rejected lots. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units and resubmit for reinspection. Resubmitted lots shall be inspected using tightened inspection. Such lots shall be separated from new lots and shall be clearly identified as reinspected lots.

4.5.1.1.2 Group B inspection. Group B inspection shall consist of the inspections specified in table IV in the order shown, and shall be made on sample units which have been subjected to and passed the group A inspection. Connectors having identical piece parts may be combined for lot purposes and shall be in proportion to the quantity of each part-numbered connector produced.

4.5.1.1.2.1 Sampling plan. The sampling plan shall be in accordance with MIL-STD-105 for special inspection level S-4. The sample size shall be based on the inspection lot size from which the sample was selected for group A inspection. The AQL shall be 2.5 percent defective.

TABLE IV. Group B inspection.

Inspection	Requirement paragraph	Method paragraph
Force to engage/disengage	3.5	4.6.2
Coupling proof torque	3.6	4.6.3
Design and construction	3.4	4.6.1
Force to engage/disengage	3.5	4.6.2
Contact gaging	3.7	4.6.4
Permeability of nonmagnetic material	3.8	4.6.5
Insulation resistance	3.10	4.6.7
VSWR	3.14	4.6.11

4.5.1.1.2.2 Rejected lots. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out defective units, and resubmit for reinspection. Resubmitted lots shall be inspected using tightened inspection. Such lots shall be separated from new lots, and shall be clearly identified as reinspected lots.

4.5.1.1.2.3 Disposition of sample units. Sample units which have passed all the group B inspection may be delivered on the contract or purchase order, if the lot is accepted. Any connector or connector part deformed or otherwise damaged during testing shall not be delivered on the contract or order.

4.5.1.2 Qualification verification inspection. Qualification verification inspection shall consist of group C. Except where the results of these inspections show noncompliance with the applicable requirements (see 4.5.1.2.1.4), delivery of products which have passed groups A and B shall not be delayed pending the results of these qualification verification inspections.

4.5.1.2.1 Group C inspection. Group C inspection shall consist of the inspections specified in table V, in order shown, group C inspection shall be made on sample units selected from inspection lots which have passed the groups A and B inspection.

4.5.1.2.1.1 Sampling plan. Nine sample units of each part-numbered connector with its mating connector shall be selected after 200,000 connectors of each part number have been produced or at least once every 3 years, whichever comes first. The sample units shall be divided equally among three subgroups.

4.5.1.2.1.2 Failures. If one or more sample units fail to pass group C inspection, the sample shall be considered to have failed.

4.5.1.2.1.3 Disposition of sample units. Sample units which have been subjected to group C inspection shall not be delivered on the contract or order.

4.5.1.2.1.4 Noncompliance. If a sample fails to pass group C inspection, the contractor shall take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected and which were manufactured under essentially the same conditions, with essentially the same materials, processes, etc., and which are considered subject to the same failure. Acceptance of the product shall be discontinued until corrective action, acceptable to the Government has been taken. After the corrective action has been taken, group C inspection shall be repeated on additional sample units (all inspection, or the inspection which the original sample failed, at the option of the Government). Groups A and B inspections may be reinstituted, however, final acceptance shall be withheld until the group C reinspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure and corrective action taken shall be furnished to the cognizant inspection activity and the qualifying activity.

TABLE V. Group C inspection.

Inspection	Requirement paragraph	Method paragraph
Subgroup 1		
Center contact retention	3.11	4.6.8
Corrosion	3.13	4.6.10
Force to engage/disengage	3.5	4.6.2
Subgroup 2		
VSWR	3.14	4.6.11
RF transmission loss	3.15	4.6.12
RF leakage	3.16	4.6.13
Connector durability	3.17	4.6.14
Contact gaging	3.7	4.6.4
Force to engage/disengage	3.5	4.6.2
Subgroup 3		
Contact resistance	3.18	4.6.15
Thermal shock	3.19	4.6.16
Dielectric withstanding voltage	3.12	4.6.9
Contact resistance	3.11	4.6.8
VSWR	3.14	4.6.11
Moisture resistance	3.20	4.6.17
Dielectric withstanding voltage	3.12	4.6.9
Insulation resistance	3.10	4.6.7
RF high potential withstanding voltage	3.21	4.6.18
Coupling mechanism retention force	3.22	4.6.19
Design and construction	3.4	4.6.1
Force to engage/disengage	3.5	4.6.2

4.5.2 Inspection of packaging. The sampling and inspection of the preservation, packing, and container marking shall be in accordance with the requirements of MIL-C-55330.

4.6 Methods of inspection. Test parameters given in the following tests assure connector integrity within the typical operating conditions and application. Methods of inspection given in the specification shall be the only acceptable methods unless an alternate method has been agreed to by the qualifying authority prior to performance of the test. The test methods described herein are the preferred methods and shall be the referee method in cases of dispute.

4.6.1 Visual and mechanical inspection. Connectors and associated fittings shall be inspected to verify that the design, construction, physical dimension, marking, and workmanship are in accordance with the applicable requirements (see 3.1, 3.3, 3.4, 3.23, and 3.24).

4.6.1.1 Dimensional inspection. Mating dimensions shall be inspected by mating the connector with its applicable mating gages or other suitable means acceptable to the Government.

4.6.2 Force to engage/disengage (see 3.5). The connector shall be engaged with its mating standard part (see 3.1). During the entire coupling/uncoupling cycle (until the connector is fully engaged/disengaged) the forces and/or torques necessary shall be as specified (see 3.1). A thread coupled connector is fully engaged with its mating standard part when their reference planes (see 3.1) coincide. The mating standard part is a steel jig containing the critical interface dimensions finished to the tolerances specified (see 3.1). Its spring members when applicable shall be heat treated beryllium copper. The surface finish or mating surfaces shall be 16 microinches rms maximum, per ANSI B46.1-1962.

4.6.3 Coupling proof torque (see 3.6). The connector under test shall be engaged with its mating standard part (gage) and the coupling nut tightened to the torque value specified (see 3.1). After one minute the connector under test and its mating standard part shall be disengaged.

4.6.4 Contact gaging (see 3.7). After insertion of the specified oversize pin the specified number of times (see 3.1), the contact to be tested shall be held rigid by means of a suitable jig or fixture. A gage containing the test pin or test ring and a suitable force indicating dial shall be aligned to within .004 TIR of any plane passing through the axis of the contact under test. Engagement or withdrawal of the test pin or test ring shall be made smoothly and at such a rate that the dial does not bounce or otherwise give a false reading. The test pin or test ring may be chamfered to facilitate entry, but the specified engagement length shall not include the chamfer length, and the finish shall be as specified and in accordance with ANSI B46.1-1962.

4.6.5 Permeability of nonmagnetic materials (see 3.8). The permeability of the connector shall be measured with an indicator conforming to MIL-I-17214.

4.6.6 Seal (see 3.9).

4.6.6.1 Hermetic-sealed connectors (see 3.9.1). The unmated connector shall be tested in accordance with method 112 of MIL-STD-202. The following details and exception shall apply:

a. Method of mounting - In its normal manner in specified mounting hole (see 3.1).

b. Test condition letter - C.

c. Procedure number - I.

d. Leakage rate sensitivity - 10^{-8} cubic centimeters per second.

4.6.6.2 Pressurized and weatherproof connectors (see 3.9.2). The unmated connector shall be mounted in its normal manner in the specified mounting hole (see 3.1) on a closed container. The specified air pressure (see 3.1) shall be applied to the interior of the container. The exposed portion of the connector under pressure shall be fully immersed in water or alcohol-water mixture and observed for 1 minute minimum.

4.6.7 Insulation resistance (see 3.10). Connectors shall be tested in accordance with method 3003 MIL-STD-1344. Measure between the center contact and body.

4.6.8 Center contact retention (see 3.11).

4.6.8.1 Axial force. The axial force specified (see 3.1 and 3.11.1) shall be applied to the center contact of an unmated connector. This force shall be applied without shock until the specified force has been reached. The force shall be applied for a minimum period of 5 seconds. After removal of specified force the actual locations of the center contact shall be determined on recessed socket contacts, the tool specified in the appendix will be used (see figure 19).

4.6.8.2 Torque (see 3.1 and 3.11.2). The torque specified shall be applied to the center contact of an unmated connector for a minimum period of 10 seconds on recessed socket contacts, and the tool specified in the appendix will be used (see figure 19).

4.6.9 Dielectric withstanding voltage (see 3.12). Connectors shall be tested in accordance with method 3001 of MIL-STD-1344. The following details shall apply:

a. Special preparations or conditions.

(1) The maximum relative humidity shall be 50 percent. When facilities are not available at this test condition, connectors shall be tested at room ambient relative humidity. In case of dispute, if the test has been performed at room ambient relative humidity, retesting shall be performed at 50 percent maximum relative humidity.

(2) The center contact of plug connectors and receptacle connectors shall be positioned in such a manner as to simulate actual assembly conditions.

(3) Precautions shall be taken to prevent air-gap voltage breakdowns.

(4) The voltage shall be metered on the high side of the transformer.

b. Magnitude of test voltage (see 3.1). The voltage shall be instantaneously applied.

c. Nature of potential - Alternating current.

d. Points of application of test voltage - Between the center contact and body.

4.6.10 Corrosion (see 3.13). Unmated connectors shall be tested in accordance with method 1001, MIL-STD-1344. The following details and exceptions shall apply:

a. Test condition letter (see 3.1).

b. Salt solution - 5 percent.

After exposure, connectors shall be washed, shaken, and lightly brushed as specified in method 1001 of MIL-STD-1344 and then permitted to dry for 24 hours at 40°C. Connectors shall then be inspected for evidence of corrosion, pitting, and ease of coupling.

4.6.11 Voltage standing wave ratio (VSWR) (see 3.14). The VSWR shall be measured in accordance with the following procedure or a method acceptable to the Government. In the event of dispute the method outlined herein shall be used. Diagrams for the swept frequency VSWR system check out and measurement procedures are shown on figure 1.

In the basic measurement setup of figure 1 detector 1 provides a feedback signal to the swept RF source in order to normalize the output signal of detector 2. The frequency-amplitude characteristics of detectors 1 and 2 should be matched within 0.5 dB.

To measure VSWR several sweeps are made with the slotted line probe incrementally positioned over at least a half wave length at the lowest frequency of interest. In this manner an X-Y display is generated whose upper and lower envelope limits represent maximum and minimum amplitudes of the standing wave for each frequency in the test band. A base line may be generated by making a sweep with no input to the measurement channel amplifier. The resultant X-Y display is calibrated according to the characteristics of the measurement channel detector and amplifier, e.g., linear, square law, logarithmic, etc.

The VSWR test system is checked out by successively terminating the slotted line with the elements shown in steps 1, 2, and 3 and sweeping the frequency over the specified test band (see 3.1). In step 1 the system VSWR shall be less than 1.02 + .004 frequency (frequency measured in GHz). In steps 2 and 3 the system VSWR shall be as specified (see 3.1).

