INCH-POUND

MIL-PRF-64266
25 November 2008

PERFORMANCE SPECIFICATION

CONNECTORS, FIBER OPTIC, CIRCULAR, PLUG AND RECEPTACLE STYLE, MULTIPLE REMOVABLE GENDERLESS TERMINI, ENVIRONMENT RESISTING GENERAL SPECIFICATION FOR

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

1. SCOPE

1.1 Scope. This specification covers the performance requirements for circular, plug and receptacle style, multiple removable genderless termini, fiber optic connectors that are for Department of Defense applications and that are compatible with multiple transmission element cables. Fiber optic connectors specified herein cover a family of general purpose, interconnection hardware providing a variety of compatible optical coupling arrangements. Connector parts specified within this specification include connector shells, connector inserts, connector backshells, connector backshell accessories, and connector dust caps.

1.1.1 Description. All connector styles are designed to assure proper orientation of the mating halves prior to mating. All connectors provide engagement between mated shells prior to terminus engagement and have the termini so located as to be protected from handling damage.

1.2 Classification. Plug and receptacle styles, as specified (see 3.1), must permit straight, wall (panel) mounted, jamnut mounted, right angle and other connector configurations as required for cable system applications.

1.2.1 Connectors. Connectors fabricated to this specification are classified as follows:

a. Classes:

A	-	Conductive plating/finish, metallic.
B	-	Conductive plating/finish, metallic (corrosion resistant).
C	-	Conductive plating/finish, non-metallic.
D	-	Non-conductive plating/finish, metallic.
E	-	Non-conductive plating/finish, non-metallic.
F	-	No plating/finish, metallic (corrosion resistant).
G	-	No plating/finish, non-metallic.

Comments, suggestions or questions on this document should be addressed to Defense Supply Center Columbus, ATTN: VAT, Post Office Box 3990, Columbus, OH 43218-3990, or emailed to FiberOpticGroup@dscc.dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at http://assist.daps.dla.mil.

b. Temperature ranges. Temperature range designations are specified in table I.

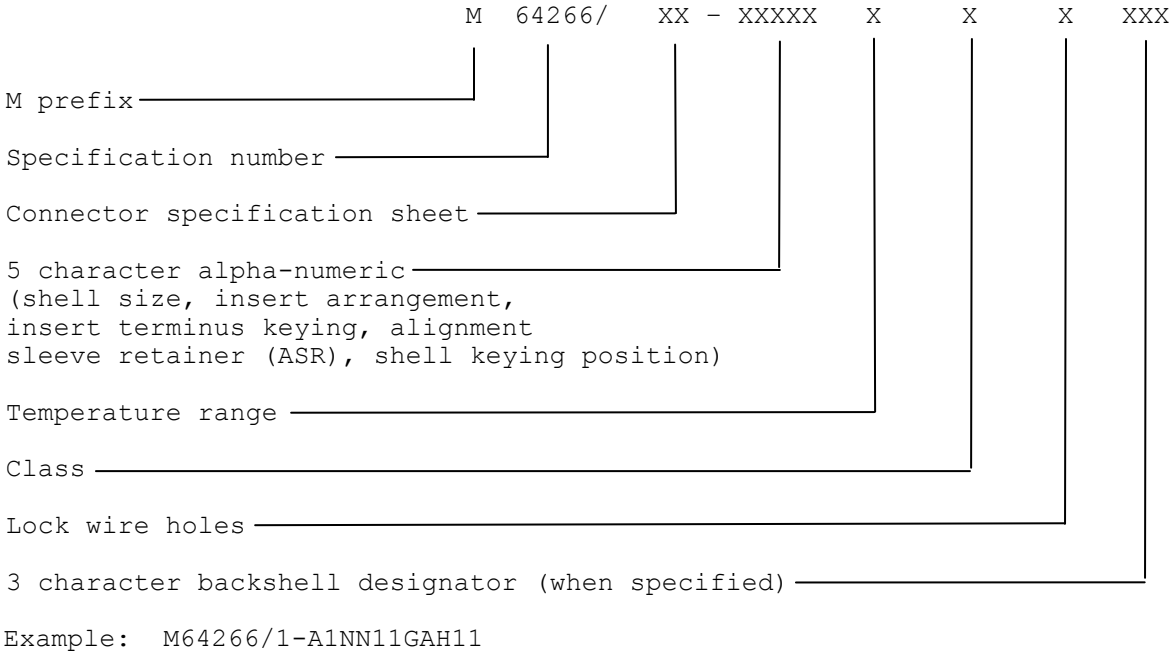
TABLE I. Temperature range designation.

Temperature range designation	Operating temperature		Non-operating temperature		Storage temperature	
	°F	°C	°F	°C	°F	°C
1	-40 to +185	-40 to +85	-40 to +185	-40 to +85	-40 to +185	-40 to +85
2	-67 to +329	-55 to +165	-40 to +185	-40 to +85	-40 to +185	-40 to +85

1.2.2 Termini. Termini are classified in accordance with MIL-PRF-29504/18 (optical terminus) and MIL-PRF-29504/19 (dummy terminus) and MIL-PRF-29504/20 (keyed optical terminus).

NOTE: Termini are not supplied with connectors acquired to this specification. When termini other than those qualified to MIL-PRF-29504 are used, the requirements stated herein may not be met.

1.3 Part or Identifying Number (PIN). PINs to be used for connectors acquired to this specification are specified as follows:



Example: M64266/1-A1NN11GAH11

2. APPLICABLE DOCUMENTS

2.1 General: The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

FEDERAL SPECIFICATIONS

TT-I-735	-	Isopropyl Alcohol.

FEDERAL STANDARDS

FED-STD-H28	-	Screw-Thread Standard for Federal Services.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-S-901	-	Shock Tests, H.I. (High-Impact) Shipboard Machinery, Equipment, And Systems, Requirements For.
MIL-PRF-16173	-	Corrosion Preventive Compound, Solvent Cutback, Cold-Application.
MIL-DTL-16884	-	Fuel, Naval Distillate.
MIL-PRF-17331	-	Lubricating Oil, Steam Turbine and Gear, Moderate Service.
MIL-PRF-17672	-	Hydraulic Fluid, Petroleum, Inhibited.
MIL-PRF-23699	-	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base, NATO Code Number O-156.
MIL-PRF-29504	-	Termini, Fiber Optic Connector, Removable, General Specification For.
MIL-PRF-29504/18	-	Termini, Fiber Optic Connector, Removable, Environment Resisting, Genderless Terminus, Rear Release, Ceramic Ferrule, 1.25 MM Ferrule, (For MIL-PRF-64266 Connectors).
MIL-PRF-29504/19	-	Termini, Fiber Optic Connector, Removable, Dummy Terminus, (For MIL-PRF-64266 Connectors).
MIL-PRF-29504/20	-	Termini, Keyed, Fiber Optic Connector, Removable, Environment Resisting, Genderless Terminus, Rear Release, Ceramic Ferrule, 1.25 MM Ferrule, (For MIL-PRF-64266 Connectors).
MIL-DTL-38999	-	Connectors, Electrical, Circular, Miniature, High Density, Quick Disconnect, (Bayonet, Threaded, and Breech Coupling), Environment Resistant, Removable Crimp and Hermetic Solder Contacts, General Specification For.
MIL-PRF-49291	-	Fiber, Optical, (Metric) General Specification For.

MIL-PRF-81309 - Corrosion Preventive Compounds, Water Displacing, Ultra-Thin Film.

MIL-DTL-83133 - Turbine Fuel, Aviation, Kerosene Type, JP-8 (NATO F-34), NATO F-35, and JP-8 + 100 (NATO F-37).

MIL-PRF-83282 - Hydraulic Fluid, Fire Resistant, Synthetic Hydrocarbon Base, Metric, NATO Code Number H-537.

MIL-PRF-85570 - Cleaning Compounds, Aircraft, Exterior.

MIL-PRF-87252 - Coolant Fluid, Hydrolytically Stable, Dielectric.

MIL-PRF-87257 - Hydraulic Fluid, Fire Resistant; Low Temperature, Synthetic Hydrocarbon Base, Aircraft and Missile.

(See supplement 1 for list of specification sheets.)

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-790 - Standard Practice for Established Reliability and High Reliability Qualified Products List (QPL) System for Electrical, Electronic, and Fiber Optic Parts

MIL-STD-1373 - Screw-Thread, Modified, 60 Degree Stub, Double.

DEPARTMENT OF DEFENSE HANDBOOKS

MIL-HDBK-454 - General Guidelines for Electronic Equipment.

(Copies of these documents are available online at http://assist.daps.dla.mil/quicksearch/ or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2.2 Other Government documents, drawing, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

NAVSEA DRAWING

8283460 - Termini, Fiber Optic, MIL-PRF-29504/18, Test Sample Configurations/Fabrication & Specific Methods/Practices.

(Copies of this document can be obtained at web site: https://fiberoptics.nswc.navy.mil.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

ASTM INTERNATIONAL

ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.

ASTM D1141	-	Standard Practice for the Preparation of Substitute Ocean Water.
ASTM D1149	-	Standard Test Methods for Rubber Deterioration-Cracking in an Ozone Controlled Environment.
ASTM D1153	-	Standard Specification for Methyl Isobutyl Ketone.
ASTM D1193	-	Standard Specification for Reagent Water.
ASTM D4814	-	Standard Specification for Automotive Spark-Ignition Engine Fuel.
ASTM G85	-	Standard Practice for Modified Salt Spray (Fog) Testing.

(Copies of these documents can be obtained online at http://www.astm.org/ or by contacting ASTM International, P.O. Box C700, 100 Barr Harbor Drive, West Conshohocken, PA, 19428-2959).

INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE)

IEEE-299	-	Standard Method for Measuring the Effectiveness of Electromagnetic Shielding Enclosures.

(Copies of these documents can be obtained online at http://www.ieee.org/ or by contacting the Institute of Electrical and Electronic Engineers (IEEE), 445 Hoes Lane, Piscataway, NJ 08854-1331).

NATIONAL CONFERENCE OF STANDARDS LABORATORIES (NCSL)

NCSL Z540.3	-	Calibration Laboratories and Measuring and Test Equipment General Requirements.

(Copies of these documents can be obtained online at http://www.ncsli.org or by contacting National Conference of Standards Laboratories, 2995 Wilderness Place, Suite 107, Boulder, CO, 80301-5404.

SAE INTERNATIONAL

SAE AMS 1424	-	Deicing/Anti-Icing Fluid, Aircraft SAE Type I.
SAE AMS 1435	-	Fluid, Generic, Deicing/Anti-Icing Runways and Taxiways.
SAE AMS 2629	-	Fluid, Jet Reference.
SAE AS-1241	-	Fire Resistant Phosphate Ester Hydraulic Fluid for Aircraft.
SAE-AS8879	-	Screw Thread – UNJ Profile, Inch Controlled Radius Root with Increased Minor Diameter.

(Copies of these documents are available online at http://www.sae.org or from the SAE World Headquarters, 400 Commonwealth Drive, Warrendale, PA 15096-0001.)

TELECOMMUNICATIONS INDUSTRY ASSOCIATION/ELECTRONIC INDUSTRIES ALLIANCE (TIA/EIA)

EIA-359	-	EIA Standard Colors for Color Identification and Coding.
EIA-364-81	-	Combustion Characteristics Test Procedure for Electrical Connector Housings, Connector Assemblies and Sockets.
EIA-364-83	-	Shell-to-Shell and Shell-to-Bulkhead Resistance Test Procedure for Electrical Connectors.
TIA/EIA-455	-	Standard Test Procedure for Fiber Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices, and Other Fiber Optic Components.
TIA/EIA-455-1	-	Cable Flexing for Fiber Optic Interconnecting Devices.
TIA/EIA-455-2	-	Impact Test Measurements for Fiber Optic Devices.
EIA/TIA-455-3	-	Procedure to Measure Temperature Cycling Effects on Optical Fibers, Optical Cable, and Other Passive Fiber Optic Components.
TIA/EIA-455-4	-	Fiber Optic Component Temperature Life Test.
TIA/EIA-455-5	-	Humidity Test Procedure for Fiber Optic Components.
TIA-455-6	-	Cable Retention Test Procedure for Fiber Optic Cable Interconnecting Devices.
TIA/EIA-455-11	-	Vibration Test Procedure for Fiber Optic Components and Cables.
TIA-455-12	-	Fluid Immersion Test for Fiber Optic Components.
TIA-455-13	-	Visual and Mechanical Inspection of Fiber Optic Components, Devices, and Assemblies.
TIA-455-14	-	Fiber Optic Shock Tests (Specified Pulse).
EIA/TIA-455-15	-	Altitude/Immersion of Fiber Optic Components.
TIA/EIA-455-16	-	Salt Spray (Corrosion) Test for Fiber Optic Components.
TIA/EIA-455-20	-	Measurement of Change in Optical Transmittance.
TIA-455-21	-	Mating Durability of Fiber Optic Interconnecting Devices.
TIA-455-26	-	Crush Resistance of Fiber Optic Cable Interconnecting Devices.
TIA/EIA-455-32	-	Fiber Optic Circuit Discontinuities.
TIA/EIA-455-34	-	Interconnection Device Insertion Loss Test.
TIA/EIA-455-35	-	Fiber Optic Component Dust (Fine Sand) Test.
TIA-455-36	-	Twist Test for Fiber Optic Connecting Devices.
EIA/TIA-455-42	-	Optical Crosstalk in Fiber Optic Components.
TIA/EIA-455-56	-	Test Method for Evaluating Fungus Resistance of Optical Fiber and Cable.
TIA/EIA-455-71	-	Procedure to Measure Temperature-Shock Effects on Fiber Optic Components.
EIA/TIA-455-98	-	Fiber Optic Cable External Freezing Test.
TIA-455-107	-	Determination of Component Reflectance or Link/System Return Loss Using a Loss Test Set.
TIA-455-189	-	Ozone Exposure Test for Fiber Optic Components.

(Copies of these documents can be obtained online at Global Engineering Documents at http:/.www.global.ihs.com.

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein (except for related specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

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

3.2 Qualification. Fiber optic connectors and accessories furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.7 and 6.3).

3.3 Materials. Materials shall be as specified herein and in the applicable specification sheets. In all cases, materials selected for use shall meet all qualification requirements as specified, and be of a type and quality to assure physical, chemical, and optical compatibility with the requirements of this specification. All materials used shall be nontoxic (see 3.3.5), non-nutrient to fungus (see 3.14.13) and manufactured to good workmanship quality (see 3.10.6). Materials chosen shall be the lightest practicable material suitable for the intended use. Materials shall not interfere with or degrade the terminus cleaning operation and shall provide 20 year service.

3.3.1 Connector parts. Connector shells shall be aluminum, composite material, or corrosion resistant (CRES) steel. Connector inserts and connectors with integral inserts (one piece shell and insert) shall be made of aluminum, a polymer material or corrosion resistant steel (CRES). Backshells, backshell accessories, and dust covers shall be aluminum, corrosion resistant (CRES) steel, or a polymer material.

3.3.2 Finish. The resultant finish on all connector parts shall be electrolytically compatible (see 3.3.7) within each class, and shall meet the requirements herein.

a. Aluminum components: The finish used for external parts shall minimize reflections and shall meet the requirements herein. The finish used for internal parts shall be corrosion resistant.

b. CRES components: Unless otherwise specified (see 3.1), all exposed corrosion resistant steel parts shall be passivated and shall be treated to minimize reflections. CRES threads shall be treated in a manner to minimize galling and cold welding with mating parts. CRES parts which may be mated to non-CRES parts shall be treated to minimize scratching or damage to mating components during mating operations.

3.3.2.1 Finish configurations. Finish configurations A though G correspond with connector class letter A through G specified in 1.2.1a herein.

A - Finish to withstand 500 hour salt spray test. Resulting finish shall be conductive.
B - Finish to withstand 500 hour salt spray test. Resulting finish shall be conductive.
C - Finish to withstand 500 hour salt spray test. Resulting finish shall be conductive.
D - Finish to withstand 500 hour salt spray test.
E - Finish to withstand 500 hour salt spray test.
F - Unplated metallic material. Base material to withstand 500 hour salt spray test.
G - Unplated composite material.

3.3.2.2 Finish color. Acceptable colors on plug shell, receptacle shell, backshell and dust cover are identified as olive drab, green, black, brown and gray in accordance with EIA-359. Colors shall be non-reflective. Additional colors shall be approved by the qualifying activity.

3.3.3 Recycled, recovered, or environmentally preferable materials. Unless otherwise specified herein, all equipment, material, and articles incorporated in the products covered by this specification shall be new and shall be fabricated using materials produced from recycled, recovered or environmentally preferable materials to the maximum extent practicable without jeopardizing the intended use, and, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs. The term "recovered materials" means materials that have been collected or recovered from solid waste and reprocessed to become a source of raw materials, as opposed to virgin raw materials. None of the above shall be interpreted to mean that the use of used or rebuilt products is allowed under this specification unless otherwise specifically specified.

3.3.4 Nonmetallic materials. Nonmetallic materials used in connector parts shall not be degraded by the use of solvents or cleaning agents, nor be degraded at the specified environmental conditions.

3.3.5 Toxic and hazardous products and formulations. Materials used in the connectors, backshells, backshell accessories, and dust covers shall not give off toxic or explosive fumes when exposed to flame. Materials used shall have no adverse effect on the health of personnel when used for its intended purpose.

3.3.6 Metals. Metals shall be corrosion resistant, or treated to be corrosion resistant. Unless otherwise specified (see 3.1), metals shall be nonmagnetic.

3.3.7 Dissimilar metals. The use of dissimilar metals in intimate contact should be avoided. When dissimilar metals are used in intimate contact with each other, protection against electrolysis and corrosion shall be provided. Conductive metallic finishes shall be electrolytically compatible with nickel. Class F connectors shall be electrolytically compatible with corrosion resistant stainless steel.

3.3.8 Sealing compounds. Sealing compounds shall not flow at the maximum specified operating temperature (see 1.2.1b) or exhibit cracking at the minimum specified operating temperature (see 1.2.1b).

3.3.9 Lubricants. Lubricants used in the construction of the connectors shall satisfy the following criteria:

a. Lubricants shall be permanent and shall not require replacement during the lifetime of the connector.

b. Lubricants shall not migrate to the optical interfaces resulting in the degradation of optical performance.

c. Lubricants shall be useful over the environmental conditions specified herein.

d. Lubricants shall not be affected by cleaning solvents.

3.3.10 Magnetic permeability. The relative permeability of the terminated, assembled and fully mated connector assembly shall be less than 2.0 mH.

3.4 Design and construction. Connector parts shall conform to appendix A, figures A-1 through A-6 specified herein, and as specified (see 3.1).

3.4.1 General. Connectors shall be designed to be compatible with optical fibers and cables as specified (see 3.1).

3.4.2 Seals. Seals shall provide environmental isolation for the optical contact junctions and connector interior parts. Grommets, O-rings, boots, gaskets, or other sealing devices, as needed by the connector design, shall accomplish their intended purpose and meet all test requirements as specified herein.

3.4.2.1 Optical junction sealing. Optical junctions shall be sealed against moisture and contamination as specified herein.

3.4.2.2 Cable sealing. Connectors shall seal the terminating cables as specified herein.

3.4.3 Interchangeability and interoperability. Connector parts shall be interchangeable and interoperable as specified in 3.4.3.1 and 3.4.3.2.

3.4.3.1 Interchangeability. All connector parts having the same military PIN shall be physically and functionally interchangeable without need for modification of such items or of the mating equipment.

3.4.3.2 Interoperability. All connectors of the same PIN shall be interoperable. Upon qualification of the first manufacturer, all subsequent manufacturers shall provide proof of interoperability with each qualified manufacturer as specified in 4.10. The connectors shall meet the requirements of 3.11.1, 3.12.3, 3.12.4 and 3.14.18 for each specified interoperability condition (see 4.10).

3.5 Connector parts.

3.5.1 Shells. The connector shells shall retain the connector insert. The plug to receptacle connections shall be environmentally and water sealed. A visual full mate indicator is required.

3.5.1.1 Plugs. Plugs shall be of the inline (straight) type as specified (see 3.1).

3.5.1.2 Receptacles. Receptacles shall be of the wall (panel) mount and jamnut types as specified (see 3.1). A visual full mate indicator shall be provided and shall be a red band that is located on the receptacle. Red color of band shall minimize reflections and maximize contrast of shell finish color. The full visual indicator shall be not visible when the plug and receptacle are completely mated. The full visual indicator shall be fully covered when completely mated and visible otherwise).

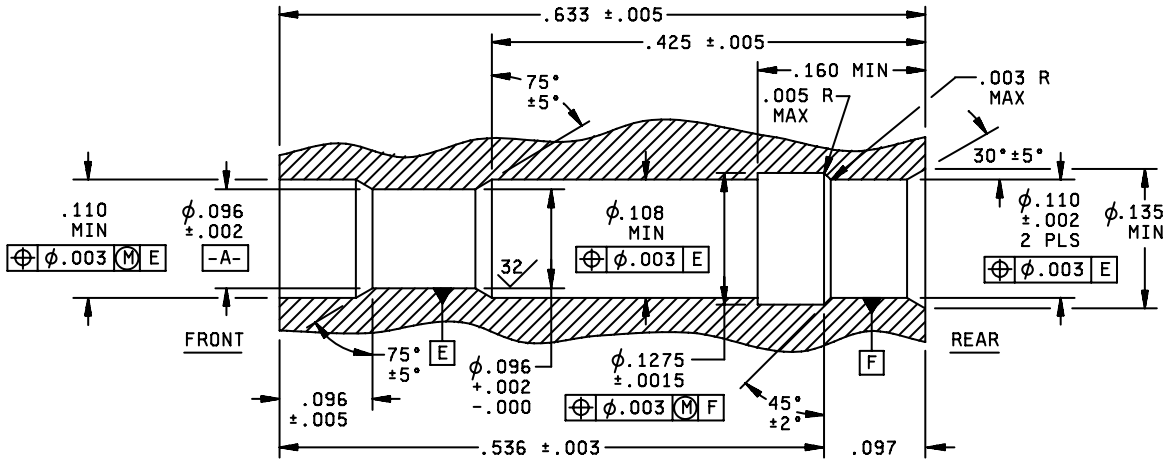
3.5.1.3 Engagement of connectors. Counterpart connectors of any arrangement and accessories shall be capable of being fully engaged and disengaged without the use of tools (except shell size 23). Overall connector engagement/alignment sequence shall provide for keying for course alignment, alignment sleeve retainer (ASR) guide pins providing finer alignment with connector inserts, termini ferrules engaging alignment sleeves, and final shell coupling and thread engagement.

