



AEROSPACE STANDARD

AS5590™**REV. B**

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Superseding AS5590A

Connectors, Fiber Optic, Advanced, Circular or Rectangular, Plug and Receptacle,
Environment Resistant, Removable Termini/Contacts, General Specification For

RATIONALE

This document has been determined to contain basic and stable technology which is not dynamic in nature.

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1. SCOPE

1.1 Scope

This specification covers the performance requirements for a plug and receptacle. The connector inserts may contain multiple termini or multiple termini and electrical contacts. The connectors use removable termini, or removable termini and electrical contacts, and are capable of operating within a temperature range of -65 to +200 °C (see 1.2.1.1). These connectors are supplied under AS9100 reliability assurance program.

1.2 Description

All series include removable termini or removable termini and removable electrical contacts. All series are designed to ensure proper orientation of the mating halves prior to mating. All connectors include EMI shielding capability, with conductive finishes, which provide electrical continuity between mated shells prior to terminus/contact engagement and have the termini/contacts so located as to be protected from handling damage. Connectors specified are designed for use with termini as specified in MIL-PRF-29504 or as listed in the individual slash sheet, and shall meet the clip-to-clip dimensions specified in the individual slash sheet. The test procedures and performance requirements of this specification are oriented toward circular connector designs. Appropriate test procedures and performance requirements for other shell configurations shall be addressed in the individual detail sheet requirements.

1.2.1 Design Considerations

Connectors are capable of satisfactory performance during and after, as applicable, when subjected to the following environmental conditions:

1.2.1.1 Temperature

Connectors are class dependent: -65 to +150 °C, +175 °C, or +200 °C (see 1.3.1c).

1.2.1.2 Vibration

See 3.18

- a. Random of 41.7 g rms: At rated high temperature with simulated accessory load.
- b. Random of 49.5 g rms: At ambient temperature.
- c. Sine: 60 g rms: With temperature cycling and simulated accessory load.

1.2.1.3 Altitude

Altitudes from sea level to 100 000 feet (8 torr) (see 3.11).

1.2.1.4 Shock

In accordance with EIA-364-27 (see 3.19).

1.2.1.5 Humidity

Humid conditions up to 98% relative humidity including condensation (see 3.26).

1.2.1.6 Corrosion

Exposure to salt-laden atmosphere (see 3.15).

1.2.1.7 Thermal Shock

Temperature cycling (see 3.7).

1.2.1.8 Immersion

Immersion in jet fuel, lubrication oil, liquid coolant, hydraulic fluid, gasoline, cleaning compound, defrosting fluid, and solvents (see 3.30).

1.2.1.9 EMI Shielding

EMI shielding effectiveness: 100 MHz to 10 GHz (see 3.28).

1.3 Classification

1.3.1 Connectors

Connectors specified are designed for use with termini as specified in MIL-PRF-29504 or in the individual slash sheet and shall meet the clip-to-clip dimensions specified on the individual slash sheet.

Connectors fabricated to this specification are classified as follows:

a. Series:

Series 1 - AS5590/1, Connector, Fiber Optic, Circular, Environment Resistant, Removable Termini/Contacts Triple Start, Self-locking Threaded Coupling

Series 2 - AS5590/2, Connector, Fiber Optic, Circular, Environment Resistant, Removable Flush Termini with Guide Pins, Triple Start, Self-locking Threaded Coupling

b. Types:

00 - Receptacle, square flange, wall mounting, front and rear

01 - Receptacle, in-line

02 - Receptacle, square flange, box mounting

04 - Receptacle, jam nut

06 - Plug, straight, shell-to-shell bottoming with ground fingers for additional shielding

08 - Plug, straight, shell-to-shell bottoming

09 - Plug, straight, lanyard release

c. Classes and temperature ranges:

A - Olive drab cadmium plate, conductive, composite material, -65 to +175 °C

B - Electroless nickel plate, conductive, composite material, -65 to +200 °C

D - Olive drab cadmium plate, conductive, aluminum alloy, -65 to +175 °C

E - Electroless nickel plate, conductive, aluminum alloy, -65 to +200 °C

F - Electroless nickel plate, space grade, conductive, aluminum alloy, -65 to +200 °C

G - Electrodeposited nickel, conductive, corrosion resistant steel, -65 to +200 °C

H - Passivated, conductive, corrosion resistant steel, -65 to +200 °C

J - Olive drab zinc nickel plate, cadmium free, conductive, composite material, -65 to +175 °C