The hermphroditic connector (see figure 1) for the standard precision adapter (item 11) and standard precision test fixture (item 12) shall conform to IEEE standard 287. The standard test connector interface on precision adapters shall be in accordance with the appropriate connectors in figures 8, 9, and 10 of MIL-C-39012.

Refer to Appendix (see 30.3) for precision adapters and precision test fixture design parameters.

NOTE: Transition end is considered as part of the complete connector and must be included in all tests with the surface launch stripline connector. The enlarged terminal end of the contact ("nail head") is a mechanical feature to attach to the stripline. Its effect is determined by impedance matching techniques incorporated by the user. Thus, contact modification to adapt to a test fixture is specified. All situations specifying transition end is covered by one of the specified test methods.

For qualification inspection the connector under test is measured with the slotted line terminated as in step 4. The VSWR shall be as specified (see 3.1).

NOTE: For steps 1, 2, 3, and 4, see figure 1.

4.6.12 Radio frequency (RF) transmission loss (see 3.15). The RF transmission loss shall be measured in accordance with the following procedure or a method acceptable to the government. In the event of dispute, the method outlined herein shall be used. Diagrams for the RF transmission loss system check out and measurement procedures are shown on figure 2.

The samples shall be tested as shown on figure 2. This test set up is identical to the VSWR measurement with an addition power detector, isolator and a power amplifier.

The test system is checked out as follows:

a. Check out VSWR per steps 1, 2, and 3 in VSWR test method (see 4.6.11). See 3.1 for test frequency ranges.

Step

1 Systems VSWR shall be less than 1.02 + .004 frequency (frequency measured in GHz).

2 & 3 Systems VSWR shall be as specified (see 3.1).

b. Check out power transmission per steps:

Step

4 Plot basic power reference curve on X-Y recorder.

5 Standard test adapter (back to back). The transmission loss shall not be greater than specified (see 3.1) over the basic power reference established in step 4.

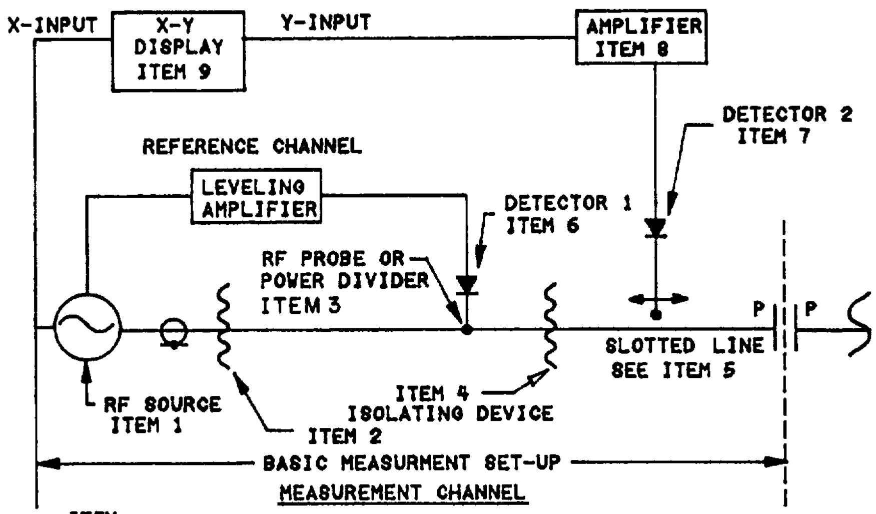
6 Standard test fixture set. The transmission loss shall not be greater than specified (see 3.1) over the basic power reference established in step 4.

7 Connector under test. Attach the appropriate precision adapter and standard test fixture half to the connector under test. (Same configuration as step 4 in VSWR (see 4.6.11) test method.)

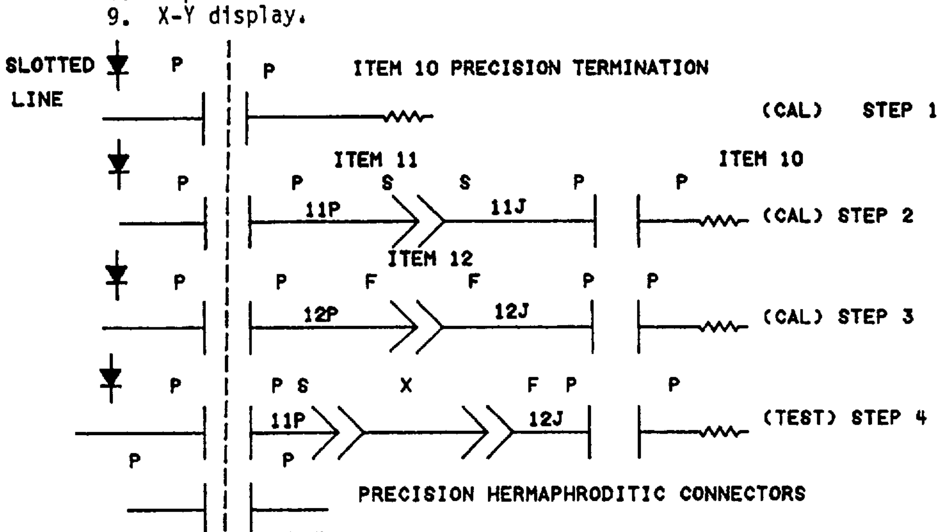
The transmission loss shall be free of any loss spikes greater than 0.3 dB and shall not be greater than specified (see 3.1) over the basic power reference established in step 4.

4.6.13 Radio frequency (RF) leakage (see 3.16). The connecter under test shall be connected to a mating connector and mounted to an appropriate test fixture (see 3.1). The assembly shall be as shown on figure 3A and tested as shown in figure 3B (the procedure for determining the dimensions of the cavity in figure 3B may be found in paragraph 30 of the appendix). This test setup between 500 MHz and 7.5 GHz shall have a dynamic range from -20 dBm to better than -100 dBm or if not within this power range, a difference of at least 90 dB. If -20 dBm is the maximum power range, using a +20 dBm RF source with 30 dB attentuation including the isolator pad, an additional 30 dB range can be obtained.

4.6.14 Connector durability (see 3.17). Each connector under test shall be mated with a typical production connector per this specification or same series of MIL-C-39012. This test also applies to transition pins if applicable. The connector and transition pin shall be subject to the number of cycles of mating and unmating specified (see 3.1). The connector and its mating part and the transition pin if applicable shall be completely engaged and completely disengaged each cycle. Lubrication of the threads or rotational parts shall not be employed for this test unless specified (see 3.1). It is permissible to shake or blow debris from the threads or interface surfaces at intervals of not less than 50 cycles. Solvents or tools shall not be used for cleaning.



ITEM:
1. Swept RF source.
2. Isolating device.
3. RF probe or power divider.
4. Isolating device.
5. Slotted line with precision hermaphroditic output connector. Residual VSWR less than 1.006 + .003F (F in GHz).
6. Detector No. 1.
7. Detector No. 2.
8. Amplifier
9. X-Y display.



ITEM:
10. Precision hermaphroditic termination.
11. Standard precision adapter maximum VSWR (see 3.1).

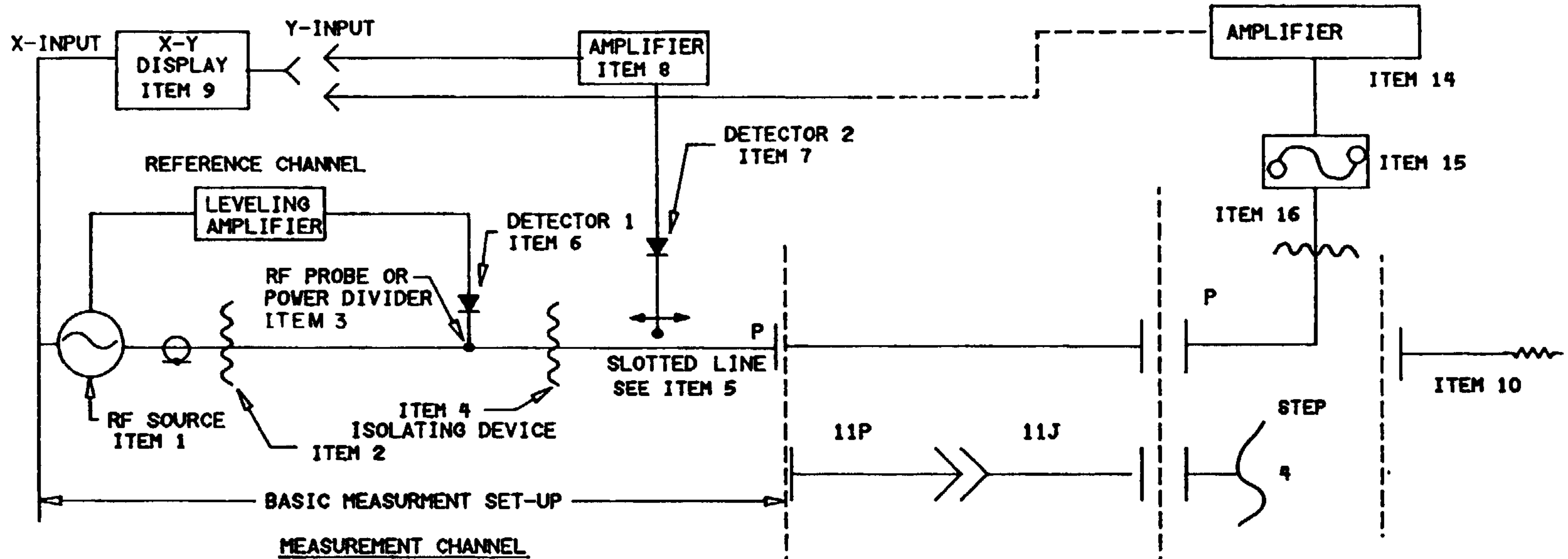
Hermaphroditic Interface — P-S 11p — Standard Test Connector Interface Per MIL-C-39012
P-S 11j

12. Standard test fixture set (see 3.1 and appendix).

P F 12p
P F 12j

13. Connector under test X

FIGURE 1. Swept frequency VSWR test.



ITEM:
1. Sweep RF source.
2. Isolating device.
3. RF probe or power divider.
4. Isolating device.
5. Slotted line with precision hermaphroditic output connector.
   Residual VSWR less than 1.006 + .003F (F in GHz).
6. Detector No. 1.
7. Detector No. 2.
8. Amplifier.
9. X-Y display.
10. Precision hermaphroditic connectors.
11. Standard precision adapter:

    Standard Test Connector Interface per MIL-C-39012 — Hermaphroditic Interface — P-S 11p; P-S 11j — P P

12. Standard test fixture set

    P F 12p

    P F 12j

13. Connector under test X
14. Amplifier (power).
15. Power detector.
16. Isolating device.

FIGURE 2. RF transmission loss test.

