

Connectors, Electrical, Bayonet Coupling,
Environment Resisting, Umbilical,
General Specification For

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1. SCOPE:

1.1 Scope:

This specification covers environment-resisting, quick disconnect, EMI/RFI shielded and non-shielded umbilical, electric connectors and adapter assemblies with removable crimp or nonremovable solder-type contacts and accessories. Connectors are rated for operation from -55°C (-67°F) to 200°C (392°F). Adapter assemblies are rated for operation from -55°C (-67°F) to 125°C (257°F). The upper temperature is the maximum internal hot spot temperature resulting from any combination of electrical load and ambient temperature.

1.2 Classification:

1.2.1 Classes: All classes shall be environment resistant and shall include the following features as specified in the applicable specification sheet:

Class E - Grommet seal

Class F - Grommet seal and strain relief clamp

Class P - Potted seal

Class J - Insert seal with gland seal for jacketed cable

1.2.2 Contact designator: Contact style shall be designated by one of the following:

P - Pin contacts

S - Socket contacts

1.2.3 Military part number: The military part number for qualified items, procured in accordance with this specification shall conform to the applicable specification sheet (see 3.1).

1.3 Accessories:

This specification also covers the following accessories:

Adapters, Connector to Cable, Straight and 105°, open wiring and shielded cable.

Adapter, Connector to Connector, 90°

Connector, Dummy Stowage Receptacle

Caps, Protective

1.4 Insulation resistance:

Minimum insulation resistance versus hot-spot temperature is shown on figure 1.

1.5 Service life:

Service life is dependent upon hot spot temperature in accordance with figure 2.

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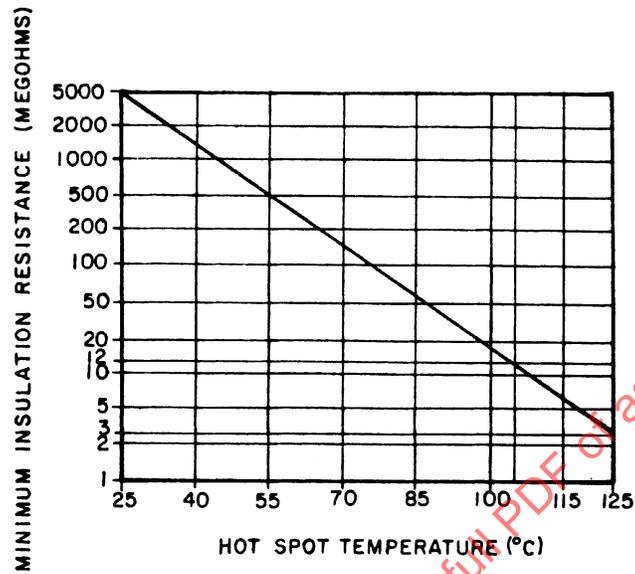


FIGURE 1A. Adapter assemblies.

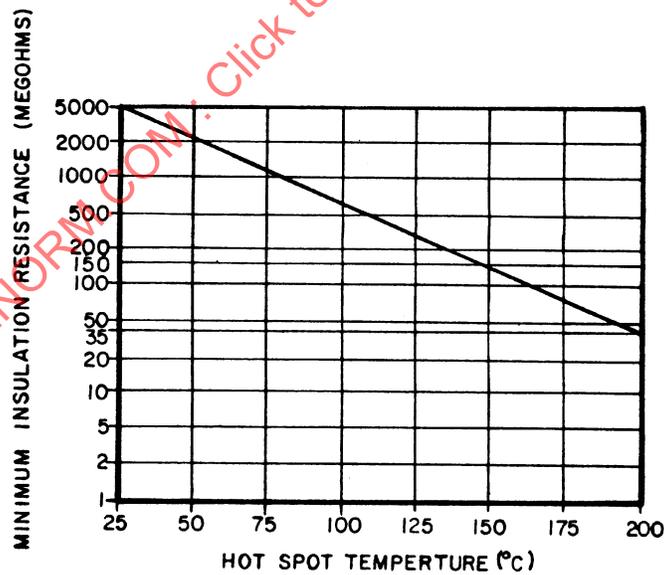


FIGURE 1B. Connectors.

FIGURE 1. Minimum insulation resistance vs. hot spot temperature.

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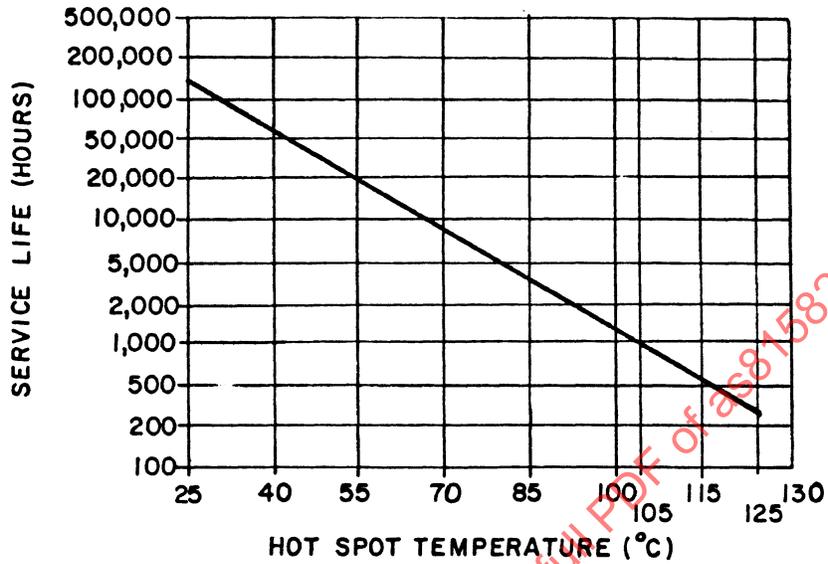


FIGURE 2A. Adapter assemblies.

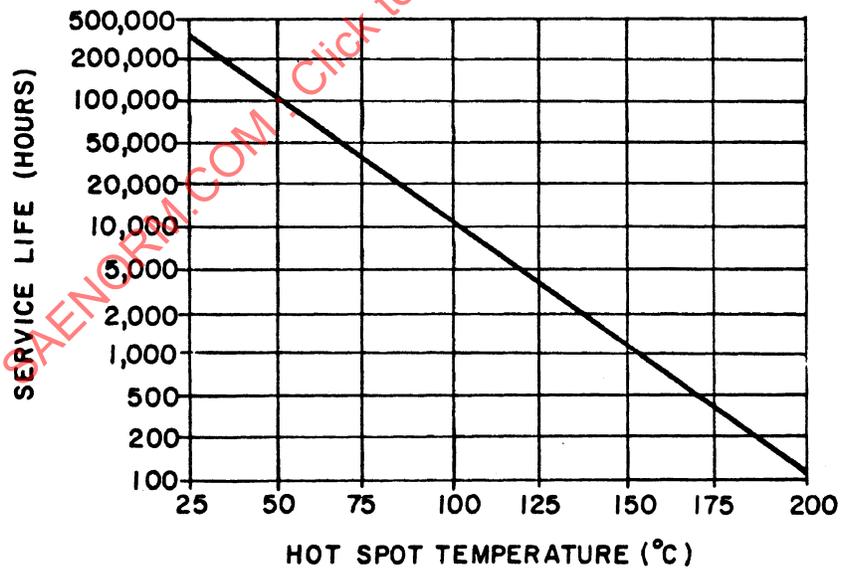


FIGURE 2B. Connectors.

FIGURE 2. Service life versus hot spot temperature.

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2. APPLICABLE DOCUMENTS:

- 2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

SPECIFICATIONS

FEDERAL

L-P-395	Plastic Molding (and Extrusion) (Nylon) Glass Fiber Reinforced.
QQ-S-225	Aluminum and Aluminum Alloy Bar, Rod, Wire, or Special Shapes; Rolled, Drawn, or Cold Finished; General Specification for.
QQ-A-367	Aluminum Alloy Forgings.
QQ-A-591	Aluminum Alloy Die Castings.
QQ-P-416	Plating, Cadmium (Electrodeposited).
TT-S-735	Standard Test Fluids, Hydrocarbon

MILITARY

MIL-M-14	Molding Plastics and Molded Plastic Parts, Thermosetting.
MIL-P-116	Preservation-Packaging, Methods of.
MIL-H-5606	Hydraulic Fluid, Petroleum Base; Aircraft, Missile, and Ordnance.
MIL-T-5624	Turbine Fuel, Aviation Grades JP-4 and JP-5.
MIL-S-7742	Screw Threads, Standard, Optimum Selected Series, General Specification for.
MIL-A-8243	Anti-icing and Deicing and Defrosting Fluid
MIL-S-8516	Sealing Compound, Polysulfide Rubber, Electric Connectors and Electric Systems, Chemically Cured.
MIL-L-8937	Lubricant, Solid Film, Heat Cured.
MIL-T-10727	Tin Plating; Electrodeposited or Hot-Dipped, for Ferrous and Nonferrous Metals.
MIL-I-17214	Indicator, Permeability: Low-Mu (Go-No-Go).
MIL-M-20693	Molding Plastic, Polyamide (Nylon), Rigid.
MIL-C-22520/1	Crimping Tool, Contact, Electric, Hand for Contact Size 12 Through 20.
MIL-C-22520/2	Crimping Tool, Contact, Electric, Hand for Contact Size 20 Through 28.
MIL-W-22759/4	Wire, Electric, Fluoropolymer-Insulated, TFE-Glass-FEP, Medium Weight, Silver-Coated Copper Conductor, 600 Volt.
MIL-W-22759/5	Wire, Electric, Fluoropolymer-Insulated, Abrasion Resistant, Extruded TFE, Silver-Coated Copper Conductor, 600 Volt.
MIL-W-22759/7	Wire, Electric, Fluoropolymer-Insulated, Abrasion Resistant, Extruded TFE, Medium Weight, Silver-Coated Copper Conductor, 600 Volt.
MIL-W-22759/9	Wire, Electric, Fluoropolymer-Insulated, Extruded TFE, Silver-Coated Copper Conductor, 1,000 Volt.
MIL-W-22759/11	Wire, Electric, Fluoropolymer-Insulated, Extruded TFE, Silver-Coated Copper Conductor, 600 Volt.