K - Olive drab zinc nickel plate, cadmium free, conductive, aluminum alloy, -65 to +175 °C

L - Nickel fluorocarbon polymer, conductive, composite material, -65 to +175 °C

M - Nickel fluorocarbon polymer, conductive, aluminum alloy, -65 to +175 °C

N - Pure dense electrodeposited aluminum, conductive, composite material, -65 to +175 °C

P - Pure dense electrodeposited aluminum, conductive, aluminum alloy, -65 to +175 °C

Z - Zinc nickel, black, conductive, aluminum alloy, -65 to +175 °C

2. REFERENCES

2.1 Applicable Documents

The following documents may or may not be applicable to all slash sheets and the body of this document. The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of the other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 SAE International Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

AS3582	Packing, Preformed - O-Ring Seal, AMS3304
AIR4567	Composite Electrical Connectors
AIR4789	Aerospace Information Report on Evaluating Corrosion Testing of Electrical Connectors and Accessories for the Purpose of Qualification
AS9100	Quality Management Systems - Requirements for Aviation, Space and Defense Organizations
AS39029	Contacts, Electrical Connector, General Specification For
AS85049	Connector Accessories, Electrical, General Specification For
AS85049/138	Connector Accessories, Electrical, Cap, Dust, Plastic, Category 9
AMS-QQ-P-416	Plating, Cadmium (Electrodeposited)
AMS-QQ-N-290	Nickel Plating (Electrodeposited)

2.1.2 U.S. Government Publications

Available from DLA Document Services, Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6396, <http://quicksearch.dla.mil/>.

MIL-DTL-17	Cables, Radio Frequency, Flexible and Semi-rigid, General Specification For
MIL-DTL-5624	Turbine Fuel, Aviation, Grades JP4 and JP5, JP8ST
MIL-S-7742	Screw Threads, Standard, Optimum Selected Series, General Specification For
MIL-PRF-29504	Termini, Fiber Optic Connectors
MIL-DTL-38999	Connectors, Electrical, Circular
MIL-A-46146	Adhesive Sealants, Silicone, RTV, Non-Corrosive (for use with sensitive equipment)
MIL-DTL-55330	Connectors, Preparation for Delivery of
MIL-I-81969	Installation and Removal Tools, Connector, Electrical, General Specification For
MIL-DTL-83723	Connector, Electrical, Circular

MIL-DTL-83488	Coating, Aluminum, High Purity
MIL-PRF-49291	Fiber, Optical
MIL-PRF-85045	Cables, Fiber Optic, (Metric), General Specification For
MIL-STD-202	Test Methods for Electronic and Electrical Component Parts
MIL-STD-810	Environmental Engineering Considerations and Laboratory Tests
MIL-STD-889	Dissimilar Metals
MIL-STD-1285	Marking of Electrical and Electronic Parts
MIL-STD-1373	Screw Thread, Modified, 60 Degree, Stub, Double
MIL-STD-1560	Insert Arrangement, MIL-DTL-38999
MS27488	Plug, End Seal, Electrical Connector
NASA Reference Publication 1124	Outgassing Data for Selecting Spacecraft Materials

2.1.2.1 Federal Standards

Available from DLA Document Services, Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6396, <http://quicksearch.dla.mil/>.

FED-STD-H28	Screw Thread Standards for Federal Services
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2.1.3 Non-Government Publications

The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the document, which are DoD adopted, are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

2.1.3.1 ECIA Publications

Available from Electronic Components Industry Association, 1111 Alderman Drive, Suite 400, Alpharetta, GA 30005, Tel: 678-393-9990, www.eciaonline.org.

EIA RS-359	Standard Colors for Color Identification and Coding (ANSI C-83.1-1973)
EIA364	Connector Test Method Standards
EIA 364-03	Altitude Immersion Test Procedure for Electrical Connectors
EIA 364-10	Fluid Immersion Test Procedure for Electrical Connectors
EIA 364-14	Ozone Exposure Test Procedure for Electrical Connectors
EIA 364-24	Maintenance Aging Test Procedure for Electrical Connectors
EIA 364-26	Salt Spray Test Procedure for Electrical Connectors, Contacts and Sockets

