INCH-POUND

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SUPERSEDING
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DETAIL SPECIFICATION

CONNECTORS, FIBER OPTIC, CIRCULAR, ENVIRONMENTAL RESISTANT, HERMAPHRODITIC, 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 characteristics, performance and testing criteria for a circular, environmental resistant, hermaphroditic interface, fiber-optic connector. The connectors covered have a consistent and predictable optical performance and are sufficiently rugged to withstand military field application.

1.2 Classification. Hermaphroditic connector designs are included in this specification. Hardware associated with the connector is also specified including backshells, protective covers and storage receptacles.

Comments, suggestions, or questions on this document should be addressed to: Defense Supply Center, Columbus, Attn: DSCC-VAT, P. O. 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/.

AMSC N/A FSC 6060

1.3 Part or Identifying Number (PIN). The PIN is in the following format, consisting of the letter "M" followed by the basic specification number, sequentially assigned dash number and additional designators from applicable specification sheets (see 3.1 and 6.2).

M 83526/ XX - X X X X

Denotes military specification
Basic specification number
Specification sheet number
Number of terminus positions required

Quantity	Designator
2	A
4	B
6	C
8	D
10	E
12	F

Cable size 1/

Cable Jacket OD in Inches	Designator
0.178 - 0.216	1
0.217 - 0.256	2

Terminus supplied for actual fiber size 2/

Fiber OD in microns	Designator
123.0 - 124.4	A
124.5 - 127.0	B
138.0 - 139.6	C
139.7 - 142.0	D
No termini specified	E

Keying position for terminus insert arrangement

Position	Designator
A (STD)	1
B (non rated 60°)	2
No altering keying Position required	3

1/ Select cable size and type in accordance with MIL-PRF-85045.
2/ Select fiber size and tolerance in accordance with MIL-PRF-49291.

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 (see 6.2).

FEDERAL STANDARDS

FED-STD-H28 - Screw Threads Standards for Federal Services.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-DTL-5624	-	Turbine Fuel, Aviation, Grades JP-4, JP-5, and JP-5/JP-8ST
MIL-PRF-16884	-	Fuel, Naval Distillate
MIL-PRF-17331	-	Lubricating Oil, Steam Turbine Gear, Moderate Service
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-49291	-	Fiber, Optical, (Metric), General Specification For
MIL-PRF-85045	-	Cables, Fiber-Optics, (Metric), General Specification For
MIL-PRF-87252	-	Coolant Fluid, Hydrolytically Stable, Dielectric

(See supplement 1 for list of associated specifications).

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-790	-	Established Reliability and High Reliability Qualified Products List (QPL) Systems for Electrical, Electronic, and Fiber Optic Parts Specifications
MIL-STD-889	-	Dissimilar Metals
MIL-STD-1285	-	Marking Of Electrical and Electronic Parts

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

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 (see 6.2).

ELECTRONICS INDUSTRY ASSOCIATION / TELECOMMUNICATIONS INDUSTRY ASSOCIATION

EIA-364-81	-	Combustion Characteristics test Procedure for Electrical Connector Housings, Connector Assemblies and Sockets
EIA/TIA-455-12	-	Fluid Immersion Test Procedure for Electrical Connectors and Sockets
EIA/TIA-455-98	-	Fiber Optic Cable External Freezing Test
* TIA-455-6	-	Connectors, Electrical, Cable Pull-Out Test Procedures for
* TIA -455-13	-	Visual and Mechanical Inspection of Fiber Optic Components, Devices, and Assemblies
* TIA-455-14	-	Fiber Optic Shock Tests
* TIA-455-15	-	Altitude/Immersion of Fiber Optic Components
* TIA-455-21	-	Fiber Optic, Interconnecting Devices, Mating Durability of
* TIA-455-26	-	Fiber Optic Cable Interconnecting Devices, Crush Resistance of
TIA-455-36	-	Twist Test for Fiber Optic Connecting Devices
TIA-455-189	-	Ozone Exposure Test Procedure for Electrical Connectors
* TIA/EIA-455	-	Standard Test Procedures 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 Interconnection Devices
* TIA/EIA-455-2	-	Optic Devices, Fiber, Impact Test Measurements for
* TIA/EIA-455-4	-	Fiber Optic Component Temperature Life
* TIA/EIA-455-5	-	Humidity Test Procedure for Fiber Optic Components and Cable
TIA/EIA-455-11	-	Vibration Test Procedure for Fiber Optic Components
* TIA/EIA-455-16	-	Salt Spray Test Procedure for Fiber Optic Components
* 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/EIA-455-71	-	Procedure to Measure Temperature-Shock Effects on Fiber Optic Components
* EIA-557	-	Statistical Process Control Systems
* TIA/EIA-604	-	Fiber Optic Connector Intermateability Standards (FOCIS)

* Adopted by DoD

(Application for copies of publications should be addressed to Electronic Industries Association, Engineering Dept. /Telecommunications Industry Association, Standards and Technology Dept., 2500 Wilson Blvd., Arlington, VA 22201, http://www.tiaonline.org/ or http://www.eia.org/).

INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE)

* IEEE-299	-	Measuring the Effectiveness of Electromagnetic Shielding Enclosures

* Adopted by DoD

(Application for copies should be addressed to the Institute of Electrical and Electronic Engineers, 445 Hoes Lane, Picataway, New Jersey 08855-1331, http://shop.ieee.org/ieeestore/).

2.4 Order of precedence. 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 sheets. 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, which are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.5 and 6.3).

3.2.1 QPL system. The manufacturer shall establish and maintain a QPL system for parts covered by this specification. Requirements for this system are specified in MIL-STD-790.

3.2.2 SPC system. As a part of the overall MIL-STD 790 QPL system, the manufacturer shall establish a SPC system that meets the requirements of EIA-557

3.3 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible, provided that the material meets or exceeds the operational and maintenance requirements, and promotes economically advantageous life cycle costs

3.3.1 Materials. The connectors, caps, covers, storage receptacles or other protective accessory hardware shall be constructed of material as specified herein and in the applicable specification sheet (see 3.1). 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 3.3.4.2), nonnutrient to fungus (see 3.3.4.6) and manufactured to good workmanship quality (see 3.13). Materials chosen shall be the lightest practicable material suitable for the intended use. Materials shall not interfere with or degrade the terminus cleaning operation.

3.3.1.1 General. Materials may be dielectric or conductive as applicable. Materials shall in no manner interfere with or degrade the fiber-optical termination process, termini cleaning operation, or optical junction transmission. Materials which are not specified shall be of the lightest practical weight and suitable for the intended purpose.

3.3.2 Metals. Unless otherwise specified (see 3.1), all metals shall be corrosion resistant types (300 series CRES recommended), or shall be suitably plated or otherwise finished to prevent corrosion during service life under any of the environmental conditions specified by the document. All metals shall be nonmagnetic.

3.3.2.1 Dissimilar metals. Dissimilar metals shall not be used in intimate contact with each other unless suitably finished to prevent electrolytic corrosion. The criteria for the selection and protection of dissimilar metal combination shall be in accordance with MIL-STD-889.