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2.1 (Continued):

MIL-W-22759/12	Wire, Electric, Fluoropolymer - Insulated, Extruded TFE, Nickle-Coated Copper, 600 Volt
MIL-L-23699	Lubricating Oil, Aircraft Turbine Engines, Synthetic Base.
MIL-C-25769	Cleaning Compound, Aircraft Surface, Alkaline Waterbase
MIL-C-39029	Contacts, Electric, General Specification for.
MIL-G-45204	Gold Plating, Electrodeposited.
MIL-C-45662	Calibration System Requirements.
MIL-C-55330	Connectors, Preparation for Delivery of.

STANDARDS

MILITARY

MIL-STD-104	Limits for Electrical Insulation Color.
MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-130	Identification Marking of US Military Property.
MIL-STD-202	Test Methods for Electronic and Electrical Component Parts.
MIL-STD-454	Standard General Requirements for Electronic Equipment.
MIL-STD-810	Environmental Test Methods.
MIL-STD-1285	Marking of Electrical and Electronic Parts.
MIL-STD-1344	Test Methods for Electrical Connectors.
MIL-STD-1672	Connector Umbilical, Insert Arrangements for MIL-C-81582

SPECIFICATION SHEETS

MIL-C-81582/1	Connectors, Electric, Bayonet Coupling, Umbilical; Receptacle, Jam Nut Mounting, RFI Shielded, Crimp Contact, Class E
MIL-C-81582/2	Connector, Plug, Electric, Bayonet Coupling, Lanyard Release, RFI Shielded, Crimp-Type Contacts, Class E
MIL-C-81582/3	Connector, Electric, Insert Arrangement (Superseded by MIL-STD-1672)
MIL-C-81582/4	Connector Adapter, RFI Shielded, Cable to Electric Connector
MIL-C-81582/5	Connector Adapter, Right Angle, RFI Shielded, Electric Connector to Electric Connector
MIL-C-81582/6	Connector, Adapter Assembly, Umbilical Cable to Stores Interface, Lanyard Release
MIL-C-81582/7	Connector, Adapter Assembly, Umbilical Cable to Stores Interface, Lanyard Release
MIL-C-81582/8	Connector, Adapter Assembly, Umbilical Cable to Stores Interface, Lanyard Release

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

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2.2 American Society for Testing and Materials:

ASTM A484	Specifications for General Requirements for Stainless and Heat-Resisting Wrought Steel Products (Except Wire).
ASTM A582	Specification for Free Machining, Stainless Steel Bars, Hot-Rolled or Cold-Finished

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

2.2 Other publications:

The following document forms a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on the date of invitation for bids or request for proposal shall apply.

United States of America Standards Institute Publications.

ANSI Y14.5-1973 Dimensioning and Tolerancing for Engineering Drawings.

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

MIT Radiation Laboratory Series.

Volume 10, The Waveguide Handbook.

(Application for copies should be addressed to the McGraw-Hill Book Co., Inc. New York, New York.)

3. REQUIREMENTS:

3.1 Specification sheets:

All requirements herein apply to all the connectors and accessories covered by the applicable specification sheet. Detail requirements or exceptions applicable to the individual types shall be as specified herein or on 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:

Connector assemblies and accessories furnished under this specification and the applicable specification sheet shall be products which are qualified for listing on the applicable Qualified Products List (QPL) at the time set for the opening of bids (see 4.4 and 6.4).

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3.2.1 Use of military identification: Military part identification shall not be applied to a product, except for qualification test samples (see 6.4), until notification has been received from the activity responsible for qualification that the product has been approved for listing on the Qualified Products List (QPL).

3.3 Materials:

Materials shall be as specified herein. However, when a definite material is not specified, a material shall be used which will enable the connectors to meet the performance requirements of this specification and the applicable specification sheet. Acceptance or approval of any constituent material shall not be construed as a guaranty for acceptance of the finished product.

3.3.1 Dissimilar metals: When dissimilar metals are used in intimate contact with each other, protection against electrolysis and corrosion shall be provided. The use of dissimilar metal in contact, which tends toward active electrolytic corrosion (particularly brass, copper, or steel used in contact with aluminum or aluminum alloy), is not acceptable. However, metal spraying or metal plating of dissimilar base metals to provide similar or suitable abutting surfaces is permitted. Dissimilar metals shall be as defined in 6.7 through 6.7.4 inclusive, and table XXI in hermetic seals, the 0.25 volt difference between the header material and the housing material is not applicable.

3.3.2 Nonmagnetic materials: The relative permeability of the connector assembly shall be less than 2.0, when measured with an indicator conforming to MIL-I-17214.

3.3.3 Contact materials: Contacts shall be made from suitably conductive materials protected from corrosion.

3.3.3.1 Contact plating: Contact plating shall be in accordance with MIL-C-39029.

3.3.4 Dielectric materials:

3.3.4.1 Insert and grommet: Insert and grommet materials shall be high grade dielectric having hardness, electrical, and mechanical characteristics suitable for the purpose intended.

3.3.4.1.1 Rigid dielectric material: Rigid dielectric materials shall be in accordance with L-P-395, MIL-M-14, or MIL-M-20693.

3.3.4.1.2 Resilient: Unless otherwise specified (see 3.1), the mating face of pin inserts shall be a resilient material within a Shore A Durometer range of 40 - 68.

3.3.4.1.3 Insert faces: Insert faces shall be as specified in the applicable specification sheet (see 3.1).

3.3.5 Shells and metallic accessories material: Shells and metal accessories (see 1.3), shall be fabricated of high grade aluminum such as alloy 6061, temper T6 in accordance with QQ-A-367. Connectors shall have a grounding spring member as specified (see 3.1).

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- 3.3.5.1 Component parts: Other metal component parts may be fabricated from aluminum conforming to QQ-A-591 or QQ-A-225 or passivated stainless steel in accordance with QQ-S-764.
- 3.3.5.2 Bayonet pins: Bayonet pins shall be made of stainless steel.
- 3.3.5.3 Finish: Unless otherwise specified (see 3.1) aluminum parts shall be cadmium plated to withstand 500 hour salt spray (see 4.6.19). A preliminary plating of another metal is permissible. The resultant finish shall be olive drab (light to dark) and shall be electrically conductive.
- 3.3.5.4 Grounding spring member: The grounding spring shall be made of an electrically conductive metal suitable for the intended purpose.
- 3.4 Design and construction:
- Connectors shall be of the design, construction, and physical dimensions specified (see 3.1). Connectors shall be so designed that neither the pins nor the sockets will be damaged during normal mating of counterpart connectors. True position dimensions shown herein and on the specification sheets are in accordance with ANSII14.5-1973.
- 3.4.1 Contact design: Contacts shall conform to MIL-C-39029, except as otherwise specified herein for solder contacts and thru-bulkhead contacts. When specified in the contract or order, connectors may be supplied less crimp type contacts to permit procurement of these items in bulk.
- 3.4.1.1 Solder contacts: Solder contacts shall be as specified (see 3.1), and shall be nonremovable from the insert. Solder cups shall be such that during soldering no components will be damaged and no liquid solder shall escape.
- 3.4.1.2 Crimp contacts: Crimp contacts shall be qualified as specified (see 3.1).
- 3.4.2 Insert design and construction: Inserts shall be of voidless construction and shall be secured to prevent rotation within the shell. The inserts shall be nonremovable from the shell and shall be installed in the position specified in the applicable specification sheet. The insert shall be designed and constructed to eliminate all air paths between contacts by permanently attaching the dielectric members to each other. The socket insert shall be designed to prevent a bent pin in a mating counterpart insert from penetrating the insert alongside the socket contact. Inserts shall be so designed that MIL-S-8516 potting material will adhere to the insert without treatment by the user.
- 3.4.3 Shell design: Connector shells shall be seamless and shall retain their inserts in a positive manner.
- 3.4.3.1 Screw threads: Screw threads shall conform to MIL-S-7742. Slight out-of-roundness beyond the specification tolerance is acceptable if threads can be checked without forcing the thread gages.

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- 3.4.4 Coupling: Unless otherwise specified (see 3.1), the coupling type shall be a 3-pin bayonet design with a lanyard release mechanism. Coupling shall be accomplished by clockwise rotation of the coupling ring; uncoupling shall be accomplished by the application of a force to the lanyard. The design shall also permit uncoupling by counterclockwise rotation of the coupling ring. The coupling rings shall be fluted or knurled to provide a gripping surface.
- 3.4.4.1 Engagement of connectors: Counterpart connectors of any arrangement and accessories shall be capable of being fully engaged and disengaged without the use of tools. Engagement of connectors shall be defined as full insertion of pins into sockets and proper sealing of the mating insert faces. Full engagement shall be indicated by an audible sound at the completion of the coupling cycle, and a positive detent shall be included in the coupling mechanism to lock connectors in the engaged position.
- 3.4.4.1.1 Bayonet pins: Unless otherwise specified (see 3.1), bayonet pins on connector shells shall have surfaces whose color is yellow. The color shall be within the limits described in MIL-STD-104. The ends of the pins shall be visible through suitable holes in the coupling ring when the connectors are engaged and the coupling ring is in the locked position.
- 3.4.4.2 Shell polarization: Polarization of connectors shall be accomplished by matched integral key(s) and keyway(s) of counterpart connectors. The polarization of counterpart connectors shall take place before coupling rings are engaged, and before any pin contacts can touch the opposing insert face or sockets of the counterpart connector.
- 3.4.4.3 Engagement seal: Connectors shall contain sealing means so that engaged connectors comply with the requirements specified herein. The design of the seal shall be such that in mated connectors all air paths between adjacent contacts and between contacts and shells are eliminated. There shall be interfacial mating of the engaged connector insert to provide dielectric under compression of 0.005 inch minimum.
- 3.4.4.4 Lubrication: Bayonet coupling slots, including the inside diameter in the bayonet coupling slot area shall be coated with a lubricant conforming to MIL-L-8937, form B to aid in mating connectors. Features which are intended to provide potting compound anchorage shall be free of lubricant.
- 3.4.4.5 Protective covers and stowage receptacles: When mated to counterpart connectors, the protective covers and stowage receptacles shall maintain the connector free of moisture, prevent air leakage, and comply with the applicable requirements of table XVII. Protective covers and stowage receptacles shall be provided with an EMI/RFI shielding feature where required (see 3.1).
- 3.4.4.6 Lanyard: Mounting of the lanyard to the connector shall be such that rotation of the connector for engagement will not shorten the effective length of the lanyard.