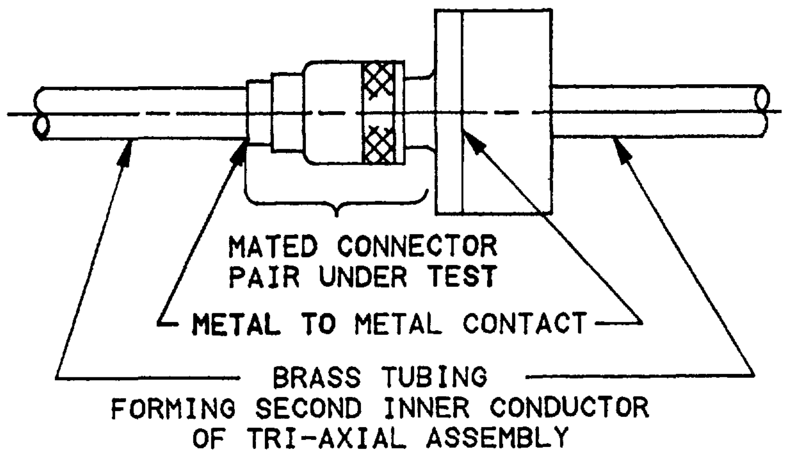


FIGURE 3A. Connector assembly for RF leakage test.

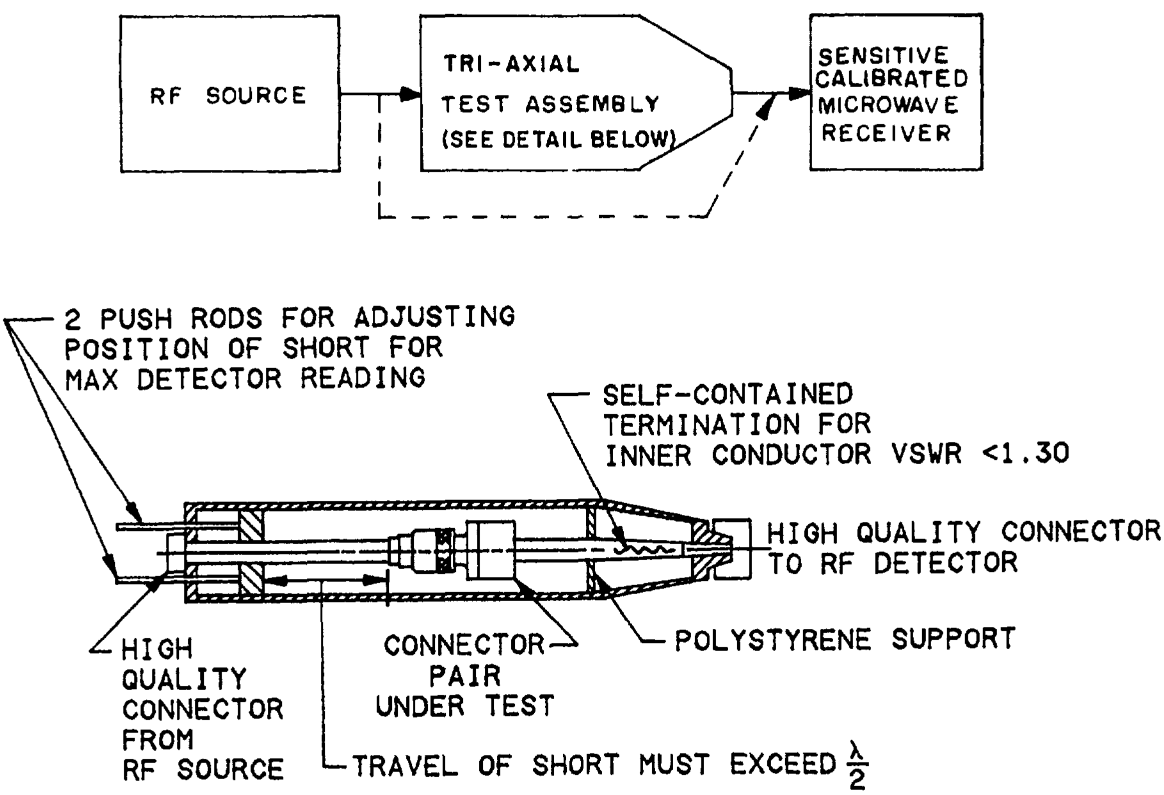
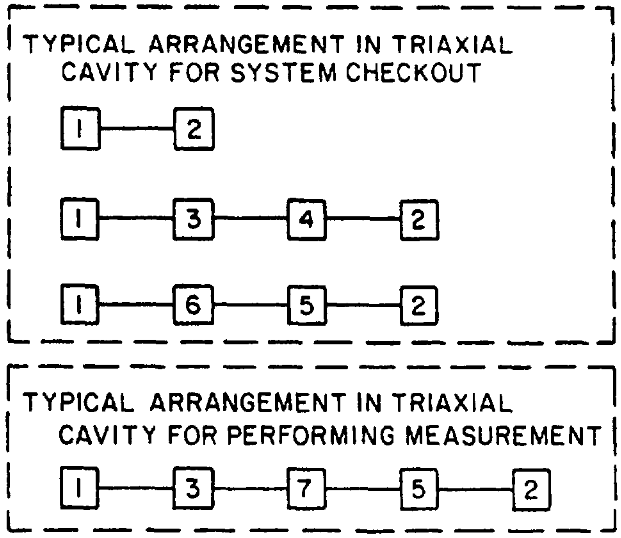


FIGURE 3B. RF leakage test set-up.

FIGURE 3. Method of RF leakage measurements.



3C. Typical arrangements in triaxial cavity.

ITEM
1. Cable connector with hermaphroditic output fitting.
2. Cable connector with hermaphroditic input fitting compatible with output fitting of item 1.
3. Standard test connector with hermaphroditic input fitting compatible with output fitting of item 1, and output interface compatible with input interface of adapter to be tested.
4. Standard test connector of opposite sex to item 3, and hermaphroditic output fitting compatible with input fitting of item 2.
5. Standard test connector with hermaphroditic output fitting compatible with input fitting of item 2, and input interface compatible with output interface of adapter to be tested.
6. Standard test connector of opposite sex to item 5 and hermaphroditic input fitting compatible with output fitting of item 1.
7. Two identical connectors mated with a transition test pin in accordance with figure 3.

FIGURE 3. Method of RF leakage measurements - Continued.

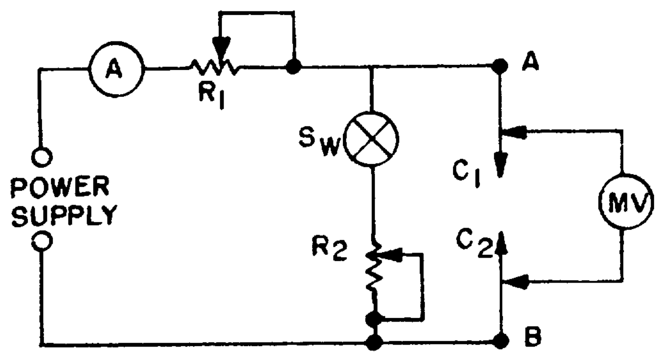
4.6.15 Contact resistance (see 3.18). All contact resistance tests shall be conducted with the apparatus shown in figure 4. Circuit adjustments and the measurement procedures for all contact resistance tests shall be in accordance with 4.6.15.1. The contact resistance to be measured are:

a. The contact resistance between the outer conductors of the connector under test and a simulated mounting surface (see 3.1).

b. The contact resistance between the outer conductors of the connector under test and a mating connector (the coupling nut must be removed for this measurement).

c. The contact resistance between the inner conductors of the connector under test and a mating connector. This test will include a mated transition pin if applicable.

4.6.15.1 General procedure. The apparatus shall be assembled as shown in figure 4. The contacts, C_1 - C_2, shown in figure 4, represent the mating contacts upon which millivolt drop tests are to be conducted.



a. Remove contacts C_1-C_2 from the measuring circuit.
b. Close switch SW.
c. Adjust R_2 for a millivoltmeter (mVm) reading of 50 millivolts.
d. Connect contacts C_1-C_2 to the measuring circuit and mate.
e. Check to see that mVm drops significantly prior to opening switch in (f).
f. Open switch SW.
g. Adjust R_1 for circuit current (A) of 1 ampere.
h. Measure the millivolt drop across contacts C_1-C_2 and call this "c".
i. Compute contact resistance. Contact resistance (milliohms) = c millivolts ÷ 1 ampere.

FIGURE 4. Diagram for contact resistance.

4.6.16 Thermal shock (see 3.19). Connectors shall be subjected to method 107 of MIL-STD-202. The following details shall apply:

a. Test condition letter (see 3.1).

b. The contact resistance tests on the center contact shall be performed before and after the thermal shock test and then inspected for mechanical damage (see 3.1).

c. Connectors shall meet the requirements for VSWR (see 3.14).

4.6.17 Moisture resistance (see 3.20). The sample shall be mounted on the appropriate test fixture and shall be subjected to method 106 of MIL-STD-202. The following exceptions and conditions shall apply:

a. No initial measurements.

b. No load.

c. Measurements shall be made at high humidity when specified (see 3.1).

d. The connector shall withstand the dielectric withstanding voltage specified (see 4.6.9) after the drying period.

4.6.18 Radio frequency (RF) high potential withstanding voltage (see 3.21). The test sample shall be mated to a cabled connector per MIL-C-39012 (the cable shall be approximately 2 inches long). This assembly shall then be inserted into the high impedance circuit as shown on figure 5, or equivalent, and instantaneously subjected to the RF voltage and frequency specified (see 3.1) between the center contact and body of the connectors. The duration of the test shall be 1 minute. The RF voltage source shall be frequency stabilized and shall have an approximate pure sine wave output with minimum harmonic content. Means shall be provided to indicate disruptive discharge.

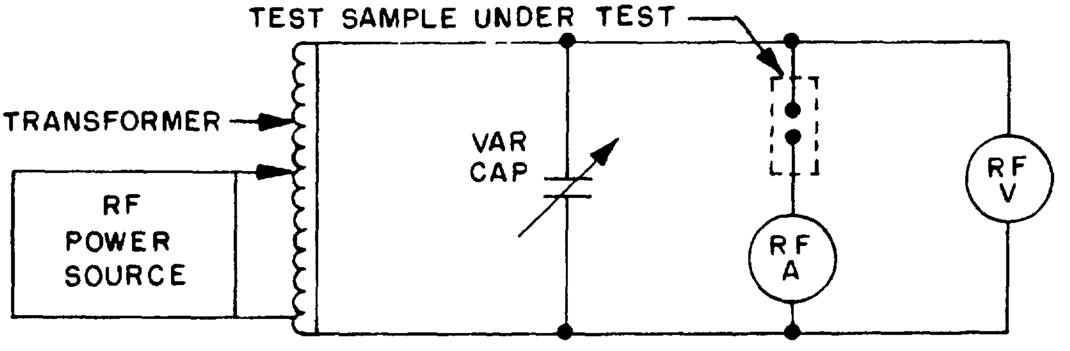


FIGURE 5. Circuit diagram for RF high potential withstanding voltage.