3.3.3 Steel parts and finishes. Unless otherwise specified (see 3.1), all exposed corrosion-resistant steel parts of the connector assembly shall have a passivated finish which permits the attainment of a surface finish condition compatible with external coatings or platings of the type and color specified (see 3.1).

3.3.3.1 Stainless steel components. Stainless steel components shall be passivated and nonreflective.

3.3.4 Nonmetallic materials. All nonmetallic materials used in the construction of connectors specified by this document shall not be affected by the use of cleaning materials nor shall any substance used in the construction of the connectors be degraded when operating at the environmental conditions herein specified.

3.3.4.1 Mercury and radioactive material. Mercury and radioactive materials shall not be used in the construction of the connectors, caps, covers, storage receptacles, or other protective accessory hardware specified by this document.

3.3.4.2 Toxic and hazardous products and formulations. Materials used in the connector, backshell, or accessories shall not give off toxic or explosive fumes when exposed to flame. The material shall have no adverse effect on the health of personnel when used for its intended purpose. Questions pertinent to this effect shall be referred by the contracting activity to the appropriate departmental medical service who will act as an advisor to the contracting agency.

3.3.4.3 Solvents, adhesives and cleaning agents. No incompatability shall exist between the materials employed in the fiber to terminus securing or polishing processes, such that degradation of these materials shall result from in-service use or when tested in accordance with requirements of the temperature life test of 4.9.20.

3.3.4.4 Epoxies. Epoxies are not precluded from use in the construction of the connectors controlled by this specification. However, only those epoxy types, which have been tested and found to be fungus-inert, shall be specifically defined in the detail specification sheet for the connector type. The detail sheet shall also specify the process to be followed in mixing and curing the epoxy. Epoxies may not be used in the optical path of the connector. The service life of epoxy material shall be consistent with the intended useful lifetime of the connector. The termination and retermination of the connector shall not be affected by the use of epoxy material.

3.3.4.5 Sealing compounds. Sealing compounds which may flow at the maximum upper storage temperature specified herein, or crack at the minimum lower storage temperature specified herein shall not be used.

3.3.4.6 Fungus resistance. All materials used in connectors designed to this specification shall be non-nutrient to fungus. When tested in accordance with 4.11, 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.

3.4 Design and construction. Connectors, backshells and protective accessories shall be of the design, construction, and physical dimensions specified (see 3.1).

3.4.1 Threads. Threads shall be in accordance with FED-STD-H28.

3.4.1.1 Thread lubricants. Suitable lubricants are allowed on ramps and threads of metal connectors. Lubricants shall not be affected by cleaning solvents, which are required to maintain the optical performance of the connectors.

3.4.2 Sealing. When specified, the connector design shall include environmental sealing capabilities at the interface and rear of the connector. The seals, dynamic, static or both, shall preclude the entrance of moisture, dust, sand, and dirt that might degrade the performance required under specified environmental conditions.

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

3.4.2.2 Cable sealing. Connectors shall seal the terminating cables to meet the environmental requirements specified herein.

3.4.2.3 Adhesives and sealing compounds. When specified, the connector manufacturer shall specify necessary adhesives for terminating the optical fiber or for sealing the connector. These compounds shall not be used unless otherwise specified (see 3.1).

3.4.3 Intermateability and interoperability (see Appendix A). When specified (see 3.1) connector parts shall be intermateable and interoperable as specified in 3.4.3.1 and 3.4.3.2 respectively.

3.4.3.1 Intermateability. All connectors having the same termini, insert arrangement and shell size shall be intermateable with their counterpart connectors (see Appendix A).

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 Appendix A. The connectors shall meet the requirements of insertion loss (see 3.10.1), terminus insertion and removal forces (see 3.11.9), and terminus retention force (see 3.11.8) for each specified interoperability condition (see Appendix A).

3.4.4 Nontoxic and nonhazardous. The connectors shall not release toxic or explosive fumes exceeding the limits specified when exposed to flame or chemical agents commonly used in the environment in which the connectors are intended for use.

3.4.5 Cleaning. The design of the connector shall permit cleaning of the optical face of the terminus without requiring major disassembly of the connector or removal of the terminus from the connector. The connector shall not be softened, embrittled, etched, or otherwise affected by the optical cleaning agent. Attention shall be given to the criteria for inspection and test of the connector to determine if the cleaning procedure has been successful.

3.4.6 Scoop proof. The optical mating faces must be suitably protected to prevent degradation of the specified light transfer characteristics as a result of repeated mechanical matings and unmatings. Neither the shell assemblies nor the connector dust cover shall make contact with the optical faces during the mating or unmating of the connector.

3.4.7 Mating characteristics. The connectors specified herein shall satisfy the following operational and human factor requirement.

3.4.7.1 Blind mating. The connector designs shall allow mating and unmating in “blind” conditions where the operator cannot fully observe the connector during the mating process.

3.5 Connectors.

3.5.1 Shell. The connector shell or backshells shall retain the connector insert.

3.5.2 Engagement of connectors. Unless otherwise specified (see 3.1), the connector shall be capable of being mated and unmated without the use of special tools.

3.5.3 Coupling mechanism. Coupling rings of the connectors shall be knurled or fluted to facilitate hand tightening, and designed so that the mating halves optical termini shall approach or recede from each other as the coupling mechanism is respectively tightened by clockwise rotation or loosened in the counter-clockwise direction as viewed from rear of plug connector. No strap wrenches or other tools shall be required to torque the connectors to accomplish mate up. 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 FED-STD-H28, and as specified (see 3.1). If the coupling threads must be lubricated to meet the requirements contained herein, the lubricant shall be applied only during manufacture. The lubricant selected shall not be reapplied nor migrate into the optical junctions region during use.

3.5.4 Polarization. Polarization of the mating halves shall be provided and designed to prevent physical contact of the mating optical termini or of the termini with the insert surface of the counterpart connector until properly aligned for engagement. Backshell splines, keys, and keyways shall be polarized and mated prior to coupling (see 3.1).

3.5.5 Termini. Termini shall be sufficiently specified to insure interchangeability and intermateability. 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 (see 3.1).

3.5.6 Inserts. The connector design shall preclude fiber damage due to potential cable winding (see 3.8.1).

3.5.6.1 Number of termini, arrangement and spacing. The insert pattern, that is, the number of termini, their arrangement and spacing shall be as specified (see 3.1). Every terminus position shall accept either optical or dummy termini. Termini spacing shall permit adequate terminus marking identification and easy terminus insertion and removal.

3.5.6.2 Terminus insertion and removal methods. Optical terminus insertion shall be accomplished by inserting the terminus through the inserts of the connector mating halves and by locking it in place. 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 damage to the terminus or connector insert when using the terminus removal tool. Requirements for these tools shall be as specified (see 3.1).