EIA 364-27	Mechanical Shock (Specified Pulse) Test Procedure for Electrical Connectors
EIA 364-28	Vibration Test Procedure for Electrical Connectors and Sockets
EIA 364-29	Contact Retention Test Procedure for Electrical Connectors
EIA 364-31	Humidity Test Procedure for Electrical Connectors and Sockets
EIA 364-32	Thermal Shock (Temperature Cycling) Test Procedure for Electrical Connectors and Sockets
EIA 364-35	Insert Retention Test Procedure for Electrical Connectors
EIA 364-42	Impact Test Procedure for Electrical Connectors
EIA 364-54	Magnetic Permeability Test Procedure for Electrical Connectors, Contacts and Sockets
EIA 364-66	EMI Shielding Effectiveness Test Procedure for Electrical Connectors
EIA 364-83	Shell-to-Shell and Shell-to-Bulkhead Resistance Test Procedure for Electrical Connectors
TIA/EIA 455-13	Visual and Mechanical Inspection of Fiber, Cable, Connectors and/or Other Fiber Optic Devices
TIA/EIA 455-20	Measurement of Change in Optical Transmittance
TIA/EIA 455-21	Mating Durability of Fiber Optic Interconnecting Devices
TIA/EIA 455-32	Fiber Optic Circuit Discontinuities
TIA/EIA 455-34	Interconnection Device Insertion Loss Test
TIA/EIA 455-42	Optical Crosstalk in Fiber Optic Components
TIA/EIA 455-43	Output Near-Field Radiation Pattern Measurement of Optical Waveguide Fibers
TIA/EIA 455-47	Output Far Field Radiation Pattern Measurement
TIA/EIA 455-107	Return Loss for Fiber Optic Components
TIA/EIA 455-171	Attenuation by Substitution Measurement for Short-Length Multi-Mode Graded-Index and Single-Mode Optical Fiber Cable Assemblies

2.1.3.2 ISO Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

AFNOR NF ISO 68-1	ISO General Purpose Screw Threads, Basic Profile, Part 1: Metric Screw Threads.
AFNOR NF ISO 261	ISO General Purpose Metric Screw Threads, General Plan.
AFNOR NF ISO 262	ISO General Purpose Metric Screw Threads, Selected Sizes for Screws, Bolts and Nuts.

- AFNOR NF ISO 965 Part 1 - ISO General Purpose Metric Screw Threads, Tolerances, Principals and Basic Data
- Part 2 - ISO General Purpose Metric Screw Threads, Tolerances, Limits of Sizes for Medium Quality Commercial Bolt and Nut threads 1.6 to 39mm
- Part 3 - ISO General Purpose Metric Screw Threads, Tolerances and Deviations for Constructional Threads 1.6 to 355mm
- ISO 10012-1 Calibration System Requirements

2.1.3.3 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

- ASTM B733-90 Standard Specification for Autocatalytic (Electroless) Nickel-Phosphorus Coatings on Metal
- ASTM B841-94 Electrodeposited Coatings of Zinc Nickel Alloy Deposits
- ASTM D570-81 Plastic, Water Absorption
- ASTM E595-84 Materials for Outgassing in a Vacuum Environment, Total Mass Loss and Collected Volatile Condensable, Standard Test Method for

2.1.3.4 ANSI Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

- ANSI Y14.5 Dimensioning and Tolerancing

3. REQUIREMENTS

3.1 Slash Sheet Form/Specification Sheets

The individual item requirements shall be as specified herein and in accordance with applicable slash sheet form or specification sheets and this specification. In the event of conflict between this specification and the slash sheet, the slash sheet shall govern.

3.2 Qualification

Fiber optic connectors and accessories furnished under this specification shall be products that are qualified for listing on the applicable qualified products list at the time for opening of bids.

3.2.1 Reliability

The contractors reliability program for assembled connectors and assembly procedures shall meet the requirements of AS9100 (see 4.1.3) with the exception that the failure reporting period shall be 12 months in lieu of 6 months.

3.3 Materials

3.3.1 Metals

Metals shall be of a corrosion resistant type or shall be plated or treated to resist corrosion.

3.3.1.1 Dissimilar Metals and Compatible Couples

When dissimilar metals are used in intimate contact with each other, protection against galvanic corrosion shall be provided. The use of dissimilar metals in termini, which tend toward active galvanic corrosion (particularly brass, copper or steel used in contact with aluminum or aluminum alloy) is not acceptable. However, metal plating or dissimilar base metals to provide similar or suitable abutting surfaces is permitted. The use of dissimilar metals separated by a suitable insulating material is also permitted. Dissimilar metals and compatible couples are defined in requirement 16 of MIL-STD-889.