3.5.1.4 Coupling mechanism. Coupling rings of the connectors shall be knurled, and designed so that plug and receptacle optical termini shall approach or recede from each other as the coupling mechanism is respectively tightened by clockwise rotation or loosened in the counterclockwise direction as viewed from the rear of the plug connector. The coupling mechanism shall be captive on the plug to mate with the receptacle shell. Coupling ring and coupling screw threads shall be in accordance with MIL-STD-1373 and as shown on figures A-4 and A-5, and as specified (see 3.1). If the coupling threads must be lubricated to meet the requirements contained herein, the lubricant shall meet all of the requirements specified herein (see 3.3.9).

3.5.1.5 Plug and receptacle shell polarization (keying). Polarization keying shall be incorporated in the shells of plugs and receptacles to assure correct alignment of the inserts before mating is permitted. The polarization shall be accomplished by integral keys and keyways (see figure A-3) in the plug and receptacles shells. The keying shall be designed to prevent physical contact of the mating optical termini, or of the termini with the insert surface of the counterpart connector until the keyways are properly aligned for engagement and coupling mechanisms are engaged.

3.5.2 Alignment sleeve retainer (ASR) (see MIL-PRF-64266/9). The alignment sleeve retainer (ASR) is an interchangeable part and defines the gender of the connector assembly. The alignment sleeves shall provide the mechanical and optical alignment with mating two termini ferrules for each ASR cavity, be made from ceramic and be captive within the alignment sleeve retainer. Installation orientation of the ASR onto the connector endface shall be unique to that endface and shall be not capable of being installed in two orientations by rotation of 180 degrees. Unless otherwise specified, the ASR shall be installed in the receptacle. The ASR shall be retained to the connector insert by means of a jackscrew. The jackscrew shall not loosen nor the ASR detach under vibration or shock. The screw head shall be flush or recessed to the ASR. The jackscrew shall push the ASR off of the termini during ASR removal. The desired functional alignment sequence of the ASR is guide pins, jackscrew, and then termini/alignment sleeves.

3.5.3 Inserts. Inserts may be either removable or non removable. Removable inserts shall be secured to prevent rotation within the connector shell. Inserts shall be such that they will not crack, chip, or break in normal service or assembly. Multiple piece inserts are permissible under the constraint that the insert retention radial strength is met after the conclusion of both group II and group III testing. The insert dimensions shall be as specified (see 3.1). The insert termini cavity configuration shall conform to the dimensions specified on figure 1. Insert to insert bottoming is required when the plug and receptacle are mated. Insert to insert bottoming shall occur through the ASR. Non-integral inserts shall seal to the connector plug or receptacle.



Inches	mm	Inches	mm
.0015	.04	.110	2.79
.002	.05	.1275	3.24
.003	.08	.135	3.43
.005	.13	.160	4.06
.096	2.44	.425	10.80
.097	2.46	.536	13.61
.108	2.74	.633	16.08

FIGURE 1. Termini cavity dimensions.

3.5.4 Termini. Removable, environment resisting fiber optic termini shall be used with these connectors for interconnecting fiber optic cables. The termini are not supplied with connectors acquired to this specification. Termini, for use with the connectors specified herein, shall be in accordance with MIL-PRF-29504/18 (optical terminus) and MIL-PRF-29504/19 (dummy terminus) and MIL PRF-29504/20 (keyed optical terminus) (see 3.1).

3.5.4.1 Number of termini, arrangement, and spacing. The insert patterns, that is, the number of termini, their arrangements and spacing shall be as specified in appendix B. Every terminus position shall accept an optical terminus, dummy terminus or when specified, keyed optical terminus.

3.5.4.2 Terminus insertion and removal methods. Optical terminus insertion shall be accomplished by inserting the terminus, using a terminus insertion tool, into the rear of the connector insert. A means for locking the terminus in place shall be provided. Optical terminus removal shall be accomplished by inserting the terminus removal tool into the rear of the connector and by withdrawing the terminus out the rear of the connector. The individual termini shall be positively retained in the connector when installed with the terminus insertion tool and shall be capable of being removed without terminus or insert damage when using the terminus removal tool. Tools shall be as specified in appendix A of NAVSEA Drawing 8283460.

3.6 Backshells and backshell accessories.

3.6.1 Backshells. Backshells shall conform to the requirements as specified (see 3.1). The backshells shall be provided with cable strain relief as specified (see 3.1). The backshells shall be free of any sharp edges or other configurations that could cause damage to optical fibers extending through them.

3.6.2 Backshell accessories. Backshell accessories shall conform to the requirements as specified (see 3.1). The backshell accessories shall be provided without cable strain relief as specified (see 3.1). The backshell accessories shall be free of any sharp edges or other configurations that could cause damage to optical fibers extending through them.

3.7 Protective caps or covers. All optical connectors (plugs and receptacles) shall be provided with throwaway caps or covers on both ends. Each cap or cover shall be free of mold release, lubricants, or any other contaminants. Cap or cover materials shall be selected to minimize the outgassing of condensable volatile materials into the optical connector.

3.8 Dust covers. Dust covers shall conform to the requirements as specified (see 3.1). The dust covers shall be free of any sharp edges or any other configurations that could cause damage to the optical termini.

3.9 Tools. Tools used to terminate connectors onto cables shall be as specified (see 3.1).

3.10 Visual and mechanical.

3.10.1 Size. When examined in accordance with 4.9.2.1, the dimensions and dimensional tolerances for the connector parts shall be as specified (see 3.1).

3.10.2 Weight. When tested in accordance with 4.9.2.2, the weight of the connector parts shall be as specified (see 3.1).

3.10.3 Identification marking (see 4.9.2.3). Identification marking shall be as specified in 3.10.3.1. Markings shall be legible and permanent. Markings shall be legible to the extent that none are missing, in whole or in part, faded, blurred, smeared, or shifted (dislodged) and shall be readily readable. Marking methods used that penetrate to connector base metal (for plated connectors) shall be readable (and show no appreciable corrosion) after salt spray. Contrast between characters and surface shall be good. Markings shall be permanent to the extent of withstanding cleaning procedures and of withstanding environmental and mechanical performance tests conducted.

3.10.3.1 Connectors, alignment sleeve retainer (ASR), backshells and dust covers. Connectors, ASR, backshells and dust covers shall be identified with markings that are permanent, clearly visible and legible. Identification marking shall include the PIN and either the manufacturer's CAGE code, name or logo. Connectors shall also be marked with a yellow band in accordance with EIA-359, or the phrase "FIBER OPTICS" as specified (see 3.1). Connector receptacles shall also be marked with a red full-mate indicator in accordance with EIA-359 as specified in appendix A, figure A-2 herein.

3.10.3.2 Inserts and alignment sleeve retainer (ASR). Marking shall correspond between mating inserts and ASR and shall be as specified in Appendix B. Raised or depressed characters shall not be used on mating faces, not to exclude laser or ink marking. Terminus locations shall be designated by identifiable characters on the front and rear faces of the insert or the insert assembly. Character position and arrangement shall assure appropriate terminus cavity identification. The ASR shall be marked. Marking on the ASR shall be restricted to the circular surface (side) only.

3.10.3.3 JAN and J marking. The United States Government has adopted and is exercising legitimate control over the certification marks "JAN" and "J", respectively, to indicate that items so marked or identified are manufactured to, and meet all the requirements of specifications. Accordingly, items acquired to, and meeting all of the criteria specified herein and in applicable specifications shall bear the certification mark "JAN" except that items too small to bear the certification mark "JAN" shall bear the letter "J". The "JAN" or "J" shall be placed immediately before the part number except that if such location would place a hardship on the manufacturer in connection with such marking, the "JAN" or "J" may be located on the first line above or below the part number. Items furnished under contracts or orders which either permit or require deviation from the conditions or requirements specified herein or in applicable specifications shall not bear "JAN" or "J". In the event an item fails to meet the requirements of this specification and the applicable specification sheets, the manufacturer shall remove completely the military part number and the "JAN" or the "J" from the sample tested and also from all items represented by the sample. The "JAN" or "J" certification mark shall not be used on products acquired to contractor drawings or specifications. The United States Government has obtained Certificate of Registration Number 504,860 for the certification mark "JAN" and Registration Number 1,586,261 for the certification mark "J".

3.10.4 Screw threads. When tested in accordance with 4.9.2.4, slight out-of-roundness beyond the tolerances specified is acceptable if the threads can be checked without forcing the thread gauges. Screw threads may be relieved provided the relief does not interfere with proper performance of the screw threads. Unless otherwise specified, English unit screw threads shall be 2A or 2B conforming to SAE-AS8879. Unless otherwise specified, metric unit screw threads shall conform to FED-STD-H28.

3.10.5 Maintainability. The connectors shall require no preventive maintenance.

3.10.6 Workmanship. All details of workmanship shall be as specified herein when examined in accordance with 4.9.2.4. Connector parts shall be dimensionally uniform and free of manufacturing flaws that would degrade performance, inhibit proper connection to interfacing elements, and otherwise yield an inferior product. The following shall be a minimal level of visual examination to be performed and is not intended to restrict other pertinent workmanship examinations:

a. Loose termini, inserts, or other connector parts which adversely affect the environmental sealing, or degrade optical termini alignment shall not be permitted.

b. Peeling or chipping of plating or finish, galling of mating parts indicating excessive wear, nicks, burrs, or other substandard connector surface blemishes shall not be permitted.

3.11 Optical performance. The optical performance requirements of 3.11.1 through 3.11.5 shall be used to monitor effects of the inspection requirements specified in 3.12, 3.13 and 3.14 as required by 4.9 and 4.10.

3.11.1 Insertion loss. The initial insertion loss and the insertion loss verified at any time during testing for a mated pair of connectors shall be not greater than the values specified in table II for each of the mated measurements. The insertion loss shall be measured for 10 mates and demates except for shell size 23 which shall be measured for 5 mates and demates (see 4.9.3.1).

TABLE II. Insertion loss. 1/

Fiber size (um)	Temperature range 1		Temperature range 2	
	Initial insertion loss (dB)	Insertion loss verification (dB)	Initial insertion loss (dB)	Insertion loss verification (dB)
Single mode < 9/125	NA	NA	0.75	1.00
Single mode 9/125	0.50	0.75	0.50	0.75
50/125	0.50	0.75	0.75	1.00
62.5/125	0.50	0.75	0.50	0.75
62.5/125/155	NA	NA	0.75	1.00
100/140	0.50	0.75	0.50	0.75
100/140/172	NA	NA	0.75	1.00

1/ These maximum insertion loss values pertain when the MIL-PRF-64266 connector is used with MIL-PRF-29504/18 or MIL-PRF-29504/20 termini, the applicable MIL-PRF-49291 or other specified optical fiber and placed on the end of the optical fiber with the specified termination procedure.

3.11.2 Discontinuities. When measured in accordance with 4.9.3.2, no discontinuity shall occur. For multimode termini, a discontinuity is considered to be a reduction of optical transmittance of 0.5 dB or more for a duration of 50 microseconds or more. For single mode termini, a discontinuity is considered to be a reduction of optical transmittance of 0.5 dB or more for a duration of 50 microseconds or more during vibration or 10 milliseconds or more during shock.

3.11.3 Crosstalk. When connectors with 3 or more channels are tested in accordance with 4.9.3.3, the signal power levels, or sum of levels of the passive channels, shall be below the signal level of the active channel by at least 60 dB.

3.11.4 Change in optical transmittance. When tested in accordance with 4.9.3.4, the change in optical transmittance shall be less than 0.5 dB.

3.11.5 Return loss. When measured in accordance with 4.9.3.5, the return loss of a standard polish multimode or single mode optical terminus shall be not less than 30 dB. The return loss of an enhanced polish single mode optical terminus shall be not less than 40 dB.

3.12 Functional requirements.

3.12.1 Insert retention radial strength. When tested in accordance with 4.9.4.1, connector inserts shall withstand the clockwise and counterclockwise radial torque specified in table III for a minimum period of one minute. No rotational displacement shall be observed between the inserts and their shell body during or after the test exposure.

TABLE III. Insert retention radial strength.

Connector shell size	Maximum radial torque (inch pounds (N-m))
11	15 (1.7)
13	20 (2.3)
15	25 (2.8)
23	37 (4.2)

3.12.2 Insert retention axial strength. When tested in accordance with 4.9.4.2, connector inserts shall withstand an applied minimum pressure of 100 pounds per square inch (0.69 Mpa) in both the forward direction and the backward direction for a minimum period of 1 minute without cracking, breaking, or being dislocated from their normal positions in the connector shell. No axial displacement detrimental to performance shall be observed between the inserts and their shell body during or after the test exposure.

3.12.3 Terminus insertion and removal forces. Connectors shall be tested in accordance with 4.9.4.3. The terminus insertion force and the force required to remove unlocked termini shall not exceed 22.0 pounds (98 N).

3.12.4 Terminus retention force. When tested in accordance with 4.9.4.4 and subjected to axial loads of 22.0 pounds (98 N) termini shall be retained in their inserts and axial displacements of the termini shall not exceed .015 inch (0.38 mm).

3.12.5 Maintenance aging (see 4.9.4.5).

3.12.5.1 Termini. Connectors with removable termini shall be tested in accordance with 4.9.4.5.1. Connectors shall show no visible evidence of wear or deformation which may degrade their ability to perform as specified. The terminus insertion and removal forces (see 3.12.3) requirement of 22.0 pounds (98 N) shall be met.

3.12.5.2 Alignment sleeve retainer. Connectors with an alignment sleeve retainer shall be tested in accordance with 4.9.4.5.2. Connectors and the alignment sleeve retainer shall show no visible evidence of wear or deformation which may degrade their ability to perform as specified.

3.12.6 Connector coupling engagement and disengagement torque. When tested in accordance with 4.9.4.6, the maximum coupling ring and coupling screw engagement and disengagement torques shall be as specified in table IV.

TABLE IV. Connector coupling engagement and disengagement torques.

Connector shell size	Maximum engagement and disengagement torque (inch-pounds (N-m))	Minimum engagement and disengagement torque (inch-pounds (N-m))
11	15 (1.7)	2 (0.2)
13	20 (2.3)	2 (0.2)
15	25 (2.8)	3 (0.3)
23	37 (4.2)	7 (0.8)

3.12.7 Backshell and backshell accessory attachment. When tested in accordance with 4.9.4.7, the minimum backshell or backshell accessory disengagement torque shall be not less than the maximum coupling engagement/ disengagement torque specified in table V. No evidence of excessive thread binding, seal pinching, or any contamination buildup shall be observed.

3.12.7.1 Accessory thread strength. When tested as specified in 4.9.4.7, the accessory threads, the portion of the connector that accepts backshells or backshell accessories shall withstand the torque specified in table V.

TABLE V. Accessory thread strength.

Shell Size	Accessory Thread Strength	
	Inch-pound	Newton-meters
11 13 15	55	6.2
23	105	11.9

3.13 Mechanical requirements

3.13.1 Cable pull out force (connectors with heavy duty and medium duty backshells only). When tested in accordance with 4.9.5.1, the minimum cable to connector pullout strength for connectors with heavy duty backshells shall be 162 pounds (720.3 N). The minimum cable to connector pullout strength for connectors with medium duty backshells shall be 100 pounds (445 N). There shall be no evidence of cable jacket damage, cable strain relief failure, cable to backshell seal damage, distortion or bending of metallic connector parts, or cable disengagement from the cable strain relief. The connector shall meet the requirements of 3.11.4 during and after the test.

3.13.2 External bending moment (connectors with heavy duty backshells only). When tested in accordance with 4.9.5.2, connectors and backshells shall exhibit no visible evidence of damage that may degrade their ability to perform as specified (see 3.1).

3.13.3 Cable seal flexing (connectors with heavy duty and medium duty backshells only). When tested in accordance with 4.9.5.3, connector strain relief mechanisms shall prevent loss of environmental sealing or other damage which may impair the connector operation.

3.13.4 Twist (connectors with heavy duty and medium duty backshells only). When tested in accordance with 4.9.5.4, connector seals shall be not rendered inoperable nor shall any other connector damage occur. The change in optical transmittance attributable to the connector shall be less than 0.5 dB during and after the test.

3.13.5 Mating durability. When tested in accordance with 4.9.5.5, mating connectors shall show no evidence of mechanical defects detrimental to connector operation. The connector shall meet the requirements of 3.11.4 during and after the test.

3.13.6 Impact. When tested in accordance with 4.9.5.6, connectors shall not be visibly damaged or otherwise rendered unfit for operational use. The requirements of 3.11.4 shall be met after the test.

3.13.7 Crush (connectors with heavy duty backshells only). When tested in accordance with 4.9.5.7, connectors shall show no evidence of inability to mate or unmate, broken parts, loss of optical continuity, or damage to shells, backshells, or dust covers. The requirements of 3.11.4 shall be met during and after the test.

3.14 Environmental requirements.

3.14.1 Temperature ranges. Terminated connectors shall meet all requirements specified (see 3.1), during the specified operating environments and after the specified storage environments. The operating temperature range and storage temperature range shall be in accordance with 1.3 and as specified (see 3.1). Unterminated connectors shall meet the requirements of the most extreme temperature range specified in table I (see 1.2.1b).

3.14.2 Thermal shock. When tested in accordance with 4.9.6.1, terminated and unterminated connectors shall show no evidence of mechanical damage, loosening of component parts, separation of bonded surfaces, or other damage detrimental to the operation of the connector. Terminated connectors shall meet the requirements of 3.11.4 after the test.

3.14.3 Temperature/humidity cycling. When tested in accordance with 4.9.6.2, terminated and unterminated connector parts shall not swell or otherwise degrade such that connector performance is impaired. Terminated connectors shall meet the requirements of 3.11.4 during and after the test.

3.14.4 Temperature cycling. When tested in accordance with 4.9.6.3, a post test visual examination of the terminated and unterminated connectors shall reveal no evidence of connector part dimensional change, no leakage of waterproofing compounds or other apparent loss of sealing capability, no surface or identification marking impairment, no coupling-thread binding or other evidence of mating or unmating incapability, and no other damage detrimental to the operation of the connector. Terminated connectors shall meet the requirements of 3.11.4 during and after the test.

3.14.5 Life aging. When tested in accordance with 4.9.6.4, terminated and unterminated connectors subjected to the specified accelerated aging exposures, shall not exhibit visual evidence of dimensional change, opening of seals, cracking or crazing of components or finishes, identification marking impairment, fusion or seizure of mating parts, leakage of waterproofing compounds, or other effects detrimental to connector operation. Terminated connectors shall meet the requirements of 3.11.4 after the test. Connectors with dielectric inserts shall meet the insert retention radial strength (see 3.12.1) and insert retention axial strength (see 3.12.2) requirements after aging.

3.14.6 Freezing water immersion. When tested in accordance with 4.9.6.5, connectors shall not be physically damaged. The connectors shall meet the optical requirements specified in 3.11.4 during and after the test.

3.14.7 Sand and dust. When tested in accordance with 4.9.6.6, the connectors shall show no evidence of physical damage which will adversely affect the operation of the connector. The change in optical transmittance requirements of 3.11.4 shall be met during and after the test, and coupling torques requirements of 3.12.6 shall be met after the test.

3.14.8 Terminus cleaning. After cleaning the terminus in accordance with 4.9.6.7, the marking requirements of 3.10.3 and the change in optical transmittance of 3.11.4 shall be met after the test.

3.14.9 Electromagnetic effects. When tested in accordance with 4.9.6.8 the propagated radio frequency (RF) attenuation of the connector shall be not less than the value specified in table VI for specified frequencies.

TABLE VI. Electromagnetic effects.

Frequency MHz	Leakage attenuation (dB) minimum
100	90 (Planewave)
200	88 (Planewave)
300	88 (Planewave)
400	87 (Planewave)
800	85 (Planewave)
1,000	85 (Planewave)
1,500	76 (Microwave)
2,000	70 (Microwave)
3,000	69 (Microwave)
4,000	68 (Microwave)
6,000	66 (Microwave)
10,000	65 (Microwave)
18,000	60 (Microwave)

3.14.10 Fluid immersion. When tested in accordance with 4.9.6.9, visual examination of the test connector shall reveal no swelling or softening of material, no loss of sealing capability or identification marking, and no discoloration or other effects detrimental to the intended use of these connectors, such as corrosion, distortion, blistering, or delamination of plating as a result of fluid immersion.

3.14.11 Salt spray (corrosion) (see 4.9.6.10).

3.14.11.1 Temperature range 1 only. When tested in accordance with 4.9.6.10.1, no visible evidence of salt penetration into the connector sealed area shall be observed. No corrosive effects shall be seen on the external connector parts that would be detrimental to the operation of the connector.

3.14.11.2 Temperature range 2 only. When tested in accordance with 4.9.6.10.2, no corrosive effects shall be seen on the internal connector or terminus parts, as applicable, which would be detrimental to the operation of the connector/terminus. No optical degradation shall occur as a result of this test. Optical degradation occurs if requirement for insertion loss verification is not met (see 3.11.1).

3.14.12 Flammability. When tested in accordance with 4.9.6.11, the mated cable-connector assembly shall meet the optical requirements of 3.11.4. The unmated connector assembly shall not exceed a combined flame and afterglow extinguishing time of 30 seconds after removal of the applied flame. There shall be no dripping that will cause the flammable material to ignite and there shall be no violent burning or explosive type fire.

3.14.13 Fungus resistance. When tested in accordance with 4.9.6.12, polymeric connector materials shall show sparse or very restricted microbial growth and reproduction with minor or inhibited substrate utilization. There shall be little or no chemical, physical or structural change detectable.

3.14.14 Ozone exposure. When tested in accordance with 4.9.6.13, seals shall show no evidence of excessive swelling or embrittlement which may degrade environmental isolation.

3.14.15 Vibration. When tested in accordance with 4.9.6.14, mated connectors shall not disengage nor exhibit loosening of the connector parts (including the coupling mechanism or backshell). Test samples shall not be damaged, and there shall be no loosening of parts, no leakage of the index matching material, and no other damage which can produce physical distortion or wear and may result in fatigue of the mechanical parts. The requirements of 3.11.2 shall be met during the test and 3.11.4 shall be met after the test.

3.14.16 Shock. When tested in accordance with 4.9.6.15, connectors shall not be damaged and there shall be no loosening of parts. The requirements of 3.11.2 shall be met during the test and 3.11.4 shall be met after the test.

3.14.17 Water pressure. When tested in accordance with 4.9.6.16, visual inspection of the test connector shall reveal no penetration of water into the sealed region of the mated connector. The requirements of 3.11.4 shall be met after the test.

3.14.18 Shell to shell conductivity. When tested as specified in 4.9.6.17, the probes shall not puncture or otherwise damage the connector finish. The maximum measured potential drop across assemblies shall be as follows:

a. Class A and C: 3.0 millivolts initial, 5.0 millivolts after conditioning (salt spray and coupling torque).

b. Class B and F: 10 millivolts initial, 20 millivolts after conditioning.

3.14.19 Altitude immersion. When tested in accordance with 4.9.6.18, connectors shall not be damaged and there shall be no evidence of moisture penetration into the connector interior. The requirements of 3.11.4 shall be met during and after the test.