4.6.19 Coupling mechanism retention force (see 3.22). The connector body and coupling mechanism shall be respectively secured to the lower and upper jaws of a tensile tester in an appropriate manner. A tensile load shall be applied at a rate of approximately 100 pounds/minute up to the force as specified and held at that value for 1 minute (see 3.1). During the 1 minute of steadily applied force, the coupling mechanism shall be rotated with respect to the connector body, two full revolutions in each direction.

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging of coaxial connectors shall be in accordance with MIL-C-55330.

6. NOTES

6.1 Intended use. The connectors and fittings covered by this specification are intended for use in radio frequency application up to the frequency specified (see 3.1). These connectors are not recommended for field replacement unless the final end product is retested.

6.1.1 Intended use - packaging. The preservation, packing, marking, and packaging inspection specified herein are intended for direct shipments to the Government. However, this specification may also be used for the preparation of coaxial connectors for shipment from the parts contractor to the original equipment manufacturer.

6.2 Ordering data. Acquisition documents should specify the following:

a. Title, number and date of this specification.

b. Title, number and date of the applicable detail specification.

c. The complete part number of the connector or fitting ordered.

d. Specific finish when required (see 3.3.1).

6.3 Customary test requirements. Some customary test requirements normally applied to RF connectors have been omitted because the end item circuitry determines product integrity. These requirements are to be imposed on the end item. Typical requirements not specified are shock, vibration, and corona.

6.4 Qualification. With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of the contractor is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government, tested for qualification, in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Air Force Acquisition Logistic Division, Electronic Support Division, (AFALD/PTSP), Gentile AF Station, Ohio 45444.

6.5 Assembly instructions. Assembly instructions should include:

a. List of special tools if required.

b. Pictoral presentation of subassemblies and loose piece parts.

c. Sufficient pertinent dimensions for verification of correct parts.

6.6 Definitions.

6.6.1 Hermetic-sealed connector. A connector which is intended to mount on a surface and provide a specific maximum leak rate both internally through the connector, and externally at the mounting surface.

6.6.2 Pressurized connector. A connector which is intended to mount on a surface and provide seals, both internally through the connector and externally at the mounting surface. The sealing requirement may be less severe than for the hermetic-sealed connector.

6.6.3 Weatherproof connector. A connector which is intended to mount on a surface and provide a seal to that surface.

6.6.4 Coaxial transmission line. A transmission system in which electromagnetic waves are transmitted through a dielectric* medium bounded by two coaxial cylinders (see figure 6). The cylinders typically are identified as inner and outer conductors.

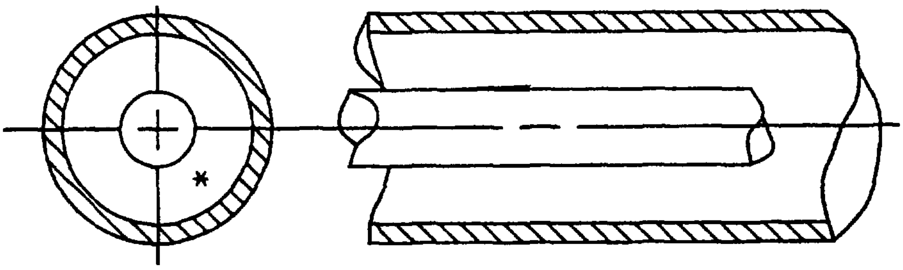


FIGURE 6. Coaxial.

6.6.5 Strip transmission line. A transmission system in which electromagnetic waves are transmitted through a dielectric* medium. The inner conductor is bounded by two parallel outer conductors (see figure 7).

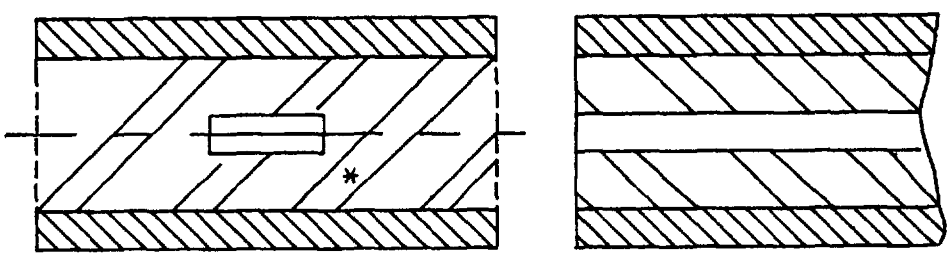


FIGURE 7. Strip.

6.6.6 Microstrip transmission line. A transmission system in which electromagnetic waves are transmitted through a dielectric* medium. The strip inner conductor is typically bounded to the dielectric medium which bounded to an outer plate conductor (see figure 8).

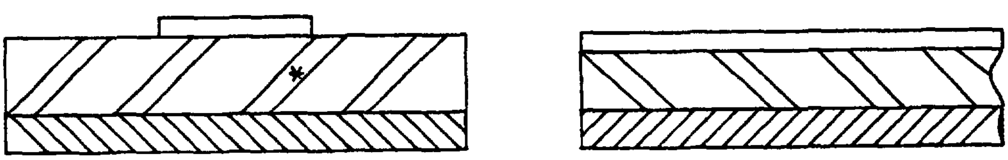


FIGURE 8. Microstrip.

6.6.7 Copper alloy. Copper mixed with a more valuable metal to give durability or some other desired quality. For connectors acquired to this specification and materials indicated as copper alloy (see 1.2.2). The mating connector body shall be copper beryllium; however, the outer external parts are allowed to be brass.

6.7 Engineering parameters. The parameters of nominal impedance, voltage rating, frequency range, and temperature range should be as specified (see 3.1).

Custodians:
Army - CR
Navy - EC
Air Force - 85

Review activities:
Army - AR, MI, AT
Navy - SH, AS
Air Force - 11, 99
DLA - ES

User activities:
Navy - MC
Air Force - 19

Preparing activity:
Air Force - 85

(Project 5935-3159)

PROCEDURE FOR MEASUREMENTS OF VOLTAGE STANDING WAVE RATIO, RADIO FREQUENCY LEAKAGE AND RADIO FREQUENCY TRANSMISSION LOSS

10 SCOPE

10.1 Scope. This appendix is to provide additional information to the user of this specification in performing the voltage standing wave ratio (VSWR), radio frequency (RF) leakage and radio frequency (RF) transmission loss measurements.

20 APPLICABLE DOCUMENTS

This section is not applicable to this appendix.

30 PROCEDURE FOR VOLTAGE STANDING WAVE RATIO (VSWR)

30.1 Voltage standing wave ratio (VSWR) test (see 4.6.11). The intent of the VSWR measurement is to assure connector integrity at its mating connector interface and typical mechanical mounting or component attaching surfaces. The test fixtures will incorporate a low mismatch design which will continue the coaxial structure to a precision hermaphroditic connector. The test fixtures are not intended to represent low VSWR launches to strip, microstrip or other transmission lines.

30.2 Test connector. The standard test connector interface shall be in accordance with figures 8, 9, and 10 of MIL-C-39012.

30.3 Standard precision adapters. The standard precision adapters shall be of design compatible with appropriate dimensions for the hermaphroditic connector, per IEEE Standard 287. The design of mating pair of adapters shall be electrically and mechanically symmetrical. The electrical phase length shall be equal where possible for plug and jack adapters. On designs where an electrical reference cannot be defined with a mechanical reference, a hypothetical plane shall be defined which symmetrically bisects a mated pair. In accordance with established policy, standard test connectors must stand alone as a proper design and not compensate for deficiencies of the mating connector. The above requirement shall be met in order to assure that the calibration data, step 2 of figure 1, is within required accuracy to qualify item 11.

The VSWR as specified for item 11 is for one adapter, but the VSWR value is determined by taking the square root of the value of a matched pair. The above computation can be considered valid when adapter symmetry exists.

By definition, the above method shall be used to establish the adapter acceptance value.

This test method is not to be interpreted as a method to measure absolute VSWR values for adapters.

30.4 Standard precision test fixtures. The standard precision test fixtures shall be of design compatible with appropriate dimensions for the hermaphroditic connector per IEEE Standard 287. The design of the mating test fixture set shall be electrically and mechanically symmetrical. The electrical phase length shall be equal where possible. On designs where an electrical reference cannot be defined with a mechanical reference, a hypothetical plane shall be defined which bisects the mated set.

The VSWR as specified for item 12 is for one half of the fixture set, but the VSWR value is determined by taking the square root of the value of the set. By definition, the above method shall be used to establish the test fixture acceptance value. This test method is not to be interpreted as a method to measure absolute VSWR value for the test fixture.

Test fixtures and fixture extension where required are illustrated in the following figures.

a. FIGURE 10. Calibration and test orientation for a tab terminal.

b. FIGURE 11. Calibration and test orientation for .010 diameter and extended terminal.

c. FIGURE 12. Calibration and test orientation for .050 diameter and slotted terminal.

d. FIGURE 13. Calibration test fixture 12p of figures 1 and 2.

e. FIGURE 14. Final test fixture 12j of figures 1 and 2.

f. FIGURE 15. Accessory alignement gauge.

g. FIGURE 16. Final test fixture and device under test 12j and X, of figures 1 and 2.

h. FIGURE 17. Configuration of final test fixture and device under test with extension.

i. FIGURE 18. Contact resistance simulated mounting surface for SMA flange mount connectors.

j. FIGURE 19. SMA test tool for center contact retention.

30.5 Test fixtures.

40 PROCEDURE FOR RF LEAKAGE

40.1 RF leakage (see 4.6.13). The measurement of the leakage from connectors is performed by collecting the leakage energy in a coaxial system surrounding the leakage source. An outline of the instrumentation is shown in figure 3B. The device from which leakage is to be measured is incorporated in a uniform transmission line which is terminated in a matched load. The matched termination simplifies both the measurement procedure and data reduction. This complete coaxial system is embodied within a cylinder which forms, externally, a second coaxial system. The second coaxial system is terminated at one end in an adjustable short-circulating plunger and at the other in a tapered transition terminated in a matched detector.

For direct leakage measurements, the adjustable short circuit serves several purposes.