3.6 Backshell accessories. Backshells shall conform to the requirements as specified (see 3.1). The backshell shall provide cable strain relief. The backshell shall be free of any sharp edges or other configurations that could cause damage to optical fibers extending through them.

3.7 Protective covers and storage receptacles. Connectors shall be provided with a protective cover or storage receptacle. These protective devices shall maintain the connector free of moisture, prevent entry of air or dust into the connector and comply with the applicable requirements as specified herein and in the specification sheet. When not in place, the protective device shall be protected against the environment so that dirt, dust, or moisture are not carried to the connector mating surfaces by the protective cover.

3.8 Cable strength member terminations. The termination of the cable strength member shall be such that applying the tensile force specified herein to the cable will not damage the optical fibers or degrade optic performance within specified limits.

3.8.1 Cable strain relief. As specified, the cable strain relief shall grip the cable as it exits the connector to prevent degradation of optical performance by:

a. Cable flexing or twisting at or near the termination.

b. Cable pull out by tensile forces.

3.8.2 Cable service loop. Connectors shall be of a design so as to provide room for a service loop in the optical fibers of sufficient length to allow an individual connector terminus to be repaired at least one time before it is necessary to reterminate the entire connector.

3.9 Tools. Tools used to terminate connectors onto cables shall be as specified (see 3.1). The connector manufacturer shall provide the tools when specified in the acquisition documents (see 6.2).

3.10 Optical performance requirements. The optical performance requirements of 3.10.1 through 3.10.6 shall be used to monitor the effects of the inspection requirements specified in 3.11 as required by 4.7.1.2, 4.7.1.3, and 4.7.1.4.

3.10.1 Insertion loss. When measured in accordance with 4.8.1, the maximum per channel insertion loss under all conditions shall be 1.5 dB for 100 μm core fibers, 1.8 dB for 62.5 μm core fibers and 2.0 dB for 50 μm core fibers.

3.10.2 Discontinuities. When measured in accordance with 4.8.2, no discontinuity shall occur. A discontinuity is considered to be a reduction of strength of 0.5 dB or more for a duration of 50 microseconds (μs) or more.

3.10.3 Analog modulation. When tested in accordance with 4.8.3, the peak-to-peak analog modulation, band pass limited to between 4 hertz (Hz) and 40 kilohertz (kHz), shall be not more than one percent of the steady state signal level.

3.10.4 Crosstalk. The signal power level of passive channel(s) shall be below the signal on the active channel by at least the amount shown in table I when tested in accordance with 4.8.4.

TABLE I. Crosstalk reduction values for a given number of channels.

Independent signal channels	Reduction
2	50 dB
3	53 dB
4 or 5	56 dB
6 or 9	58 dB
10 or more	60 dB

3.10.5 Change in optical transmittance. When tested in accordance with 4.8.5, the optical transmittance shall not degrade by more than 0.5 dB.

3.10.6 Return loss. When measured in accordance with 4.8.6, the return loss of a standard polish multimode or single mode optical terminus shall not be greater than 37 dB. The return loss of an enhanced polish single mode optical terminus shall be not less than 40 dB.

3.10.7 Ambient light susceptibility. When tested in accordance with 4.8.7, the optical power of the light from the optical ports (after accounting for cable and optical junction losses between the device and the detector) shall be less than –70 dBm.

3.11 Physical requirements.

3.11.1 Size. When examined in accordance with 4.9.1, the dimensions and dimensional tolerances for these connectors, backshells, and accessories shall be as specified (see 3.1).

3.11.2 Weight. When tested in accordance with 4.9.2, the weight of the connectors, backshells and accessories shall be as specified (see 3.1).

3.11.3 Color. The external color of the connector shall be as specified in the acquisition document (see 6.2) in accordance with this paragraph. The preferred colors are as specified (see 3.1). All background colors shall be nonreflective (see 4.9.3).

3.11.4 Identification marking. Marking characters shall be a minimum of 2.0 mm in height. When tested in accordance with 4.9.4, the connectors, backshells and accessories shall be marked as specified in 3.11.4.1, 3.11.4.2, or as specified (see 3.1). All marking characters in any face of the connector, backshell, or accessory shall be identifiable. The connector shall also be marked with a yellow band and the phrase “Fiber-Optics” as specified (see 3.1).

3.11.4.1 Connector, backshell and accessory. The connector, backshell and accessory parts shall be identified by a legible and permanent marking applied in accordance with MIL-STD-1285.

3.11.4.2 Terminus location identification. Terminus location shall be designated with identifiable characters as indicated on the applicable specification sheet (see 3.1). Raised characters shall not be used on mating faces. All positions shall be identified on the front of the insert except where space limitations make this impracticable. Location of terminus identifying characters shall be in close proximity to the terminus but need not be placed exactly where indicated on the standard. The preferred color of the terminus location identification character is white. When the background is a color against which white is difficult to distinguish, a color will be chosen for which the identifying character can be easily distinguished. Character position and arrangement shall assure appropriate terminus cavity identification.

3.11.4.3 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 or associated specifications, 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”.”

3.11.5 Terminus cleaning. After cleaning the terminus in accordance with 4.9.5, the marking requirements of 3.11.4 shall be met; also the requirements of 3.10.1 shall be met before, during, and after the test.

3.11.6 Insert retention axial strength. When tested in accordance with 4.9.6, connector inserts shall withstand an applied minimum pressure of 100 pounds per square inch (69 Mpa) in both the forward direction and the backward direction for a minimum period of one minute without cracking, breaking, or being dislocated from their normal position 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. The requirements of 3.10.1 shall be met during and after the test.

3.11.7 Insert retention radial strength. When tested in accordance with 4.9.7, connector inserts shall withstand the clockwise and counter clockwise radial torque specified (see 3.1) when held for a minimum period of one minute in each direction. No rotational displacement detrimental to performance shall be observed between the inserts and their shell body during or after the test exposure.

3.11.8 Terminus retention force. When tested in accordance with 4.9.8, and subjected to axial loads of 22.0 pounds, locked termini shall be retained in their inserts and axial displacements of the termini shall not exceed .012 inch. No damage to termini or inserts shall occur.

3.11.9 Terminus insertion and removal forces. When tested in accordance with 4.9.9, the insertion force and the force required to remove unlocked termini shall not exceed 22.0 pounds.

3.11.10 Maintenance aging. When tested in accordance with 4.9.10, connectors shall show no visible evidence of wear or degradation, which may degrade their ability to perform as specified. The connector insertion loss shall be within the limits specified in 3.10.1.

3.11.11 Coupling forces. When specified (see 3.1) connectors shall be tested in accordance with 4.9.11. The maximum forces for coupling and uncoupling of the connectors shall be as specified (see 3.1).

3.11.12 Coupling torques. When specified (see 3.1) connectors shall be tested in accordance with 4.9.12. The maximum torque for coupling and uncoupling of the connectors shall be as specified (see 3.1).

3.11.13 Mating durability. When tested in accordance with 4.9.13, the connector shall show no defects detrimental to the operation of the connector and shall have mating forces and coupling torques in accordance with 3.11.11 and 3.11.12 respectively. The requirements of 3.10.1 shall be met before and after the test.