3.14.20 Modified SO_2/salt spray (fog). When tested in accordance with 4.9.6.19, no visible evidence of modified SO_2/salt penetration into the connector sealed area shall be observed. No corrosive effects shall be seen on the external connector parts which would be detrimental to the operation of the connector (including mechanical mating). When specified for separate testing of the termini, the insertion loss verification requirement shall be met.

4. VERIFICATION

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

a. Qualification inspection (see 4.7).

b. Conformance inspection (see 4.8).

4.2 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in TIA/EIA-455 or as specified herein.

4.3 Verification program. A verification program shall be established and maintained in accordance with MIL-STD-790. Evidence of such compliance shall be verified by the qualifying activity of this specification as a prerequisite for qualification and continued qualification. The verification system procedures, planning and all other documentation and data that comprise the verification system shall be available to the Government for review. The Government may perform any necessary inspections, verifications and evaluations to ascertain conformance to the requirements and adequacy of the implementing procedures.

4.4 Assembly plants. Assembly plants shall be listed on, or approved for listing on, the applicable qualified products list. The assembly plant shall use only piece parts supplied by the qualified connector manufacturer. No testing other than visual examination is required of certified piece parts obtained from the qualified connector manufacturer, except when there is cause for rejection. All assemblies produced at the assembly plant shall be subjected to examination of the product to assure that the assembly process conforms with that established at the qualified manufacturing plant. Quality control requirements shall be the same as required for the qualified connector manufacturer.

4.5 Test equipment and inspection facilities. Provision for test and measuring equipment and inspection facilities of sufficient accuracy, quality, and quantity to permit performance of the required inspections shall be the responsibility of the contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with NCSL-Z540-3.

4.6 Optical transmittance instrumentation stability. Optical transmittance instrumentation shall be subjected to the following stability tests before qualification testing is performed. The first test shall consist of measuring the transmitted power through each channel once every minute for a four-hour period. The second test shall consist of measuring the transmitted power through each channel once every 30 minutes for a 96 hour period. The data for each channel shall be analyzed to determine average transmittance, minimum and maximum transmittance, the standard deviation of the transmittance, and the minimum and maximum percent deviation of the transmittance.

4.7 Qualification inspection. Qualification inspection shall be performed at a laboratory acceptable to the Government (see 6.3) on sample units produced with equipment and procedures normally used in production. This inspection shall consist of performing the inspections and optical tests specified in table VII, in the sequence shown therein, on the qualification test samples specified in 4.7.1.

4.7.1 Test samples. Fiber optic connector parts complying with the specified requirements (see 3.1) shall be submitted for qualification. The parts submitted for qualification shall be selected from units produced on typical manufacturing lines. The manufacturer shall provide a counterpart connector for each connector subjected to qualifying tests requiring mating assemblies. The counterpart connectors provided for this purpose shall be new, previously qualified connectors or new connectors submitted for qualification testing. For those tests specifying the use of mated connectors, optical and mechanical test assessments shall be made using the assigned counterpart connector for those test measurements as required.

4.7.1.1 Sample size. For plug/receptacle qualification, six mating pairs shall be submitted for qualification testing for each fiber size, temperature range, and shell size to be tested (not including the additional test samples required for interoperability). Unless otherwise specified (see 3.1), these samples shall consist of MIL-PRF-64266/1 wall (panel) mounted receptacles with MIL-PRF-64266 straight backshells and MIL-PRF-64266/2 plugs with MIL-PRF-64266/4 straight backshells. Dust covers that conform to MIL-PRF- 64266/10 shall be provided with plugs. Dust covers that conform to MIL-PRF-64266/11 shall be provided with receptacles. For backshell qualification, six mating pairs shall be submitted, consisting of MIL-PRF-64266/1 wall (panel) mounted receptacles and MIL-PRF-64266/2 plugs, both with the backshell undergoing qualification.

4.7.1.2 Sample preparation. Unless otherwise specified, connectors shall be fully assembled into cable-connector assemblies using the types of cable specified in the applicable connector specification sheet (see 3.1) and the termination procedure shall be in accordance with NAVSEA Drawing 8283460 for temperature range 1. Cable type and termination procedure for temperature range 2 shall be in accordance with NAVSEA Drawing 8283460. Connector termini shall be optically finished with the termini properly seated within their inserts. For mated connectors, full sealing capability shall be provided as specified. Connectors shall be provided with backshell or backshell accessory, and attached to an appropriate length of the specified cable type.

4.7.1.2.1 Termini. The minimum number of active termini required for testing for each shell size shall be as follows: A minimum of two termini shall be active in connectors of shell size 11. A minimum of four termini shall be active in connectors of shell sizes 13. A minimum of eight termini shall be active in connectors of shell sizes 15 and 23. For shell sizes 15 and 23, the active termini shall be placed at different locations in each of the six samples. When shell sizes 13, 15 and 23 are tested together (but not shell size 11), the minimum number of active termini for shell size 15 may be reduced to four termini.

4.7.2 Inspection routine. Connector parts shall be tested in accordance with the sequence of table VII. Manufacturers desiring qualification for only backshells, backshell accessories or dust covers shall, at a minimum, test connectors as specified in 4.7.1 in those tests indicated in table VII. Group II, III, and IV testing may be conducted simultaneously.

4.7.2.1 Qualification of modified designs. Qualification inspection of items which contain design changes from previously qualified items may be limited to a subset of the qualification inspections identified in 4.7.2. Qualification inspection reductions will be determined by the qualification activity based on the extensiveness of the design changes and the anticipated effects of those changes on the item performance.

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

4.7.4 Retention of qualification. To retain qualification, the manufacturer shall verify in coordination with the qualifying activity, the capability of manufacturing products which meet the performance requirements of this specification. Refer to the qualifying activity for the guidelines necessary to retain qualification with respect to this particular specification. The manufacturer shall immediately notify the qualifying activity at any time that the inspection data indicates failure of the qualified product to meet the performance requirements of this specification.

TABLE VII. Qualification inspection. 1/

Inspection tests	Part applicability 2/			Requirements paragraph	Test method
	Connector	Backshell/ backshell accessories	Dust covers		
Group I (6 mated pairs)					
Interoperability 3/	X	X		3.4.3.2	4.10
Visual and mechanical					
Size	X	X	X	3.10.1	4.9.2.1
Weight	X	X	X	3.10.2	4.9.2.2
Identification marking	X	X	X	3.10.3	4.9.2.3
Screw threads	X		X	3.10.4	4.9.2.4
Workmanship	X	X	X	3.10.6	4.9.2.5
Functional					
Insert retention radial strength	X			3.12.1	4.9.4.1
Insert retention axial strength	X			3.12.2	4.9.4.2
Terminus (contact) insertion and removal forces	X			3.12.3	4.9.4.3
Terminus (contact) retention force	X			3.12.4	4.9.4.4
Maintenance aging	X			3.12.5	4.9.4.5
Shell to shell conductivity	X			3.14.18	4.9.6.17
Connector coupling engagement and disengagement torque	X		X	3.12.6	4.9.4.6
Backshell and backshell accessory attachment	X	X		3.12.7	4.9.4.7
Optical					
Insertion loss	X	X		3.11.1	4.9.3.1
Return loss	X	X		3.11.5	4.9.3.5
Crosstalk	X			3.11.3	4.9.3.3
Group II (2 mated pairs)					
Cable pull out force	X	X		3.13.1	4.9.5.1
External bending moment	X	X		3.13.2	4.9.5.2
Cable seal flexing	X	X		3.13.3	4.9.5.3
Twist	X	X		3.13.4	4.9.5.4
Mating durability	X		X	3.13.5	4.9.5.5
Return loss	X			3.11.5	4.9.3.5
Impact	X	X	X	3.13.6	4.9.5.6
Crush	X	X		3.13.7	4.9.5.7
Insertion loss verification	X			3.11.1	4.9.3.1
Vibration	X	X		3.14.15	4.9.6.14
Return loss	X	X		3.11.5	4.9.3.5
Shock	X	X		3.14.16	4.9.6.15
Water pressure	X	X		3.14.17	4.9.6.16
Insertion loss verification	X			3.11.1	4.9.3.1
Modified SO_2 /salt spray	X	X	X	3.14.20	4.9.6.19
Insert retention radial strength 4/					
Group III (2 mated pairs)					
Thermal shock	X	X		3.14.2	4.9.6.1
Temperature/humidity cycling	X	X		3.14.3	4.9.6.2
Temperature cycling	X	X		3.14.4	4.9.6.3
Altitude immersion	X	X		3.14.19	4.9.6.18
Life aging	X	X		3.14.5	4.9.6.4

See footnotes at end of table

TABLE VII. Qualification inspection - Continued. 1/

Inspection Tests	Part applicability 2/			Requirements Paragraph	Test method
	Connector	Backshell/ Backshell accessories	Dust covers		
Group III (2 mated pairs) cont'd					
Insert retention radial strength 5/	X			3.12.1	4.9.4.1
Insert retention axial strength 5/	X			3.12.2	4.9.4.2
Freezing water immersion	X	X		3.14.6	4.9.6.5
Insertion loss verification	X			3.11.1	4.9.3.1
Return loss	X			3.11.5	4.9.3.5
Sand and dust	X	X	X	3.14.7	4.9.6.6
Connector coupling engagement and disengagement torque	X		X	3.12.6	4.9.4.6
Terminus cleaning	X			3.14.8	4.9.6.7
Identification marking	X	X	X	3.10.3	4.9.2.3
Insert retention radial strength 4/	X			3.12.1	4.9.4.1
Group IV (2 mated pairs and parts)					
Electromagnetic effects (2 mated pairs) 6/	X	X	X	3.14.9	4.9.6.8
Fluid immersion (2 mated pairs)	X	X		3.14.10	4.9.6.9
Salt spray (2 mated pairs)	X	X	X	3.14.11	4.9.6.10
Connector coupling engagement and disengagement torque	X		X	3.12.6	4.9.4.6
Shell to shell conductivity	X			3.14.18	4.9.6.17
Flammability (1 mated pair)	X	X		3.14.12	4.9.6.11
Fungus resistance (parts) 7/	X	X	X	3.14.13	4.9.6.12
Ozone exposure (parts) 7/	X	X	X	3.14.14	4.9.6.13
Insertion loss verification	X			3.11.1	4.9.3.1

1/ Group I mated pairs are to be used for groups II, III, and IV.
2/ "X" indicates test applies for particular part(s).
3/ Separate samples are required for interoperability testing. Connector interoperability samples are to be fully populated with termini on single fiber cable and configured without backshells. Backshell interoperability samples are to be constructed with terminated cables that fully populate the connector of the shell size under test.
4/ To be performed for connectors with multiple piece inserts only.
5/ Perform only for connector samples utilizing non-metallic inserts.
6/ Perform only for connector samples utilizing non-metallic inserts or non-metallic backshells. Use of a conductive gasket for EMI testing is permitted.
7/ Polymeric parts from 1 mated pair.

4.7.4.1 Additional shell sizes. Retention of qualification for all shell sizes may be granted after completion of testing for one shell size as determined by the qualifying activity.

4.7.5 Qualification of additional connectors and backshells. Qualification of wall (panel) mounted receptacles shall qualify jamnut mounted receptacles. Qualification of the straight backshell shall qualify the 45° and 90° backshells for that shell size.

4.7.5.1 Additional shell sizes.

4.7.5.1.1 Shell qualification by test. If a connector shell of one shell size is qualified, and connector shells of a larger shell size(s) with similar design, construction, and materials meet the interoperability, visual and mechanical, size, weight, identification marking, workmanship, screw thread, insert retention radial strength, insert retention axial strength, coupling engagement and disengagement torque, backshell and backshell accessory attachment, insertion loss, return loss, mating durability, return loss (after mating durability), impact, crush, vibration, return loss (after vibration), shock, water pressure, thermal shock, temperature cycling, altitude immersion, insertion loss verification (after group III tests), return loss (after Group III tests) and electromagnetic effects inspections herein, then the connector shells of the tested larger shell size(s) are qualified. This testing covers one temperature range. See 4.7.5.6 to address the second temperature range. Life aging shall be performed after altitude immersion for connectors with non-metallic shells or non-metallic inserts.

4.7.5.1.2 Shell qualification by extension. If connectors of one shell size are qualified by test, and connector shells of smaller shell size(s) with similar design, construction and materials meet the interoperability, visual and mechanical, size, weight, identification marking, workmanship, screw thread, backshell and backshell accessory attachment, and return loss inspections herein, then the connector shells of the smaller shell size(s) are qualified.

4.7.5.1.3 Backshell qualification by test. If a connector backshell of one shell size is qualified, and connector backshells of a second shell size with similar design, construction, and materials meet the interoperability, visual and mechanical, size, weight, identification marking, workmanship, screw threads, backshell and backshell accessory attachment, insertion loss, cable pull out, external bending moment, cable seal flexing, impact, crush, vibration, shock, water pressure, temperature cycling and electromagnetic effects inspections herein, then the connector backshells of the second shell size are qualified.

4.7.5.1.4 Backshell qualification by extension. If a connector backshell of one shell size is qualified by test, and connector backshells of the next smallest shell size with similar design, construction and materials meet the interoperability, visual and mechanical, size, weight, identification marking, workmanship, screw thread, backshell and backshell accessory attachment, and insertion loss inspections herein, then the connector shells of the smaller shell size are qualified.

4.7.5.2 Alternate insert materials (including ASR materials). If a connector with a non-integral insert of one material is qualified, and connectors with a non-integral insert of a second material meet the interoperability, visual and mechanical, size, weight, identification marking, workmanship, insert retention radial strength, insert retention axial strength, terminus insertion and removal force, terminus retention force, maintenance aging, insertion loss, return loss, shock, temperature cycling, life aging, electromagnetic effects, flammability, fungus resistance, and ozone exposure inspections herein, then the connectors with the second insert material are qualified. Connector interoperability shall be performed using a previously qualified plug/receptacle connector with a minimum of two termini from all qualified vendors.

4.7.5.3 Alternate shell/backshell materials. If a connector with a shell/backshell of one material is qualified, and connectors with shells/backshells of a second material meet the visual and mechanical, size, weight, identification marking, workmanship, screw thread, insert retention radial strength, insert retention axial strength, coupling engagement and disengagement torque, backshell and backshell accessory attachment, insertion loss, return loss, cable pull out, external bending moment, mating durability, impact, crush, shock, water pressure, altitude immersion, thermal shock, temperature humidity cycling, temperature cycling, life aging, sand and dust, fluid immersion, electromagnetic effects, salt spray, flammability, fungus resistance, and ozone exposure inspections herein, then the connectors with shells/backshells of the second material are qualified.

4.7.5.4 Alternate plating processes. If a connector with one plating is qualified, and connectors with a second plating meet the visual and mechanical, weight, identification marking, workmanship, external bending moment, mating durability, thermal shock, sand and dust, electromagnetic effects, fluid immersion, and salt spray inspections herein, then the connectors with the second plating are qualified.

4.7.5.5 Joint qualification of connectors and termini. Connectors may be qualified using previously qualified termini or using unqualified termini. Connectors shall be qualified using both multimode termini and single mode termini (in different mated pair), see 4.7.5.7. The failure of any inspection by any terminus shall be cause for refusal to grant qualification approval.

4.7.5.6 Additional temperature ranges. If a connector is qualified to temperature range 1 and connector mated pair terminated to configurations for temperature range 2 (in accordance with NAVSWEA Drawing 8283460) meet the insertion loss, return loss, vibration, shock, thermal shock, temperature cycling, altitude immersion, life aging, insertion loss verification, and return loss (after insertion loss verification) inspections for temperature range 2, then the connector is qualified for temperature range 2.

4.7.5.7 Multimode qualification once completed single mode. Manufacturers shall perform all applicable tests on test samples as specified in MIL-PRF-64266, constructed as specified in NAVSEA Drawing 8283460, utilizing single mode fibers. Test samples for each shell size tested and constructed utilizing multimode fiber shall be tested for interoperability only. Testing for fiber size shall be specified in MIL-PRF-29504 qualification in lieu of MIL-PRF-64266 qualification.

4.8 Conformance inspection. Conformance inspection shall consist of the inspections and optical tests specified for group A inspection (table VIII), group B inspection (table X), and group C inspection (table XI). Requirements for alternate forms of conformance inspection and equivalent test methods shall be as specified in 4.9.1.

4.8.1 Inspection of product for delivery. Inspection of product for delivery shall consist of group A inspection.

4.8.1.1 Inspection lot. The inspection lot shall consist of the number of units offered for inspection at one time, and all of the same design as covered by one specification sheet.

4.8.1.1.1 Sample unit. A sample unit shall be selected at random from the inspection lot. For conformance inspections, a sample unit shall consist of an individual unit of supply.

4.8.1.2 Group A inspection. Group A inspection shall consist of the inspection tests specified in table VIII. All connector parts in the inspection sample shall be subjected to the inspection tests listed.

TABLE VIII. Group A inspection.

Inspection tests	Part applicability 1/			Requirement paragraph	Test method
	Connector	Back-shell	Dust covers		
Visual and mechanical					
Size 1/	x	x	x	3.10.1	4.9.2.1
Weight 1/	x	x	x	3.10.2	4.9.2.2
Identification marking	x	x	x	3.10.3	4.9.2.3
Screw threads 2/	x		x	3.10.6	4.9.2.4
Workmanship	x	x	x	3.10.4	4.9.2.5
Functional					
Backshell and backshell accessory attachment	x	x		3.12.7	4.9.4.7

1/ "X" indicates test applies for particular part(s).
2/ In process inspections or controls may be used to verify conformance to these requirements.

4.8.1.2.1 Sampling plan. Tests shall be performed on 100 percent of the product supplied under this specification, unless otherwise allowed by the qualifying activity (see 4.8.1.2.2).

4.8.1.2.2 Alternate sampling plan for Group A inspection. If allowed by the qualifying activity, random sampling may be performed in lieu of 100 percent of product supplied under this specification. Number of samples for random sampling inspected per lot size is specified in table IX. This random sampling alternative shall require acceptance criterion of a zero nonconformance regardless of sample size. If any nonconformance is found, then 100 percent inspection shall be used until the qualifying activity is satisfied that the cause for the nonconformance has been corrected and will not reoccur. Also, until the nonconformance has been corrected, inspection with the requirement that data be provided (in lieu of inspection by attribute) may be specified by the qualifying activity.

4.8.1.2.3 Process control demonstration and metrics. When specified, critical parameters within the process will be identified, along with the method for measurement and the degree of variability for each parameter. Controls within the process (variability control) will be demonstrated by continual statistical tracking of these critical parameters or other metrics that show a capable sustained process. Sustained process control is considered to be when a C_{pk} level of 5 or higher is achieved. This represents a level sufficient to demonstrate an equivalent nonconformance of zero).

TABLE IX. Alternate sampling plan for Group A inspection. 1/

Lot size		Sample size
From	To	Sample
0	8	8
9	150	13
151	500	50
501	1,200	80
1,201	3,200	125
3,201	10,000	200
10,001	35,000	315
35,001	150,000	500
150,001	500,000	800
500,001	$\geq$ 500,002	1,250

1/ The random sampling alternative and inspection by attributes are applicable for the specified quality conformance inspections only. For qualification and for initial validation of the process, inspection should be performed on 100 percent of samples with data supplied.

4.8.1.2.4 Failures. One or more failures shall constitute group A inspection failure of the sample unit.

4.8.1.2.5 Disposition of sample units. Sample units that have failed any of the group A inspection tests shall not be shipped or submitted for group B testing.

4.8.2 Group B inspection. Group B inspection shall consist of the tests specified in table X in the order shown. Group B inspection shall be performed on sample units selected from inspection lots which have passed group A inspection. The maximum time from the end of one group B inspection to the beginning of the following group B inspection shall be not greater than 24 months.

4.8.2.1 Sampling plan. A minimum of sixteen sample units shall be selected from a lot of the same PIN within 24 months after the date of notification of qualification and during every 24 month period thereafter, except, when the total production in a 24 month period is less than 500 units of product or a total of 60 months have elapsed since the inspection was performed, in which case only eight specimens shall be tested. At no time shall the group B inspections be extended beyond 60 months.

4.8.2.2 Failures. If one or more sample units fail to pass group B inspection, the lot from which the samples were selected shall be rejected.

4.8.2.3 Disposition of sample units. Sample units which have been subjected to group B inspection may be delivered on the contract or purchase order.

4.8.2.4 Rejected lots. If a group B inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units (if applicable), and resubmit the lot for inspection.

TABLE X. Group B inspection.

Inspection tests	Part applicability 1/			Requirement paragraph	Test method
	Connector	Back-shell	Dust covers		
Optical					
Insertion loss (initial)	x			3.11.1	4.9.3.1
Functional					
Connector coupling engagement and disengagement torque	x		x	3.12.6	4.9.4.6
Insert retention radial strength	x			3.12.1	4.9.4.1
Insert retention axial strength	x	x		3.12.2	4.9.4.2
Terminus retention force	x			3.12.4	4.9.4.4

1/ "X" indicates test applies for particular part(s).

4.8.3 Periodic inspection. Periodic inspection shall consist of group C. Except where the results of these inspections show noncompliance with the applicable requirements (see 4.8.3.1.5), delivery of products which have passed groups A and B inspections shall not be delayed pending the results of periodic inspection.

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

4.8.3.1.1 Sample unit preparation. Connectors shall be fully assembled into cable-connector assemblies using the types of cable specified in the applicable connector specification sheet (see 3.1). Connector termini shall be optically finished with the termini properly seated within their inserts. For mated connectors, full sealing capability shall be provided as specified (see 3.1). Connectors shall be provided with backshell or backshell accessory, and attached to an appropriate length of the specified cable type.

TABLE XI. Group C inspection.

Inspection tests	Part applicability 1/			Requirement paragraph	Test method
	Connector	Back-shell	Dust covers		
Group I (All mated pairs)					
Optical					
Insertion loss	x	x		3.11.1	4.9.3.1
Return loss	x	x		3.11.5	4.9.3.5
Functional					
Terminus insertion and removal forces	x			3.12.3	4.9.4.3
Group II (2 mated pairs)					
Cable pull out force	x	x		3.13.1	4.9.5.1
Cable seal flexing	x	x		3.13.3	4.9.5.3
Twist	x	x		3.13.4	4.9.5.4
Mating durability	x			3.13.5	4.9.5.5
Return loss	x			3.11.5	4.9.3.5
Insertion loss verification	x			3.11.1	4.9.3.1
Shock	x			3.14.16	4.9.6.15
Water pressure	x	x		3.14.17	4.9.6.16
Group III (2 mated pairs)					
Temperature/humidity cycling	x			3.14.3	4.9.6.2
Life aging	x			3.14.5	4.9.6.4
Insert retention radial strength 2/	x			3.12.1	4.9.4.1
Insert retention axial strength 2/	x			3.12.2	4.9.4.2
Identification marking	x	x	x	3.10.3	4.9.2.3

1/ "X" indicates test applies for particular part(s).
2/ Tests are only applicable for connectors with nonmetallic inserts.