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3.4.5 Wire sealing:

- 3.4.5.1 Classes E and F connectors: Classes E and F connectors shall be provided with a wire sealing resilient grommet and gland nut capable of sealing the wire sizes as specified in tables IA and IB.
- 3.4.5.2 Class P connectors: Class P connectors shall be provided with a potting form suitable to accept and bond to MIL-S-8516 potting material. Inserts of class P connectors shall be so designed that potting material will adhere to the shell and insert without treatment by the user.
- 3.4.5.3 Class J connectors: Class J connectors shall be provided with a resilient gland and gland nut capable of sealing on appropriate single-jacketed multiconductor cables.

TABLE IA. Adapter assemblies - Wire range accommodations.

Wire barrel size	Wire size	OD of finished wire (inch) ^{1/}		Wire number ^{2/} (ref.)
		Crimp contact connectors	Solder contact connectors	
20	24	0.046 (min.)	0.060 (min.)	MIL-W-22759/7-24
	22	0.047 (min.)	0.060 (min.)	MIL-W-22759/11-22, /7-22
	20	0.085 (max.)	0.085 (max.)	MIL-W-22759/4-20
16	18	0.066 (min.)	0.066 (min.)	MIL-W-22759/11-18
	16	0.109 (max.)	0.109 (max.)	MIL-W-22759/4-16
12	14	0.097 (min.)	0.097 (min.)	MIL-W-22759/9-14
	12	0.142 (max.)	0.142 (max.)	MIL-W-22759/12-10

^{1/} For OD's smaller than that specified, see 6.1(h).

^{2/} Wire numbers are for reference only and are not intended to restrict the use of acceptable wire-types with these adapter assemblies.

TABLE IB. Connectors - Wire range accommodations.

Wire barrel size	Wire size	OD of finished wire (inch)	Wire number (ref.) ^{1/}
20	24	0.041 min.	MIL-W-22759/11-24
	22	0.047 min.	MIL-W-22759/11-22
	20	0.090 max.	MIL-W-22759/5-20
16	18	0.068 min.	MIL-W-22759/9-18, /11-18
	16	0.130 max.	MIL-W-22759/5-16
12	14	0.107 min.	MIL-W-22759/5-12
	12	0.170 max.	

^{1/} Wire numbers are for reference only and are not intended to restrict the use of acceptable wire-types with these connectors.

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3.4.5.4 Grommet sealing plugs: The grommets of classes E and F connectors shall be designed to accept sealing plugs as specified (see 3.1), in lieu of wire where unused contacts are employed. When specified in the contract or order, connectors may be supplied less grommet sealing plugs to permit procurement of these items in bulk.

3.4.6 Grounding spring member: When specified (see 3.1), the grounding spring member shall have a minimum of six fingers per inch. The spring fingers shall be shaped in a manner which will ensure proper engagement of the mating shell. The grounding spring shall be permanently fixed to the shell periphery and the attachment of the grounding spring to the shell shall not impede spring flexing. The spring fingers shall engage the mating shell at a minimum of 0.090 inch prior to the pin-socket engagement.

3.5 Interchangeability:

All connectors and accessories having the same military part number shall be completely interchangeable with each other with respect to installation (physical) and performance (function) as specified herein. Solder and crimp contact connectors shall be intermateable (see 6.1(f)).

3.6 Performance:

Connectors shall perform as follows when subjected to the conditions and tests specified.

3.6.1 Contact protection, connector mating: Connectors equipped with pin contacts shall not permit the edge of the shell of the counterpart mating connector to touch the pin contacts (see 4.6.2).

3.6.2 Resistance to test probe damage (size 12 and smaller socket contacts): Socket contacts shall withstand the bending moment and depth of test probe insertion without evidence of visible damage (see 4.6.3). Contacts shall meet the requirements of 3.6.4 after test.

3.6.3 Contact insertion and removal force (crimp removable contact connectors only): Contacts shall meet the insertion and removal forces specified in table II, when tested as specified (see 4.6.4).

TABLE II. Contact insertion and removal forces.

Contact size	Insertion and removal force (pounds max.)
20 - 20	20
16 - 16	20
12 - 12	30

3.6.4 Contact engaging and separating force: The contact engaging and separating force shall not exceed the applicable values specified in table III (see 4.6.5).

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TABLE III. Contact engaging and separating forces (ounces).

Mating end size	Minimum separation force (ounces)	Maximum average engagement force (ounces)	Maximum engagement force (ounces)
20	0.7	12	18
16	2	24	30
12	3	24	30

3.6.5 Mating and unmating forces: The coupling torque for mating and unmating of counterpart connectors shall meet the torque requirements of table IV. The connectors used in this test shall have the complete complement of contacts. The dummy stowage receptacles and protective covers, when mated with their applicable connector, shall also comply with the torque requirement of table IV (see 4.6.6).

TABLE IV. Mating and unmating forces.

Shell size	Torque (pound-inches)	
	Maximum mating and unmating forces	Minimum unmating force
8	8	1
10	12	1
12	16	2
14	20	4
16	24	4
18	28	4
20	32	6
22	50	20
24	60	25

3.6.6 Contact retention: Contacts shall be retained in their inserts when subjected to the contact retention test in accordance with the axial loads of table V. The axial displacement of crimp contacts shall not exceed 0.012 inch while under load with the accessory tightened or 0.015 inch while under load with the accessory removed. The axial displacement of solder contacts shall not exceed 0.012 inch after the load has been removed (see 4.6.7).

TABLE V. Contact retention with axial loads.

Contact size	Axial load (pounds-minimum)	
	Removable contacts	Nonremovable contacts
20 - 20	15	15
16 - 16	25	25
12 - 12	25	25

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3.6.7 Thermal shock: There shall be no evidence of damage detrimental to the operation of the connector or assembly after being subjected to the applicable temperature extremes (see 3.1) of table VI in accordance with the thermal shock test (see 4.6.8).

TABLE VI. Temperature extremes.

Test part	Extremes	Degrees C	Degrees F
Adapter assemblies	Low	-55 ⁺⁰ -3	-67 ⁺⁰ -5.5
	High	+125 ⁺³ -0	+257 ^{+5.5} -0
Individual connectors	Low	-55 ⁺⁰ -3	-67 ⁺⁰ -5.5
	High	+200 ⁺⁵ -0	+392 ⁺⁹ -0

3.6.8 Dielectric withstanding voltage: Connectors shall show no evidence of breakdown or flashover when subjected to the test voltages and altitudes of table VII (see 4.6.9).

TABLE VII. Test voltage (ac, rms). ^{1/}

Condition	Service rating I		Service rating II	
	Sea level	70,000 ft.	Sea level	70,000 ft.
Mated	1,500	1,000 ^{2/} 350 ^{3/}	2,300	1,200 ^{2/} 500 ^{3/}
Unmated	1,500	275	2,300	500

- ^{1/} These are not working voltages.
- ^{2/} Integral grommet or potted only.
- ^{3/} Removable grommet or no grommet.

3.6.9 EMI/RFI shielding effectiveness:

3.6.9.1 Shielding effectiveness: When specified (see 3.1), the shells shall exhibit a leakage attenuation equal to or greater than that specified in table VIII (see 4.6.10.1).

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TABLE VIII. EMI/RFI shielding effectiveness.

Frequency (MHz)	Leakage attenuation (dB)	Frequency (MHz)	Leakage attenuation (dB)
100	65	400	55
150	60	600	50
200	60	800	45
300	55	1,000	45

3.6.9.2 Shell to shell continuity: The overall DC resistance shall not exceed 0.005 ohms (see 4.6.10.2).

3.6.10 Fluid immersion: Unmated connectors shall mate within the torque specified in table IV, after being subjected to fluid immersion (see 4.6.11).

3.6.10.1 Retention system fluid immersion: When tested as specified in 4.6.11.1, the insert assemblies shall meet the requirements of contact retention (see 3.6.6). Effect of the fluids on resilient sealing members shall not be a consideration of this test.

3.6.11 Durability: Counterpart connectors shall show no mechanical or electrical defects detrimental to the operation of the connector after 500 cycles of coupling and uncoupling (see 4.6.12).

3.6.12 Vibration: Mated connectors shall not be damaged and there shall be no loosening of parts due to vibration. Counterpart connectors shall be retained in full engagement and there shall be no interruption of electrical continuity longer than 1 microsecond (see 4.6.13).

3.6.13 Shock: Mated connectors shall not be damaged and there shall be no loosening of parts, nor shall there be an interruption of electrical continuity longer than 10 microseconds during the exposure to mechanical shock for adapter assemblies or 1 microsecond for individual connectors.

3.6.14 Acceleration: Mated connectors shall not be damaged and there shall be no loosening of parts due to acceleration. Counterpart connectors shall be retained in full engagement and there shall be no interruption of electrical continuity longer than 1 microsecond when tested in accordance with 4.6.15.

3.6.15 Acoustic noise: When specified (3.1), mated connectors shall not be damaged and there shall be no loosening of parts when exposed to acoustic noise. Counterpart connectors shall be retained in full engagement and there shall be no interruption of electrical continuity longer than 1 microsecond during exposure to acoustic noise (see 4.6.16).

3.6.16 Moisture resistance: Mated connectors, subjected to the moisture resistance test shall maintain an insulation resistance of 100 megohms or greater at 25°C for adapter assemblies and 1,000 megohms or greater at 25°C for individual connectors (see 4.6.17).

3.6.17 Insulation resistance: Insulation resistance shall be measured at ambient and elevated temperatures.

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3.6.17.1 Insulation resistance at ambient temperature: The insulation resistance at ambient temperature (25°C or 77°F) shall be greater than 5,000 megohms (see 4.6.18.1).

3.6.17.2 Insulation resistance at elevated temperature: Table IX shows the minimum insulation resistance after exposure to the required conditions (see 4.6.18.2).

TABLE IX. Temperature.