3.3.2 Components

Materials for specific components of the connector shall be as follows:

3.3.2.1 Class A, B, J, L, and N (Composite Connectors)

- a. Shell, coupling, and jam nut - Corrosion resistant, high performance resins with or without filler materials. The resins must be defined by specifications listed in the DODISS, published by professional materials associations, or as described in AIR4567.
- b. Insert - Reinforced epoxy resin or other suitable rigid material.
- c. Spring fingers - Heat treated beryllium copper or corrosion resistant steel. Spring fingers are not required for unplated composite connectors.
- d. Filler compound - RTV silicone in accordance with MIL-A-46146, or equivalent.
- e. Gasket, grommet and interfacial seal - Silicone or fluorosilicone elastomer.

3.3.2.2 Class D, E, F, and K (Aluminum Connectors)

- a. Shell - Impact extruded or machined aluminum alloy.
- b. Coupling and jam nut - Machined aluminum alloy.
- c. Insert - Reinforced epoxy resin or other suitable rigid material.
- d. Spring fingers - Heat treated beryllium copper or corrosion resistant steel.
- e. Filler compound - RTV silicone in accordance with MIL-A-46146 or equivalent.
- f. Gaskets, grommet and interfacial seals - Silicone or fluorosilicone elastomer.

3.3.2.3 Class G and H Environment Resisting (Stainless Steel Connectors)

- a. Shell - Corrosion resistant steel
- b. Coupling, jam nut - Corrosion resistant steel
- c. Insert - Reinforced epoxy resin or other suitable rigid dielectric material.
- d. Spring fingers - Heat treated beryllium copper or corrosion resistant steel.
- e. Filler compound - RTV silicone in accordance with MIL-A-46146 or equivalent.
- f. Gasket, grommet and interfacial seal - Silicone or fluorosilicone elastomer.

3.3.3 Fungus Resistance (All Classes)

Materials used in the construction of these connectors shall be fungus inert (see 4.1.4).

3.3.4 Magnetic Permeability

The relative permeability of the terminated, assembled and fully mated connector assembly shall be less than 2.0 μ when measured in accordance with 4.6.33.

3.4 Design and Construction

Connectors and accessories shall be designed and constructed to withstand normal handling incident to installation and maintenance in service. Connector intermateability control dimensions shall be as specified on individual slash sheets. Connector accessory interface dimensions shall be as specified on individual slash sheets. Recommended panel cutout dimensions are shown on individual slash sheets. Dimensioning and tolerancing shall be in accordance with ANSI Y14.5M.

3.4.1 Fiber Optic Termini

Terminus shall be removable as specified.

3.4.1.1 Indirect Shipment of Fiber Optic Termini

Connectors are supplied less termini.

3.4.1.2 Removable Fiber Optic Termini

Removable termini may be used with all environment resisting classes of connectors. Termini shall be qualified to the detail specification sheets of MIL-PRF-29504, or as defined in the slash sheets.

3.4.1.3 Fiber Optic Termini Arrangement

3.4.1.4 Terminus arrangements shall be in accordance with connector slash sheets. AS5590/1 inserts; 15-15, 15-97, 17-99, 19-28, 19-30, 21-39, 25-4, 25-20, 25-24, 25-43, 25-46, and 25-90 are intended for a combination of electrical contacts and fiber optic termini.

3.4.1.5 Fiber Optic Termini Insertion/Removal Tools

For proper terminus insertion and removal tools, reference MIL-PRF-29504 or appropriate terminus slash sheet.

3.4.2 Electrical Contacts

3.4.2.1 Indirect Shipment of Contacts

Connectors may be specified without electrical contacts.

3.4.2.2 Crimp Removable Contacts

Crimp removable contacts may be used with all environment resisting classes of connectors. Crimp contacts shall be qualified products in accordance with AS39029 (see 6.2). The quantity of crimp contacts to be supplied with each connector unit package shall consist of a full complement of contacts plus one spare contact for each size used in the arrangement utilizing 26 contacts or less. For arrangements utilizing more than 26 contacts, two spare contacts of each size used in the arrangement shall be supplied. Spare coax and twinax contacts are not required.

3.4.2.2.1 Contact Styles

1. Contact designators for connectors using standard contact arrangements as specified in MIL-STD-1560 are as follows:

P - Pin - 500-cycle contact

S - Socket - 500-cycle contact

H - Pin - 1500-cycle contact

J - Socket - 1500-cycle contact

C - Pin - Feedthrough

D - Socket - Feedthrough

R - Pin - Rhodium plating

M - Socket - Rhodium plating

G - Pin - Heavy gold plating

U - Socket - Heavy gold plating

The P, S, H, J, X, Z, C, D R, M, G, and U designators are used to indicate that connectors will be supplied with a full complement of the applicable standard contacts as specified in MIL-STD-1560. These designators are part of the connector Part or Identifying Number (PIN) and shall be marked on the connectors. Contacts shall be obtained from a qualified AS39029 supplier.