3.11.14 Impact. When tested in accordance with 4.9.14, connectors shall show no evidence of broken, loose, deformed or displaced parts, cracks, chips, or other damage, which would result in a degradation of optical performance. Insertion loss shall not exceed the limits specified in 3.10.1.

3.11.15 Twist. When tested in accordance with 4.9.15, the cable/connector interface shall have no damage detrimental to the operation of the cable or connector. The connector insertion loss shall not exceed the limits specified in 3.10.1 before, during, and after the test.

3.11.16 Cable seal flexing. When tested in accordance with 4.9.16, connector strain relief mechanisms shall prevent loss of environmental sealing or other damage, which may impair the connector operation. The requirements of 3.10.1 shall be met before, during, and after the test.

3.11.17 Cable retention. When tested in accordance with 4.9.17, there shall be no evidence of cable jacket damage, cable clamp failure, cable to connector seal damage, distortion or bending of metallic connector parts, or cable disengagement from the clamp. The minimum cable to connector pull-out strength shall be 400 pounds. The requirements of 3.10.1 shall be met before, during, and after the test.

3.11.18 Crush resistance. When tested in accordance with 4.9.18, connectors shall show no broken parts, no degradation of mating-unmating, or no damage to the seals. The connector shall meet the requirements of 3.10.4 before and after the test and the requirements of 3.10.1 before, during, and after the test.

3.11.19 External bending moment. When tested in accordance with 4.9.19, connectors shall show no evidence of damage detrimental to their normal operation nor shall there be any interruption of their ability to perform as specified (see 3.1). The requirements of 3.10.1 shall be met before, during, and after the test.

3.11.20 Temperature life. When tested in accordance with 4.9.20, 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 or waterproofing compounds, or other effects detrimental to connector operation. No evidence of adhesive degradation shall be present. The requirements of 3.10.1 shall be met before and after the test.

3.11.21 Thermal shock. When tested in accordance with 4.9.21, a post-test visual examination of the tested connectors shall reveal no evidence of connector part dimensional change, no leaking 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/unmating incapability and no other damage detrimental to the operation of the connector. Before, during, and after the test, the insertion loss of the mated connector shall be measured and shall be within the limits in 3.10.1. During the thermal stress, the insertion loss of each connector channel shall be measured at the extremes as well as at ambient temperatures and shall be within the limits specified in 3.10.1.

3.11.22 Physical shock. When tested in accordance with 4.9.22, the connectors shall show no evidence of broken, loose, deformed or displaced parts, cracks, chips or other damage, which would result in a degradation of optical performance. Insertion loss shall not exceed the limits in 3.10.1 before and after the test and the requirements of 3.10.2 shall be met before, during, and after the test.

3.11.23 Vibration. When tested in accordance with 4.9.23, there shall be no transient change in optical performance beyond specification limits and there shall be no disengagement of the mated connectors, backing off from the coupling mechanism, evidence of cracking, breaking, or loosening of parts. The requirements of 3.10.2 and 3.10.3 shall be met before, during, and after the test.

3.11.24 Humidity. When tested in accordance with 4.9.24, the connectors shall operate without degradation beyond the performance limits specified in 3.10.1 before, during, and after exposure to the humidity conditions specified. There shall be no visual evidence of deterioration of component parts or constituent materials, loosening of finishes, physical distortion, corrosion of metals, entrapment of materials, separation of bonded surfaces or other damages.

3.11.25 Salt spray. When tested in accordance with 4.9.25, the mated connectors shall not show exposure of base metal or corrosion products, which will adversely affect performance. No visible evidence of salt penetration into the connector sealed area shall be observed. Following the test, insertion loss shall be within the limits in 3.10.1.

3.11.26 Altitude immersion. When tested in accordance with 4.9.26, assembled, mated connectors shall show no deterioration, which will adversely affect performance of the connectors. Insertion loss shall be within the limits in 3.10.1 before and after the test.

3.11.27 Fluid immersion test. When tested in accordance with 4.9.27, 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.

3.11.28 Water pressure/freezing. When tested in accordance with 4.9.28, visual inspection of the test connector shall reveal no penetration of water into the sealed region of the mated connector. The requirements of 3.10.1 shall be met before, during, and after the test.

3.11.29 Sand and dust. When tested in accordance with 4.9.29, 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 3.10.5 shall be met during and after the test, also the coupling force and coupling torque requirements of 3.11.11 and 3.11.12 shall be met after the test.

3.11.30 Ozone exposure. When tested in accordance with 4.9.30, there shall be no evidence of cracking of plastic and rubber parts or other damage due to ozone exposure that will adversely affect performance.

3.11.31 Flammability. When tested in accordance with 4.9.31, burning and after-flow extinguishing time shall be three seconds maximum. Dripping which will cause flammable material to ignite and violent burning or an explosive type fire shall not occur.

3.12 Assembly instructions. Complete assembly instruction shall be furnished by the vendor with each connector acquired under this specification. Assembly instructions shall include but not be limited to:

a. Cable preparation-stripping dimensions and tolerances.

b. List and description of crimping or special tools if required.

c. Sufficient pertinent dimensions for verification of correct parts; as a minimum the entry openings shall be specified.

d. Military PIN and manufacturer's ID.

3.13 Workmanship. All details of workmanship shall be in accordance with high-grade fiber-optic connector manufacturing practice when visually examined in accordance with 4.9.32. Connectors and accessories shall be complete, dimensionally uniform and free of manufacturing flaws that would degrade performance, inhibit proper connection to interfacing elements, or otherwise yield an inferior product. The following shall be a minimal level to visual examination to be performed and is not intended to restrict other pertinent workmanship examinations.

a. Loose termini, insert or other connector parts, which adversely affect the environment sealing, permit cable sealant penetration 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 sub-standard connector surface blemishes shall not be permitted.

3.14 Mud test (see 4.10). When specified (see 3.1), the insertion loss, measured following the mud test per paragraph 4.10, shall not increased by more than 0.2 dB.

3.15 Electromagnetic shielding. When tested in accordance with 4.12, the propagated radio frequency (RF) attenuation of the connector shall be not less than 60 dB for frequencies greater than 10 GHz.

4. VERIFICATION

4.1 Verification program. Requirements for the verification program shall be as identified in the qualification instructions (see 6.7).

4.1.1 Assembly plants. Assembly plants must 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.

4.1.2 Test equipment and inspection facilities. Requirements for test equipment and inspection facilities shall be as identified in the qualification instructions (see 6.8).

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

a. Qualification inspection (see 4.4).

b. Conformance inspection (see 4.7).

4.3 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.

4.4 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 II. Upon successful completion of Group I testing, Groups II thru IV shall be subjected to their respective tests specified in table II in the sequence shown herein and Group V shall be submitted for qualification test as specified in Appendix A.