Test part	Ambient temperature	Qualification inspection	Group B inspection	Insulation resistance megohms (minimum)
Adapter assemblies	105°C	1,000 hrs	720 hrs	12
	125°C	250 hrs	250 hrs	3
Individual connectors	150°C	1,000 hrs	720 hrs	150
	200°C	100 hrs	100 hrs	35

3.6.18 Salt spray (corrosion): Unmated connectors, stowage receptacles, protective covers, and accessories shall show no exposure of basis metal due to corrosion which will affect performance (see 4.6.19).

3.6.19 External bending moment: Connectors, stressed using the applicable bending moment shown in table X shall exhibit no evidence of damage as revealed by inspection with 3X magnification. There shall be no interruption of electrical continuity (see 4.6.20).

TABLE X. External bending moment.

Shell size	Bending moment (inch-pounds)
10	200
12	300
14	350
16	419
18	433
20	437
22	440
24	450

3.6.20 Temperature life: The connectors shall perform satisfactorily after exposure to the temperature life test and shall pass the succeeding tests in the qualification test sequence (see 4.6.21).

3.6.21 Ozone exposure: The connectors shall show no evidence of cracking of materials or other damage due to ozone exposure that will adversely affect subsequent performance in the qualification test sequence (see 4.6.22).

3.6.22 Magnetic permeability: The relative magnetic permeability of connectors and accessories shall be less than 2 (see 4.6.23).

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3.6.23 Insert retention: The insert shall retain its normal position in the connector shell for at least 5 seconds at maximum specified pressure (see 4.6.24).

3.6.24 Air leakage:

3.6.24.1 Connectors, nonremovable contacts and accessories: The air leakage rate shall not be greater than 1 cubic inch per hour ($4.55 \times 10^{-3} \text{ cm}^3/\text{sec.}$) (see 4.6.25.1).

3.6.24.2 Stowage receptacles and protective covers: The air leakage rate shall not be greater than 1 cubic inch per hour ($4.55 \times 10^{-3} \text{ cm}^3/\text{sec.}$) (see 4.6.25.3).

3.6.25 Altitude immersion connectors only): Unless otherwise specified (see 3.1), individual connectors shall have an insulation resistance of at least 5,000 megohms after being subjected to altitude immersion, and shall maintain a dielectric withstanding voltage at sea level as specified in table VII (see 4.6.26).

3.6.26 Contact resistance: Contacts in the mated condition shall meet the contact resistance requirements of table XI in addition to the requirements of MIL-C-39029 (see 4.6.27).

TABLE XI. Contact resistance limits.

Contact size	Wire size	Test current (amperes)	Maximum voltage drop (millivolts)	
			Initial	After corrosion
20-20	20	7.5	55	65
	22	5.0	45	55
	24	3.0	45	55
16-16	16	13.0	50	60
	18	10.0	45	55
	20	7.5	45	55
12-12	12	23.0	50	60
	14	17.0	45	55

3.6.27 Cover chains: Protective covers with sash chains or wire rope as specified (see 3.1) shall withstand a 25-pound tensile test without damage (see 4.6.28).

3.6.28 Lanyard retention: The lanyard, including all hardware and joints shall withstand an axial tensile force of 150-pounds minimum (see 4.6.29).

3.6.29 Lanyard release force: The lanyard release force shall be less than 50 pounds at ambient temperature and less than 300 pounds at -55°C (see 4.6.30).

3.6.30 Coupling ring retention: The connector shall withstand an axial separation force between coupling mechanism and plug shell when applied in both directions. There shall be no loosening of component parts when subjected to the minimum force specified in table XII (see 4.6.31).

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TABLE XII. Coupling ring retention forces (min).

Shell size	Force lbs.	Shell size	Force lbs.
8	45	18	75
10	45	20	95
12	45	22	110
14	45	24	130
16	60		

- 3.6.31 Low temperature high humidity: Mated wired connectors shall show no signs of deterioration or breakage and shall pass the lanyard release tests at -55°C (see 4.6.32).
- 3.6.32 Systems compatibility: Certification of compliance of systems compatibility shall be furnished to the qualifying activity by the connector or accessory manufacturer. However, certification to the requirements indicated herein does not relieve the manufacturer of responsibility for qualification testing of the product (see 4.4). Verification of systems compatibility shall be conducted by the qualifying activity (see 4.6.33).
- 3.6.33 Stores release: Connectors and connector assemblies furnished under this specification and the applicable specification sheet shall be products which have been successfully installed and operated in the system for which the products are intended (see 4.6.33.1).
- 3.7 Identification of product:
- Each connector and accessory shall be legibly and permanently marked on the shell or coupling ring in accordance with MIL-STD-130 and MIL-STD-1285. The part number shall be as shown (see 3.1).
- 3.7.1 Insert marking: Inserts shall be marked as shown on the applicable specification sheet. Raised or depressed characters shall not be used on mating faces.
- 3.7.1.1 Contact designations: Contact locations shall be designated by identifiable characters of contrasting color on the front and rear faces of the insert or insert assembly. Positioning and arrangement of the characters shall be such that the appropriate contact cavity be readily identifiable. On the rear face of solder contact inserts, those individual contact designations may be omitted where space limitations render identifiability marginal. The characters on any face of the connectors shall remain identifiable after completion of the tests specified in tables XIII through XVII.
- 3.7.2 Grommet marking: Wire openings on the rear face of grommets shall be marked with legible characters of contrasting colors corresponding to the insert contact designators. On grommets of solder contact connectors it is permissible to identify, where space limitations dictate, only those wire openings which are located on the vertical centerline.

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TABLE XIII. Qualification inspection for removable contact type connector.

Title	Requirement paragraph	Test paragraph	Test sample number						Mating shell	
			1	2	3	4	5	6	1 & 2	
Examination of product - - - - -	3.1, 3.3 thru 3.5, 3.7, 3.8	4.6.1	X	X	X	X	X	X	X	X
EMI/RFI shielding effectiveness - - -	3.6.9.1	4.6.10.1								X
Contact protection, connector mating -	3.6.1	4.6.2	X		X					
Contact resistance, initial - - - - -	3.6.26	4.6.27	X	X						
Probe damage - - - - -	3.6.2	4.6.3	X							
Contact insertion and removable force	3.6.3	4.6.4	X		X					
Coupling torque - - - - -	3.6.5	4.6.6	X	X	X	X				
Coupling ring retention - - - - -	3.6.30	4.6.31	X							
Contact retention - - - - -	3.6.6	4.6.7	X	X						
Thermal shock - - - - -	3.6.7	4.6.8	X	X						
Dielectric withstanding voltage (mated at sea level) - - - - -	3.6.8	4.6.9.1	X	X			X			
Fluid immersion (lubricating oil) - -	3.6.10	4.6.11		X						
Fluid immersion (hydraulic fluid) - -	3.6.10	4.6.11			X					
Vibration - - - - -	3.6.12	4.6.13	X							
Shock - - - - -	3.6.13	4.6.14	X							
Acceleration - - - - -	3.6.14	4.6.15			X					
Acoustic noise - - - - -	3.6.15	4.6.16				X				
Moisture resistance - - - - -	3.6.16	4.6.17					X			
Insulation resistance (ambient temperature) - - - - -	3.6.17.1	4.6.18.1	X	X	X	X	X	X		
Salt spray (corrosion) - - - - -	3.6.18	4.6.19						X		X
External bending moment - - - - -	3.6.19	4.6.20						X		
Temperature life - - - - -	3.6.20	4.6.21	X							
Insulation resistance (elevated temperature) - - - - -	3.6.17.2	4.6.18.2	X							
Ozone exposure (unmated) - - - - -	3.6.21	4.6.22		X						
Magnetic permeability - - - - -	3.6.22	4.6.23	X							
Insulation resistance (ambient temp.) -	3.6.17.1	4.6.18.1		X			X			
Insert retention - - - - -	3.6.23	4.6.24	X	X	X	X				
Low temperature high humidity - - - -	3.6.31	4.6.32	X							
Coupling torque - - - - -	3.6.5	4.6.6	X	X	X	X				
Coupling ring retention - - - - -	3.6.30	4.6.31	X							
Lanyard release force - - - - -	3.6.29	4.6.30			X					
Altitude immersion - - - - -	3.6.25	4.6.26				X				
Insulation resistance (ambient temperature) - - - - -	3.6.17.1	4.6.18.1				X				
Dielectric withstanding voltage (mated at sea level) - - - - -	3.6.8	4.6.9.1				X	X			
Contact retention - - - - -	3.6.6	4.6.7	X	X	X	X				
Dielectric withstanding voltage (mated at altitude) - - - - -	3.6.8	4.6.9.2	X							
Dielectric withstanding voltage (unmated at altitude) - - - - -	3.6.8	4.6.9.2	X							
Contact insertion and removal force -	3.6.3	4.6.4		X	X					
Contact resistance - - - - -	3.6.26	4.6.27	X	X						
EMI/RFI shielding effectiveness - - -	3.6.9.1	4.6.10.1					X			X
Durability - - - - -	3.6.11	4.6.12				X				X
Examination of product - - - - -	3.1, 3.3 thru 3.5, 3.7, 3.8	4.6.1	X	X	X	X	X			X
Systems compatability- - - - -	3.6.32	4.6.33						X		
Stores release - - - - -	3.6.32.1	4.6.33.1						X		

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TABLE XIV. Qualification inspection for nonremovable contact type connectors.