2. Contact designators for connectors supplied without contacts that are for use with separately sourced military specification contacts or non-standard contact complements as specified in MIL-STD-1560 are as follows:

A - Pin contact insert

B - Socket contact insert

The A and B designators are used to indicate that the connectors will be used with other than standard contacts as specified in MIL-STD-1560 (example: shielded, coaxial thermocouple, fiber optic). The A and B designators are part of the connector PIN and shall be marked on the connectors.

When A and B designators are used, standard contacts shall not be supplied with the connectors. The contacts that will be used with the connectors must be specified separately (see 3.4.2.1, 3.36, and 6.1). Note: If contacts other than standard power contacts are used, then the connectors may not meet the requirements stated herein.

3.4.2.2.2 Contact Arrangement

Contact arrangements shall be in accordance with MIL-STD-1560 or the individual slash sheet. The engaging end of the pin contact in assembled connectors shall be located within 0.024 inch (0.61 mm) of true position and the engaging end of socket contacts in assembled connectors shall be located within 0.015 inch (0.38 mm) of true position. Test voltages for service ratings shall be as specified in Table 1.

TABLE 1 - TEST VOLTAGES, AC rms, 60 Hz

Altitude	Service Rating M		Service Rating N		Service Rating I		Service Rating II	
	Mated	Unmated	Mated	Unmated	Mated	Unmated	Mated	Unmated
Sea level	1300	1300	1000	1000	1800	1800	2300	2300
50 000 feet	800	550	600	400	1000	600	1000	800
70 000 feet	800	350	600	260	1000	400	1000	500
100 000 feet	800	200	600	200	1000	200	1000	200

3.4.2.2.3 Installing and Removal Tools

For connectors with electrical contacts, both MIL-I-81969/8 and MIL-I-81969/14 tools shall be utilized to properly assemble and disassemble the pin and socket contacts into their connector inserts. One MIL-I-81969/14 tool for each contact size shall be enclosed in the unit package. For indirect shipments, connectors may be specified without installation and removal tools (see 6.2).

3.4.3 Insert Design

3.4.3.1 Environment Resisting Classes

The entire fiber cable sealing or cable supporting member of the environment resisting assemblies shall be essentially one integral part, designed to provide suitable sealing and support (except box mounted connectors) around the fiber cable and to be non-removable. The insert may be one piece or no more than two pieces bonded so as to form essentially one integral piece, or the insert may be of two-piece design where the front half of the insert is removable and captivates the terminus alignment sleeve. The design shall be such as to permit the removal and replacement of individual termini into their connector inserts with installation/removal tools. The termini locking device shall be contained in the rigid insert and shall so retain the terminus as to meet the termini retention requirements of this specification. Inserts shall be secured to prevent rotation. All pin termini inserts shall have a resilient interface seal bonded to the front face in accordance with the applicable standards. Socket entry holes and pin "donut" rings shall conform to the requirements in the detail specification sheets.

3.4.4 Sealing

3.4.4.1 Fiber Cable Sealing (Except Box Mount Connectors)

Environment resisting assemblies shall be designed to meet the environmental requirements of this specification using fiber cable of outer diameter within the applicable range as shown in Table 2. Connectors shall meet the requirements specified when:

- A full complement of fiber optic cable of the applicable minimum or maximum diameter is installed.
- Any combination of fiber optic cable diameters within the extremes of (a) above are used.

TABLE 2 - OUTER DIAMETER OF FIBER CABLE

Finished Fiber Cable Outside Diameter				
Terminus Size	Minimum		Maximum	
	Inches	mm	Inches	mm
16	0.065	1.65	0.109	2.77

3.4.4.2 Electrical Cable Sealing

Not applicable to box mount connectors. Environment resisting assemblies shall be designed to meet the environmental requirements of this specification using wire of outer diameter within the applicable range as shown in Table 3.