4.4.1 Reliability and Quality.

4.4.1.1 QPL system. The manufacturer shall establish and maintain a QPL system as described in 3.2.1. Evidence of such compliance is a prerequisite for qualification and verification of qualification.

4.4.1.2 SPC program. A SPC program shall be maintained in accordance with EIA-557 as described in 3.2.2. Evidence of such compliance shall be verified by the qualifying activity of this specification as a perquisite for qualification and continued qualification.

4.5 Test sample. Fiber-optic connector, backshell, and accessory samples complying with the specified requirements (see 3.1) shall be submitted for qualification. 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 either, previously qualified connectors or new connectors submitted for qualification testing. Manufacturers not producing mating connectors shall submit data substantiating that tests were performed with qualified counterpart connectors. For those tests specifying the use of mated connectors, optical and mechanical test assessment shall be made using the assigned counterpart connector for those test measurements as required.

4.5.1 Sample size. Eight mated in-line cable connectors, manufactured by normal production methods shall be provided for qualification testing.

4.5.1.1 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. Connector terminals shall be optically finished with termini properly seated within their inserts. For mated connectors, full sealing capability shall be provided as specified. Connectors shall be provided with backshell, strain relief cable clamp and attached to a 13 feet minimum length of the specified cable type terminated with ST type connectors.

4.5.2 Inspection routine. Connector, backshell, and accessory samples shall be tested in accordance with the sequence of table II. The connector group samples may be tested simultaneously.

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

4.5.4 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.

4.6 Materials inspection. Materials inspection shall consist of certification supported by verifying data that materials used in fabricating the delivered fiber-optic connectors are in accordance with the requirements of 3.3 and as specified (see 3.1).

4.7 Conformance inspection. Conformance inspection shall consist of the inspections and optical tests specified for group A inspection (table IV), group B inspection (table V), group C inspection (table VI), and packaging inspection.

4.7.1 Inspection of product for delivery. Inspection of product for delivery shall consist of groups A and B inspections.

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

4.7.1.2 Group A inspection. Group A inspection shall consist of the inspections and optical tests specified in table IV. All connectors, backshells, and accessories of the inspection lot shall be subjected to the inspections and optical tests listed.

4.7.1.2.1 Sampling plan. Group A inspection shall be performed on 100 percent of the delivered product.

TABLE II. Qualification inspection.

Inspection	Part applicability 1/			Requirement paragraph	Test paragraph
	Connector	Backshell	Accessories		
Group I 2/ (All sample units)					
Materials inspection	X	X	X	3.3	4.6
Insertion loss	X	X	X	3.10.1	4.8.1
Size	X	X	X	3.11.1	4.9.1
Weight	X	X	X	3.11.2	4.9.2
Color	X	X	X	3.11.3	4.9.3
Identification marking	X	X	X	3.11.4	4.9.4
Workmanship	X			3.13	4.9.32
Crosstalk	X			3.10.4	4.8.4
Group II (2 sample units)					
Change in optical transmittance	X	X	X	3.10.5	4.8.5
Return loss	X	X	X	3.10.6	4.8.6
Ambient light susceptibility	X	X	X	3.10.7	4.8.7
Insert retention axial strength	X			3.11.6	4.9.6
Insert retention radial strength	X			3.11.7	4.9.7
Terminus retention force	X			3.11.8	4.9.8
Terminus insertion and removal forces	X			3.11.9	4.9.9
Maintenance aging	X			3.11.10	4.9.10
Temperature life	X	X	X	3.11.20	4.9.20
Crush resistance	X	X	X	3.11.18	4.9.18
Fluid immersion	X			3.11.27	4.9.27
Mud test	X	X	X	3.14	4.10
Fungus resistance	X	X	X	3.3.4.6	4.11
Group III (2 sample units)					
Coupling forces	X	X	X	3.11.11	4.9.11
Coupling torques	X	X	X	3.11.12	4.9.12
Twist	X	X		3.11.15	4.9.15
Cable seal flexing	X	X		3.11.16	4.9.16
Cable retention	X			3.11.17	4.9.17
External bending moment	X	X	X	3.11.19	4.9.19
Thermal shock	X			3.11.21	4.9.21
Altitude immersion	X		X	3.11.26	4.9.26
Water pressure/freezing	X		X	3.11.28	4.9.28
Ozone exposure	X		X	3.11.30	4.9.30
Physical shock	X	X		3.11.22	4.9.22
Vibration	X	X		3.11.23	4.9.23

See footnotes at end of table.

TABLE II. Qualification inspection – Continued.

Inspection	Part applicability 1/			Requirement paragraph	Test paragraph
	Connector	Backshell	Accessories		
Group IV 2/ (2 sample units)					
Terminus cleaning	X			3.11.5	4.9.5
Electromagnetic effects	X	X	X	3.15	4.12
Coupling force	X	X	X	3.11.11	4.9.11
Coupling torques	X	X	X	3.11.12	4.9.12
Electromagnetic shielding	X	X	X	3.15	4.12
Mating durability 3/	X			3.11.13	4.9.13
Humidity	X		X	3.11.24	4.9.24
Salt spray	X	X	X	3.11.25	4.9.25
Sand and dust	X	X	X	3.11.29	4.9.29
Impact	X	X	X	3.11.14	4.9.14
Flammability	X	X	X	3.11.31	4.9.31
Group V 2/ (2 sample units)					
Intermateability and interoperability	X	X	X	3.4.3	Appendix A

1/ X: Indicates that this test applies.
2/ Sample units: Number indicated means that the number of connectors, backshells or accessories that shall be tested, for example “2 sample units” means 2 connectors and 2 accessories shall be tested when an “X” appears in the part applicability column under “connector” and “accessories”.
3/ After every 100 cycles.

TABLE III. Sampling plans

Lot size	Samples
1 – 8	All
9 – 50	5
51 – 90	7
91 – 150	11
151 – 280	13
281 – 500	16
501 – 1200	19
1201 – 3200	23
3201 – 10,000	29

4.7.1.2.2 Rejected lots. If an inspection lot is rejected, the lot shall be screened for that particular defect and defects removed. A new sample shall be selected from table III using the sample size of the next higher lot size. If one or more defects are found in the second sample, the lot shall be rejected and not supplied to this specification.

4.7.1.2.3 Disposition of sample units. Sample units that have failed any of the group A inspection tests may be reworked to correct defects if possible and subjected to group A inspection again. Sample units that pass all tests of group A inspection may be delivered on the purchase order or contract or tested to group B inspection (see 4.7.1.3). Units that have not been corrected shall not be delivered on any order even though the inspection lot submitted is accepted.

TABLE IV. Group A inspection.

Inspection	Part applicability 1/			Requirement paragraph	Test paragraph
	Connector	Backshell	Accessories		
Workmanship	X	X	X	3.13	4.9.32
Size	X	X	X	3.11.1	4.9.1
Weight	X	X	X	3.11.2	4.9.2
Color	X	X	X	3.11.3	4.9.3
Identification marking	X	X		3.11.4	4.9.4
Terminus insertion and removal force	X			3.11.9	4.9.9
Coupling forces	X	X	X	3.11.11	4.9.11
Coupling torques	X	X	X	3.11.12	4.9.12

1/ X: Indicates that this test applies.