4.8.3.1.1.1 Termini. The minimum number of active termini required for testing for each shell size shall be as follows: A minimum of two termini shall be active in connectors of shell size 11. A minimum of four termini shall be active in connectors of shell sizes 13 and 15. A minimum of eight termini shall be active in connectors of shell size 23. For shell sizes 15 and 23, the active termini shall be placed at different locations in each of the four samples.

4.8.3.1.2 Sampling plan. Group C inspection shall be performed on four connectors of the same PIN with their mating connectors 60 months after initial qualification and within each 5 year period thereafter. All mating pairs shall be subjected to group I tests. Mated pairs from the group I tests shall be divided among the group II and III tests.

4.8.3.1.3 Failures. One or more specimen or sample unit failures shall constitute group C inspection failure.

4.8.3.1.4 Disposition of sample units. Sample units which have been subjected to group C inspection shall not be shipped.

4.8.3.1.5 Noncompliance. If a sample fails to pass group C inspections, the manufacturer should notify the qualifying activity of the failure and 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, and so forth, and which are considered subject to the same failure. Acceptance of the product should be discontinued until corrective action, acceptable to the Government, has been taken. After the corrective action has been taken, group C inspection should be repeated on additional sample units (all inspection tests or the inspection test which the original sample failed, at the option of the Government). Groups A and B inspection may be reinstituted; however, final acceptance should be withheld until the group C reinspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure and corrective action taken should be furnished to the cognizant inspection activity and the qualifying activity.

4.9 Methods of inspection.

4.9.1 Equivalent test methods and alternate forms of conformance inspection. The use of equivalent test methods and alternate forms of conformance inspection are allowed provided the preparing activity and the qualifying activity have approved the use of that equivalent test method by that manufacturer. Requests for use of equivalent test methods and alternate forms of conformance inspection (see 4.8) shall be submitted to the qualifying activity. Alternate forms of conformance inspection may be used upon written approval by the qualifying activity. The manufacturer shall have conducted both test methods and have submitted complete test data to the qualifying activity verifying the equivalency of each equivalent test method proposed.

4.9.2 Visual and mechanical inspection. Connector parts shall be examined in accordance with TIA-455-13 to verify that materials, design, construction, physical dimensions, marking, and workmanship are in accordance with the applicable requirements (see 3.3, 3.4, and 3.5).

4.9.2.1 Size (see 3.10.1). Each of the dimensions specified (see 3.1) for the connector parts shall be measured using calibrated measuring devices with the precision and accuracy appropriate for the tolerances specified (see 3.1). Dimensions shall be in accordance with the applicable specification sheets.

4.9.2.2 Weight (see 3.10.2). The connector parts shall be weighed using calibrated scales, having the range, precision, and accuracy appropriate for the tolerances specified (see 3.1).

4.9.2.3 Identification marking. Identification marking on connectors, backshells, and dust covers shall be visually examined and measured for conformance with the requirements of 3.10.3. Inspection for legible markings shall be performed from a distance of at least 6 inches (15 cm) with normal room lighting and without the aid of magnification.

4.9.2.4 Screw threads. Screw threads shall be checked after protective coating by means of ring and plug gauges (see MIL-STD-1373 for guidance). (see 3.10.4).

4.9.2.5 Workmanship inspection. The connectors, backshells, backshell accessories and dust covers shall be visually examined to verify that they meet the workmanship requirements of 3.10.6.

4.9.3 Optical conformance test methods. Cladding power shall be removed. In those cases where the fiber coating does not adequately perform this function, cladding mode strippers shall be used between the source and the terminus, and between the terminus and the detector. Multiple fibers may not be concatenated during the measurement of change in optical transmittance or optical discontinuity. The center wavelength of test shall be 1300 ± 20 nm. For multimode fibers, the optical source used shall be noncoherent. Light launch conditions shall be as specified in table XII.

TABLE XII. Light launch conditions.

Fiber type	Launch conditions
Single mode	30 mm diameter mandrel
Multimode	Overfilled (initial Insertion loss only) and restricted (70/70 or equivalent)

4.9.3.1 Insertion loss (see 3.11.1). The initial insertion loss of multimode connectors shall be measured in accordance with method A of TIA/EIA-455-34, using both 70/70 and overfill launch conditions. For subsequent insertion loss tests, 70/70 launch conditions or equivalent shall be used. The insertion loss of single mode connectors shall be measured in accordance with method B of TIA/EIA-455-34.

4.9.3.2 Discontinuities (see 3.11.2). The connector shall be tested in accordance with TIA/EIA-455-32 using test equipment having a time resolution sufficient to resolve discontinuities of duration not less than 50 µs. For tests of extended duration, discontinuity measurements may be made at discrete times during the test as approved by the qualifying activity.

4.9.3.3 Crosstalk (see 3.11.3). The crosstalk shall be measured in accordance with EIA/TIA-455-42.

4.9.3.4 Change in optical transmittance (see 3.11.4). The change in optical transmittance shall be measured in accordance with TIA/EIA-455-20 or by an equivalent method. The periodicity of the measurements shall be sufficient for the environmental test performed as approved by the qualifying activity. The use of a reference fiber to evaluate the change in optical transmittance due to exposure of the cable to the environmental tests is optional.

4.9.3.5 Return loss (see 3.11.5). The return loss shall be measured in accordance with TIA-455-107 or by an equivalent method (see 4.9.1).

4.9.4 Functional inspections.

4.9.4.1 Insert retention radial strength (see 3.12.1). Unmated connector samples shall be tested for radial strength as described herein. Counterpart test devices for plugs and receptacles shall be supplied by the connector manufacturer which are capable of applying radial torque forces between the insert and its shell body. Outermost termini positions or other means may be used for application of these torques, however, no damage shall occur to the insert or ASR as a result of the test exposure. A radial torque shall be applied up to the minimum specified (see 3.12.1) and held for 1 minute. The same torque shall then be applied in the opposite direction and held for one minute. After this test is completed for forces between the insert and shell body, the ASR shall be placed on (fastened to) the insert. The test shall be repeated for forces between the ASR and insert. This test shall be performed with the ASR placed on (fastened to) both the plug and receptacle.

4.9.4.2 Insert retention axial strength (see 3.12.2). Unmated connector samples shall be tested as follows. An axial load shall be applied to either the front or rear face of the insert up to a minimum value of 100 pounds per square inch (0.69 Mpa) of insert face surface area. The load shall be held for a minimum of 1 minute and the axial displacement measured (see 3.12.2). The same pressure shall then be applied on the opposite face, held for 1 minute and the axial displacement measured. Termini positions within the insert may be either empty or filled during the test.

4.9.4.3 Terminus insertion and removal forces (see 3.12.3). Termini shall be inserted into an unmated connector using a terminus insertion tool and the force required to insert the terminus measured (see 3.12.3). A terminus removal tool shall then be engaged to unlock the terminus. The terminus shall be removed and the force required to remove the terminus measured.

4.9.4.4 Terminus retention force (see 3.12.4). Termini shall be inserted into an unmated connector and tested as follows. Termini shall be subjected to axial compressive loads applied to the front face of the terminus tending to push the terminus to the rear of the connector insert. (Care must be exercised in the design of the force application mechanism so that it does not physically touch the optical fiber endface.) A preload not greater than 3 pounds (13.3 N) may be used to seat the terminus for the initial position measurement. Axial loads shall be applied at a rate of 1.0 pound (4.4 N) per second up to the minimum load specified (see 3.12.4). The terminus position shall be measured while under the specified load. The specified load shall be maintained for a minimum of 5 seconds.

4.9.4.5 Maintenance aging (see 3.12.5).

4.9.4.5.1 Termini (see 3.12.5.1). Unmated connectors shall be tested as follows: Termini shall be inserted and removed from the connector a minimum of ten times. The termini selected for insertion and removal shall be the same termini that are monitored for optical performance. The force required to insert each terminus into the connector and the force required to remove each terminus from the connector shall be measured during the first and final maintenance aging cycle.

4.9.4.5.2 Alignment sleeve retainer (see 3.12.5.2). Unmated connectors shall be tested as follows. The alignment sleeve retainer shall be removed and reassembled to the connector a minimum of 100 times. After completion of the test, the ASR shall be visually examined in accordance with 4.8.2.

4.9.4.6 Connector coupling engagement and disengagement torque (see 3.12.6). Unmated connector samples (or connector and dust cover samples) shall be tested as follows: The two mating parts shall be brought to a position where mechanical mating begins and the torque gauge is at zero indication. The parts shall then be fully mated or coupled and the torque required for mating shall be recorded. The torque gauge shall then be reset to zero indication. The mated parts shall be fully unmated and the torque required for unmating shall be recorded.

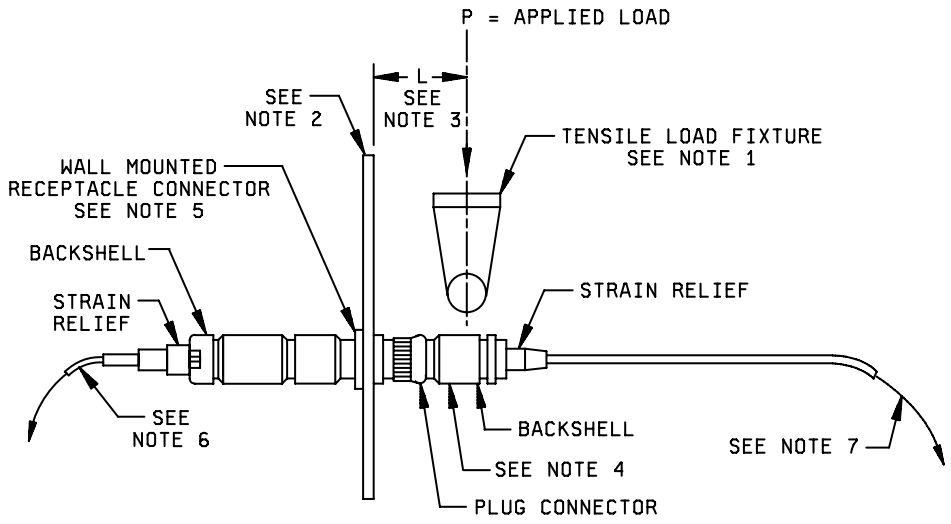
4.9.4.7 Backshell and backshell accessory attachment (see 3.12.7 and 3.12.7.1). Connector backshells and backshell accessory attachment shall be manually mated with a torque in accordance with table V and unmated five times to their counterpart connectors. The torque specified in table V shall be applied to mate the backshell or backshell accessory attachment. The torque required to remove the backshell or backshell accessory attachment shall be measured on each unmating. The backshell or backshell accessory attachment shall be visually examined in accordance with 4.9.2 after the test.

4.9.5 Mechanical test methods.

4.9.5.1 Cable pull out force (see 3.13.1) (connectors with heavy and medium duty backshells only). Mated connector samples shall be tested in accordance with TIA-455-6. The axial tensile load shall be applied up to the load specified and shall be maintained for 10 minutes. The change in optical transmittance shall be measured during and after the test (see 4.9.3.4). At the completion of the test, the connector shall be visually examined in accordance with 4.9.2.

4.9.5.2 External bending moment (see 3.13.2) (connectors with heavy duty backshells only). Cable-connector assemblies shall be tested in accordance with the following procedure: The cabled receptacle shall be mounted as in normal service to a rigid wall (panel). After mating the plug and receptacle, a minimum bending moment load of 300 inch-pounds (33.9 N-m) as measured from the wall (panel) shall be applied. The load (P) shall be applied across the smallest continuous exterior dimension of the plug connector backshell (see note 4 on figure 2). This section may be circular or conical in the longitudinal direction. The load shall be applied at a rate of approximately 10 inch-pounds (1.1 N-m) per second until the required load is applied. The load shall be held for 1 minute. As an alternate to the load directly applied to the plug connector backshell, a fixture of any convenient design may be used as a rigid bending moment test arm for the application of the applied load. Before mating the cabled plug to the receptacle, this rigid bending moment arm shall be secured to the rear of the plug shell. One design constraint on the fixture shall be that it must not provide support for the connector shell in front of the engaged threads. The change in optical transmittance shall be measured after the test (see 4.9.3.4).

4.9.5.3 Cable seal flexing (see 3.13.3) (connectors with heavy duty and medium duty backshells only). Connector assemblies shall be tested in accordance with TIA/EIA-455-1. The connector assembly shall be exposed to 100 flexing cycles, the assembly rotated approximately 90° in the flexing fixture and then exposed to another 100 flexing cycles. The cycling rate is not to exceed 14 cycles per minute if the test is performed manually. The connector assemblies shall be visually examined in accordance with 4.8.2 after the test.



NOTES:
1. Point of applied load P. Representation shows one means to apply the load P.
2. Test fixture 1. Test fixture simulating wall (rigid mounting panel) used to secure a receptacle connector in normal service.
3. Distance L is distance from plug connector side of test fixture to point of applied load.
4. Point of applied load. Load is applied on backshell at smallest, continuous section. The smallest, continuous section is defined as the smallest diameter on the backshell that is exposed and at least 2.5 inches (62.5 mm) in length. Section may be circular or conical in longitudinal direction. If conical, load may be applied anywhere along longitudinal length. Alternate means to apply load by using a rigid bending moment arm is not shown.
5. Mount receptacle connector on side opposite in which receptacle connector will be mated to plug connector.
6. Fiber optic cable that connects to optical source end test instrumentation (optional).
7. Fiber optic cable that connects to detector end test instrumentation (optional).

FIGURE 2. External bending moment test fixture and connector setup.

4.9.5.4 Twist (see 3.13.4) (connectors with heavy duty and medium duty backshells only). Mated cable-connector assemblies shall be tested in accordance with TIA-455-36. The connector-held fixture shall be rotated 360° at a rate of one cycle per 5 seconds for a total of 50 cycles. One cycle shall consist of a 360° twist ±180° about the neutral axis. The cable assemblies tested for temperature range 1 shall be placed in tension with minimum loading of 11.0 pounds (48.9 N) applied (such as clamped) at a distance of about 100 times the cable diameter from the connector optical interface. This test shall be performed for temperature range 2 regardless of backshell configuration with a minimum loading of 11 pounds (48.9 N) applied 12 inches below the optical (connecting) interface. The connectors shall be visually examined in accordance with 4.9.2 after the test. The change in optical transmittance shall be measured during and after the test (see 4.9.3.4).

4.9.5.5 Mating durability (see 3.13.5). Connector plugs and receptacles shall be tested in accordance with TIA-455-21. Five hundred complete (plug and receptacle separating) cycles (mate and unmate) shall be accomplished by hand at a rate not to exceed 1 cycle per 15 seconds. The change in optical transmittance (see 4.9.3.4) shall be measured every 100 mating cycles during the test and after the test. Cleaning of the termini is permitted during and after completion of the test in order to meet the requirements of 3.11.4.

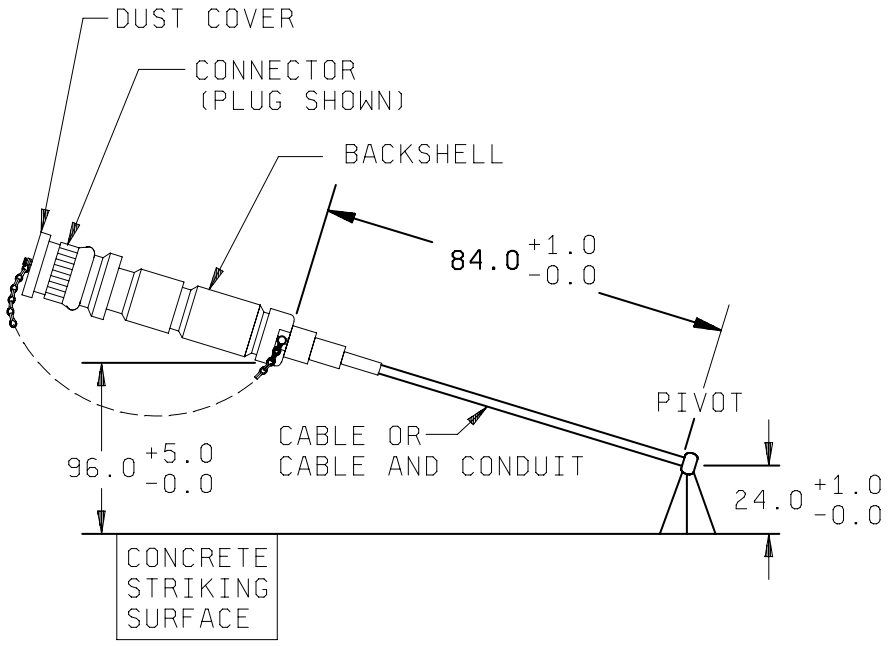
4.9.5.6 Impact (see 3.13.6). The unmated cables assembly with backshell and dust cover shall be tested in accordance with method B of TIA/EIA-455-2 (see figure 3). Impacts shall be performed on both a cable assembly with a plug connector and a cable assembly with a receptacle connector. The dust cover shall be screwed onto the connector. The cable assembly shall be extended its full length from the test fixture. The plug/receptacle shall be dropped 8 times (the eight highest drops specified for the moderate service class in TIA/EIA-455-2) and rotated after each fall so that the connector strikes the impact pad in eight different radial positions. The test assemblies shall be visually examined for damage in accordance with 4.9.2, then mated. The connector termini may be cleaned after exposure and prior to mating. The change in optical transmittance shall be measured after the test (see 4.9.3.4).

4.9.5.7 Crush (see 3.13.7) (connectors with heavy duty backshells only). Connectors shall be tested in accordance with TIA-455-26, with the exception that the test sample shall be a connector. The test load shall be 1,250 newtons, and the number of loading cycles shall be 7. The two load bearing surfaces may be faced with one-inch thick rubber pads with a durometer between 60 and 75. Position the connector on the crush pads so that the plug, plug backshell, and portion of receptacle in front of the wall (panel) mounting, is on the crush pads. The change in optical transmittance shall be measured during and after the test (see 4.9.3.4). The connector shall be visually examined in accordance with 4.9.2 after the test.

4.9.6 Environmental test methods. Connectors with a composite body shall be unmated and re-mated after each environmental test. Post exposure optical transmittance measurements may be taken up to 24 hours after completion of the environmental exposure.

4.9.6.1 Thermal shock (see 3.14.2). Mated connectors shall be tested in accordance with test schedule C of TIA/EIA-455-71 for five cycles. The temperature extremes shall be the specified non-operational temperature extremes for temperature range 1 and the specified operational temperature extremes for temperature range 2 (see 1.2.1,b). Change in optical transmittance measurements shall be measured after the test (see 4.9.3.4) for temperature range 1 and measured during and after the test for temperature range 2. The connectors shall be visually examined in accordance with 4.9.2 after the test.

4.9.6.2 Temperature/humidity cycling (see 3.14.3). Mated cable-connector assemblies shall be tested in accordance with method B of TIA/EIA-455-5. The sub-cycle shall be included in the testing. The change in optical transmittance shall be measured during and after the test (see 4.9.3.4).



Inches	mm
1.0	25.4
5.0	127.0
24.0	609.6
84.0	2133.6
96.0	2338.4

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for information only.
3. Conduit or other means of stiffening the cable may be used to ensure that the impact occurs on the connector surface in the specified orientation.

FIGURE 3. Impact test fixture connector setup.

4.9.6.3 Temperature cycling (see 3.14.4).

4.9.6.3.1 Temperature range 1. Mated cable-connector assemblies shall be tested in accordance with EIA/TIA-455-3 using the test condition schedule and soak times as specified in table XIII below. The change in optical transmittance shall be measured during and after the test (see 4.9.3.4). The connector assemblies shall be visually examined in accordance with 4.9.2 after the test.

4.9.6.3.2 Temperature range 2. Mated cable-connector assemblies shall be tested in accordance with EIA/TIA-455-3 using the following test conditions: Ramp rate of 10 ± 1 °C/minute, dwell time (soak) at temperature of 15 ± .5 minutes, frequency 1,000 cycles. Each cycle shall consist of (1) a ramp to the low operating temperature +0/-5 °C, (2) maintain (a soak at) the low operating temperature +0/-5 °C, (3) a ramp to the high operating temperature +5/-0 °C, (4) maintain the high operating temperature +5/-0 °C,. First cycle shall start at room temperature and last cycle shall include additional steps to end at (a) a ramp to room temperature followed by (b) maintaining (a soak at) room temperature. The connector assemblies shall be visually examined in accordance with 4.9.2 after the test. Test fixtures, if used must be of minimum mass and approved by the qualifying activity. No other mass shall be added inside the chamber. The change in optical transmittance shall be measured during and after the test (see 4.9.3.4). The connector assemblies shall be visually examined in accordance with 4.9.2 after the test.

TABLE XIII. Temperature cycling steps.

Step	Temperature (°C)	Duration (hours)
1. Maintain	Room ambient	4 (minimum)
2. Ramp to	Low operating temp +0, -5	2
3. Maintain	Low operating temp +0, -5	2 (minimum)
4. Ramp to	25+/-3	2
5. Maintain	25+/-3	2 (minimum)
6. Ramp to	High operating temp +5, -0	1
7. Maintain	High operating temp +5, -0	2 (minimum)
8. Ramp to	25+/-3	1
9. Maintain	25+/-3	2 (minimum)
10. Repeat steps 2 through 9 four additional times (a total of 5 cycles)		

4.9.6.4 Life aging (see 3.14.5). Mated connectors shall be tested in accordance with TIA/EIA-455-4 and as specified herein. The specimens shall be exposed to dry air at a temperature and duration specified in table XIV. The change in optical transmittance shall be monitored after the test in accordance with 4.9.3.4. The connectors shall be visually examined in accordance with 4.9.2 after the test. For connectors with dielectric inserts, the inserts shall be inspected for insert retention radial strength (see 4.9.4.1) and insert retention axial strength (see 4.9.4.2) after the test.

TABLE XIV. Life aging test conditions.

Temperature range	Test temperature (°C) +5, -0	Duration (hours)
1	110	240
2	165	1,000

4.9.6.5 Freezing water immersion (see 3.14.6). Mated connector assemblies shall be tested in accordance with method A, procedure 1 of EIA/TIA-455-98. The size of the water vessel shall be such that, when the mated connectors are placed in the vessel, the mated connectors are within 5.9 inches (150 mm) of the sides and bottom of the vessel, and within 5.9 inches (150 mm) of the surface of the water. The change in optical transmittance shall be monitored during and after the test in accordance with 4.9.3.4. At the completion of the test, the connectors shall be visually examined in accordance with 4.8.2. For the exposure at -10°C, the water is considered completely frozen when the water temperature reading is less than -1°C.