The short-circuit position is adjusted to assure that an adequately low impedance appears behind the equivalent leakage generator. A matched termination can be substituted, but the resulting 6dB loss cannot be tolerated in some cases. In addition, if the leakage source is directional, as it indeed is for connectors with multiple leakage, it is possible for the leakage to be directed to this termination at some frequencies and not collected by the detector. For surface transfer-impedance measurements on connectors with leakage from more than one point in the connector, a matched termination is desirable in order to simplify the transformation of the measured data to absolute transfer impedance data. This is not needed to make relative comparisons in this test.

The equivalent leakage generator, in general, can have field components in the radial, axial, and circumferential* directions. Furthermore, these components are not necessarily circularly symmetric. Locally, TE, TM, and TEM modes can all exist, and in fact, for complete leakage measurements, the detector should couple to all but the measurement is more complex in this case. The excitation of the outer coaxial line, however, is believed to be principally TEM, since the currents in the internal line are predominantly axial and symmetric. It is however, possible to have a symmetrical leakage current which can generate the above mentioned modes. It is recommended that all measurements be made below the frequency that the higher order modes can propagate in the outer coaxial line.

The characteristic impedance of the outer coaxial line of the tri-axial system, which is formed with the inner conductor, should be matched to the detector. 50 ohm coaxial circuits are generally desired for convenience.

The leakage power ratio is defined here as the ratio of the power detected to a 50 ohm detector at the output of the tri-axial unit to the power flowing through the internal 50 ohm connector or cable system. It is basically the attenuation through the tri-axial system. This definition appears arbitrary in the sense that 50 ohms is an arbitrary load impedance. However, since the leakage source impedance is comparatively low, the voltage at the detector is essentially the open circuit leakage voltage. The ratio of the input voltage to the leaky device to this output voltage is an absolute leakage quantity, as is the measured power ratio, which is identically equal to the square of this voltage ratio.

The surface transfer impedance is obtained from this ratio as follows:

The surface transfer impedance is:

$$Z_{21} = \frac{e_2}{i_1}$$

where

i_1 = Current flowing in internal line.

e_2 = Equivalent leakage voltage in extended line.

*The circumferential E-field component is not usually present in axially symmetric components.

In the connector leakage case, considering the equivalent leakage generator to be e_2 with an extremely low source impedance, this voltage e_2 appears at detector terminals, and the adjustable short circuit assures this. For a 50 ohm transmission line system, the input power is:

$$50 i_1^2$$

The measured output power is:

$$\frac{e_2^2}{50} \qquad (1)$$

The measured power ration A^2 is therefore,

$$A^2 = \frac{\frac{e_2^2}{50}}{50 i_1^2} = \frac{e_2^2}{(50)^2 i_1^2} \qquad (2)$$

Substituting and by definition,

$$Z_{21} = \frac{e_2}{i_1} = 50\ A \qquad (3)$$

The tri-axial system was set up principally to assess the relative leakage.

40.2 Measurement procedure. In measuring the leakage power ratio, A^2, basically a substitution technique is employed. A matched detector system is installed at the output connector of the tri-axial unit, and the unit is driven as shown in figure 3B. In this set-up, the short circuit is adjusted to produce a maximum indication at the detector. The detector is then connected directly to the source and the change of attenuation required to yield the initial detector level, is measured.

The sensitivity of this system is obviously limited by the sensitivity of the detector and the power available. A sensitive parallel IF substitution system is employed, and for the low leakage configurations about 100 milliwatts of power is required.

The principal sources of error are attenuator errors and mismatch at the receiver (mixer) input. For connector measurements, the error due to mismatch is directly proportional to VSWR since the equivalent leakage source impedance is small. The indicated leakage power can vary between the extremes, P x VSWR to P ÷ VSWR, where P is the power that would be delivered to a matched system. VSWR of 2 will produce ±3 dB error therefore.

In advance of installing the inner coaxial system into the outer of the tri-axial system, the inner system may be excited, and the immediate vicinity of the leakage point or associated connector and attachment points probed with a small loop or dipole to establish how critical the mating, the connector and joints are.

50 PROCEDURE FOR RF TRANSMISSION LOSS

50.1 RF transmission loss. The RF transmission loss is defined as the ratio of the power delivered from an energy source to a load (power measuring instrument) in the absence of the device, to the power delivered to the load with the device inserted between the source and the load (see figure 9). This ratio is typically represented in dB.

$$\text{dB loss} = 10 \log \frac{P_1}{P_2}$$

P_1 power delivered to load without device inserted

P_2 power delivered to load with device inserted

The purpose of this test is to assure the device, when mounted and mated in accordance with typical intended design, will function over the specified frequency range without adverse transmission losses which can be caused by high resistance, conductive shunt paths, mechanical resonant cavities and higher order mode resonances.

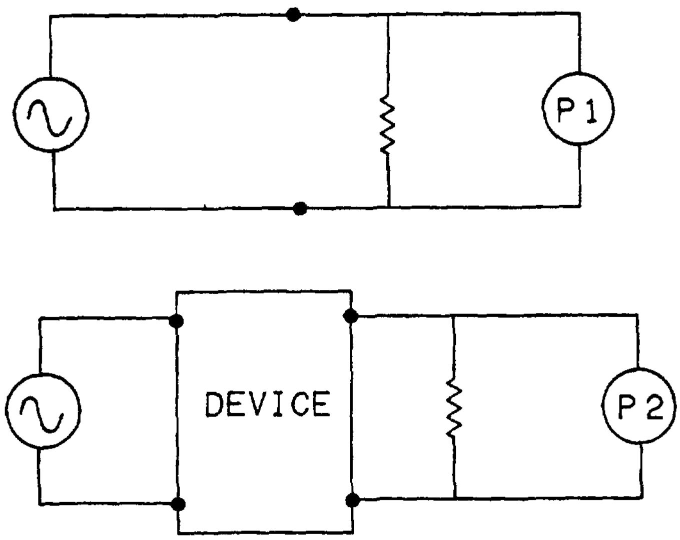


FIGURE 9. RF transmission loss.

50.2 Test fixtures. Figure 14, final tab test fixture, item 12j of figures 1 and 2, is the fixture to be used for the final connector test. Figure 13, calibration test fixture, item 12p of figures 1 and 2, is the calibration half of the test fixture.

The test fixture housing has a rotation feature (see section BB figure 14), to aline the slotted contact to accept the tabbed terminal. An accessory alinement gage is illustrated (see figure 15). The test fixture has two tapered spring loaded pins to assist in the alinement of the tab terminal to the slotted test fixture contact. In a plane 90° away, two threaded holes are located for securing the connector under test to the fixture. For two hole flanged housing, the fixture must be rotated 90° to accept tab orientation. An accessory clamp must be used to secure the connector.

The slotted test contact (see figure 14) will also have a small center hole to accept an appropriate pin of the calibration fixture. The calibration fixture will have a minimum of three precision gage located dowels which insert into appropriate holes in the test fixture.

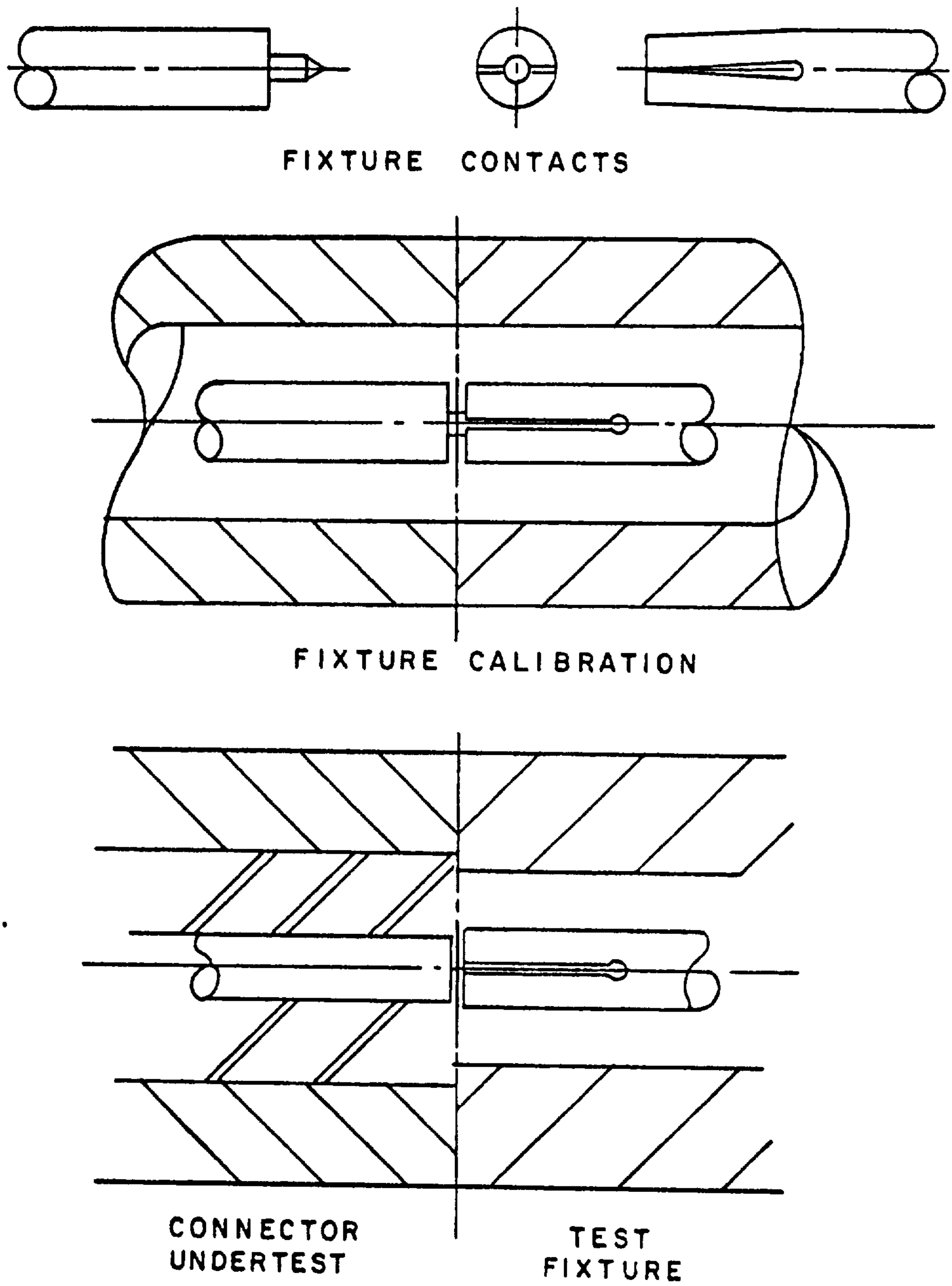


FIGURE 10. Calibration and test orientation for a tab terminal.