4.7.1.3 Group B inspection. Group B inspection shall consist of the inspections and optical tests specified in table V, in the order shown, and shall be made on sample units which have been subjected to and have passed the group A inspection.

4.7.1.3.1 Sampling plan. Samples shall be selected at random from the inspection lot. Sample size shall be in accordance with table III. If one or more defects are found, the lot shall be rejected.

4.7.1.3.2 Sample unit preparation. Connectors shall be fully assembled into cable-connector assemblies using the types of cable specified in MIL-PRF-85045. In case of no qualified sources, the following cable or equivalent shall be used.

2 Channel PIN M85045/8-B2B, 50 micron core, 125 clad, or equal.

4 Channel PIN M85045/8-B4B, 50 micron core, 125 clad, or equal.

2 Channel PIN M85045/8-B2A, 62.5 micron core, 125 clad, or equal

4 Channel PIN M85045/8-B4A, 62.5 micron core, 125 clad or equal

Connector terminals shall be optically finished with 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, strain relief cable clamp and attached to a six feet length of the specified cable type, and shall be terminated in accordance with the manufacturer's instructions.

4.7.1.3.3 Rejected lots. If an inspection lot is rejected, the contractor may rework the lot to correct the defects or screen out the defective units and resubmit for reinspection. Resubmitted lots shall be inspected using the sample size of the next higher lot size specified in table III. Such lots shall be separate from new lots and shall be clearly identified as reinspected lots.

4.7.1.3.4 Disposition of sample units. Sample units used in Group A or B inspections may be used for Group C inspection or delivered on the contract or purchase order only if the following requirements are met:

a. The lot is accepted.

b. The connector has removable termini and the ones that were terminated for testing are replaced with unterminated ones.

c. The sampling unit passed group B inspection, or the sample unit failed group B inspection but was reworked and successfully retested to group B requirements.

Sample units not meeting criteria a, b, and c above shall not be delivered on the contract or purchase order, or used for group C inspection.

TABLE V. Group B inspection.

Inspection	Part applicability 1/			Requirement paragraph	Test paragraph
	Connector	Backshell	Accessories		
Insertion loss	X			3.10.1	4.8.1
Terminus cleaning	X			3.11.5	4.9.5
Insert retention axial strength	X			3.11.6	4.9.6
Insert retention radial strength	X			3.11.7	4.9.7
Terminus retention force	X			3.11.8	4.9.8
Maintenance aging	X	X	X	3.11.10	4.9.10
Cable retention	X	X		3.11.17	4.9.17

1/ X: Indicates that this test applies.

4.7.1.4 Periodic inspection. Periodic inspection shall consist of group C. Except where the results of these inspections show noncompliance with the applicable requirements (see 4.7.1.4.1.4), delivery of products, which have passed group B inspection, shall not be delayed pending the results of these periodic inspections.

4.7.1.4.1 Group C inspection. Group C inspection shall consist of the tests specified in table VI in the order shown. Group C inspection shall be performed on sample units of each style and selected from inspection lots that have passed groups A and B inspections. Group C inspection sample shall be representative of production.

4.7.1.4.1.1 Sampling plan. Every 60 months, connector, backshell, and accessory sample units, which have passed group B inspection, shall be selected in sufficient quantity to provide two samples per applicable test group.

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

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

TABLE VI. Group C inspection.

Inspection	Part applicability 1/			Requirement paragraph	Test paragraph
	Connector	Backshell	Accessories		
Group I (2 sample units)					
Color	X	X	X	3.11.3	4.9.3
Identification marking	X	X	X	3.11.4	4.9.4
Impact	X	X	X	3.11.14	4.9.14
Twist	X	X		3.11.15	4.9.15
Cable seal flexing	X	X		3.11.16	4.9.16
Mating durability	X			3.11.13	4.9.13
External bending moment	X			3.11.19	4.9.19
Temperature life	X	X	X	3.11.20	4.9.20
Thermal shock	X			3.11.21	4.9.21
Physical shock	X			3.11.22	4.9.22
Vibration	X	X		3.11.23	4.9.23
Humidity	X		X	3.11.24	4.9.24
Group II (2 sample units)					
Color	X	X	X	3.11.3	4.9.3
Identification marking	X	X	X	3.11.4	4.9.4
Terminus cleaning	X			3.11.5	4.9.5
Salt spray	X	X	X	3.11.25	4.9.25
Water pressure/freezing	X		X	3.11.28	4.9.28
Sand and dust	X	X	X	3.11.29	4.9.29
Crush resistance	X	X	X	3.11.16	4.9.16
Flammability	X	X	X	3.11.31	4.9.31

1/ X: indicates that this test applies.

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

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

4.8 Optical conformance test methods. Cladding shall be removed. In those cases where the fiber coating does not adequately perform this function, an equilibrium mode simulator and cladding mode stripper shall be installed between the source and connector (in that order) as well as between the connector and detector (in that order) when making optical measurements. A one kilometer section of fiber may be substituted for the equilibrium mode simulator and cladding mode stripper between the source and connector if desired. In connectors with one, two, or three optical channels, optical measurements shall be made in rapid succession on each channel. Unless otherwise specified herein, in connectors with four or more channels, optical measurements shall be made in rapid succession on three randomly selected channels.

4.8.1 Insertion loss (see 3.10.1). 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.

4.8.2 Discontinuities (see 3.10.2). The connector shall be tested in accordance with TIA/EIA-455-32. The optical termini of the connector shall be connected through a minimum of 4 meters of optical test cables to an appropriate optical signal source and detector. Unused termini shall be capped. The source shall produce a constant level, static signal easily detected by the detector. The output of the detector shall be monitored for discontinuities while the connector is subjected to a mechanical or environmental test exposure. The detector and monitoring equipment shall possess sufficient sensitivity and high frequency response to detect discontinuities in the optical signal. The monitoring equipment shall include transient capture capability (such as provided by an electronic counter or by an oscilloscope with an adjustable sweep trigger and oscilloscope camera).

4.8.3 Analog modulation (see 3.10.3). The optical termini of the connector shall be connected through a minimum of 4 meters of optical cables to an optical signal source and detector. Unused termini shall be capped. The source shall produce a constant level, static signal easily detected by the detector. The output of the detector shall be monitored for analog modulation while the device under test is subjected to vibration (see 4.9.23). The detector and monitoring equipment shall possess sufficient sensitivity and frequency response to discern analog modulation at the acceptance level. The monitoring equipment shall include signal recording capability (such as provided by a triggerable oscilloscope and an oscilloscope camera).