4.9.6.6 Sand and dust (see 3.14.7). Mated cable connector assemblies shall be tested in accordance with TIA/EIA-455-35 except as noted herein. Each connector shall be oriented in the chamber such that the coupling mechanism is in line with the oncoming airflow. The connectors shall be affixed in such a manner that the orientation of the connector does not change throughout the duration of the test. The 16 hour holding period of step 5.5 is not required. Step 5.6 may proceed immediately after reaching temperature stabilization. The change in optical transmittance shall be measured before the dust test, during the 6 hour exposure period of step 5.4, before step 5.6, during the 6 hour exposure period of step 5.6, and after the test in accordance with 4.9.3.4. The connector coupling engagement and disengagement torque (see 4.9.4.6) shall be measured after the test. The connector shall be visually examined in accordance with 4.9.2, after cleaning, at the conclusion of the test.

4.9.6.7 Terminus cleaning (see 3.14.8). The optical face of the terminus shall be cleaned according to the instructions supplied by the qualifying activity. The terminus shall not be removed from its operational position within the connector to facilitate cleaning. The alignment sleeve retainer may be removed to facilitate terminus cleaning.

4.9.6.8 Electromagnetic effects (see 3.14.9). Electromagnetic effects testing of receptacles (without backshells) mated to plugs with backshells and of receptacles mated to dust covers shall be conducted as follows: The test specimens (including terminated cable) shall be tested to determine the propagation characteristics (attenuation or conduction) of the specimen assembly. The shielding effectiveness of a shielded enclosure shall be verified in accordance with the procedures specified in IEEE-299 at the discrete frequencies specified in table VI with the test specimen mounted in position. The test specimen receptacle shall be mounted into the wall (panel) of the shielded enclosure such that the plug or dust cover mates from the inside of the shielded enclosure. The cable(s) from the plug and receptacle shall be extended parallel to the test specimen for a minimum of 2 meters on each side of the enclosure wall (panel). The dynamic range of the test setup shall be measured as specified in IEEE-299 at each discrete frequency specified in table VI. The measured level of radio frequency (RF) propagation through the test specimen installed in the shielded enclosure shall be determined in accordance with the procedures specified in IEEE-299 at each discrete frequency specified in table VI. Use of a conductive gasket for EMI testing is permitted

4.9.6.8.1 Antenna placement. Antenna types and placement distances shall conform to table XV and table XVI respectively. Matched antennas shall be used for each measurement. Placement distances are specified for both antenna to test specimen cable and for antenna to setup wall (panel) of the shielded enclosure. The transmitting antenna shall be oriented in both the parallel and perpendicular directions for each frequency listed in table VI. Energy from the transmitting antenna shall be maximized by positioning the antenna parallel along the test specimen cable length and perpendicular along the test specimen cable circumference. The sensitivity of the receiving antenna shall be maximized by measuring both end view and side (length) view with a constant rotation between the horizontal and vertical antenna positions. For planewave measurements in the perpendicular direction, the transmit antenna shall be 1 meter above the test specimen cable.

TABLE XV. Antenna types.

Field propagation	Antenna type
Planewave	Log periodic or dipole
Microwave	Horn

TABLE XVI. Antenna placement distances. 1/

Location	Placement
Receiving antenna to test specimen cable	1.97 inch (5 cm)
Transmitting antenna to test specimen cable	39.37 inch (1 m)
Transmitting antenna to shielded enclosure	78.74 inch (2 m)

1/ Extended dipole antenna distance measurements shall be made from the center of the antenna elements.

4.9.6.8.2 Electromagnetic effects test documentation. Electromagnetic effects test documentation shall include a detailed test plan and test report. The test plan shall detail the specific test setups and procedures, the test facility, and the test profiles that will be used. The test report shall detail the exact procedures followed, the equipment used for each test phase, calibration dates of all test equipment, test results in graphical and tabular format, photographs/sketches of the test setups, the test data sheets, and an indication of pass/fail. The test data sheets shall include test sample identification, ambient temperature and humidity values, dates and times of the test initiation and completion, names and initials of the test personnel, and data tables. The data tables shall include the frequency at which each measurement was conducted, the field propagation/orientation, enclosure shielding effectiveness, reference level of the transmitter, dynamic range of the measurement, measured level for the test, the propagated RF attenuation, the required RF attenuation, and an indication of pass/fail. The reference level shall include the source output, receiver sensitivity, and antenna gain.

4.9.6.9 Fluid immersion (see 3.14.10). Connector assembly and separate polymeric samples shall be exposed to each of the fluids specified in table XVII below in accordance with TIA/EIA-455-12. Sample preconditioning shall be done under ambient conditions for a minimum of 4 hours. Each connector assembly and sample of each polymeric material shall be completely dried after each immersion. After testing, the connector assembly shall be visually examined.

4.9.6.10 Salt spray (corrosion) (see 3.14.11).

4.9.6.10.1 Temperature ranges 1 and 2. Mated cable-connector assemblies shall be tested in accordance with test condition I of TIA/EIA-455-16. The exposure time shall be 500 hours, and the exposure temperature 35°C. After test exposure, the assemblies shall be externally cleaned and examined under three-power magnification for salt penetration into the connector junction area and damage to external parts.

4.9.6.10.2 Temperature range 2 only. Connector halves of two unmated cable-connector assemblies, with the ASR inserted, and with or without MIL-PRF-29504/18 termini (termini on single fiber cable) as applicable, shall be tested to TIA/EIA-455-16, test condition C. Terminus ferrule may be covered up to half way from the end face to the shoulder with plastic protective dust covers. After test exposure, the assemblies shall be externally cleaned and examined under three-power magnification for salt penetration into the connector junction area and damage to external parts. An insertion loss verification test shall be performed to determine if the optical requirement is met. Insertion loss verification shall be performed prior to and after the salt spray test.

TABLE XVII. Fluid immersion test fluids.

Category	Fluid	Conforming to 1/	Temperature range 1 test temperature (°C) 2/	Temperature range 2 test temperature (°C) 2/
Fuel	Turbine fuel	SAE-AMS-2629 3/	60	60
	Fuel oil	MIL-DTL-16884	35	35
	Automobile gasoline	ASTM D4814	Not Applicable	23
Hydraulic fluid		MIL-PRF-83282	Not Applicable	70
		MIL-PRF-87257	70	70
		MIL-PRF-17672	60	60
	Skydrol LD4	SAE-AS1241 4/	Not Applicable	70
Lubricating oil		MIL-PRF-17331	70	121
		MIL-PRF-23699	70	121
Coolant fluid	Dielectric	MIL-PRF-87252	60	60
Deicer	Aircraft	SAE-AMS-1424	Not Applicable	60
	Runway	SAE-AMS-1435	Not Applicable	60
Water	Sea	ASTM D1141	25	60
	Reagent 5/	ASTM D1193	Not Applicable	60
Cleaners/solvents	Isopropyl alcohol	TT-I-735 6/	25	60
	Methyl Isobutyl Ketone	ASTM D1153	Not Applicable	60
	Alkaline detergent	MIL-PRF-85570 7/	Not Applicable	60
Corrosion prevention	Compound	MIL-PRF-16173 8/	Not Applicable	60
		MIL-PRF-81309 9/	Not Applicable	60

1/ Where available the equivalent test fluid (AMS designator) is specified in lieu of the Defense specification or commercial standard product.
2/ 73°F = 23°C, 95°F = 35°C, 140°F = 60°C, 158°F = 70°C, 250°F = 121°C
3/ Type 1, JP-8 conforming to MIL-DTL-83133 may be used if AMS-2629 Type 1 is not available if the aromatic content is increased to 25 percent Aromatic content shall be increased to 25 percent by spiking with toluene.
4/ One source of supply is Solutia Inc.
5/ Reagent water is specified in lieu of tap water.
6/ Reagent grade only.
7/ Type II tested with a 4:1 dilution.
8/ Grade 4.
9/ Type III.

4.9.6.11 Flammability (see 3.14.12). Mated and unmated cable-connector assemblies shall be tested in accordance with EIA-364-81 and as specified herein. Mated assemblies shall be exposed to a 0.75 inch (19 mm) flame height applied for ten seconds to the region of the mated pair interface. The change in optical transmittance shall be measured during the test, and after the test once the test sample has returned to room temperature (see 4.8.3.4). The sample shall then be demated, and the unmated connector assembly with backshell and dust cover exposed to a 1.50 inch (38.1 mm) inch flame height applied for 60 seconds to the backshell-cable interface region. For connectors with dielectric inserts, the connector samples shall be exposed to a third flame, with a one and one-half inch flame height. The connector samples shall be remated and the flame shall be applied for 60 seconds to the region of the mated pair interface.

4.9.6.12 Fungus resistance (see 3.14.13). Connector materials not listed as fungus inert in guideline 4 of MIL-HDBK-454 shall be tested in accordance with TIA/EIA-455-56 for a duration of 28 days.

4.9.6.13 Ozone exposure (see 3.14.14). Polymeric connector parts shall be tested to TIA-455-189 and exposed to an ozone concentration of 100 to 150 parts per million at a temperature of 70°C +5°C, -0°C and an air velocity not less than 0.6 m/s for two hours. The ozone test apparatus and ozone measuring device shall be in accordance with ASTM D1149. If a polymeric part is expanded on the connector, then the part is to be tested at the same level of expansion.

4.9.6.14 Vibration (see 3.14.15).

4.9.6.14.1 Temperature range 1. Mated cable-connector assemblies shall be tested in accordance with test condition II, test condition IV and test condition VII (test condition letter C) of TIA/EIA-455-11. The test duration for test condition VII shall be 30 minutes for each axis. The frequency range of test for test condition II shall be extended to a low frequency of 5 Hz. Optical discontinuities shall be measured during each test (see 4.9.3.2). For connectors of shell sizes 13 and larger, a minimum of four termini shall be monitored for discontinuity. The change in optical transmittance shall be measured after the test (see 4.9.3.4). The connector shall be visually examined in accordance with 4.9.2 after the test. Lockwires shall not be utilized during this test. Retightening of the connector after each axis and test condition is permitted.

4.9.6.14.2 Temperature range 2. Mated cable-connector assemblies shall be tested for sinusoidal and random vibration in accordance with the applicable vibration tests listed below. Optical discontinuities shall be measured during the test (see 4.9.3.2). For connectors of shell sizes 13 and greater, a minimum of four termini shall be monitored for discontinuity. The change in optical transmittance shall be monitored after the test (see 4.9.3.4). The connector shall be visually examined in accordance with 4.9.2 after the test. Lockwires shall not be utilized during this test. For testing, initially mate the connector assemblies and apply the specified torque value. Mark the position after the torque has been applied and check/record position after each axis. For a mating connector containing a coupling ring ratchet mechanism, do not tighten the coupling ring during testing.

a. Sine (swept sine) vibration in accordance with TIA-EIA-455-11, test condition III tailored using the vibration input (amplitude) versus frequency range in table XVIII and modified durations specified herein. Vibration shall be performed at ambient temperature only. This cycle shall be performed 12 times in each of three mutually perpendicular directions at ambient temperature. This results in a total of 36 cycles being applied for approximately 12 hours. The sequence shall be repeated twice (36 hours total at ambient temperature). Interruptions are permitted provided the requirements for rate of change and test duration are met. Completion of cycling within any separate band is permissible before proceeding to the next band.

TABLE XVIII. Sine vibration parameter inputs.

Frequency Range	Vibration Input
10 50 Hz	10 inch/sec (254 mm/sec)
50 – 140 Hz	.06 inch (1.5 mm) double amplitude
140 – 2000 Hz	60 G

b. Random vibration in accordance with 4.5.23.2.3 of MIL-DTL-38999 (43.9 G rms at a temperature of 125°C) when subjected using the test specified in TIA/EIA-455-11, test condition VII – Letter J. Duration shall be 8 hours in the longitudinal direction (orientation parallel to the optical fiber length and designated at the z axis) and 8 hours in the radial or transverse direction (orientation parallel to the optical fiber end cross section and in the x-y plane) for a total of 16 hours. Vibration shall be done at a temperature of 125°C. Calculated overall Grms value from vibration machine controller shall be provided.

c. Random vibration in accordance with TIA/EIA-455-11, test condition VI tailored using the Power Spectral Density versus frequency curve in accordance with MIL-DTL-38999, figure 25 (derived from zone 2, outlined in Aerospace Information Report AIR 1557) which starts at 25 Hz. Duration shall be 8 hours in the longitudinal direction (orientation parallel to the optical fiber length and designated at the z axis) and 8 hours in the radial direction (orientation parallel to the optical fiber end cross section and in the x-y plane) for a total of 16 hours. Vibration shall be done at ambient temperature. Calculated overall Grms value from vibration machine controller shall be provided.

4.9.6.15 Shock (see 3.14.16).

4.9.6.15.1 Temperature ranges 1 and 2. Mated cable-connector assemblies shall be tested in accordance with MIL-S-901, grade A, class I. Optical discontinuities shall be measured during the test (see 4.9.3.2). For connectors of shell sizes 13 and larger, a minimum of four termini shall be monitored for discontinuity. The change in optical transmittance shall be measured after the test (see 4.9.3.4). The connector shall be visually examined in accordance with 4.9.2 after the test. For temperature range 1 testing, retightening of the connector after each blow is permitted. For temperature range 2 testing, initially mate the connector assemblies and apply the specified torque value. Mark the position after the torque has been applied and check/record position after each impact. For a mating connector containing a coupling ring ratchet mechanism, do not tighten the coupling ring after each impact if the connector is being tested in addition to the terminus. Otherwise, retighten after each impact. Standard shock fixture 4A for bulkhead mounting shall be used. Supplement test fixture with mounting shall be performed as specified in NAVSEA Drawing 8283460.

4.9.6.15.2 Temperature range 2 only. Mated connector assemblies shall be tested in accordance with TIA-455-14, test condition D. Three shocks in each direction shall be applied along the three mutually perpendicular axes of the test sample (18 shocks). Optical discontinuities shall be measured during the test (see 4.9.3.2). For connectors of shell sizes 13 and larger, a minimum of four termini shall be monitored for discontinuity. The change in optical transmittance shall be measured after the test (see 4.9.3.4). The connector shall be visually examined in accordance with 4.9.2 after the test. Retightening of the connector after each blow is permitted.

4.9.6.16 Water pressure (see 3.14.17). Mated cable-connector assemblies shall be tested for water pressure susceptibility as follows: The assemblies shall be immersed in fresh water to an equivalent depth of 32 feet (9.8 m) for a period of 48 hours. The water temperature shall be maintained between 10°C and 35°C during the exposure period. The connector assemblies shall be externally cleaned, unmated, the ASR and backshell removed, and visually examined for water penetration into the connector. The change in optical transmittance shall be measured after the test (see 4.9.3.4).

4.9.6.17 Shell to shell conductivity (see 3.14.18). Mated connectors shall be tested in accordance with EIA-364-83.

4.9.6.18 Altitude immersion (see 3.14.19). Mated connectors shall be tested in accordance with EIA/TIA-455-15. The complete sample shall be located within the chamber, with the entire mated connector submerged in a distilled water tank within the chamber. Instrument end connections shall not be submerged and shall be either routed outside the chamber or to an optical interface port. The change in optical transmittance shall be measured during and after the test (see 4.9.3.4). During each test cycle, optical transmittance measurements shall be made at each ramp and during the plateau.

4.9.6.19 Modified SO_2/salt spray (fog) (see 3.14.20). Mated cable-connector assemblies shall be tested in accordance with ASTM G85 with the inclusion of Annex A4. Clean the test samples with reagent grade (> 99 percent pure) isopropyl alcohol prior to the test. Prepare the salt solution as specified in 8.1 of ASTM B117 ensuring proper pH (see 8.2 of ASTM B117). Purity shall be greater than 99 percent of SO_2 gas in cylinder. Verify that test samples are suspended in the chamber at an angle from 6° to 45° from the vertical. Operate the modified SO_2/salt spray (fog) chamber with a constant salt spray introducing SO_2 gas for 1 hour four times a day (every 6 hours in accordance with A.4.4.4.1 of ASTM G85). Test duration (exposure period) shall be 240 hours. Introduce the SO_2 gas at a flow rate of 1 cubic centimeter per minute per cubic foot ($cm^3/min\text{-}ft^3$) (35 cubic centimeters per minute per cubic meter ($cm^3/min\text{-}m^3$)) of cabinet volume using a method to ensure uniform dispersion throughout the chamber interior (such as gas dispersion ring). Measure the salt spray (fog) fallout rate at intervals of every 24 hours and ensure fallout has specified pH (2.5 to 3.2) and a rate of 1 to 3 $ml/80cm^2/hr$. After the exposure period, remove the test samples from the chamber. Clean test samples by gentle wash or dip in running tap water (not warmer than 38 °C (100 °F)) for at least 5 minutes. Dry immediately with a stream of clean, dry compressed air or inert gas. After cleaned and dried, the assemblies shall be examined under three-power magnification for modified SO_2/salt penetration into the connector junction area and damage to external parts. When specified for separate testing of the termini, the terminus ferrule may be covered up to half way from the end face with a plastic (protective) cover. These termini shall be tested for insertion loss verification, both prior to and after the modified SO_2/salt spray test, with the termini inserted into a shell size 15 connector. Adequate safety measures must be taken during this test. Fallout rate measurements and otherwise opening of the chamber shall not occur during an SO_2 cycle (dispersion period). Once the chamber is opened, sufficient time must be allotted for exhaust hood or other means of ventilation to remove the SO_2 atmosphere prior to exposure to the chamber interior.

4.10 Interoperability (see 3.4.3.2). Connectors, backshells and ASRs shall be tested as specified in 4.10.1, 4.10.2 and 4.10.3, respectively.

4.10.1 Connector interoperability. Unless otherwise specified (see 3.1), qualified termini shall be inserted into and shall fully populate connector specimens as specified in table XIX. Insertion loss shall be measured in accordance with 4.9.3.1. The terminus insertion and removal forces shall be measured in accordance with 4.9.4.3. The terminus retention force shall be measured in accordance with 4.9.4.4. Each configuration tested shall be measured for shell-to-shell conductivity in accordance with 4.9.6.17.

TABLE XIX. Connector interoperability test configurations.

Configuration No.	Connector receptacle	Connector plug
1	Qualified	Candidate
2	Candidate	Qualified
3	Candidate	Candidate

4.10.2 Backshell interoperability. Unless otherwise specified (see 3.1), qualified termini shall be inserted into and shall fully populate qualified connector plugs and receptacles with backshells as specified in table XX. Insertion loss shall be measured in accordance with 4.9.3.1. Each connector (plug and receptacle) to backshell configuration tested shall be measured for shell-to-shell conductivity in accordance with 4.9.6.17.

TABLE XX. Backshell interoperability test configurations.

Configuration No.	Receptacle backshell	Plug Backshell
1	No backshell	Candidate backshell
2	Candidate backshell	No backshell

4.10.3 ASR interoperability. Unless otherwise specified (see 3.1), qualified termini shall be inserted into and shall fully populate qualified connector plugs and receptacles as specified in table XXI. Insertion loss shall be measured in accordance with 4.9.3.1.

TABLE XXI. ASR interoperability test configurations. 1/ 2/

Configuration number	Receptacle	ASR	Plug
1	Qualified	Candidate	Qualified
2	Candidate	Candidate	Qualified
3	Qualified	Candidate	Candidate
4	Candidate	Candidate	Candidate
5	Candidate	Qualified	Candidate
6	Candidate	Qualified	Qualified
7	Qualified	Qualified	Candidate

1/ Configuration number 2-7 not needed if qualifying ASR only.
2/ Testing may be done concurrently with connector/termini interoperability.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The fiber optic connectors covered by this specification are intended for use in military applications where their performance characteristics are required. The connectors covered by this specification are unique due to the fact that these items will be able to operate satisfactorily in systems under the following demanding conditions: 10 g's vibration, over 1000 g's of shock, temperature excursions from -67°C to +185°C and mechanically harsh conditions. In addition, these requirements are verified under a qualification system. Commercial connectors are not designed to withstand these environmental conditions.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of the specification.

b. PIN.

c. Quantity of connectors or connector parts required.

d. Packaging requirements (see 5.1).

NOTE: Termini are not supplied with connectors acquired to this specification.

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List QPL No. 64266 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from the Qualifying Activity: Defense Supply Center Columbus, Attn: DSCC-VQP, P.O. Box 3990, Columbus, OH 43218-3990, vqp.chief@dla.mil. An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at http://assist.daps.dla.mil.

6.3.1 Conformity to qualification sample. It is understood that connectors supplied under the contract should be identical in every respect to the qualification sample tested and found satisfactory, except for changes previously approved by the Government. Any unapproved changes from the qualification sample will constitute cause for rejection.

6.3.2 Provisions governing qualification SD-6. Copies of "Provisions Governing Qualification (Qualified Products List) SD-6" may be obtained at http://assist.daps.dla.mil or upon application to the Defense Automation and Production Service, Building 4D, (DPM-DODSSP), 700 Robbins Avenue, Philadelphia, PA 19111-5094.

6.3.3 Government witnessing of qualification tests. The qualification activity may require that a Government witness be present during the following tests: Size, screw threads, connector assembly (test sample) fabrication, initial insertion loss, terminus insertion and removal forces, cable pull out force, mating durability, temperature cycling, mechanical shock, salt spray and thermal shock.

6.4 Environmentally preferable material. Environmentally preferable materials should be used to the maximum extent possible to meet the requirements of this specification. As of the dating of this document, the U.S. Environmental Protection Agency (EPA) is focusing efforts on reducing 31 priority chemicals. The list of chemicals is available on their website at http://www.epa.gov/epaoswer/hazwaste/minimize/chemlist.htm. Further information is available at the following EPA site: http://www.epa.gov/epaoswer/hazwaste/minimize/. Included in the EPA list of 31 priority chemicals are cadmium, lead, and mercury. Use of the materials on the list should be minimized or eliminated unless needed to meet the requirements specified herein (see Section 3).

6.5 Definitions. Definitions and terms are in accordance with EIA-440 and as stated below.

6.5.1 Alignment sleeve retainer (ASR). See 3.5.2 herein for ASR connector part description.

6.5.2 Backshell. The backshell attaches to the rear of the connector shell, provides for environmental sealing of the connector, and provides for cable strain relief. The backshell includes the seal or sealing mechanism which seals to a plug or receptacle connector.

6.5.3 Backshell clocking. Connector shell design should include capability to place non-straight backshells in different radial orientations around the connector.

6.5.4 Connector. The connector is the entire cable termination assembly and is composed of the connector shell, connector insert, ASR, and backshell or backshell accessory.

6.5.5 Insert. The insert is the interior portion of the connector which holds and aligns the optical termini.

6.5.6 Backshell accessory. The backshell accessory attaches to the rear of the connector shell. Typically a backshell accessory provides a lower level of mechanical/environmental protection to the optical fibers than does a connector backshell.

6.5.7 Heavy duty backshell. A connector backshell intended for use in the most demanding mechanical environments, and is capable of withstanding most forms of abuse.