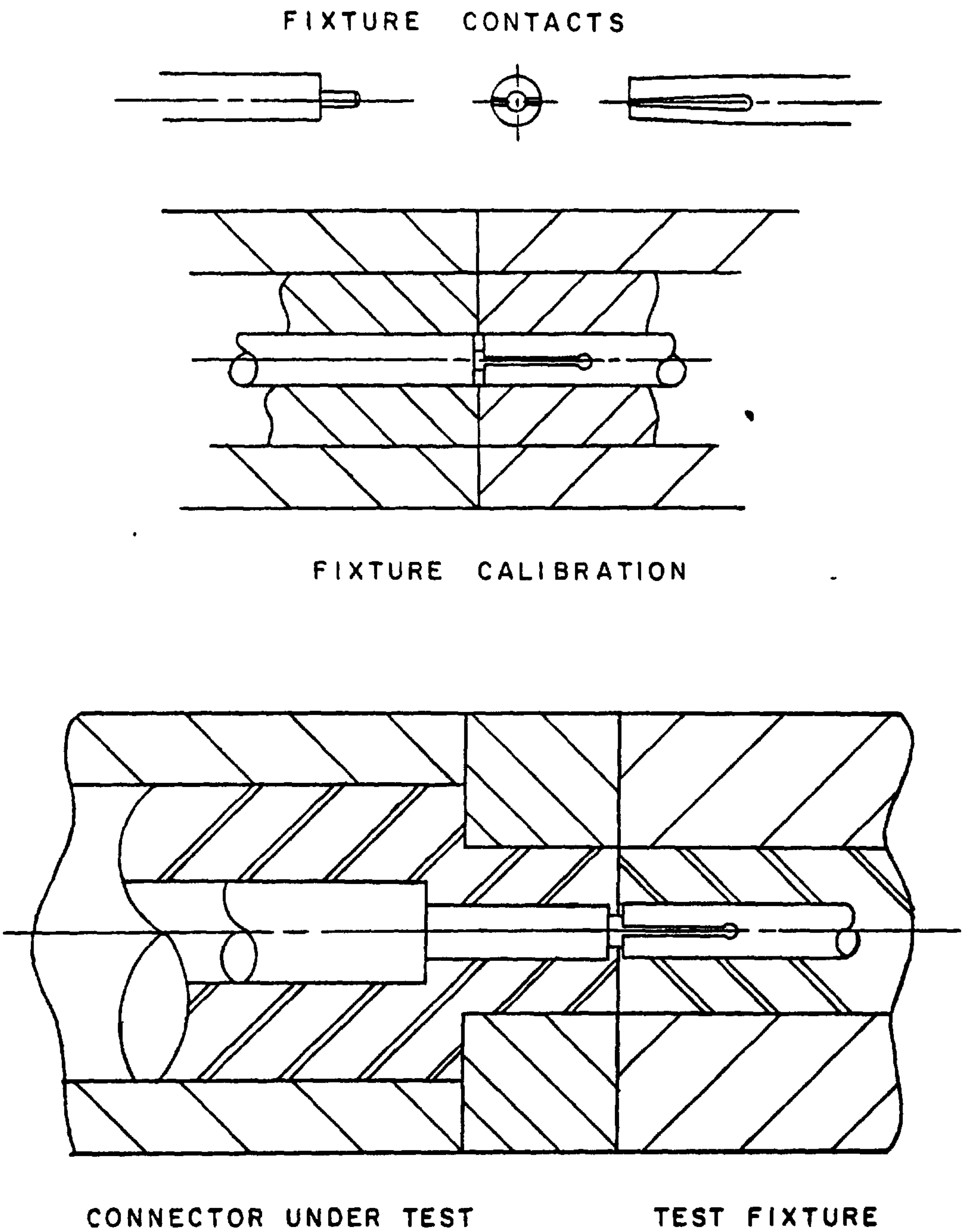


FIGURE 11. Calibration and test orientation for .010 diameter and extended terminal.

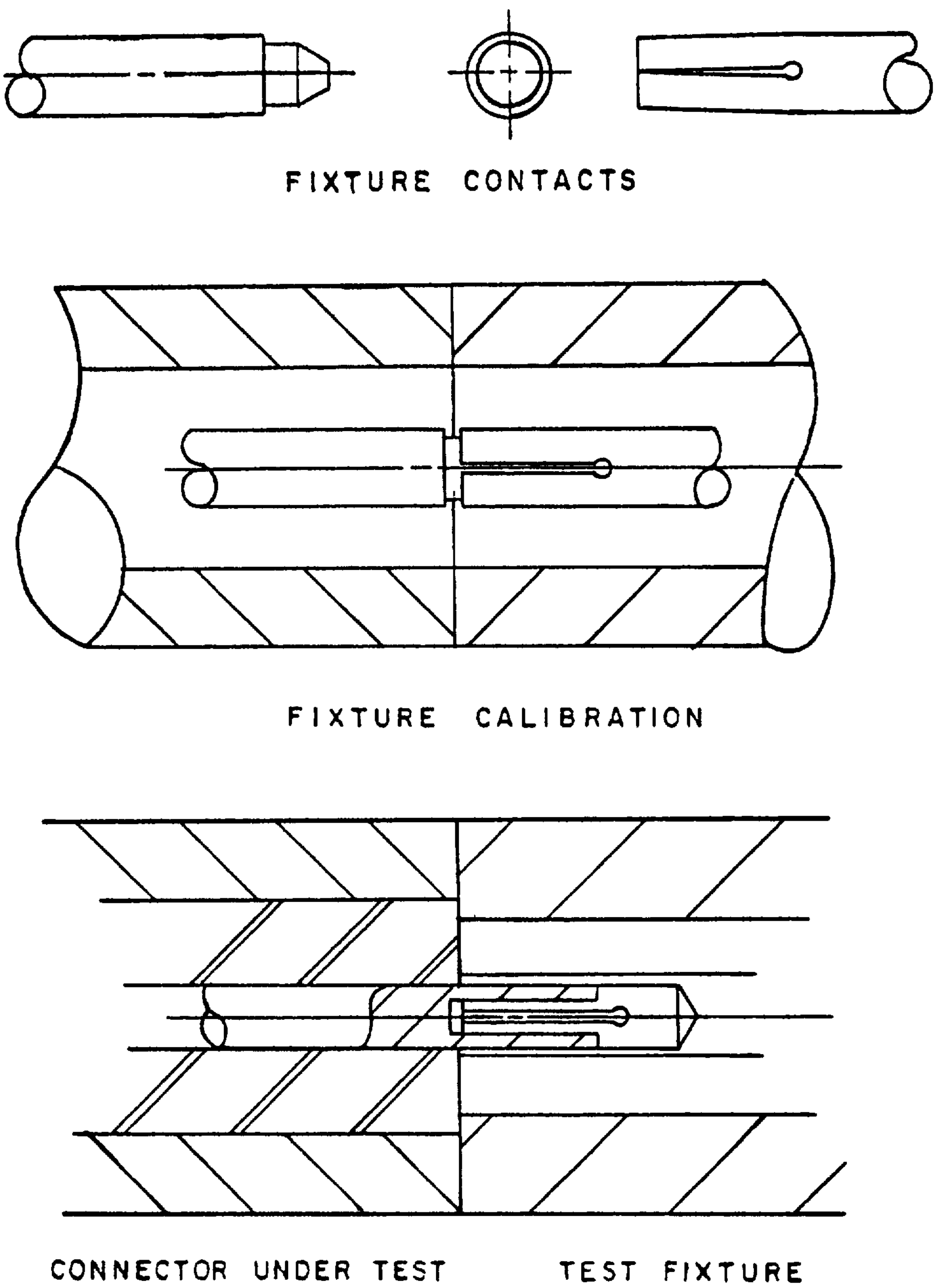


FIGURE 12. Calibration and test orientation for .050 diameter and slotted terminal.

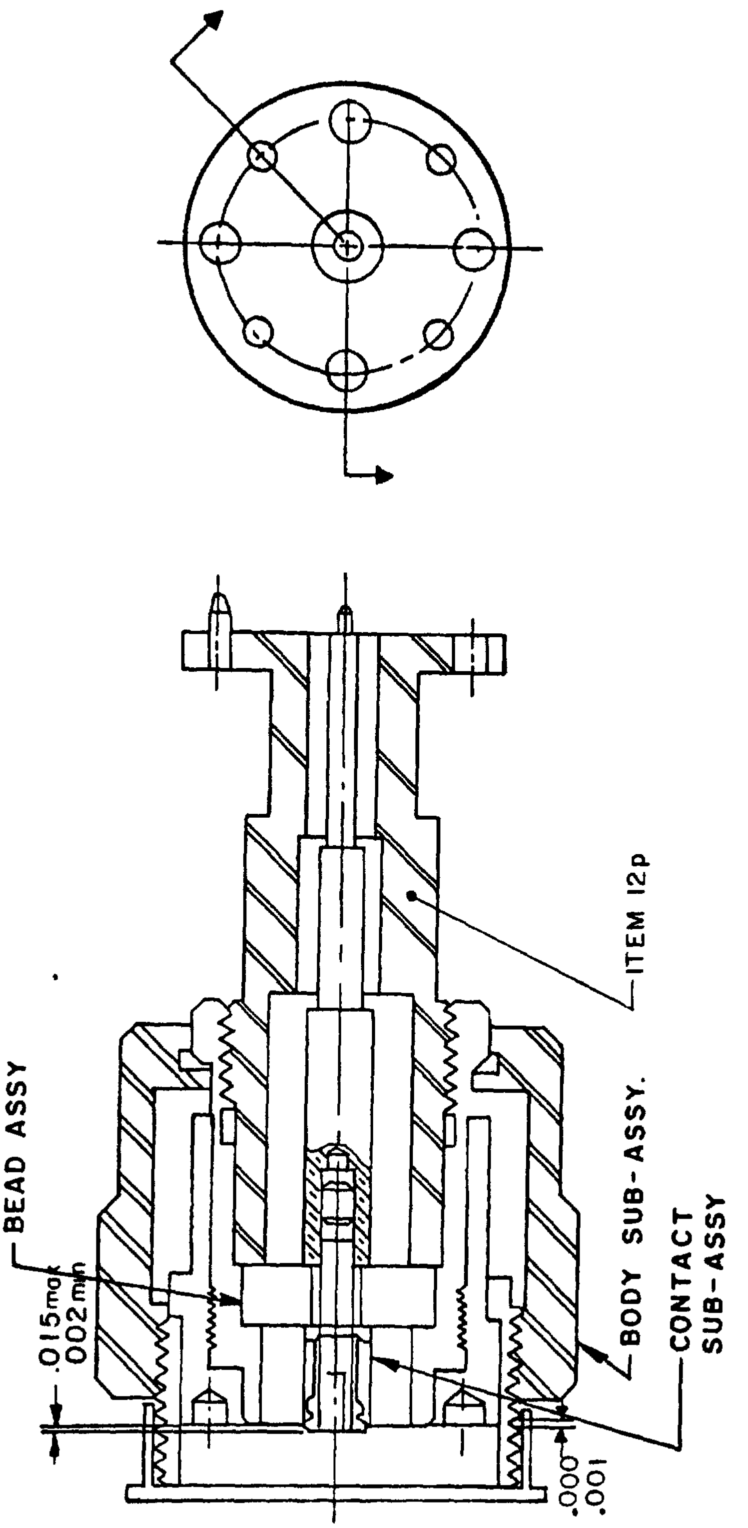


FIGURE 13. Calibration test fixture, 12p of figures 1 and 2.