TABLE 3 - WIRE SIZES AND DIAMETERS

Contact Size	Wire Size (AWG)	Finished Wire Outside Dimensions			
		Minimum		Maximum	
		Inches	mm	Inches	mm
22D	28, 26, 24, 22	0.030	0.76	0.054	1.37
22M <u>1/</u>	28, 26, 24	0.030	0.76	0.050	1.27
22 <u>1/</u>	26, 24, 22	0.034	0.86	0.060	1.52
20	24, 22, 20	0.040	1.02	0.083	2.11
16	20, 18, 16	0.065	1.65	0.109	2.77
12	14, 12	0.097	2.46	0.142	3.61
10	10	0.135	3.42	0.162	4.12
8 coax	M17/95-RG180 <u>2/</u>	0.135	3.43	0.155	3.94
8 twinax	M17/176-00002 <u>3/</u>	0.124	3.15	0.134	3.40

1/ Inactive for new design.

2/ MIL-DTL-17.

3/ The applicable insert arrangements are 19-18, 21-75, 9-1, 17-2, 25-7, 25-8, 25-20, 25-46, and 25-90.

NOTE: Connectors shall meet the requirements specified when:

- a. A full complement of wire of the applicable minimum or maximum insulation diameter is installed.
- b. Any combination of wire diameters within the extremes of (a), above are used.

3.4.4.3 Environment Resisting Classes

The entire insert and wire sealing or wire supporting member of the environment resisting assemblies shall be essentially one integral part, configured to provide suitable sealing and support (except box mount connectors) around the wires and to be non-removable. The rigid dielectric shall be one molded piece or no more than two pieces bonded so as to form essentially one integral piece. The configuration shall be such as to permit the removal and replacement of individual contacts into their connector inserts with AS81969 installation/removal tools per the detail specification sheet. The contact locking device shall be contained in the rigid dielectric insert and shall so retain the contacts as to meet the contact retention requirements of this specification. Inserts shall be secured to prevent rotation.

3.4.4.4 Grommet Sealing Plugs

Except for box mount receptacles and as otherwise specified (see 3.1), the grommet of environment resisting connectors shall be designed to accept sealing plugs in accordance with MS27488 in lieu of cable where un-terminated termini/contacts are employed.

3.4.4.5 Mating Seal

Unless otherwise specified in the slash sheet (see 3.1), plugs and receptacles with pin inserts shall have a resilient face with individual pin barriers. The pin barrier projections shall seal in their respective lead-in chamfers of the hard face socket insert. The resilient interfacial seal shall provide individual termini/contact seals in the mated condition. The receptacles shall be provided with a peripheral seal.

3.4.4.6 Dust Caps

AS85049/138 dust caps shall be placed on the mating end of each connector. For connectors with spring fingers, dust caps must be assembled externally over the coupling ring.

3.4.5 Shell

Shells, including mounting flanges, shall be of one-piece construction and shall be designed to maintain their cavity locations in one position, both axially and with respect to rotation, by mechanical means. Adhesive may be used as a supplementary retention means for environment resisting connectors. Each plug and receptacle connector shall have at least two color bands in accordance with EIA RS-359, one indicating the terminus retention system (black for front release and blue for rear release) and one violet indicating "Fiber Optic" connector. Both color bands shall be located so that they are readily visible to any person servicing a mounted connector.

3.4.5.1 Spring Fingers

Spring fingers shall be designed to make contact with the mating shell without interfering with proper engagement. The springs shall be retained about the shell periphery.

3.4.5.2 Jam Nut Mounting Receptacles

Jam nut mounting receptacles shall be provided with a mounting nut with provisions for locking and an O-ring in accordance with AS3582.

3.4.6 Screw Threads

Screw threads shall conform to FED-STD-H28, MIL-S-7742, MIL-STD-1373, ISO R68-1973, AFNOR NF ISO 68-1, AFNOR NF ISO 261, AFNOR NF ISO 262, and AFNOR NF ISO 965 as applicable. MIL-STD-1373 should be used as reference for gauge design on triple start threads. Threads shall be checked using ring or plug gauges. Slight out-of-round condition beyond the specified tolerance is acceptable if threads can accept the gauges without force.

3.4.7 Coupling

Connectors shall be coupled to counterpart connectors and the mechanism shall include a means of maintaining the mated connector in full engagement. For circular connectors, the coupling ring shall be knurled or fluted to facilitate coupling, and shall be captivated. The couplings of all circular connectors shall have two color bands in accordance with EIA RS-359, one color band indicating the terminus retention system (black for front release and blue for rear release) and one violet color band indicating "Fiber Optic" connector.

3.4.7.1 Ease of Coupling

Counterpart connectors of any arrangement shall be capable of being fully mated and un-mated in a normal and accessible location without the use of tools.