4.8.4 Crosstalk (see 3.10.4). The termini of the connector shall be connected to a minimum of 4 meters of optical test cables or opaquely capped as appropriate. The input to one optical channel (the active channel) shall be connected via its test cable to an optical signal source, the signal of which shall be either continuous or amplitude modulated. The output port(s) of the other channels (passive channel(s)) shall be connected to test cable(s). The other input ports shall be opaquely capped. The output signal power from both the active and passive channels shall be measured. When there is more than one passive channel, the output of all passive channels shall be summed. This test shall be repeated, making each remaining input port the active channel.

4.8.5 Change in optical transmittance (see 3.10.5). The change in optical transmittance shall be measured in accordance with TIA/EIA-455-20. 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. Measurements shall be made before and after environmental tests, and during tests per table VII.

TABLE VII. Measurement frequency.

Test duration (hrs.)	Time(s) after start of test (hrs.)
4 and less	Half way through
More than 4 to 6	1/3 and 2/3 of the way through the test
More than 6	¼, ½, and ¾ of the way through the test

4.8.6 Return loss (see 3.10.6). The return loss shall be measured in accordance with TIA/EIA-455-107.

4.8.7 Ambient light susceptibility (see 3.10.7). The optical connector shall be tested in accordance with TIA-455-22. The optical termini of the connector shall be either opaquely capped or connected to a minimum of 4 meters of optical test cables as appropriate. The far ends of these cables shall be either capped or connected to suitable optical power monitoring instruments. The light shall be broad spectrum with infrared, visible, and ultraviolet components and shall illuminate the connector with an irradiance (power density) of 112 ±5 milliwatts per square centimeter. Light emitting from each optical part of the device under test shall be measured by optical power monitoring equipment, having a broad spectral response compatible with the source.

4.9 Inspection methods.

4.9.1 Size. Each of the dimensions specified (see 3.1) for the connector, backshell, and accessory parts shall be measured using calibrated measuring devices with the precision and accuracy appropriate for the tolerances specified (see 3.1 and 3.11.1).

4.9.2 Weight. The connector, backshell and accessories shall be weighed using calibrated scales having the range, precision and accuracy appropriate for the tolerances specified (see 3.1 and 3.11.2).

4.9.3 Color. The colors of connectors, backshells, and accessories shall be nonreflective (see 3.11.3).

4.9.4 Identification marking. Identification markings on connectors, backshells and accessory parts shall be visually examined and measured for conformance with the requirements of 3.11.4.

4.9.5 Terminus cleaning (see 3.11.5). The optical face of each terminus shall be cleaned according to the instructions supplied by the connector manufacturer. The terminus shall not be removed from its operational position within the connector to facilitate cleaning.

4.9.6 Insert retention axial strength (see 3.11.6). Unmated connector samples shall be tested as follows. The pressure shall be applied as specified (see 3.11.6) and the axial displacement measured (see 3.11.6). The same pressure shall then be applied on the opposite face. Termini positions within the insert may be either empty or filled during the test.

4.9.7 Insert retention radial strength (see 3.11.7). Unmated connector samples shall be tested where specified (see 3.1), for radial strength as described herein. Counterpart test devices for connector 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 as a result of the test exposure. A radial torque shall be applied as specified (see 3.1).

4.9.8 Terminus retention force (see 3.11.8). 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 enface. Axial loads shall be applied at a rate of 1.0 lb (4.4 N) per second up to the minimum load specified (see 3.11.8). The specified load shall be maintained for a minimum of 5 seconds. The terminus position shall be measured from the rear of the connector insert while under the specified load and shall not exceed the requirements of 3.11.8. Additionally there shall be no evidence of damage.

4.9.9 Terminus insertion and removal forces. Termini shall be inserted into an unmated connector using a terminus insertion tool and the force required to insert the terminus measured (see 3.11.9). When required, 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.

4.9.10 Maintenance aging (see 3.11.10). 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 testing. Insertion and withdrawal tools shall be as defined in 6.6. 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. Upon completion, units shall meet the requirements of 3.11.10 and 3.10.1.

4.9.11 Coupling forces. When specified (see 3.1) unmated connector samples (see 4.7.1.1.3) shall be tested for axial engagement and disengagement forces as follows. One connector shall be rigidly mounted. The other connector shall be attached to a force gage and brought into position such that the outermost surfaces of the insert caps are in the same plane. The force gage shall be set to zero. An axial force shall be allied such that the connectors mate fully. The force shall be recorded. While in this position, the gage shall be reset to zero and an axial force shall be applied to unmate the connectors and return to starting position (outermost surfaces of the insert caps are in the same plane). The procedure shall be repeated 2 times and all force measurements shall be within the limits specified in 3.11.11.

4.9.12 Coupling torques (see 3.11.12). When specified (see 3.1) unmated connector samples shall be tested as follows. Two mating connectors shall be brought to a position where mechanical mating of the connector body and coupling nut begins. A torque gauge attached to the coupling nut shall be set to zero indication. The connectors shall then be fully coupled and the torque required for mating shall be recorded. The torque gauge shall then be reset to zero indication. The mated connectors shall be fully unmated and the torque required for unmating shall be recorded. The procedure shall be repeated 2 times and all torque measurements shall be within the limits specified in 3.11.12.

4.9.13 Mating durability (see 3.11.13). The terminated assembly made of one cable mounted connector and one wall mount, jam-nut mount or in line connector as specified (see 3.1) shall be mated and unmated in accordance with TIA-455-21. One thousand complete (part separating) cycles (mated and unmated) shall be accomplished by hand at an optional rate. The change in insertion loss (see 3.10.1), coupling torque (see 3.11.12) and coupling force (see 3.11.11) after the durability tests shall be measured. The coupling torque and mating forces shall be measured in accordance with the requirements of this specification and the specification sheet. The connector termini may be cleaned prior to insertion loss measurements (see 4.9.5) and shall be so noted on data sheets. Connector coupling hardware shall not require cleaning to meet coupling torque and mating force requirements.

4.9.14 Impact (see 3.11.14). Each connector to be qualified shall be subjected to the test (impact) in accordance with method B, service class severe of TIA/EIA-455-2.

4.9.15 Twist. Mated cable-connector assemblies shall be tested in accordance with TIA-455-36. Connector-held fixture shall be rotated ± 90 degrees at a rate of one cycle per five seconds for a total of 1,000 cycles. The cable assemblies shall be stretched with a minimum tension of 11.0 pounds to their maximum lengths and clamped at a distance of about 10 times the cable diameter from the connector to the fixture tabletop. The fixturing and cable clamping are to be done in a manner that does not affect the cable's optical transmittance beyond acceptable limits as specified (see 3.11.15). Measurements shall be taken before and after testing.

4.9.16 Cable seal flexing (see 3.11.16). Unmated cable-connector assemblies, of each type to be qualified shall be tested in accordance with test procedure I, of TIA/EIA-455-1.

4.9.17 Cable retention. Mated connector samples shall be tested in accordance with TIA-455-6. The axial tensile load shall be applied up to the load specified (see 3.11.17) and shall be maintained for 10 minutes. Elongation of the cable shall have no effect on the insertion loss while the load is applied for the specified time. Tests and measurements before, during, and after test shall be taken as required by the detail specification.