6.5.8 Medium duty backshell. A connector backshell intended for use in a demanding mechanical environment, but with practical limitation on pull strength and side loading.

6.5.9 Light duty backshell. A connector backshell intended for use in a relatively benign mechanical environment. Light duty backshells provide minimal pull strength and physical protection to the optical fiber cable.

6.5.10 Insertion loss. Insertion loss is the radiant power loss (dB) caused by absorption, scattering, diffusion, leaky waves, dispersion, microbends, macrobends, reflection, radiation, or other causes when a connector is inserted into the system.

6.5.11 Overfill launch. An overfill launch is a launch with a source spot size at least 100 percent the fiber spot size and source aperture at least 100 percent of the fiber numerical aperture.

6.5.12 Protective covering. A protective covering is a disposable protective cap or cover.

6.5.13 70/70 restricted launch. A 70/70 restricted launch is beam optics launch with a 70 percent spot size and source aperture equal to 70 percent of the fiber numerical aperture.

6.5.14 Shell. The shell is the front portion of the connector which holds the connector insert and contains the connector coupling mechanism. Shells are either of the plug or receptacle configuration.

6.5.15 Terminus. Terminus is the part of the connector that provides a means of positioning and holding the fiber within the connector.

6.6 Subject term (key word) listing.

Alignment sleeve retainer
Backshells
Cable
Class
Covers, protective
Dust covers
Epoxies
Inserts
Military specification
Screw threads
Strain relief, cable
Style
Test

APPENDIX A

CONNECTOR INTERFACE DIMENSIONS

A.1 SCOPE

A.1.1 Scope. This appendix lists the connector interface dimensions and is a mandatory part of the specification. This Appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

A.2 DRAWINGS

A.2.1 Interface dimension. The connector interface dimension drawings (figures A-1 through A-6) are listed as follows.

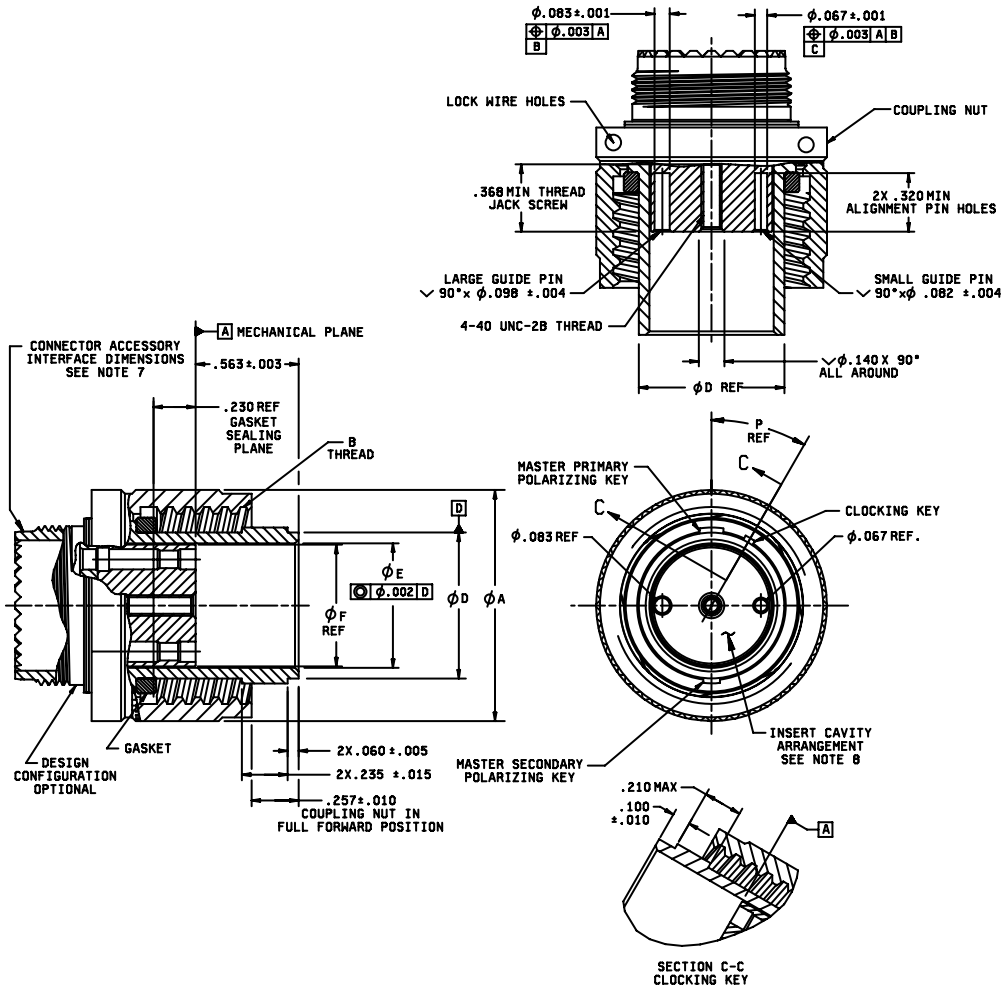


FIGURE A-1. Interface dimensions, connector, plug, fiber optic.

Shell Size	A dia max	B Thread Class – 2A Blunt start	D dia +/- .005	E dia +/- .005	F dia REF	P° REF
11	1.028 (26.11)	.7500-.1P-.2L-DS	.497 (12.62)	.420 (10.67)	.410 (10.41)	See figure A-3
13	1.141 (28.98)	.8750-.1P-.2L-DS	.621 (15.77)	.500 (12.70)	.486 (12.34)	See figure A-3
15	1.263 (32.08)	1.062-.1P-.2L-DS	.793 (20.14)	.678 (17.22)	.664 (16.87)	See figure A-3
23	1.705 (43.31)	1.5000-.1P-.2L-DS	1.215 (30.86)	1.084 (27.53)	1.068 (27.13)	See figure A-3

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for information only.
3. Metric equivalents are in parentheses.
4. Dimensions apply to plated/finished part.
5. Mating key positions and dimensions are shown on figure A-3.
6. This design information establishes connector intermating criteria.
7. Back end connector design for attachment of nonrotatable backshell is shown on figure A-6.
8. Connector insert termini cavity layout and alignment sleeve retainer (ASR) guide pin cavity layout are shown herein. See MIL-PRF-64266, appendix B, figures B-1 through B-6.

Inches	mm	Inches	mm
.001	.02	.098	2.49
.002	.05	.100	2.54
.003	.08	.140	3.56
.004	.10	.210	5.33
.005	.13	.230	5.84
.010	.25	.235	5.97
.015	.38	.257	6.53
.060	1.52	.320	8.13
.067	1.70	.368	9.35
.082	2.08	.563	14.30
.083	2.11		

FIGURE A-1. Interface dimensions, connector, plug, fiber optic - Continued.

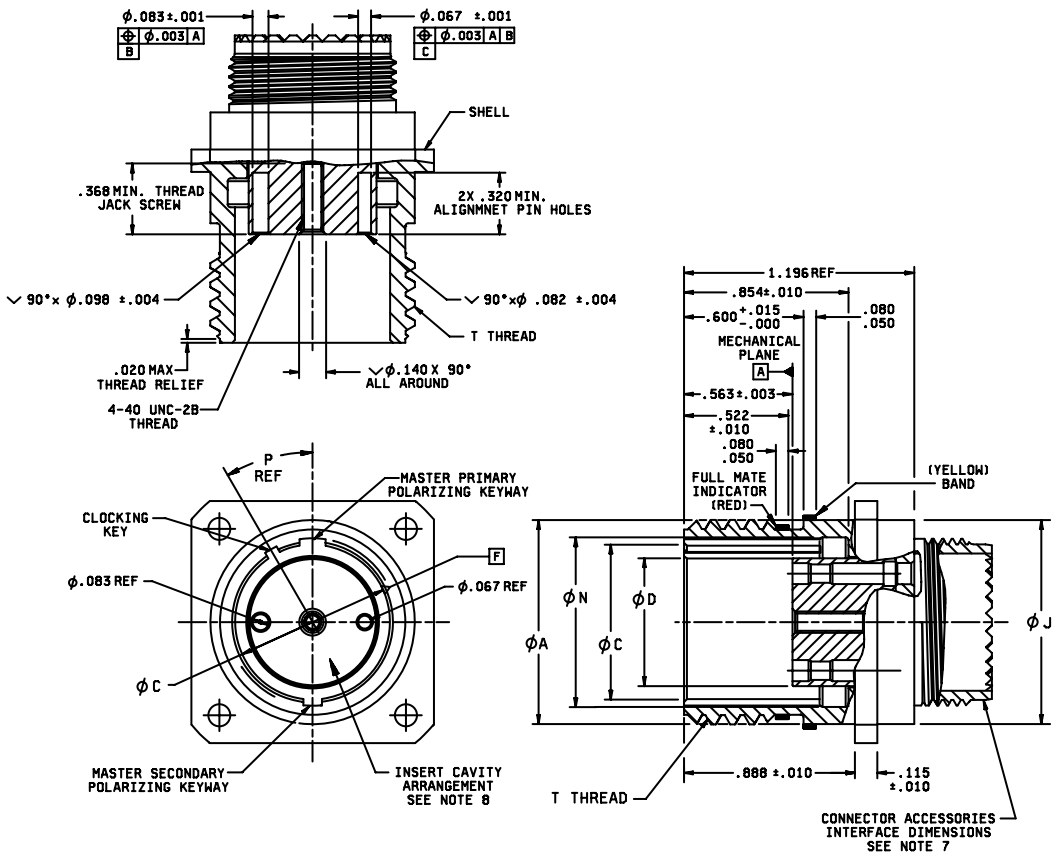


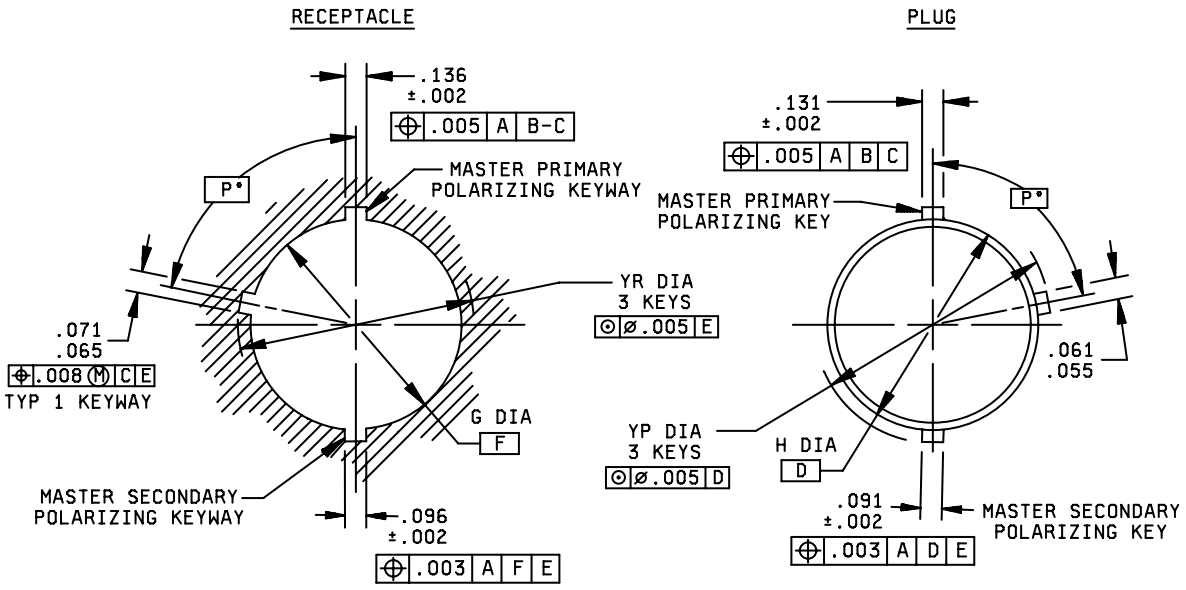
FIGURE A-2. Interface dimensions, connector, receptacle, fiber optic.

Shell size	A dia max	C dia +/- .004	D dia max	J dia Max	N dia min	P° REF	T Thread Class - 2A Blunt start
11	.750 (19.05)	.511 (12.98)	.412 (10.47)	.750 (19.05)	.585 (14.86)	See figure A-3	.7500-.1P-.2L-DS
13	.875 (22.26)	.635 (16.13)	.488 (12.40)	.875 (22.23)	.709 (18.01)	See figure A-3	.8750-.1P-.2L-DS
15	1.062 (26.98)	.805 (20.45)	.666 (16.92)	1.062 (26.98)	.881 (22.38)	See figure A-3	1.062-.1P-.2L-DS
23	1.500 (38.10)	1.229 (31.22)	1.070 (27.18)	1.500 (38.10)	1.304 (33.12)	See figure A-3	1.5000-.1P-.2L-DS

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Metric equivalents are in parentheses.
4. Dimensions apply to plated/finished part.
5. Mating key positions and dimensions are shown on figure A-3.
6. This design information establishes connector intermating criteria.
7. Back end connector design for attachment of non-rotatable backshell is specified on figure A-6.
8. Connector insert termini cavity layout and alignment sleeve retainer (ASR) guide pin cavity layout are shown herein. See MIL-PRF-64266, appendix B, figures B-1 through B-6.

Inches	mm	Inches	mm
.001	.02	.098	2.49
.003	.08	.115	2.92
.004	.10	.320	8.13
.010	.25	.368	9.35
.020	.51	.522	13.26
.050	1.27	.563	14.30
.067	1.70	.600	15.24
.080	2.03	.854	21.69
.082	2.08	.888	22.56
.083	2.11	1.196	30.38

FIGURE A-2. Interface dimensions, connector, receptacle, fiber optic - Continued.



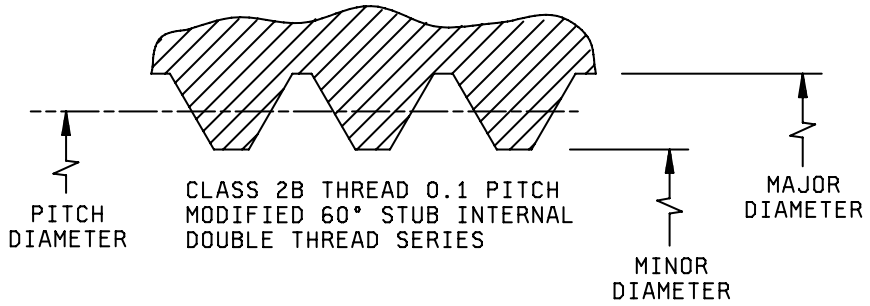
Keying identifier	P degrees +/- 0.5
1	30
2	55
3	80
4	105
5	130
6	155
7	205
8	230
9	255
A	280
B	305
C	330

Inches	mm	Inches	mm
.002	.02	.071	2.49
.003	.08	.091	2.92
.005	.10	.096	8.13
.055	.25	.131	9.35
.061	.51	.136	13.26
.065	1.27		

Shell size	YR dia +/- .004	YP dia +/- .004
11	.575 (14.61)	.555 (14.10)
13	.699 (17.76)	.679 (17.25)
15	.871 (22.12)	.851 (21.62)
23	1.294 (32.87)	1.271 (32.28)

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for information only.
3. Datum A, B and C details are specified on figure A-1 herein.

FIGURE A-3. Connector, fiber optic, position of key and keyway mating.



INTERNAL THREADS

Shell size	Designation		
	Thread size	Pitch	Lead
11	.7500	.1	.2
13	.8750	.1	.2
15	1.0625	.1	.2
23	1.5000	.1	.2

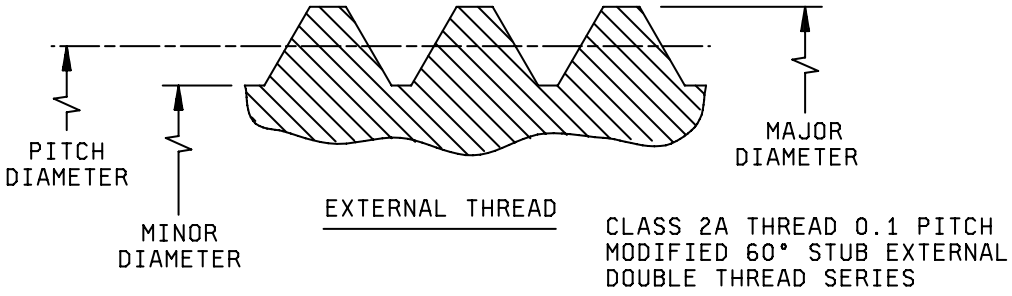
Inches	mm	Inches	mm
.100	2.54	.8950	22.733
.200	5.10	1.0025	25.464
.7042	17.887	1.0145	25.768
.7142	18.141	1.0285	26.124
.7240	18.390	1.0405	26.429
.7340	18.644	1.0625	26.988
.7500	19.050	1.0665	27.089
.7540	19.152	1.0865	27.597
.7700	19.588	1.4400	36.576
.8292	21.062	1.4520	36.881
.8392	21.316	1.4660	37.236
.8490	21.565	1.4780	37.541
.8590	21.819	1.5000	38.100
.8750	22.225	1.5040	38.202
.8790	22.327	1.5240	38.710

FIGURE A-4. Connector mating threads (internal).

Shell size	Internal thread limits of size					
	Minor diameter		Pitch diameter		Major diameter	
	Limits		Limits		Limits	
	Max	Min	Max	Min	Max	Min
11	.7142	.7042	.7340	.7240	.7700	.7540
13	.8392	.8292	.8590	.8490	.8950	.8790
15	1.0145	1.0025	1.0405	1.0285	1.0865	1.0665
23	1.4520	1.4400	1.4780	1.4660	1.5240	1.5040

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for information only.
3. Dimensions apply to plated/finished part.
4. Threads are to be inspected with a 6h go-gauge and a 6g no-go-gauge.

FIGURE A-4. Connector mating threads (internal) - Continued.



Shell size	Designation		
	Thread size	Pitch	Lead
11	.7500	.1	.2
13	.8750	.1	.2
15	1.0625	.1	.2
23	1.5000	.1	.2

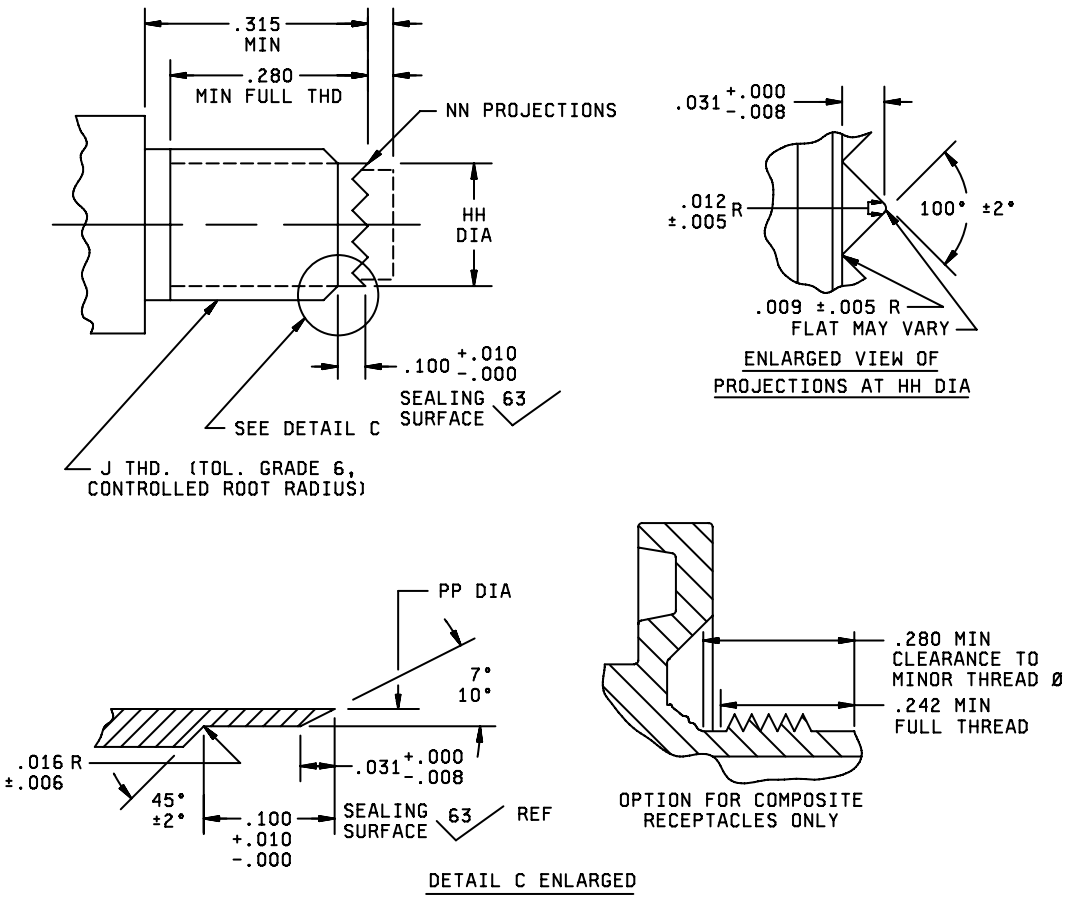
Inches	mm	Inches	mm
.100	2.54	.8750	22.225
.200	5.10	.9705	24.651
.6785	17.234	.9885	25.108
.6925	17.590	1.0165	25.819
.7145	18.148	1.0265	26.073
.7225	18.352	1.0485	26.632
.7405	18.809	1.0605	26.937
.7485	19.012	1.0625	26.988
.7500	19.050	1.4080	35.763
.8035	20.409	1.4260	36.220
.8175	20.764	1.4540	36.932
.8395	21.323	1.4640	37.186
.8475	21.526	1.4860	37.744
.8655	21.984	1.4980	38.049
.8735	22.187	1.5000	38.100

FIGURE A-5. Connector mating threads (external).

Shell size	External thread limits of size					
	Minor diameter		Pitch diameter		Major diameter	
	Limits		Limits		Limits	
	Max	Min	Max	Min	Max	Min
11	.6925	.6785	.7225	.7145	.7485	.7405
13	.8175	.8035	.8475	.8395	.8735	.8655
15	.9885	.9705	1.0265	1.0165	1.0605	1.0485
23	1.4260	1.4080	1.4640	1.4540	1.4980	1.4860

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for information only.
3. Dimensions apply to plated/finished part.
4. Threads are to be inspected with a 6h go-gauge and a 6g no-go-gauge.

FIGURE A-5. Connector mating threads (external) - Continued.



Inches	mm
.005	.13
.006	.15
.008	.20
.009	.23
.010	.25
.012	.30
.016	.41
.031	.79
.100	2.54
.242	6.15
.280	7.11
.315	8.00

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for information only.

FIGURE A-6. Interface dimensions, connector, backshell accessory attachment.