Title	Requirement paragraph	Test paragraph	Test sample number								
			1	2	3	4	5	6	H-1	H-2	
Examination of product - - - -	3.1, 3.3 thru 3.5, 3.7, 3.8	4.6.1	X	X	X	X	X	X	X	X	X
Contact protection, connector mating - - - - -	3.6.1	4.6.2	X		X					X	X
Contact resistance, initial -	3.6.26	4.6.27	X	X						X	
Contact engaging & separating force - - - - -	3.6.4	4.6.5	X	X	X	X					
Probe damage - - - - -	3.6.2	4.6.3	X		X	X					
Coupling torque - - - - -	3.6.5	4.6.6	X		X	X					
Coupling ring retention - - -	3.6.30	4.6.31	X								
Contact retention - - - - -	3.6.6	4.6.7	X	X	X	X					
Thermal shock - - - - -	3.6.7	4.6.8	X	X	X	X					X
Contact retention - - - - -	3.6.6	4.6.7	X	X	X	X					
Dielectric withstanding voltage (mated at sea level) - - - -	3.6.8	4.6.9.1						X		X	X
Fluid immersion (lubricating oil) - - - - -	3.6.10	4.6.11		X						X	
Fluid immersion (hydraulic fluid) - - - - -	3.6.10	4.6.11			X					X	
Vibration - - - - -	3.6.12	4.6.13	X							X	
Shock - - - - -	3.6.13	4.6.14	X							X	
Acceleration - - - - -	3.6.14	4.6.15			X					X	
Acoustic noise - - - - -	3.6.15	4.6.16				X					X
Moisture resistance - - - - -	3.6.16	4.6.17					X				X
Insulation resistance (ambient temperature) - - - - -	3.6.17.1	4.6.18.1	X	X	X	X	X			X	X
Salt spray (corrosion) - - - -	3.6.18	4.6.19					X			X	
External bending moment - - -	3.6.19	4.6.20					X				
Temperature life - - - - -	3.6.20	4.6.21	X								X
Insulation resistance (elevated temperature) - - - - -	3.6.17	4.6.18.2	X								X
Ozone exposure (unmated) - - -	3.6.21	4.6.22		X							
Magnetic permeability - - - -	3.6.22	4.6.23	X								
Insulation resistance (ambient temperature) - - - - -	3.6.17.1	4.6.18.1		X			X				
Insert retention - - - - -	3.6.23	4.6.24	X	X	X	X					
Low temperature humidity - - -	3.6.31	4.6.32	X								
Coupling torque - - - - -	3.6.5	4.6.6	X	X	X	X				X	X
Lanyard release force - - - -	3.6.29	4.6.30			X						
Altitude immersion - - - - -	3.6.25	4.6.26				X				X	
Insulation resistance (ambient temperature) - - - - -	3.6.17.1	4.6.18.1				X				X	
Dielectric withstanding voltage (mated at sea level) - - - -	3.6.8	4.6.9.1				X	X				
Air leakage - - - - -	3.6.24.1	4.6.25.1	X		X						
Contact retention - - - - -	3.6.6	4.6.7	X	X	X	X					
Dielectric withstanding voltage (mated at altitude) - - - -	3.6.8	4.6.9.2	X								X
Dielectric withstanding voltage (unmated at altitude) - - -	3.6.8	4.6.9.2	X								X
Contact resistance - - - - -	3.6.26	4.6.27	X	X						X	
EMI/RFI shielding effectiveness	3.6.9	4.6.10	X			X					
Durability - - - - -	3.6.11	4.6.12				X				X	
Examination of product - - - -	3.1, 3.3 thru 3.5, 3.7, 3.8	4.6.1	X	X	X	X	X			X	X
Systems compatability - - - -	3.6.32	4.6.33							X		
Stores release - - - - -	3.6.32.1	4.6.33.1							X		

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TABLE XV. Group B inspection for removable contact type connectors.

Title	Requirement paragraph	Test paragraph	Test sample number						Mating shell 1 & 2
			1	2	3	4	5	6	
Examination of product - - - - -	3.1, 3.3 thru 3.5, 3.7, 3.8	4.6.1	X	X	X	X	X	X	X
Contact insertion and removable force - - - - -	3.6.3	4.6.4	X		X				
Coupling torque - - - - -	3.6.5	4.6.6	X	X	X	X			
Coupling ring retention - - - - -	3.6.30	4.6.31	X						
Contact retention - - - - -	3.6.6	4.6.7	X	X					
Thermal shock - - - - -	3.6.7	4.6.8	X	X					
Dielectric withstanding voltage (mated at sea level)- - - - -	3.6.8	4.6.9.1	X	X			X		
Vibration (at -55°C) - - - - -	3.6.12	4.6.13	X						
Shock - - - - -	3.6.13	4.6.14	X						
Moisture resistance - - - - -	3.6.16	4.6.17						X	
Insulation resistance (ambient temperature) - - - - -	3.6.17.1	4.6.18.1	X	X	X	X	X	X	
Salt spray (corrosion) - - - - -	3.6.18	4.6.19						X	X
External bending moment - - - - -	3.6.19	4.6.20						X	
Temperature life - - - - -	3.6.20	4.6.21	X						
Insulation resistance (elevated temperature) - - - - -	3.6.17.2	4.6.18.2	X						
Insert retention - - - - -	3.6.23	4.6.24	X	X	X	X			
Low temperature high humidity - - - - -	3.6.31	4.6.32	X						
Coupling torque - - - - -	3.6.5	4.6.6	X	X	X	X			
Coupling ring retention - - - - -	3.6.30	4.6.31	X						
Lanyard release force - - - - -	3.6.29	4.6.30			X				
Altitude immersion - - - - -	3.6.25	4.6.26					X		
Insulation resistance (ambient temperature)- - - - -	3.6.17.1	4.6.18.1					X		
Dielectric withstanding voltage (mated at sea level) - - - - -	3.6.8	4.6.9.1					X	X	
Contact retention - - - - -	3.6.6	4.6.7	X	X	X	X			
Dielectric withstanding voltage (mated at altitude) - - - - -	3.6.8	4.6.9.2	X						
Dielectric withstanding voltage (unmated at altitude) - - - - -	3.6.8	4.6.9.2	X						
Contact insertion and removal force - - - - -	3.6.3	4.6.4		X		X			
Contact resistance - - - - -	3.6.26	4.6.27	X	X					
Durability - - - - -	3.6.11	4.6.12					X		X
Examination of product - - - - -	3.1, 3.3 thru 3.5, 3.7, 3.8	4.6.1	X	X	X	X	X		X

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TABLE XVI. Group B inspection for nonremovable contact type connectors.

Title	Requirement paragraph	Test paragraph	Test sample numbers								
			1	2	3	4	5	6	H-1	H-2	
Examination of product - - - -	3.1, 3.3 thru 3.5, 3.7, 3.8	4.6.1	X	X	X	X	X	X	X	X	X
Contact resistance, initial - -	3.6.26	4.6.27	X	X						X	
Contact engaging & separating force - - - - -	3.6.4	4.6.5	X	X	X	X					
Probe damage - - - - -	3.6.2	4.6.3	X		X	X					
Coupling torque - - - - -	3.6.5	4.6.6	X		X	X					
Coupling ring retention - - - -	3.6.30	4.6.31	X								
Contact retention - - - - -	3.6.6	4.6.7	X	X	X	X					
Thermal shock - - - - -	3.6.7	4.6.8	X	X	X	X					X
Contact retention - - - - -	3.6.6	4.6.7	X	X	X	X					
Dielectric withstanding voltage (mated at sea level)-	3.6.8	4.6.9.1						X		X	X
Vibration - - - - -	3.6.12	4.6.13	X							X	
Shock - - - - -	3.6.13	4.6.14	X							X	
Moisture resistance - - - - -	3.6.16	4.6.17						X			X
Insulation resistance (ambient temperature) - - - - -	3.6.17.1	4.6.18.1	X	X	X	X	X			X	X
Salt spray (corrosion)- - - -	3.6.18	4.6.19					X			X	
External bending moment - - - -	3.6.19	4.6.20					X				
Temperature life - - - - -	3.6.20	4.6.21	X								X
Insulation resistance (elevated temperature) - - - - -	3.6.17	4.6.18.2	X								X
Insert retention - - - - -	3.6.23	4.6.24	X	X	X	X					
Low temperature humidity - - -	3.6.31	4.6.32	X								
Coupling torque - - - - -	3.6.5	4.6.6	X	X	X	X				X	X
Lanyard release force - - - - -	3.6.29	4.6.30			X						
Altitude immersion - - - - -	3.6.25	4.6.26				X				X	
Insulation resistance (ambient temperature) - - - - -	3.6.17	4.6.18.1				X				X	
Dielectric withstanding voltage (mated at sea level)- - - -	3.6.8	4.6.9.1				X	X				
Air leakage - - - - -	3.6.24.1	4.6.25.1	X		X						
Contact retention - - - - -	3.6.6	4.6.7	X	X	X	X					
Dielectric withstanding voltage (mated at altitude) - - - - -	3.6.8	4.6.9.2	X								X
Dielectric withstanding voltage (unmated at altitude) - - - -	3.6.8	4.6.9.2	X								X
Contact resistance - - - - -	3.6.26	4.6.27	X	X						X	
Durability - - - - -	3.6.11	4.6.12				X				X	
Examination of product - - - -	3.1, 3.3 thru 3.5, 3.7, 3.8	4.6.1	X	X	X	X	X			X	X

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TABLE XVII. Qualification and group B inspection
for connector accessories and crimp contact retention feature.

Title	Requirement paragraph	Test paragraph	Test sample	
			1	2
<u>Protective Covers, Stowage Receptacles and Cable Clamps</u>				
Examination of product - - - - -	3.1, 3.3 thru 3.5, 3.7, 3.8	4.6.1	X	X
Magnetic permeability - - - - -	3.6.22	4.6.23	X	X
Low temperature high humidity - - - -	3.6.31	4.6.32	X	X
Coupling torque - - - - -	3.6.5	4.6.6	X	X
Vibration - - - - -	3.6.12	4.6.13	X	X
Moisture resistance - - - - -	3.6.16	4.6.17	X	X
Cover chains, tensile strength - - - -	3.6.27	4.6.28	X	X
Air leakage - - - - -	3.6.24.1	4.6.25.1	X	X
EMI/RFI shielding effectiveness - - -	3.6.9	4.6.10.2	X	X
Examination of product - - - - -	3.1, 3.3 thru 3.5, 3.7, 3.8	4.6.1	X	X
<u>Crimp Contact Retention Feature</u>				
Examination of product - - - - -	3.1, 3.7, 3.8	4.6.1	82 Contact Cavities Minimum	
Contact insertion and removal force -	3.6.3	4.6.4		
Contact retention - - - - -	3.6.6	4.6.7.2		
<u>Connector Assemblies, Class J</u>				
Examination of product - - - - -	3.1, 3.3 thru 3.5, 3.7, 3.8	4.6.1	X	X
Magnetic permeability - - - - -	3.6.22	4.6.23	X	X
External bending moment - - - - -	3.6.19	4.6.20	X	X
Thermal shock - - - - -	3.6.7	4.6.8	X	X
Vibration - - - - -	3.6.12	4.6.13	X	X
Moisture resistance - - - - -	3.6.16	4.6.17	X	X
Salt spray (corrosion) - - - - -	3.6.18	4.6.19	X	X
Air leakage - - - - -	3.6.24.1	4.6.25.1	X	X
EMI/RFI shielding effectiveness - - -	3.6.9	4.6.10	X	X
Fluid immersion (lub. oil) - - - - -	3.6.10	4.6.11	X	
Fluid immersion (hyd. fluid) - - - -	3.6.10	4.6.11	X	
Examination of product - - - - -	3.1, 3.3 thru 3.5, 3.7, 3.8	4.6.1	X	X

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TABLE XVII (Continued).