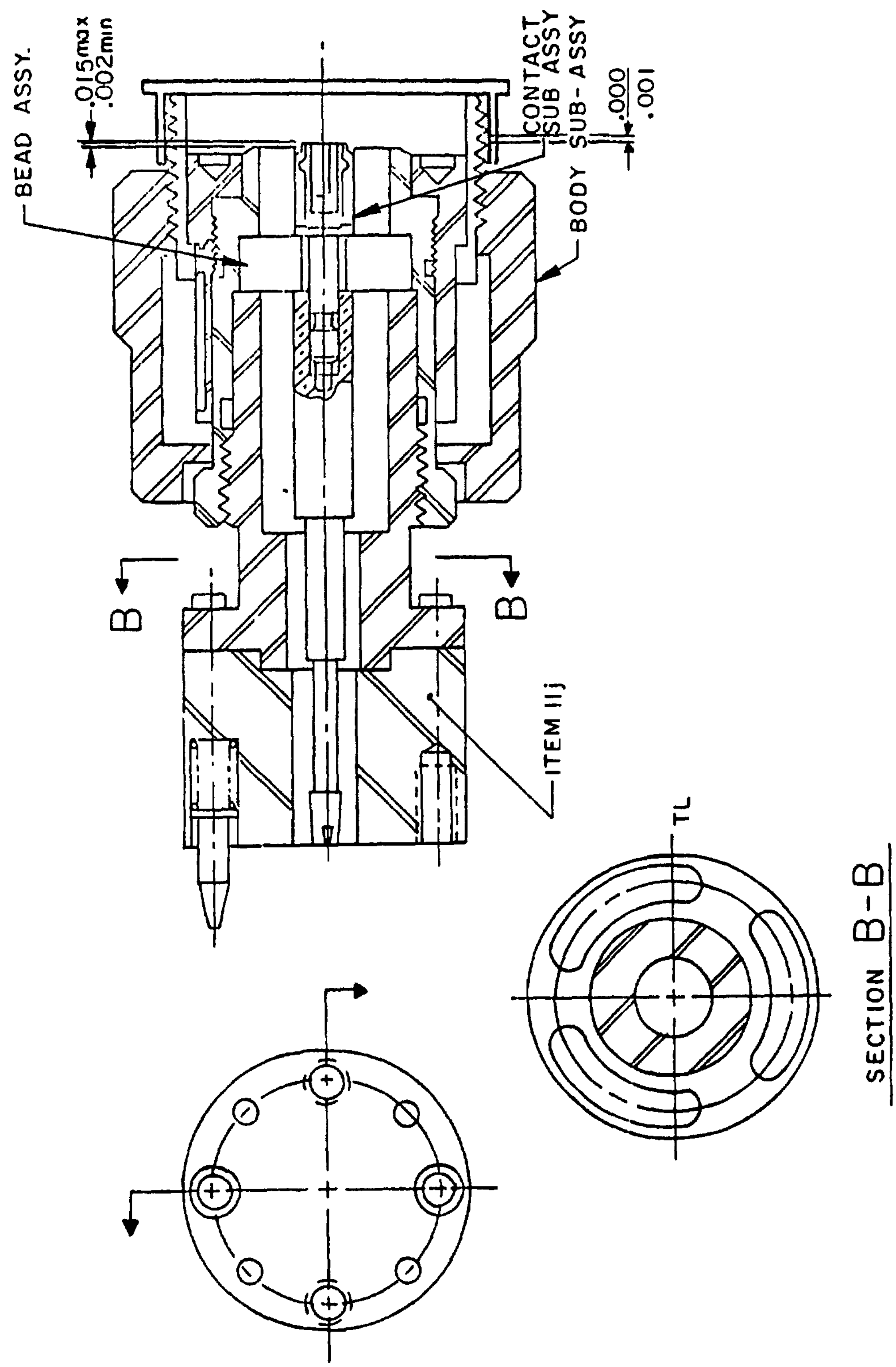


FIGURE 14. Final test fixture 12j of figures 1 and 2.

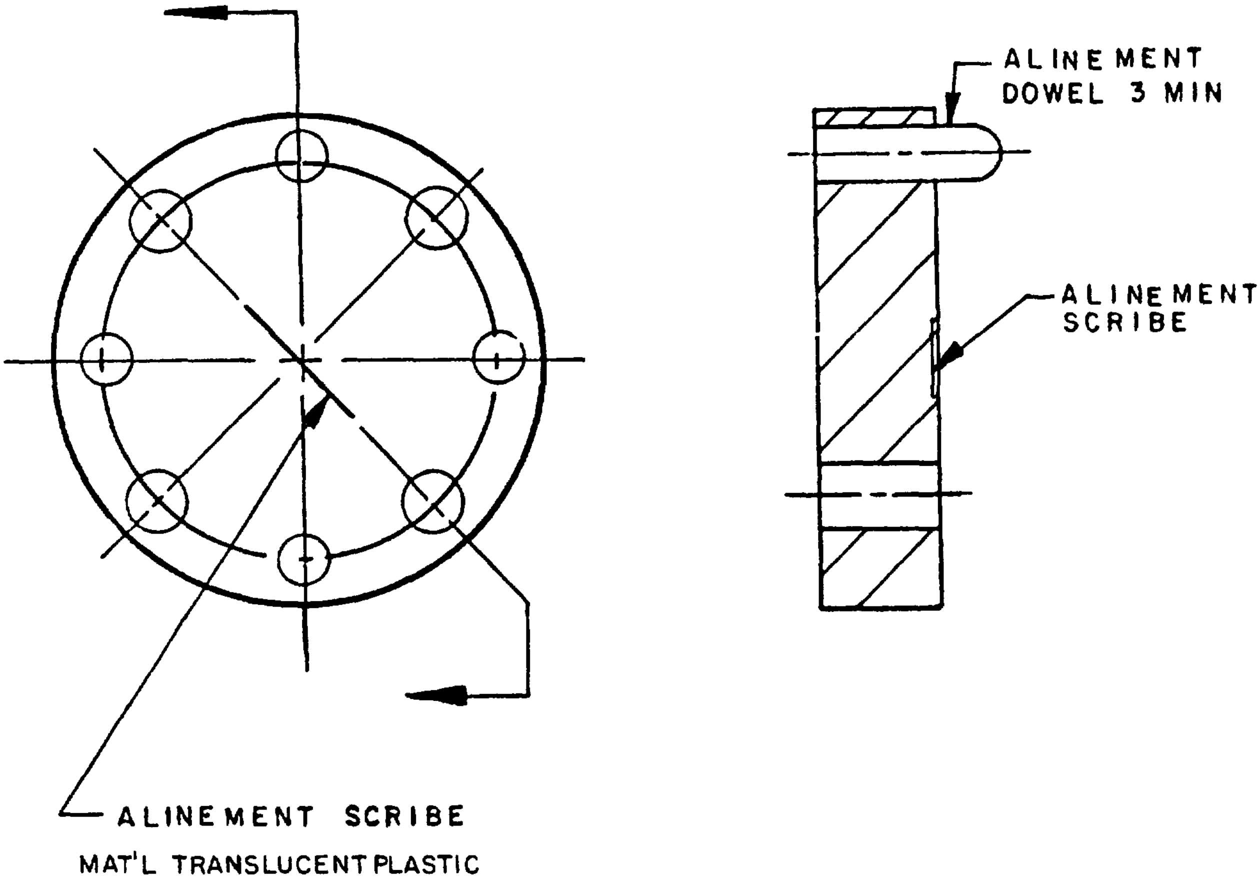


FIGURE 15. Accessory alinement gage.

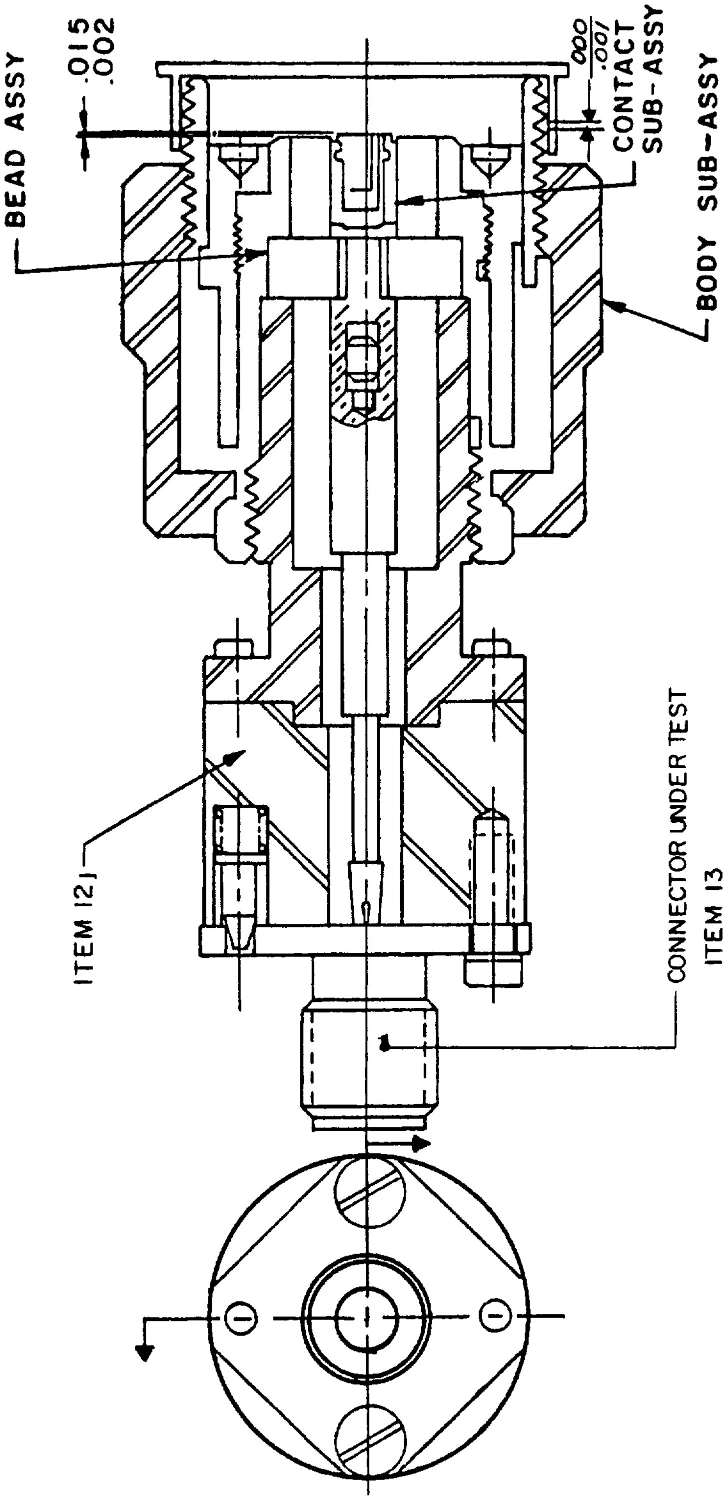


FIGURE 16. Final test fixture and device under test, 12J and X, of figures 1 and 2.