3.4.7.2 Locking Circular Connectors

Complete coupling shall be accomplished by approximately 360 degree clockwise rotation of the coupling ring and shall provide shell-to-shell, metal-to-metal bottoming. An anti-decoupling device shall be provided to maintain complete coupling. A red band shall be located on the receptacle so as to be visible when unmated and fully covered when completely mated.

3.4.7.2.1 Polarization of Connector Shells

Polarization of circular connector shells shall be accomplished by means of integral keys and suitable matching keyways on the counterpart. Polarization shall be accomplished before initial engagement of the coupling ring. During axial engagement, termini/contacts shall not touch the opposing insert face until polarization has been achieved.

3.4.7.2.2 Alternates

Shells shall also be supplied with the keys or keyways rotated from normal position as indicated in figures in each slash sheet.

3.4.7.3 Lubrication

Lubricant is not recommended for connectors utilizing fiber optic termini.

3.4.7.4 Pin to Pin Mating Prevention

Connectors shall be designed such that pin-to-pin termini/contacts, physical mating, is not possible in the event that a plug with pin termini/contacts is inadvertently mated with a receptacle with pin termini/contacts.

3.4.8 Cavity Fill (Environment Resisting Classes)

If the rear grommet design does not allow for intimate contact between it and the complete inner perimeter of the shell, any resulting cavity between the insert and the shell shall be filled with RTV silicone conforming to MIL-A-46146, or equivalent.

3.4.9 Plating

- A - Olive drab cadmium plate, composite material, in accordance with AMS-QQ-P-416 over a suitable underplate to withstand 2000-hour salt spray test. Resulting finish shall be conductive.
- B - Electrically conductive electroless nickel plating, composite material, to withstand 2000-hour salt spray test. Use of a suitable underplate is permissible.
- D - Olive drab cadmium plate in accordance with AMS-QQ-P-416 over a suitable underplate to withstand 500-hour salt spray test. Resulting finish shall be conductive.
- E - Electrically conductive electroless nickel plating conforming to ASTM B733-90, Sc2, Type I, Class 5. Finish shall withstand 48-hour salt spray test. Use of a suitable underplate is permissible.
- F - Same as 'E' except space grade conforming to ASTM B733-90, Sc4, Type I, Class 5, matte finish.
- G - Electrodeposited nickel in accordance with AMS-QQ-N-290, Class 2, 0.0001 to 0.0002 inch (0.003 to 0.005 mm) thickness, 48 hour salt spray test.
- H - Electrically conductive corrosion resistant steel, Passivated, 500 hour salt spray test.
- J - Olive drab, cadmium free, zinc nickel plate, composite material, in accordance with ASTM B841-94 to withstand 2000-hour salt spray test. Use of a suitable underplate is permissible. Resulting finish shall be electrically conductive.
- K - Olive drab, cadmium free, zinc nickel plate, aluminum alloy, in accordance with ASTM B841-94 to withstand 500-hour salt spray test. Use of a suitable underplate is permissible. Resulting finish shall be electrically conductive.
- L - Nickel fluorocarbon polymer, conductive, composite material, 1000 hour salt spray test. Use of a suitable underplate is permissible. Resulting finish shall be electrically conductive.
- M - Nickel fluorocarbon polymer, conductive, aluminum alloy, 500 hour salt spray test. Use of a suitable underplate is permissible. Resulting finish shall be electrically conductive.
- N - Pure dense electrodeposited aluminum in accordance with MIL-DTL-83488, Type II, composite material, 1000 hour salt spray test.

P - Pure dense electrodeposited aluminum in accordance with MIL-DTL-83488, Type II, aluminum alloy, 500 hour salt spray test.

Z - Zinc nickel in accordance with ASTM B841, type D (black), over a suitable underplate to withstand 500 hours of dynamic salt spray testing. Color shall be nonreflective.

3.4.9.1 Shell Spring Fingers

Shell spring fingers shall be suitably protected to prevent corrosion.

3.4.9.1.1 Coupling (Classes A, B, and J)

The coupling of Classes A, B, and J may be unplated.

3.4.9.1.2 Jam Nut

Jam nut of Classes A, B, and J may be unplated.

3.5 Interchangeability

All connectors having the same part number shall be completely interchangeable with each other with respect to installation and performance.

3.6 Maintenance Aging

When tested as specified in 4.6.3, the termini/contact installation and removal forces shall not exceed the requirements of Tables 4 and 5.

TABLE 4 - MAINTENANCE AGING REQUIREMENTS

Terminus Size	Maximum Installation and Removal Forces	
	Pounds	Newtons
16	20	89

TABLE 5 - ELECTRICAL CONTACT INSTALLING AND REMOVAL FORCES.