Title	Requirement paragraph	Test paragraph	Test sample	
			1	2
<u>Dielectric After Fluid Immersion</u>				
Examination of product - - - - -	3.1, 3.7, 3.8	4.6.1	X	X
Dielectric withstanding voltage at sea level - -	3.6.8	4.6.9.1	X	X
Coupling torque - - - - -	3.6.5	4.6.6	X	X
Fluid immersion - - - - -	3.6.10	4.6.11	X	X
Dielectric withstanding voltage at sea level - -	3.6.8	4.6.9.1	X	X
Coupling torque - - - - -	3.6.5	4.6.6	X	X
Examination of product - - - - -	3.1, 3.7, 3.8	4.6.1	X	X
<u>Retention System After Fluid Immersion</u>				
Examination of product - - - - -	3.1, 3.7, 3.8	4.6.1	X	X
Retention system fluid immersion - - - - -	3.6.10,1	4.6.11	X	X
Contact retention - - - - -	3.6.6	4.6.7.2	X	X
Examination of product - - - - -	3.1, 3.7, 3.8	4.6.1	X	X

3.8 Workmanship:

Connectors and accessories shall meet all design dimensions and intermateability requirements of this specification. Loose contacts, poor molding fabrication, loose materials, defective bonding, damaged or improperly assembled contacts, peeling, or chipping or plating or finish, galling of mating parts, nicks and burrs of metal parts and post molding warpage will be considered adequate basis for rejection of items of quality inferior for the purpose intended.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for inspection:

With the exception of the stores release requirements, the supplier is responsible for the performance of all inspection requirements as specified herein unless otherwise specified in the contract or purchase order. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to 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 equipment and inspection facilities shall be of sufficient accuracy, quality, and quantity to permit performance of the required inspection. The supplier shall establish calibration of inspection equipment to the satisfaction of the Government. Calibration of the standards which control the accuracy of inspection equipment shall comply with the requirements of MIL-C-45662.

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4.2 Classification of inspection:

The inspection of connectors shall be classified as follows:

- (a) Qualification inspection (see 4.4).
- (b) Quality conformance inspection (see 4.5).
 - (1) Inspection of product for delivery (see 4.5.1).
 - (2) Inspection of preparation for delivery (see 4.5.2).

4.3 Inspection conditions and preparation of sample:

4.3.1 Inspection conditions: Unless otherwise specified, all inspection shall be made in accordance with the general requirements of MIL-STD-1344.

4.3.2 Preparation of samples: Connectors (except for the systems compatibility test), shall be wired with approximately 3 feet of wire, as applicable from table I. A MIL-C-22520/1 or MIL-C-22520/2 crimping tool, as applicable, shall be used to crimp removable contacts to the wires. Soldering shall be in accordance with requirement 5 of MIL-STD-454 for nonremovable contacts.

4.4 Qualification inspection:

Qualification inspection shall consist of the examinations and test performed in the sequence in either table XIII or table XIV, and table XVII on the qualification test samples specified in 4.4.1. After receipt of the letter of authorization from the activity responsible for qualification (see 6.4), the applicant shall submit three copies of his test reports (certified by the Government inspector indicating the extent to which the tests were witnessed), together with the systems compatibility certification and the required samples specified in 4.4.1 to the activity responsible for qualification.

4.4.1 Samples: Test samples shall be produced with materials, equipment, and procedures normally used in production.

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4.4.1.1 Connector assemblies (classes E, F, and P): Five complete connector assemblies, class E wall-mount receptacles and class E or F straight plugs shall be provided. These assemblies shall have the most compact insert arrangements in each voltage and temperature range and in each shell size for which qualification is desired. Separate samples are required for crimp-contact connectors and solder-contact connectors. Crimp contacts shall not be installed in connectors submitted for qualification testing. The wired samples of class P connectors shall be potted with a material suitable for the temperature conditions of 4.6.21.

- (a) The connectors for test samples 1, 3, and 5 shall be assembled with wire approaching the applicable minimum diameter shown in table I.
- (b) Connectors for test samples 2 and 4 shall be assembled with wire approaching the applicable maximum diameter shown in table I.
- (c) Qualification of these samples shall admit qualification of other types and the balance of insert patterns in classes E, F, and P by similarity. If qualification of classes E and F is not sought, samples of class P shall be substituted for class E or F in the foregoing, except that nominal gage wire may be used. However, qualification of class P samples alone shall not admit qualification of classes E and F connectors.

4.4.1.2 Connector assemblies (class J): Two mated pairs of class J connector assemblies, in each shell size, shall be supplied.

- (a) The connectors need not be wired but shall be assembled using a solid polychloroprene cylinder of suitable length and OD in accordance with table XVIII. The Shore A durometer of the test cylinder shall be from 75 to 85.
- (b) Qualification of these samples when subjected to the tests of Table XVII will admit qualification of all class J assemblies if classes E and F are being qualified at the same time or have previously been qualified to this specification. If not, class J assemblies shall be subjected to all of the tests of tables XIII and XIV.

TABLE XVIII. Test cylinder OD sizes.

Shell size	Diameter ± 0.016 inch
8	0.214
10	.250
12	.384
14	.462
16	.596
18	.646
20	.681
22	.716
24	.817

4.4.1.3 Connector assembly for systems compatibility: One complete connector assembly, in accordance with the applicable specification sheet, shall be provided for the systems compatibility inspection.

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- 4.4.1.4 Shells for EMI/RFI testing: Two pairs of mating shells shall be selected for qualification and shall be tested without inserts or contacts installed. These pairs of mating shells shall be submitted to the applicable qualification sequence specified in table XIII.
- 4.4.1.5 Contact retention feature samples: A sufficient number of additional connectors shall be supplied to provide a minimum of 82 contact cavities of the size of contacts for which qualification of the crimp contact retention feature is desired.
- 4.4.1.6 Protective covers: Two protective covers of each shell size with mating classes E or F connectors, shall be subjected to the tests of table XVII for group B.
- 4.4.1.7 Stowage receptacles: Two stowage receptacles of each size, with mating class E or F connectors, shall be subjected to the tests of table XVII.
- 4.4.1.8 Adapters (cable to connector and connector to connector): Four adapters of each type shall be selected for qualification. They shall be tested with a qualified connector or an accessory device having identical mating features. Two of each type adapter selected shall be submitted to the applicable qualification inspection specified in table XVII. The remaining untested samples shall be forwarded to the qualifying activity with the qualification test reports.
- 4.4.2 Test routine: Sample units shall be subjected to the applicable inspection specified in tables XIII and XIV in the order shown. Connector accessories shall be subjected to the inspection test sequence of table XVII in the order shown.
- 4.4.3 Qualification rejection: There shall be no failures during any examination or tests of the connectors or accessories detrimental to the operation of the connector submitted for qualification tests. After notification of any failure, detrimental to the operation of the connector, the activity responsible for qualification testing shall receive details of corrective action from the supplier before initiating any further tests deemed necessary to assure compliance with connector requirements.
- 4.4.4 Retention of qualification: In order to retain qualification, a summary of group B test results shall be furnished at one or two year intervals (see 4.5.1.4.1), and shall cover the results of group B tests performed during that period. The summary shall also include the number and type of any part failures and shall be forwarded via the Government Inspector to the activity responsible for qualification. If the summary of results indicates nonconformance with specification requirements, 4.5.1.4.2 (nonconformance) shall apply. Failure to furnish the summary shall result in loss of qualification for that product.

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4.4.5 Assembly plants: Assembly plants must be listed on or approved for listing on the applicable qualified products list. The qualified connector supplier shall certify that the assembly plant is approved for the distribution of the supplier's parts. The assembly plant shall use only piece parts supplied by the qualified connector supplier. No testing other than visual examination is required of certified piece parts obtained from the qualified connector supplier, except when there is cause for rejection. All assemblies produced at the assembly plant shall be subjected to the quality assurance provisions specified herein. Quality control requirements, including Government inspection surveillance, shall be the same as required for the qualified connector supplier.

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, as far as practicable, shall consist of all connectors covered by one specification sheet, produced under essentially the same conditions, and offered for inspection at one time.

4.5.1.2 Disposition of sample units: Sample units which have been subjected to the group A inspection may be delivered on the contract or order. Sample units which have been subjected to the group B inspection shall not be delivered on the contract or order.

4.5.1.3 Group A inspection: Group A inspection shall consist of the examinations and tests specified in table XIX and shall be made on the same set of sample units in the order shown. In process control of component parts, unrelated to lot sizes of finished connectors, may be used in lieu of examination of these components in the finished connectors to assure performance of these component parts.

TABLE XIX. Group A inspection.

Examination or test	Connector type		Accessories	Requirement paragraph	Test par.
	Removable	Non-removable			
Examination of product	X	X	X	3.1, 3.3 thru 3.5, 3.7, 3.8	4.6.1
Insulation resistance	X	X		3.6.17	4.6.18
Dielectric withstanding voltage (unmated)	X	X		3.6.8	4.6.9

4.5.1.3.1 Sampling plan: Statistical sampling and inspection shall be in accordance with MIL-STD-105 for general inspection level II. The acceptable quality shall be 1.0.