Shell size	HH +.00, -.006	NN	PP max	J thread
11	.534 (13.56)	16	.475 (12.07)	M15x1.0-6g 0.100R
13	.653 (16.58)	20	.589 (14.96)	M18x1.0-6g 0.100R
15	.810 (20.57)	24	.714 (18.14)	M22x1.0-6g 0.100R
23	1.282 (32.56)	40	1.195 (30.35)	M34x1.0-6g 0.100R

Metric external thread dimension J						
Designation (thread size)	Major diameter		Pitch diameter		Minor diameter	
	Max	Min	Max	Min	Max	Min
M15x1.0-6g 0.100R	14.974	14.794	14.324	14.206	13.747	13.557
M18x1.0-6g 0.100R	17.974	17.794	17.324	17.206	16.747	16.557
M22x1.0-6g 0.100R	21.974	21.794	21.324	21.206	20.747	20.557
M34x1.0-6g 0.100R	33.974	33.794	33.324	33.199	32.747	32.550

FIGURE A-6. Interface dimensions, connector, backshell accessory attachment - Continued.

APPENDIX B

CONNECTOR INSERT ARRANGEMENTS AND INTERFACE DIMENSIONS

B.1 SCOPE

B.1.1 Scope. This appendix lists the connector insert arrangements and interface dimensions. This Appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

B.2 APPLICABLE DOCUMENTS

B.2.1 Non-Government publications. The following document forms a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents 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).

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME Y14.5M - Dimensioning and Tolerancing. (DoD adopted)

(Application for copies should be addressed to the American Society of Mechanical Engineers, 3 Park Avenue, New York, NY 10016).

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

B.3 REQUIREMENTS

B.3.1 Dimensions. Dimensions shall be in accordance with figures B-1 through B-4 herein, and the following dimensional data:

a. ▼ indicates the insert indexing feature position and vertical centerline of insert arrangement.

b. Dimensioning and tolerancing in accordance with ASME Y14.5M. (Dimensions are true position and are in inches.)

c. Metric equivalents are given in parentheses for general information only.

d. Dimensions, features and markings shown are for engaging face of pin (plug)insert and the engaging face of the socket (receptacle)insert.

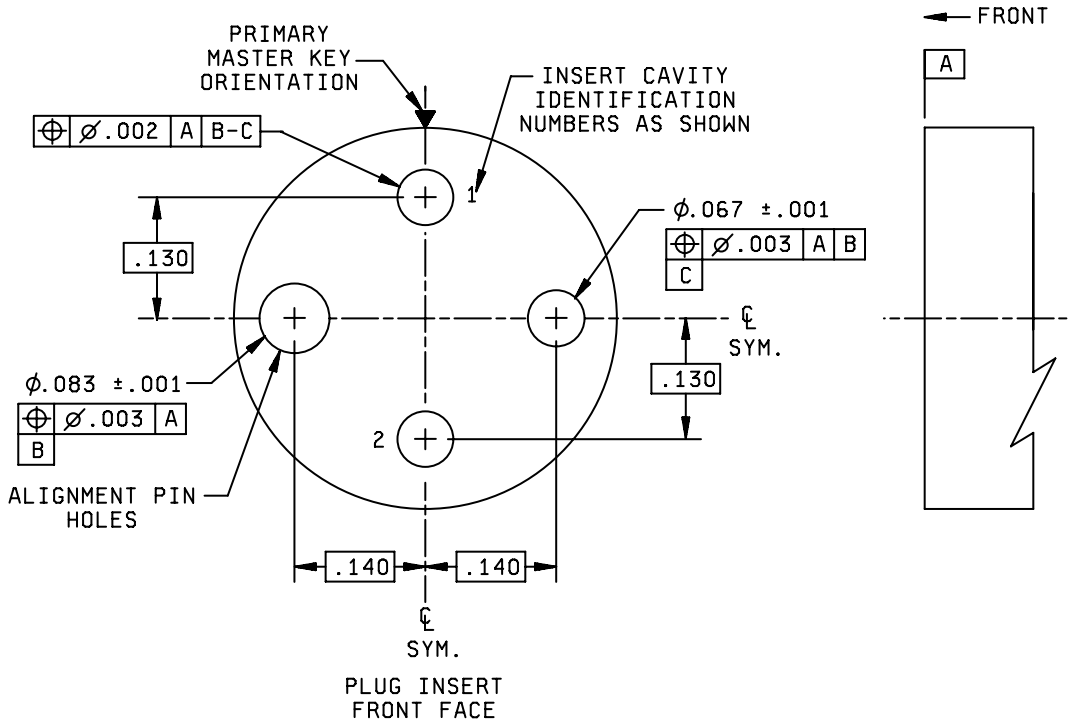
e. Unless otherwise indicated, dimensions are symmetrical about centerlines.

f. Each insert arrangement is shown in the "normal position" with indexing feature at top of vertical centerline of the engagement face.

g. Shell polarization shall be in accordance with figure A-3 of MIL-PRF-64266, appendix A.

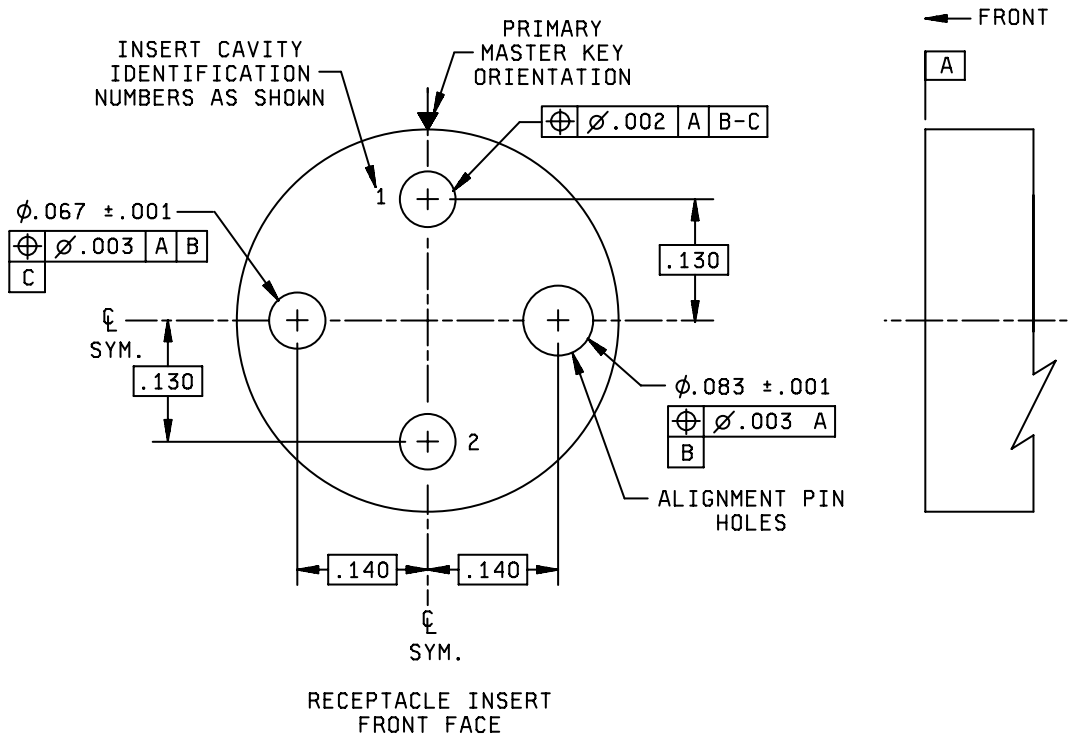
h. Tolerance is + .010 for three decimal places and + .030 for two decimal places unless otherwise stated.

APPENDIX B



Shell size	Shell size Designator	Arrangement number	Number of termini
11	B	1	2

FIGURE B-1. Two-position termini arrangement for shell size 11.

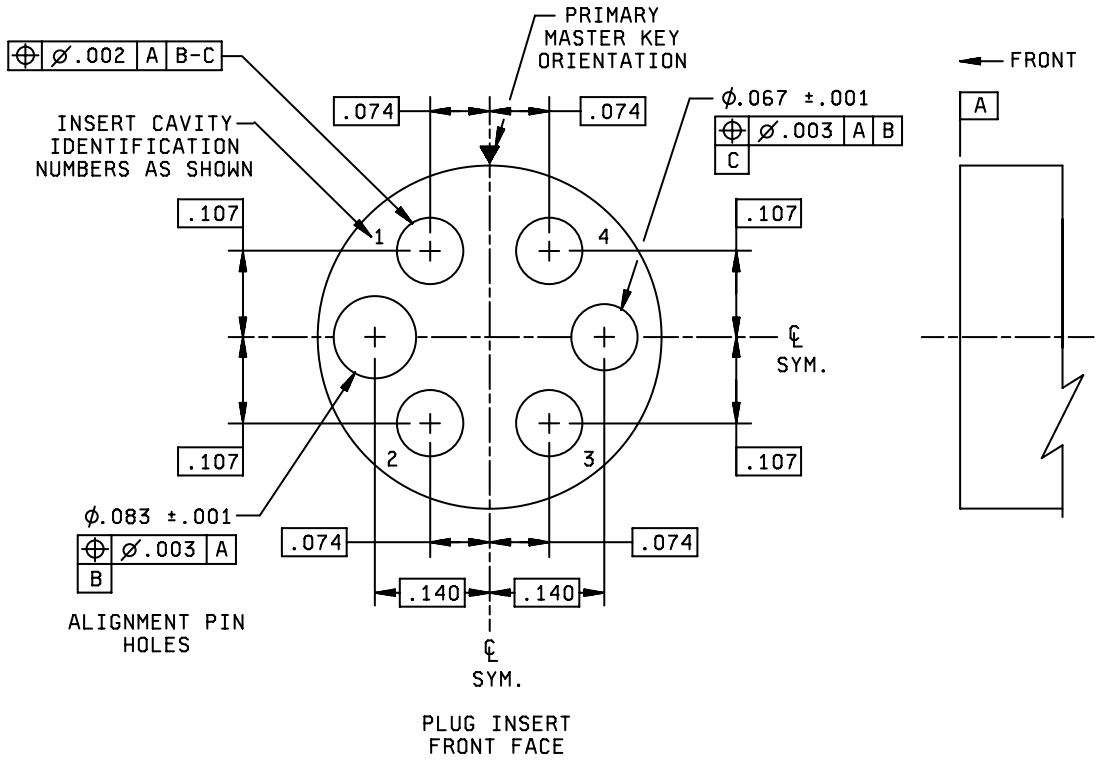


Inches	mm
.001	.025
.002	.051
.003	.076
.067	1.70
.083	2.12
.130	3.30
.140	3.56

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for information only.

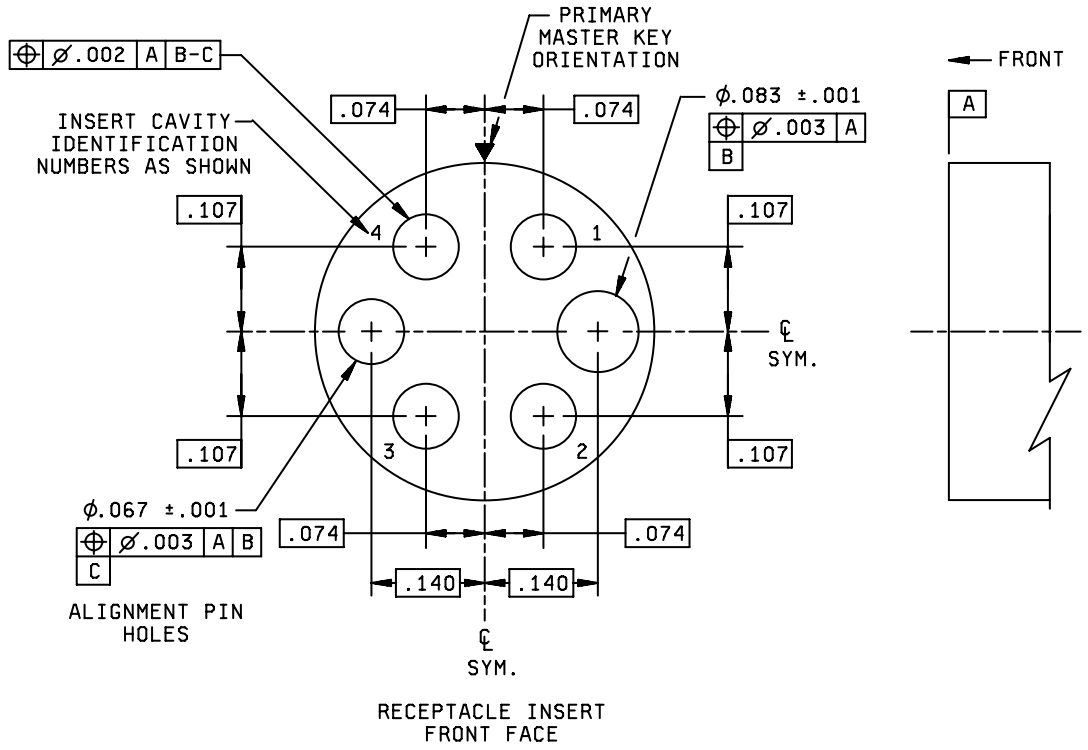
FIGURE B-1. Two-position termini arrangement for shell size 11 - Continued.

APPENDIX B



Shell size	Shell size Designator	Arrangement number	Number of termini
11	B	2	4

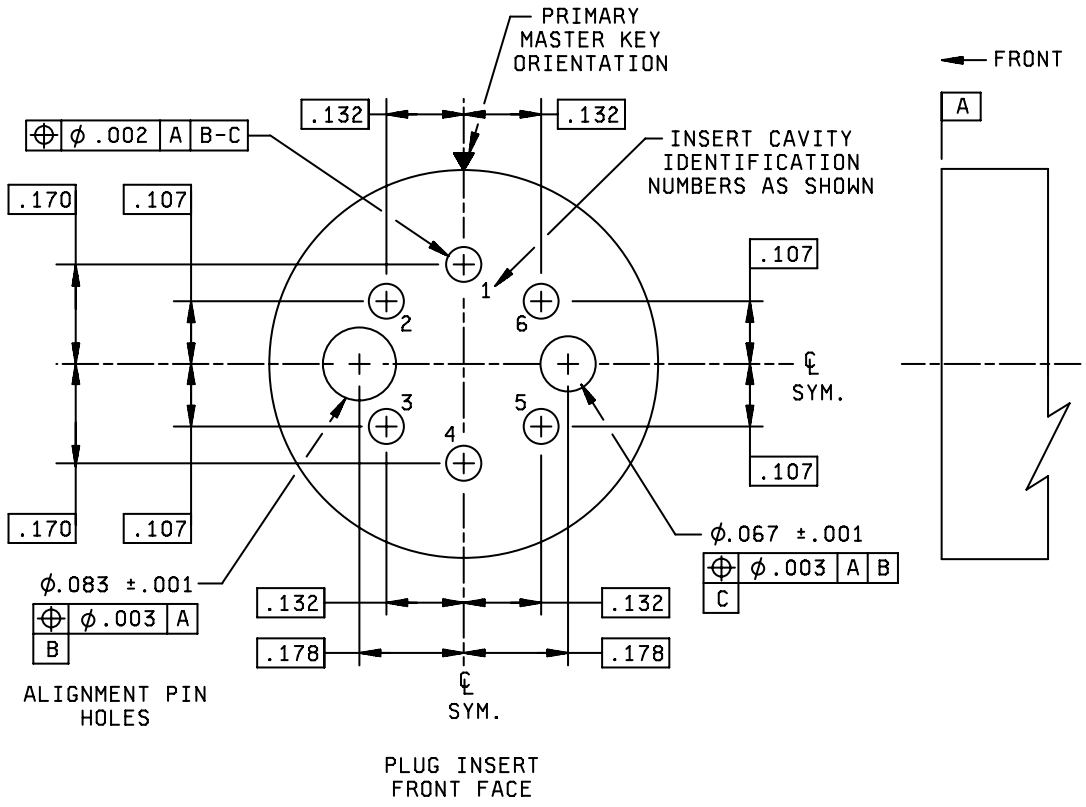
FIGURE B-2. Four-position termini arrangement for shell size 11.



Inches	mm
.001	.025
.002	.051
.003	.076
.067	1.70
.074	1.88
.083	2.12
.107	2.72
.140	3.56

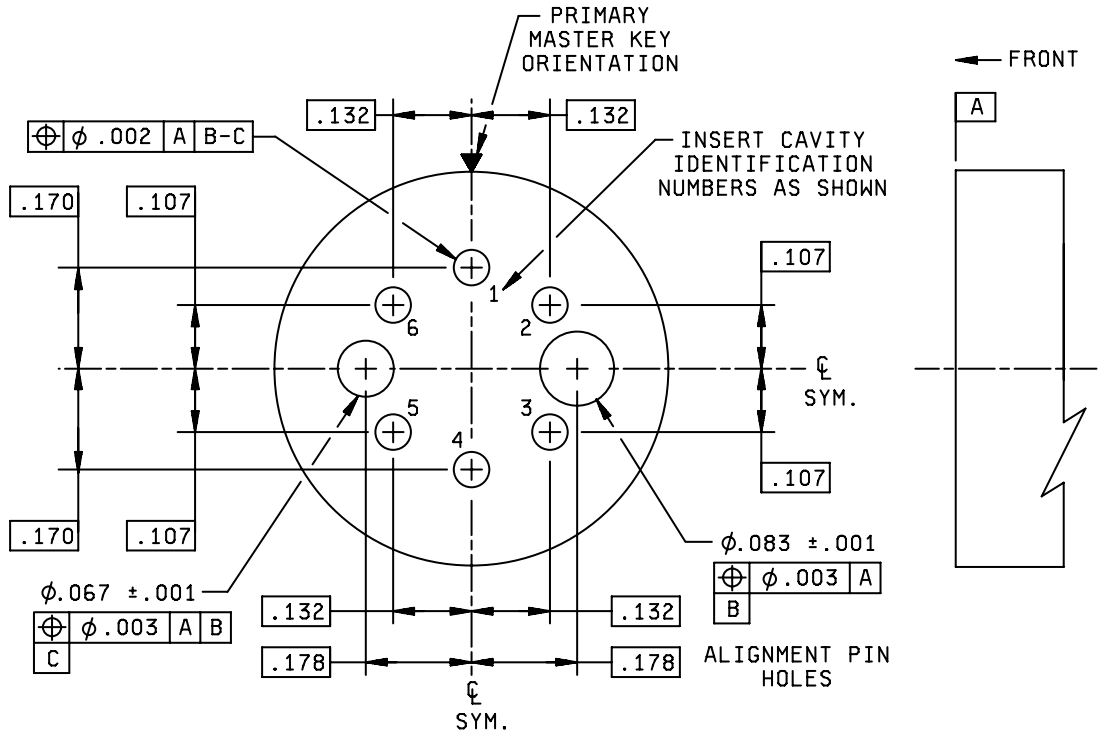
NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for information only.

FIGURE B-2. Four-position termini arrangement for shell size 11 - Continued.



Shell size	Shell size Designator	Arrangement number	Number of termini
13	C	1	6

FIGURE B-3. Six-position termini arrangement for shell size 13.

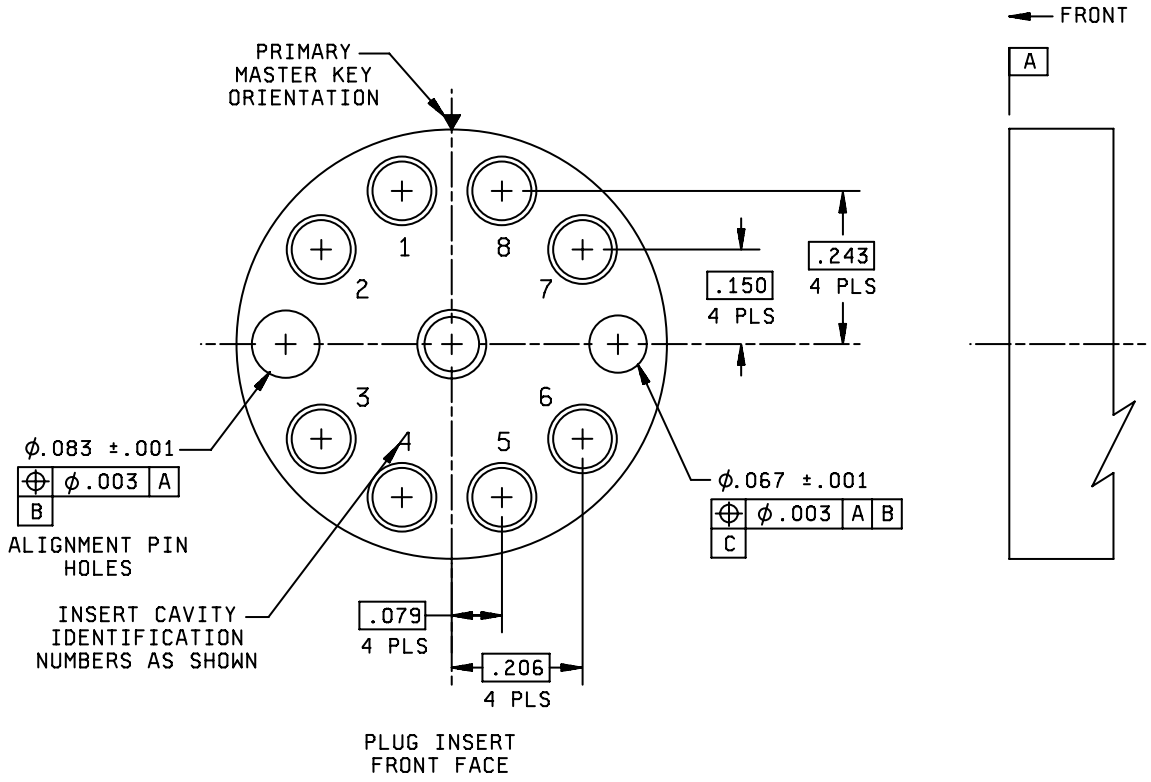


RECEPTACLE INSERT
FRONT FACE

Inches	mm
.001	.025
.002	.051
.003	.076
.067	1.70
.083	2.12
.107	2.72
.132	3.35
.170	4.32
.178	4.52

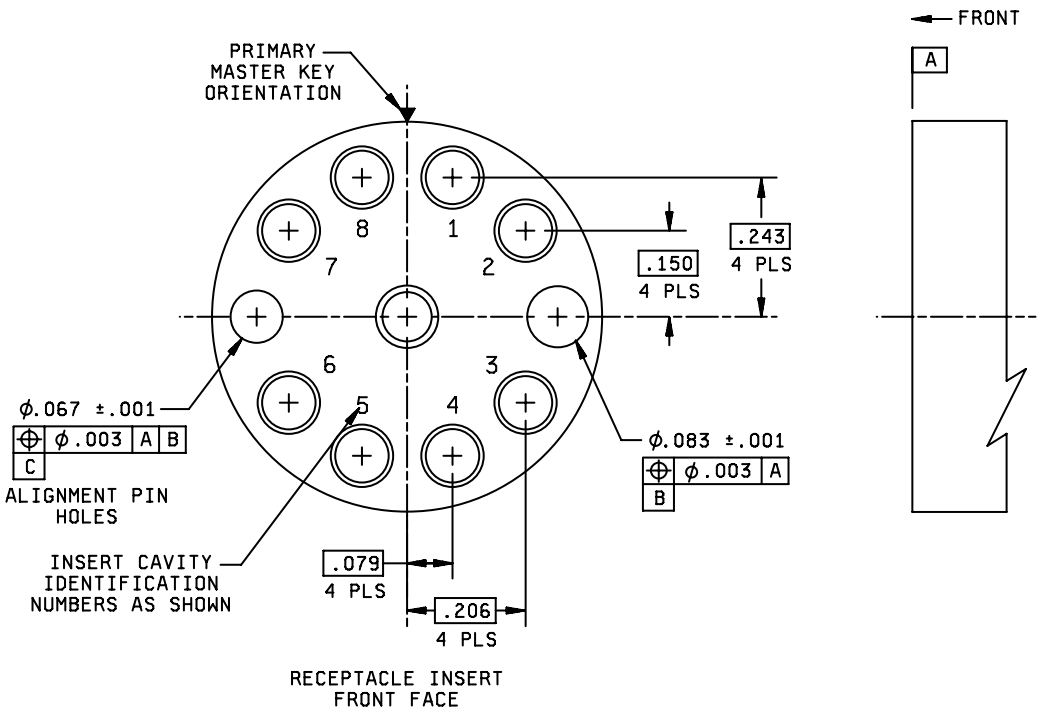
NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for information only.