Contact	Installing and Removal Forces	
	Pounds	Newtons
22D	10	44
22M <u>1/</u>	10	44
22 <u>1/</u>	10	44
20	20	89
16	20	89
12	30	133
10	35	156
8 Triax	35	156

1/ Inactive for new design.

3.7 Temperature Cycling

When tested as specified in 4.6.4, there shall be no blistering, peeling or separation of plating or other damage detrimental to the operation of the connector.

3.8 Coupling Torque

When tested as specified in 4.6.5, the coupling torque for mating and un-mating of the counterpart connectors and protective covers shall meet the requirements of Table 6.

TABLE 6 - COUPLING TORQUE

Shell Size	Maximum Engagement and Disengagement		Minimum Disengagement	
	Inch Pound	Newton Meters	Inch Pound	Newton Meters
A,08,09	8	0.9	2	0.2
B,10,11	12	1.4	2	0.2
C,12,13	16	1.8	2	0.2
D,14,15	20	2.3	3	0.3
E,16,17	24	2.7	4	0.4
F,18,19	28	3.2	5	0.6
G,20,21	32	3.6	6	0.7
H,22,23	36	4.1	7	0.8
J,24,25	40	4.6	7	0.8

3.9 Durability

When tested as specified in 4.6.6, the connectors shall show no defects detrimental to the operation of the connectors and shall meet the subsequent test requirements (see 4.4.4).

3.10 Altitude Immersion

When tested as specified in 4.6.8, the mated connector pair shall be optically tested per 3.43.1.

3.11 Insulation Resistance for Electrical Contacts

When tested as specified in 4.6.9, the insulation resistance between any pair of contacts and between any contact and the shell shall be greater than 5000 MΩ. Insulation resistance after altitude immersion shall be 1000 MΩ minimum. Insulation resistance after humidity shall be 100 MΩ minimum.

3.12 Dielectric Withstanding Voltage for Electrical Contacts

When tested as specified in 4.6.10, the maximum leakage current shall be 2 mA, and there shall be no evidence of electric breakdown or flashover.

3.13 Insert Retention

When tested as specified in 4.6.11, unmated connectors shall retain their cavity locations in their proper shell location and there shall be no evidence of cracking, breaking, separation from the shell, or loosening of parts.

3.14 Salt Spray (Corrosion)

When tested in 4.6.12, unmated connectors shall show no exposure of base material due to corrosion, which adversely affects performance (see AIR4789). For class A and J (initial qualification) after 500 hours of salt spray, inspect connector for plating wear (inspection method optional). No underplate or base material shall be exposed. Return to chamber for completion of the 2000 hours.

3.15 Electrical Engagement

When tested as specified in 4.6.13, wired, mated connectors with electrical contacts shall provide a minimum of 0.050 inch (1.27 mm) electrical engagement.

3.16 Accessory Thread Strength

When tested as specified in 4.6.19, the accessory threads and portion of the connector that accepts cable clamps and adapters shall be capable of withstanding the torque listed in Table 7.

TABLE 7 - ACCESSORY THREAD STRENGTH

Shell Size	Accessory Thread Torque	
	Inch Pound	Newton Meters
A,08,09	45 / 55	5.1 / 6.2
B,10,11	45 / 55	5.1 / 6.2
C,12,13	45 / 55	5.1 / 6.2
D,14,15	45 / 55	5.1 / 6.2
E,16,17	45 / 55	5.1 / 6.2
F,18,19	45 / 55	5.1 / 6.2
G,20,21	95 / 105	10.7 / 11.9
H,22,23	95 / 105	10.7 / 11.9
J,24,25	95 / 105	10.7 / 11.9

3.17 Vibration (Qualification Only)

When tested as specified in 4.6.20, there shall be no optical discontinuity per 3.43.2. Also there shall be no dis-engagement of the mated connectors, backing off of the coupling mechanism, evidence of cracking, breaking, or loosening of parts.

3.18 Shock

When tested as specified in 4.6.21, there shall be no optical discontinuity per 3.43.2. Also there shall be no dis-engagement of the mated connectors, evidence of cracking, breaking, or loosening of parts.

3.19 Shell to Shell Conductivity

When tested as specified in 4.6.29, the probes shall not puncture or otherwise damage the connector finish. The maximum measured potential drop across assemblies shall be as follows:

- Class A, B, and J - 3.0 mV initial, 5.0 mV after conditioning.
- Class D and K - 2.5 mV.