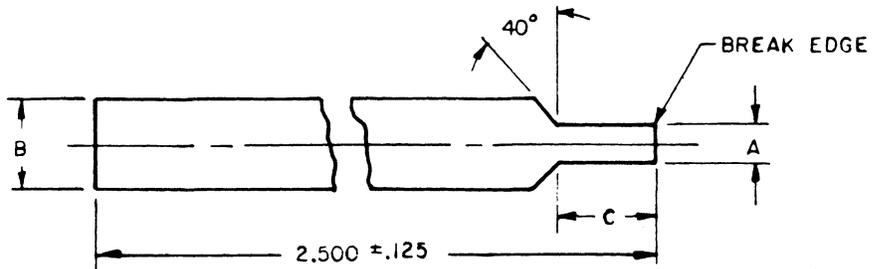
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- 4.5.1.3.2 Rejected lots: If an inspection lot is rejected, the supplier shall withdraw the lot, rework it to correct the defects, or screen out the defective units, as applicable, and reinspect. Such lots shall be separate from new lots, and shall be clearly identified as reinspected lots. Rejected lots shall be reinspected using tightened inspection.
- 4.5.1.4 Group B inspection: Group B inspection shall consist of the applicable examinations and tests specified in either table XV or table XVI, and table XVII. Shipment shall not be held up pending results of this inspection.
- 4.5.1.4.1 Sampling plan: Sample units of one size, insert configuration, and each class representative of production at the time of selection shall be selected at 6-month intervals. Upon passing this inspection, the supplier may select sample units every 12 months. If the second level of sampling is passed two successive times, the supplier may select sample units every 24 months. In the event of a failure, sampling shall revert to the 6-month interval.
- 4.5.1.4.2 Noncompliance: If a sample fails to pass group B inspection, the supplier 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 related lots shall be discontinued until corrective action, acceptable to the Government, has been taken. After the corrective action has been taken, group B inspection shall be repeated on new samples. Group A inspection may be reinstated; however, final acceptance shall be withheld until the group B inspection 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 with contracting officer and to the qualifying activity who will initiate action to remove the failing product from the qualified products list.
- 4.5.2 Inspection of preparation for delivery: Sample packages and packs and the inspection of the preservation-packaging, packing and marking for shipment and storage shall be in accordance with the requirements of MIL-C-55330.
- 4.6 Methods of examination:
- 4.6.1 Examination of product: The connectors, accessories, and piece parts shall be examined to insure conformance with this specification and the applicable specification sheets. In process control of component parts, unrelated to lot sizes of finished connectors, may be utilized in lieu of examination of these components in the finished connectors to assure conformance of these component parts.
- 4.6.2 Contact protection, connector mating: The front edge of the shell of the plug connector shall be scooped as deep as possible within the front aperture made by the shell of the mating receptacle. The front edges of both shells shall be in contact during this test (see 3.6.1).

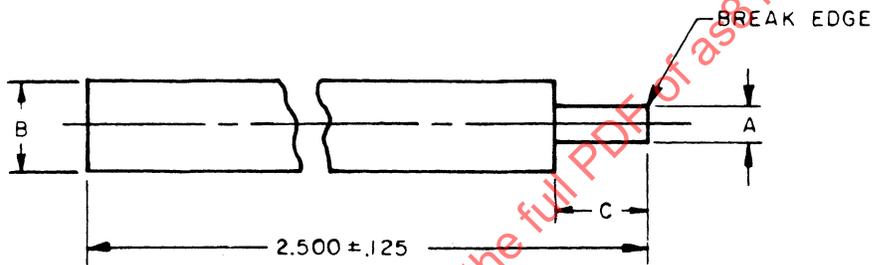
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- 4.6.3 Resistance to test probe damage: One socket contact of each size shall be tested in accordance with method 2006 of MIL-STD-1344. The contact shall be installed in a collet type holder or connector for this test. Probe depths used shall be 1/2, 3/4 and full depth (see 3.6.2).
- 4.6.4 Contact insertion and removal force (removable crimp contacts only): Connectors shall be tested in accordance with method 2012 of MIL-STD-1344. Insertion and removal shall be done 9 times. Contacts shall not be wired.
- 4.6.5 Contact engaging and separating force: Socket contacts shall be tested in accordance with the contact engagement and separation test of MIL-C-39029. Socket contacts may be tested installed in the connectors (see 3.6.4).
- 4.6.6 Mating and unmating forces: Receptacles, plugs, dummy stowage receptacles, and protective covers shall be engaged with and disengaged from counterpart connectors in accordance with method 2013 of MIL-STD-1344. The torque shall be applied at a uniform rate of approximately one inch-pound per second (see 3.6.5).
- 4.6.7 Contact retention: Retention of contacts shall be tested in accordance with method 2007 of MIL-STD-1344 and table V. One sample of each connector shall be tested. Measurement of displacement shall be done while maximum load is applied and shall meet the requirements of 3.6.6.
- 4.6.7.1 Crimp contacts: Contacts shall be tested as specified in 4.6.7. Rear accessory hardware shall be connected and tightened on connector, the axial load shall be applied in the outward direction from the mating end of contacts only (see 3.6.6).
- 4.6.7.2 Crimp contact retention feature: Connectors shall be tested as specified in 4.6.7.1, except that the rear accessory hardware shall be removed prior to the test and the loads shall be applied successively to the mating and wire barrel ends of the contacts. The contacts selected for this test shall be crimped to metal rods complying with figure 3. The rods shall be capable of being crimped to the contacts with the MIL-C-22520/1 or MIL-C-22520/2 tool and shall be capable of being used to apply the specified axial load, without excessive bending, to the rear of the contacts during this test. Contact cavities not filled with rod contact assemblies shall be filled with wired contacts (see 3.6.6).
- 4.6.7.3 Solder type: Contacts shall be tested as specified in 4.6.7. The load shall be applied only to the mating ends of contacts and the grommet retaining nut shall be loose. Displacement shall be measured after the specified load is removed (see 3.6.6).

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ROD FOR SIZE 20 CONTACT



ROD FOR SIZE 16 AND 12 CONTACTS

CONTACT SIZE	A DIA	B DIA	C ± .010
20	.047 .045	.080 .075	.187
16	.065 .063	.100 .095	.294
12	.097 .095	.142 .137	.294

NOTE:

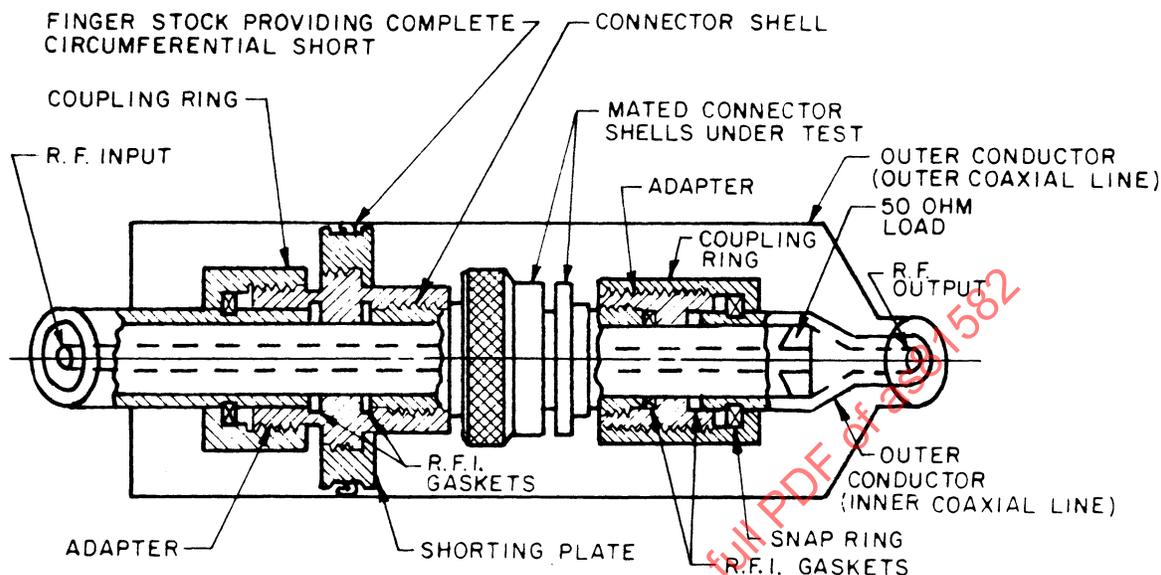
All diameters to be concentric with each other within .004 TIR.

FIGURE 3. Rod for retention feature test.

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- 4.6.8 Thermal shock: Unmated connectors or unmated connectors with adapters shall be tested in accordance with Method 1003 of MIL-STD-1344, except that during the low temperature extreme of the fifth cycle, while at a minimum (-55°C) ambient, the connectors shall be mated and unmated 5 times. At the completion of the last cycle, the connectors shall be returned to room temperature for further inspection. Test condition B shall be used for connectors and test condition C shall be used for adapter assemblies (see 3.6.7).
- 4.6.9 Dielectric withstanding voltage (see 3.6.8):
- 4.6.9.1 Dielectric withstanding voltage (sea level): Mated and unmated connectors shall be tested in accordance with Method 3001 of MIL-STD-1344. The applicable test voltages (see table VII) shall be applied between all adjacent contacts and between the shell and each contact closest to the shell. If an insert possesses more than one service rating, similar connections shall be made for the different test voltages as necessary (see 3.6.8).
- 4.6.9.2 Dielectric withstanding voltage (altitude): The connectors shall be tested in accordance with Method 3001, Test Condition IV, MIL-STD-1344. After 30 minutes at the simulated altitude, the connectors shall be tested as specified in 4.6.9.1 (see 3.6.8).
- 4.6.10 EMI/RFI shielding effectiveness (see 3.6.9):
- 4.6.10.1 Shielding effectiveness: The electromagnetic susceptibility of mated pairs of shells shall be measured in a tri-axial radio frequency leakage tester as shown on figure 4. The RF leakage from the coaxial line through the shells of the connector pairs into outer coaxial geometry shall be measured at the frequency shown in table VIII (accuracy of frequency ± 5 percent). The level of detected signal power indicated by a tuned radio frequency field intensity meter is a result of RF leakage from the mated pair of shells. The test set-up and procedure shall be as shown on figure 5 (see 3.6.9.1).
- 4.6.10.2 Shell to shell continuity: The dc resistance of the wired, mated, assembled connectors shall be measured between the points shown on figure 5. The applied potential shall be 1.5 volts dc maximum. A resistance shall be inserted in the circuit to limit the current to 0.100 ± 0.010 amperes. Probes with spherical ends of 0.05 inch minimum shall be used to make the voltage measurements and shall be placed on the simulated panel and at the extreme edge of the plug as shown on figure 6. The probe shall not puncture or otherwise damage the connector (see 3.6.9.2).