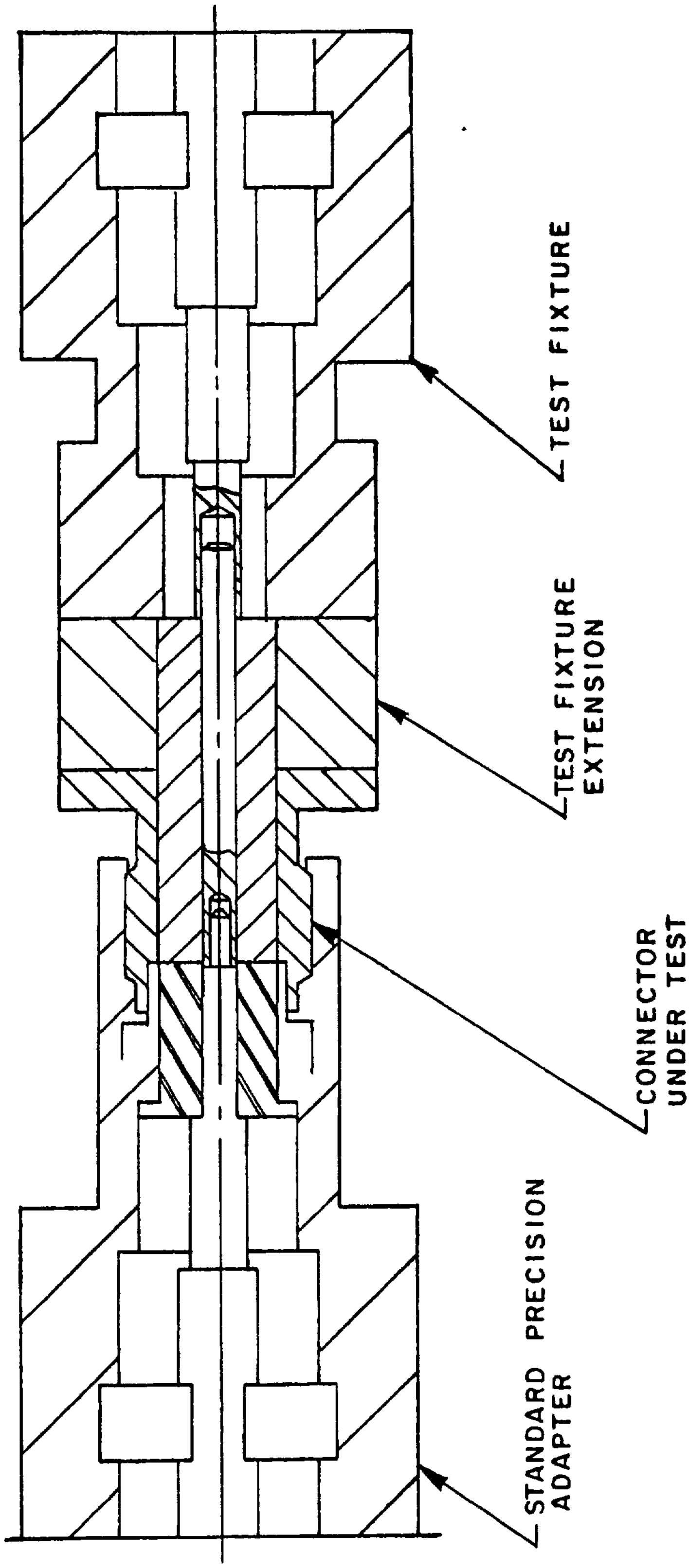


FIGURE 17. Configuration of final test fixture and device under test with extension.

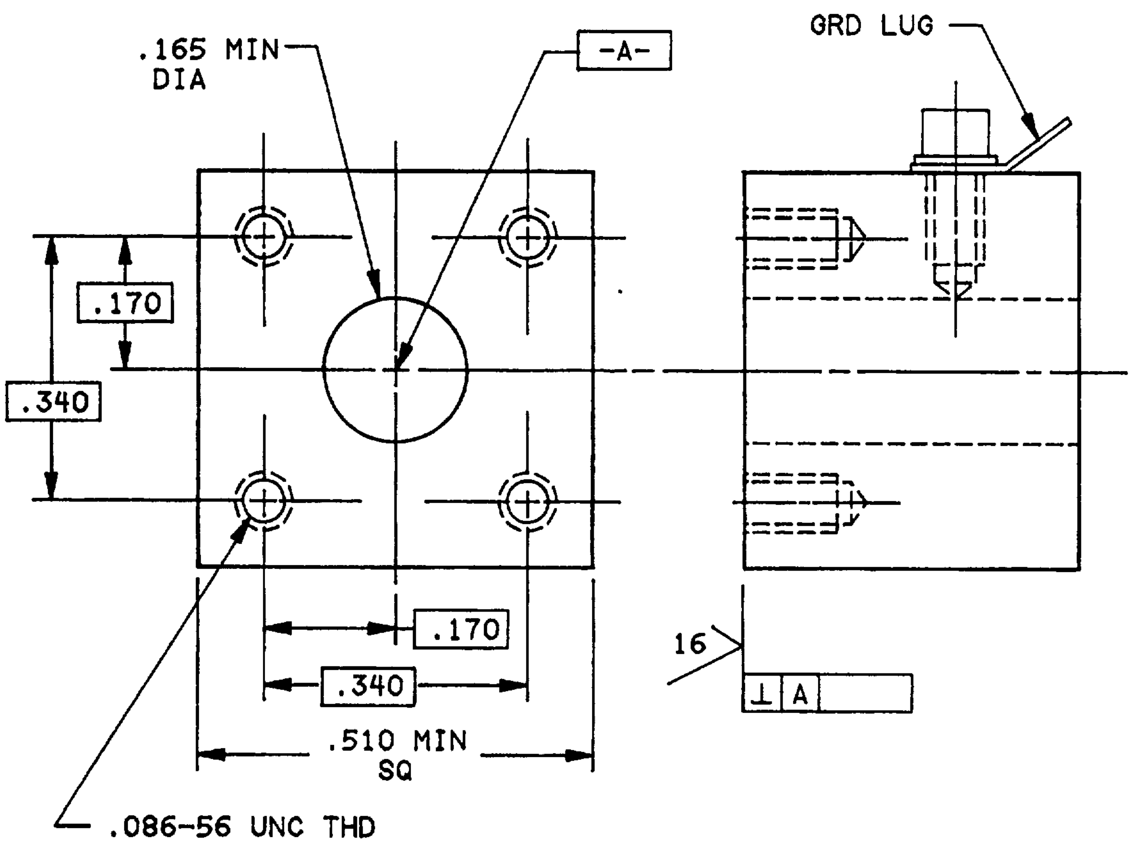


FIGURE 18. Contact resistance simulated mounting surface for SMA flange mount connectors (for test paragraph see 4.6.15.a).

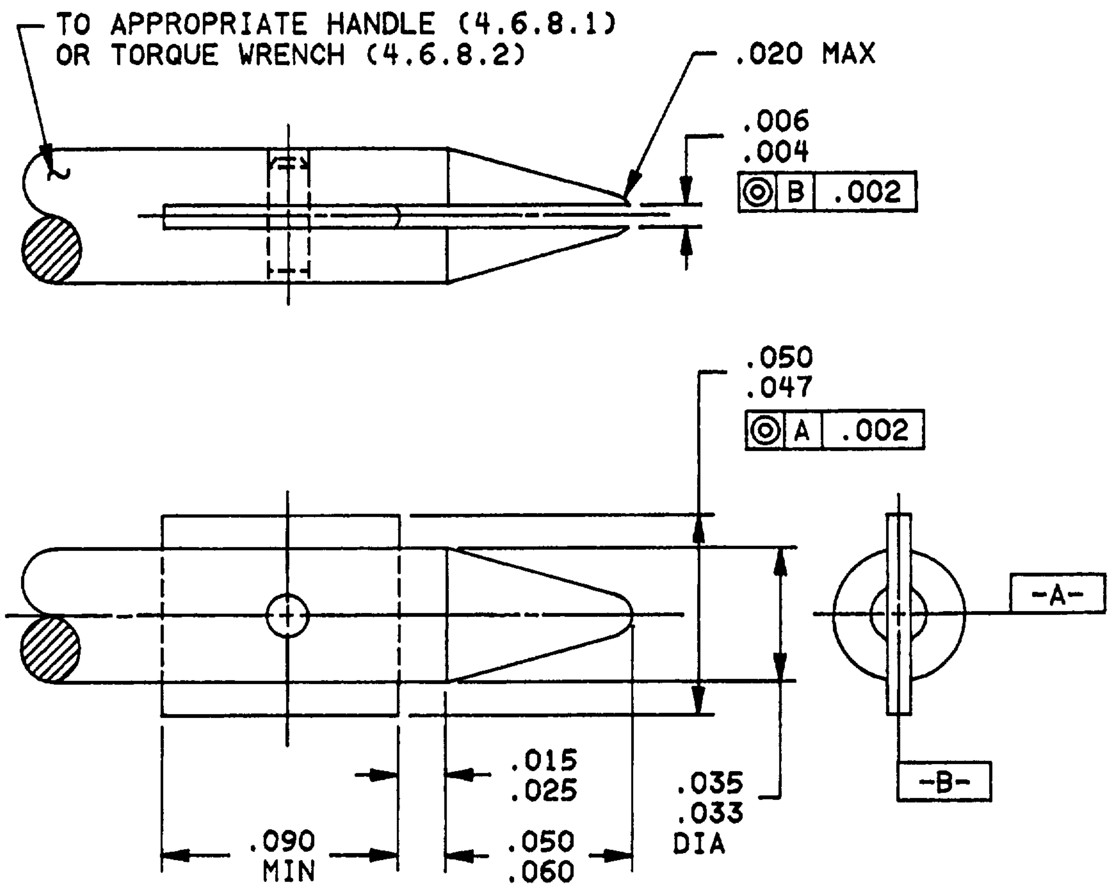


FIGURE 19. SMA test tool for center contact retention (see 4.6.8), (for axial force see 4.6.8.1, and torque see 4.6.8.2).

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