FIGURE B-3. Six-position termini arrangement for shell size 13 - Continued



Shell size	Shell size designator	Arrangement number	Number of termini
15	D	1	8

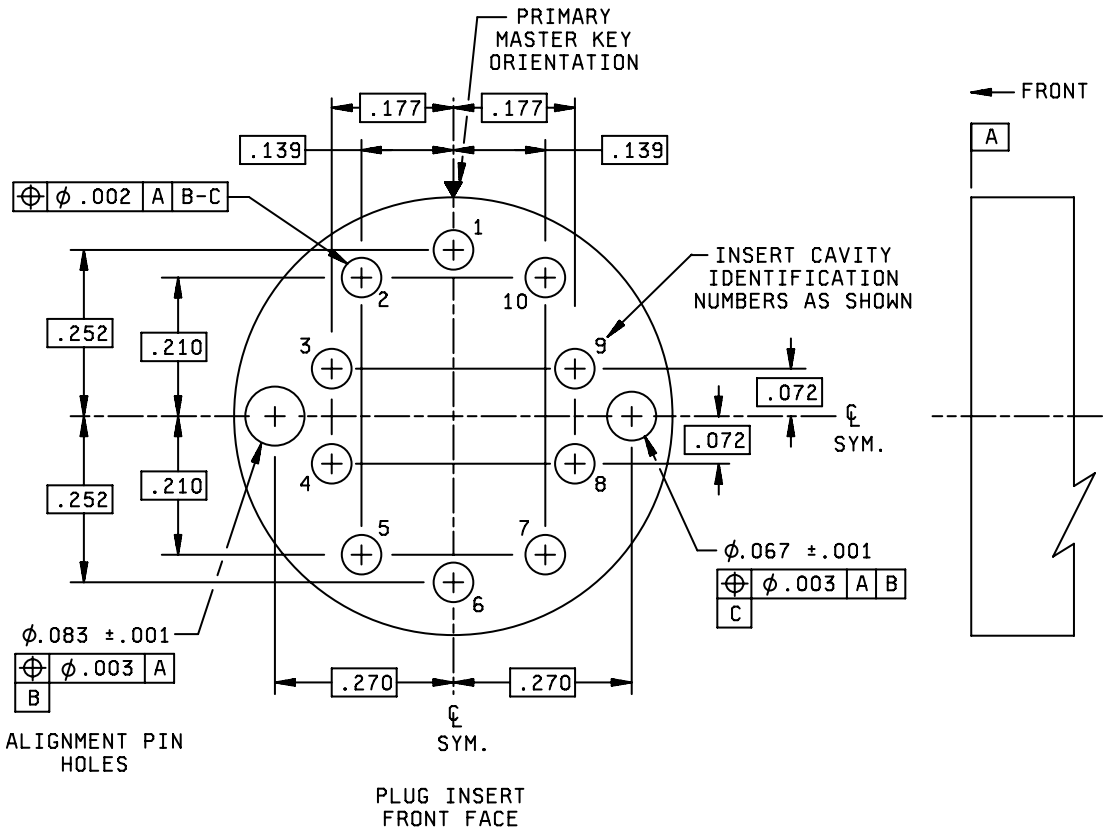
FIGURE B-4. Eight-position termini arrangement for shell size 15.



Inches	mm
.001	.025
.002	.051
.003	.076
.067	1.70
.079	2.01
.083	2.12
.150	3.81
.206	5.23
.243	6.17

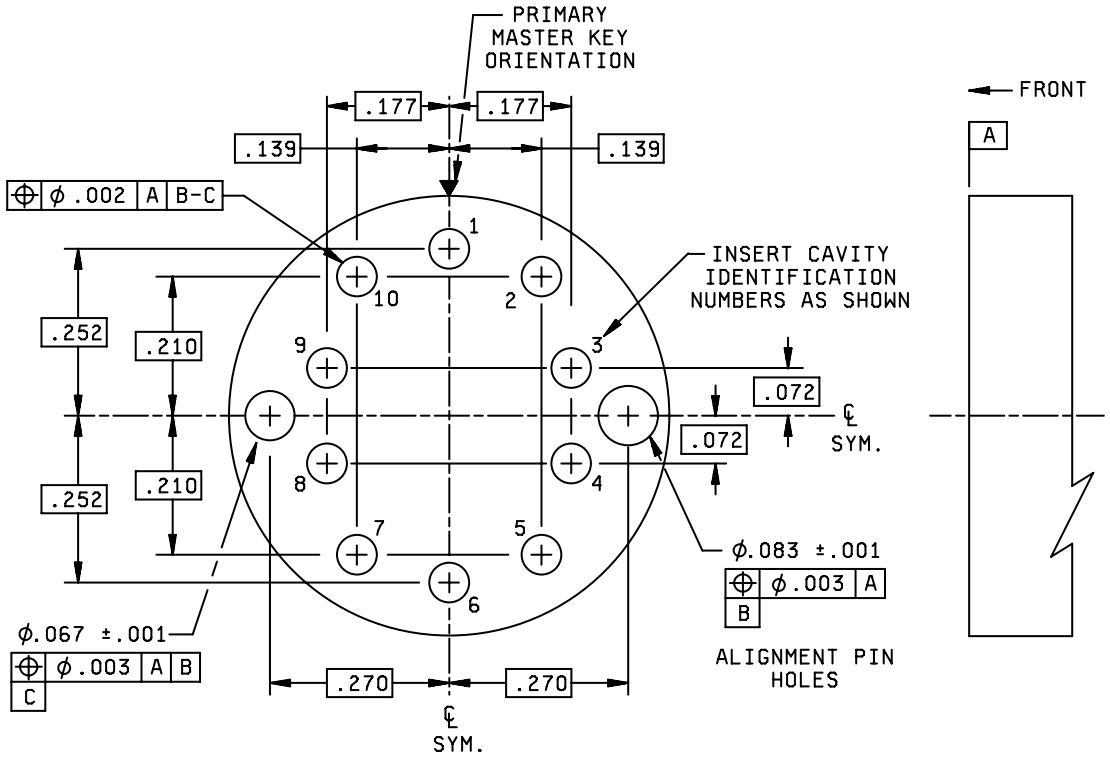
NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for information only.

FIGURE B-4. Eight-position termini arrangement for shell size 15 - Continued.



Shell size	Shell size designator	Arrangement number	Number of termini
15	D	2	10

FIGURE B-5. Ten-position termini arrangement for shell size 15.

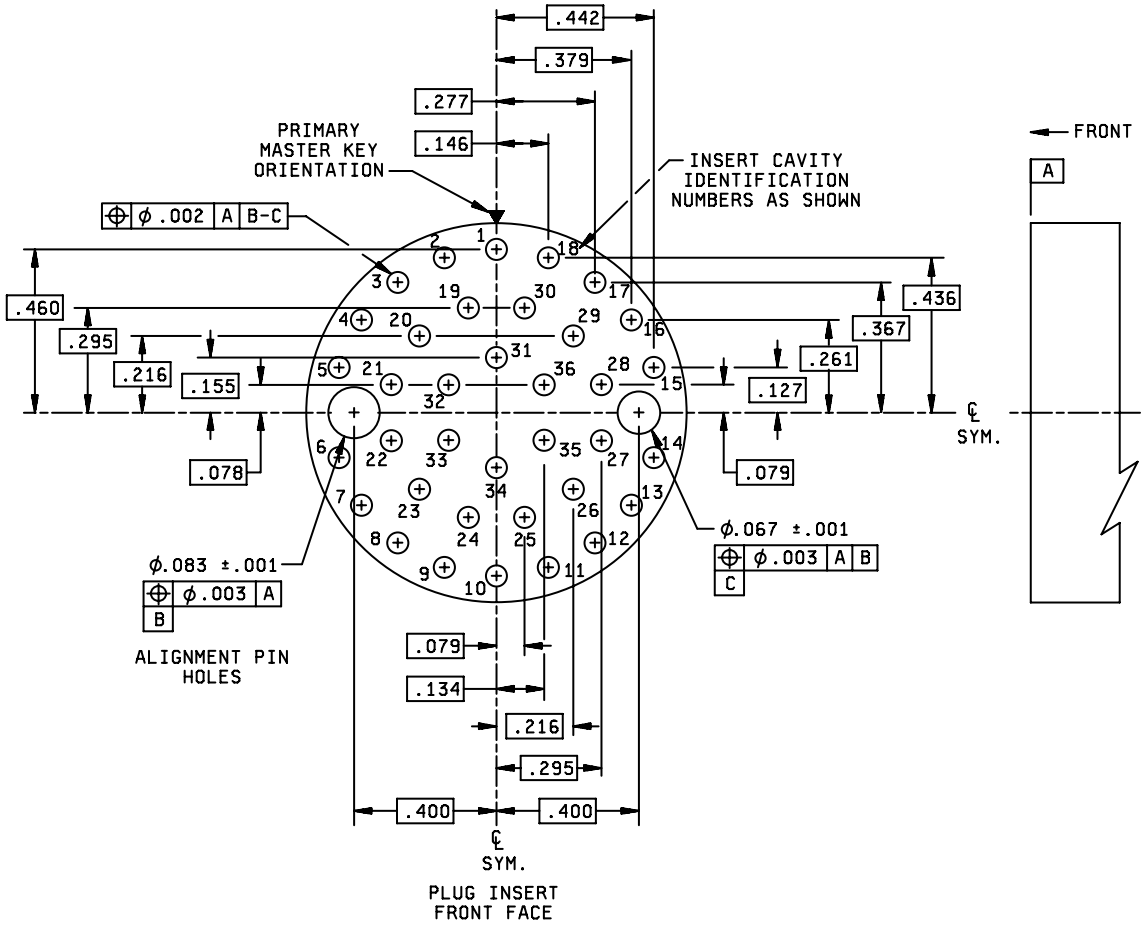


RECEPTACLE INSERT
FRONT FACE

Inches	mm
.001	.025
.002	.051
.003	.076
.067	1.70
.072	1.83
.083	2.12
.139	3.53
.177	4.50
.210	5.33
.252	6.40
.270	6.86

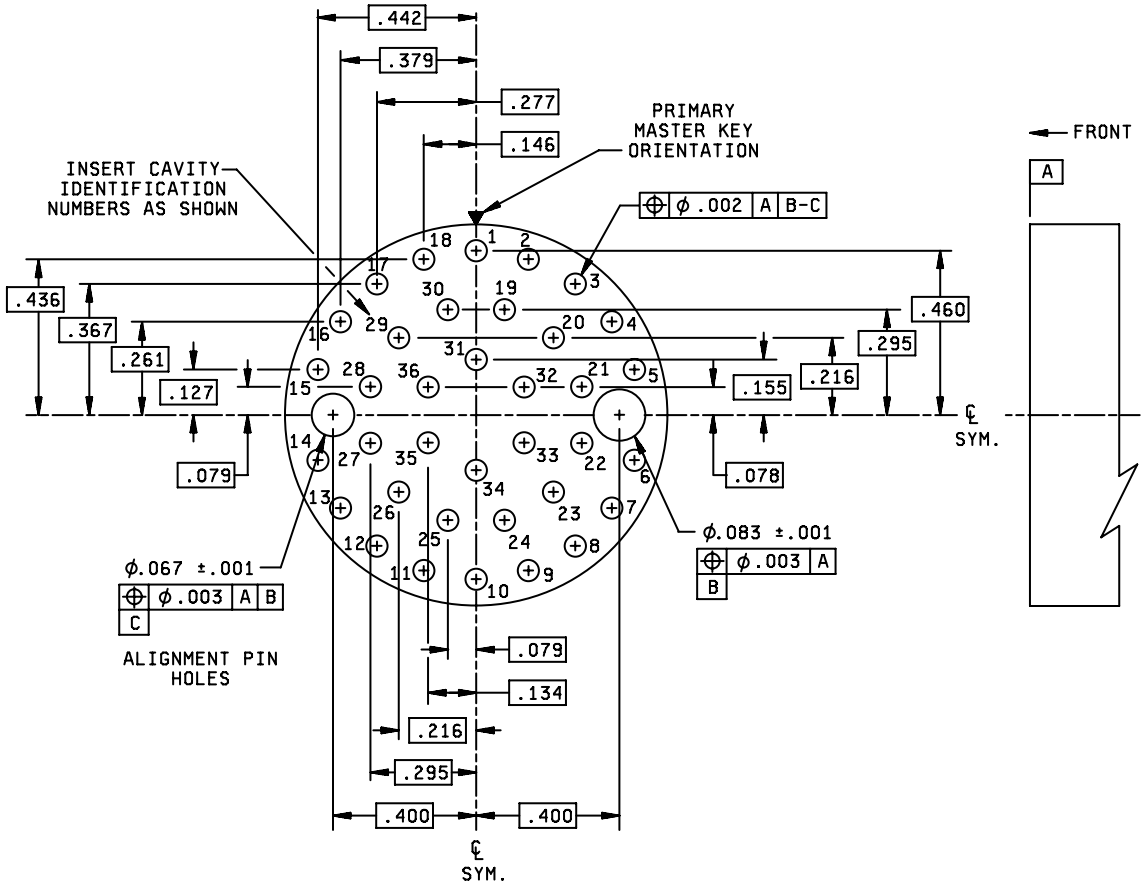
NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for information only.

FIGURE B-5. Ten-position termini arrangement for shell size 15 - Continued.



Shell size	Shell size designator	Arrangement number	Number of termini
23	H	1	36

FIGURE B-6. Thirty six-position termini arrangement for shell size 23.



Inches	mm	Inches	mm
.001	.025	.216	5.49
.002	.051	.261	6.63
.003	.076	.277	7.04
.067	1.70	.295	7.49
.078	1.98	.367	9.32
.079	2.01	.379	9.63
.083	2.12	.400	10.16
.127	3.23	.436	11.07
.134	3.40	.442	11.23
.146	3.71	.460	11.68
.155	3.94		

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for information only.

FIGURE B-6. Thirty six-position termini arrangement for shell size 23 - Continued.

APPENDIX C

CONNECTOR BACKSHELL AND ACCESSORY CONFIGURATIONS

C.1 SCOPE

C.1.1 Scope. This appendix covers connector backshell and accessories for use with fiber optic connectors under environmental and non-environmental conditions. Connector backshells and accessories are defined by type of duty. Connector backshells and accessory interface dimensions are a mandatory part of the specification. This Appendix is a mandatory part of the specification. The information contained herein is intended for compliance. Table C-I provides a comparison of the differences in performance between heavy duty, medium duty, and light duty backshells.

C.2 DRAWINGS

C.2.1 Connector backshell and accessory categories. Connector backshells and accessories covered in this appendix shall include but are not limited to the following categories:

Category A - Heavy Duty,
Category B - Medium Duty
Category C - Light Duty category

C.2.2 Classification. Connector accessories shall be of the size, style, finish, and class as specified on the applicable military specification sheet (see 3.1).

C.3 DESIGN AND CONSTRUCTION

C.3.1 Materials. Materials shall be suitable for the purpose intended and specified (see 3.1) however, when a definite material is not specified, a material shall be used which will enable the connector assembly to meet the performance requirements of this specification. Acceptance or approval of any constituent material shall not be construed as a guarantee for acceptance of the finished product.

C.3.2 Connector accessories. Connector accessories shall be designed and constructed to withstand normal handling incident to installation and maintenance in service.

C.3.3 Configuration. The configuration and dimensions of connector accessories shall be as specified in the applicable specification sheets (see 3.1).

C.3.4 Screw threads. Backshell screw threads shall be in accordance with figure A-6 in appendix A and shall conform to 3.10.4 when tested in accordance with 4.9.2.4.

C.3.5 Safety wiring. When specified, threaded coupling connector interfaces shall be designed for safety wiring. A minimum of two holes shall be provided for shell size 14 or smaller, and at least three equally spaced holes for sizes 16 and larger. Holes shall be of a diameter sufficient to accommodate .020 inch wire. For non-self-locking accessories, safety wire holes shall not be optional. Self-locking accessories shall not have safety wire holes on the coupling nut.

APPENDIX C

C.4 Interchangeability. All connector accessories having the same military part number shall be completely interchangeable with each other with respect to installation and performance as specified herein.

C.5 Intermateability. Unless otherwise specified (see 3.1), the intermateability control dimensions for the threaded mating end of the connector accessories shall conform to the interface dimensions specified in figure A-6.

C.6 Spin coupling. Unless otherwise specified (see 3.1), for all circular connector accessory applications, the coupling nut shall have spin coupling. The coupling nut shall be captivated to, and free to rotate on, the follower of the circular connector accessory. Unless otherwise specified (see 3.1), the spin coupling nut will be either non-self-locking or self-locking. The self-locking coupling devices may exhibit some mechanical resistance while captivated to the follower.

C.7 Self-locking devices. The self-locking device within the coupling nut shall be a corrosion-resistant material and shall provide a positive detent. Couplings with self-locking devices shall meet all the performance requirements specified herein for the accessories specific category.

APPENDIX C

TABLE C-I. Backshell attributes.

Category	Item	Description 1/
1A Heavy Duty	Connector Accessory, Cable Sealing, Environmental	Provides water proofing and environmental sealing under specified hydrostatic pressure. Straight, 45°, or 90° configurations. May include termination features for individual or overall EMI/RFI shielding. May include strain relief. Withstands most severe shock, vibration, cable pullout, and external bending moment.
1B Medium Duty	Connector Accessory, Cable Sealing, Environmental	Same as for Category 1A. Withstands less severe shock, vibration, cable pullout, and external bending moment than Category 1A.
1C Light Duty	Connector Accessory, Cable Sealing, Environmental	Same as for Category 1A. Withstands less severe shock, vibration and external bending moment than Category 1B. No cable pullout capability.
2A Heavy Duty	Connector Accessory, Environmental	Does not provide waterproofing and environmental sealing under hydrostatic pressure. Straight, 90°, or 45° configurations. May include termination features for individual or overall EMI/RFI shielding. May include strain relief. Withstands most severe shock, vibration, cable pullout, and external bending moment.

See notes at end of table.

TABLE C-I. Backshell attributes - continued.

Category	Item	Description 1/
2B Medium Duty	Connector Accessory, Environmental	Same as for Category 2A. Withstands less severe shock, vibration, cable pullout, and external bending moment than Category 2A.
2C Light Duty	Connector Accessory, Environmental	Same as for Category 2A. Withstands less severe shock, vibration and external bending moment than Category 2B. No cable pullout capability.
3A Heavy Duty	Connector Accessory, Nonenvironmental	May provide termination features for individual or overall, fiber or cable shielding. May extend working area for fiber or cable termination. Straight, 90°, or 45° configurations. May include termination features for individual or overall EMI/RFI shielding. May include strain relief. Withstands most severe shock, vibration, cable pullout, and external bending moment.
3B Medium Duty	Connector Accessory, Nonenvironmental	Same as for Category 3A. Withstands less severe shock, vibration, cable pullout, and external bending moment than Category 3A.
3C Light Duty	Connector Accessory, Nonenvironmental	Same as for Category 3A. Withstands less severe shock, vibration and external bending moment than Category 3B. No cable pullout capability.

See notes at end of table.

TABLE C-I. Backshell attributes - continued.

Category	Item	Description 1/
4A Heavy duty	Connector Accessory, Strain Relief, Nonenvironmental	Provides mechanical strain and side loading relief to fiber bundles and cable support to jacketed cables. Straight, 90°, or 45° configurations. May be attached to fiber bundle or cable by means of metal clamp, plastic straps, lacing cord, or twine. Withstands same shock, vibration, cable pullout, and external bending moment as medium duty connector accessories of Categories 1, 2, and 3.
4B Medium duty	Connector Accessory, Strain Relief, Nonenvironmental	Same as for Category 4A. Withstands less severe shock, vibration, cable pullout, and external bending moment than Category 4A.
4C Light Duty	Connector Accessory, Strain Relief, Nonenvironmental	Same as for Category 4A. Withstands less severe shock, vibration, and external bending moment than Category 4A. No cable pullout capability.
5	Connector Accessory, Adapter, Shrink Boot and Ring, Potting Boot	Provides means of attaching heat shrinkable boot to connector. Provides means of attaching potting boot to connector.
6	Boots and Sleeves, Heat Shrinkable	TBD

See notes at end of table.

TABLE C-I. Backshell attributes - continued.

Category	Item	Description 1/
7	Connector Accessory, Miscellaneous Devices	Examination of product. This category defines connector accessories which require relatively few test procedures for qualification. Additional requirements and test procedures shall be defined in the individual specification sheet.
8A	Connector Accessory, Adapter, Conduit, Cable Sealing	Provides waterproofing and environmental sealing under hydrostatic pressure. Straight or angled.
8B	Connector Accessory, Adapter, Conduit, Nonenvironmental	Provides termination area for connectors on conduit. Straight or angled.

1/ See individual specification sheets for detailed requirements of each product.

Custodians:
Army - CR
Navy - SH
Air Force – 85
DLA - CC

Preparing activity:
DLA - CC

Review activities:
Navy - AS
Air Force - 13, 19, 93, 99
NASA - NA

(Project 6060-0168)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at http://assist.daps.dla.mil.