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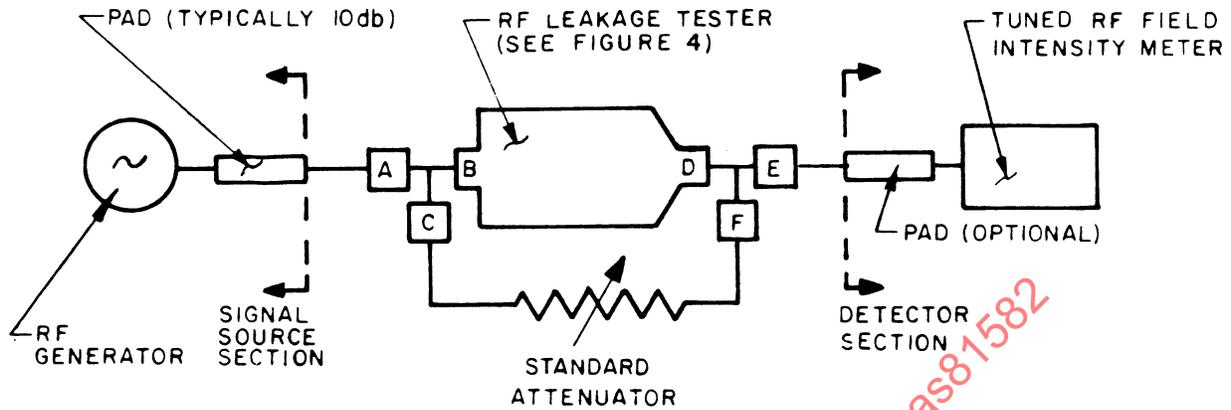
The mated pairs of connector shells shall be connected to the center coaxial line as shown and tested as shown in fig. 5. Attachment of the connector shells to the outer conductor of the inner coaxial line shall be accomplished using R.F. gaskets to prevent leakage through the adapters.

TESTER DESIGN REQUIREMENTS AND TERMINATIONS.

- a. The characteristic impedances of the coaxial lines comprising the leakage tester shall be a nominal 50 ohms.
- b. The VSWR ($Z_0 = 50$ ohms) looking into B shall be 1.5 or less when the mated pairs of connector shells are removed and replaced by a 50 ohm line section.
- c. Existence of higher order modes, especially the transverse electric 1.1 (TE_{11}) mode will cause errors in required measurements. The frequencies at which these modes exist must be avoided. The frequencies may be calculated by referring to Section 2.4b of The Waveguide Handbook, Vol. 10 of the M.I. T. Radiation Laboratory Series, when the diameters of the outer coaxial section are known.
- d. The input and output VSWR of the standard attenuator (see fig. 6) should be less than 1.5 in the 20 to 100 dB attenuation range.
- e. The output impedance of the signal source and the input impedance of the detector (see fig. 5) shall be a nominal 50 ohms having a maximum allowable VSWR of 1.5.
- f. Connectors A, B, C, D, E, and F (see fig. 6) should be of a low leakage type which exhibit R. F. leakage attenuation of >100 dB.

FIGURE 4. Tri-axial RF leakage tester.

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A standard attenuator capable of providing at least 100 dB (accuracy ± 3 dB) of attenuation in one dB steps shall be used to measure the RF leakage.

1. Tune the detector to the generator signal frequency by connecting C to A and F to E, using approximately 85 dB attenuation in the standard attenuator.
2. Disconnect C from A and F from E and couple A to B and D to E. Adjust frequency slightly, if necessary, to maximize output indication on the tuned Radio Field Intensity Meter. Record output level.
3. Disconnect A from B and D from E. Connect C to A and F to E within one minute, so as to prevent excessive drift of voltage in the signal source and of calibration in the Tuned Radio Frequency Field Intensity Meter. Adjust the standard attenuator until the output level recorded in Step 2 is reached. The value of the attenuation provided by the standard attenuator is a measure of the RF leakage attenuation of the mated pair of shells, measured in dB of power.

FIGURE 5. Test set-up and procedure for shielding susceptibility test.

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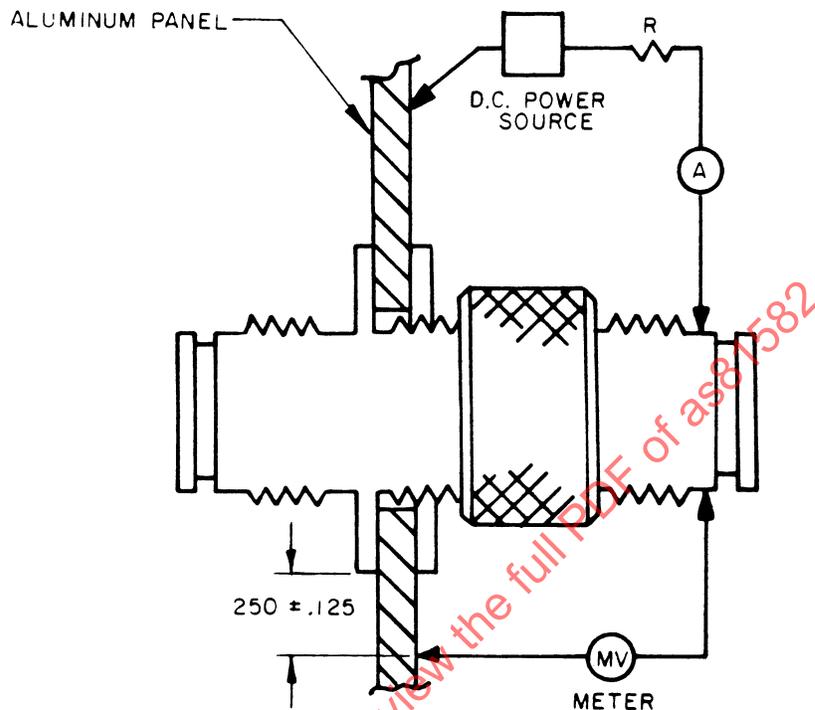


FIGURE 6. Shell to shell continuity test diagram.

- 4.6.11 Fluid immersion: Connector samples shall be subjected to the test procedures and fluids as specified in Method 1016 of MIL-STD-1344 (one sample per fluid). Following the fluid immersion cycles the connectors shall be tested for coupling torque as specified in 4.6.6, and dielectric withstanding voltage at sea level as specified in 4.6.9.1 within 3 hours.
- 4.6.11.1 Retention system fluid immersion (see 3.6.10.1): Unmated connectors with contacts removed shall be immersed in the fluids specified in Method 1016 of MIL-STD-1344 (one sample per fluid) for two hours at room temperature. After removal, excess fluid shall drain from the connectors for 4 hours and the contacts reinstalled. Following the test, the connectors shall be subjected to contact retention as specified in 4.6.7.
- 4.6.12 Durability: Counterpart connectors shall be mated and unmated at a maximum rate of 300 cycles per hour in a manner to simulate actual service in that plugs and receptacles shall be completely separated during each cycle (see 3.6.11) (see 4.6.19).
- 4.6.12.1 Uncoupling (coupling ring): Connectors shall be mated and unmated 300 times with the coupling rings.

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- 4.6.12.2 Uncoupling (lanyard release): Connectors shall be mated and unmated 200 times using the lanyard release. The connector shall be rigidly mounted as in service. The direction of force application shall be at an angle of 15° from the connector longitudinal axis for the first 50 cycles, along the longitudinal axis for the next 100 cycle cycles and 15° from the connector longitudinal axis on the opposite side for the last 50 cycles. The force shall be applied at maximum rate of 50 pounds per second.
- 4.6.13 Vibration: Each receptacle shall be mounted on a suitable fixture, which in turn shall be attached to a vibration table. A suitable sensor shall monitor the vibration of the receptacle at a point on or near the receptacle. A counterpart plug shall be engaged with the receptacle and held by normal locking means without the use of safety wire. The wire bundles shall be clamped to nonvibrating points at least 8 inches from the rear of the connectors. The wire bundle shall be defined as a complete compliment of size 20 wire, one braided cable shield, and an outer jacket of an acceptable insulation material to meet the temperature requirements. The average cable weight shall be 0.4 oz. per inch minimum and shall have a minimum length of 24 inches. The connector assembly shall be tested in accordance with method 214, test condition I, test condition letter A, of MIL-STD-202. All contacts shall be wired in series, and a current of 100 10 milliamperes (mA) shall flow through the series circuit during the test. A suitable instrument shall monitor the current flow and indicate any discontinuity longer than 10 microseconds. The assembly shall be vibrated 8 hours in the longitudinal direction and 8 hours in the perpendicular direction. (See 3.6.12.)
- 4.6.14 Shock: Mated connector shall be tested in accordance with method 2004, test condition A, of MIL-STD-1344, except only one shock instead of three shall be applied in each direction (6 shocks). Receptacles shall be mounted similar to 4.6.13.1. Plugs shall be engaged with the receptacles and held by normal locking means only. All contacts shall be wired in series and the wire bundles or cables shall be clamped to structures that move with the connectors. A minimum of 8 inches of wire or cable shall be unsupported behind the rear of each connector. A suitable instrument shall be employed to indicate any discontinuity or interruption of current flow (see 3.6.13).
- 4.6.15 Acceleration: Connectors shall be tested in accordance with Method 2011, test condition A, of MIL-STD-1344. Contacts shall be wire to check for continuity during test (see 3.6.14).
- 4.6.16 Acoustic noise: The mated and wired connectors shall be mounted as in normal service to a rigid plane and tested in accordance with Method 515 of MIL-STD-810. The noise level and duration of exposure shall be category C for 30 minutes. At least 100 milliamperes shall flow through the series wired contacts during the test. A suitable instrument shall be employed to monitor the current flow and to indicate any discontinuity of contact or interruption of current flow (see 3.6.15).