4.9.18 Crush resistance (see 3.11.18). Cable connector assemblies shall be tested in accordance with TIA-455-26. The test load shall be 450 pounds and shall be applied a total of four times, rotating the sample 90º about its axis after each loading. The load shall be applied for a period of 5 to 10 seconds.

4.9.19 External bending moment (see 3.11.19). The wall or jam-nut mounted connector shall be mounted as in normal service to a rigid panel. Before mating the cable connector to the wall or jam-nut mounted connector, an adapter or test torque arm shall be attached as shown on figure 1. After mating the two connectors, the distance "L" from the point of load application "P" to the mounting panel shall be determined. The load to be applied at point "P" shall then be determined as the bending moment specified divided by the lever arm "L". This load shall be applied at a rate of approximately 49.5 newtons per second until the required load of 71 newton meters is achieved. The applied load shall be held for one minute, and then the load shall be released. Insertion loss of the termini shall be monitored during the test.

4.9.20 Temperature life. Mated connectors shall be tested in accordance with TIA/EIA-455-4 for 250 hours at 85ºC ± 2ºC. The change in insertion loss shall be measured during and after the test (3.11.20).

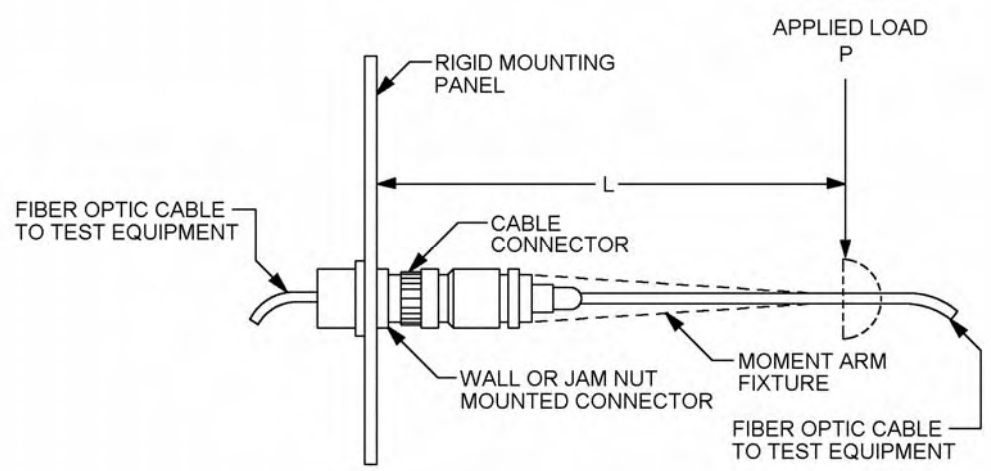
4.9.21 Thermal shock. Cable-connector assemblies (at least one mated and one unmated) shall be tested in accordance with TIA/EIA-455-71, schedule C for five cycles. The fiber shall be in accordance with MIL-PRF-49291. The number of fibers shall be given by the specification sheet (see 3.1). The mated and unmated cable-connector assemblies shall be examined for degradations of any sort after testing. The following conditions shall apply:

a. High test temperature: +85ºC.

b. Examination during test: Verify that the optical performance is within the limits specified in 3.10.1.

c. Examination after test: Examine for compliance to 3.11.21.

4.9.22 Physical shock. Mated cable-connector assemblies shall be tested in accordance with test condition C of TIA-455-14 applying 5 shocks per axis (30 total shocks). The cable shall be clamped to the shock table approximately 8 inches from the rear of the connector. The change in insertion loss shall be measured after the shock test (see 3.11.22).



NOTE: Moment arm fixture shall be of a convenient design.

FIGURE 1. External bending moment test setup.

4.9.23 Vibration. A complete connector assembly shall be mounted as shown on figure 2 or suitable test fixture and vibrated in accordance with EIA/TIA-455-11 as follows; test conditions III at 10 G's and test condition VI, test letter C for 1.5 hours. Specimen cable, using the normal connecting devices of the connector and clamped as shown on figure 2, shall be used. The connector shall be mounted by its normal mounting device. Cable to cable connectors may be held to the jig of figure 2 by a suitable clamp on one half of the connector assembly. The following conditions shall apply:

a. Test condition letter if other than above (see 3.1).

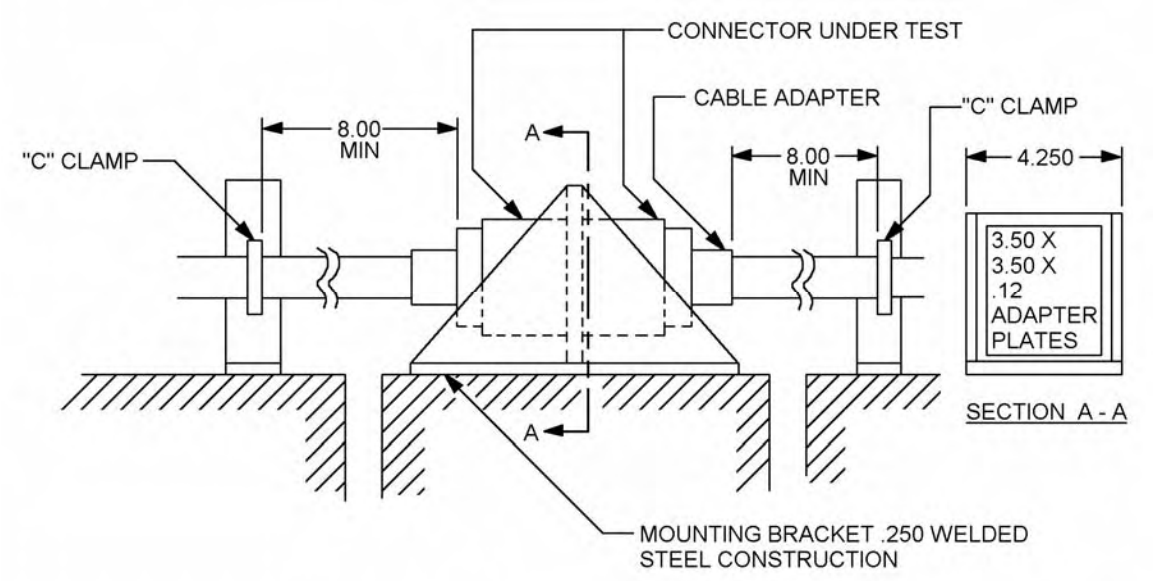
b. Signal discontinuity (see 4.8.2) and analog modulation (see 4.8.3), shall be monitored during vibration.

c. Upon completion of the test, the connectors shall be examined for compliance to 3.11.23.

4.9.24 Humidity. Cable-connected assemblies (at least one mated and one unmated), shall be tested in accordance with test method B of TIA/EIA-455-5 for 10 total cycles with 5 including sub cycle. The cable used shall be in accordance with MIL-PRF-85045. Measurements shall be made of the sample after conditioning process and after humidity test (see 3.11.24).

4.9.25 Salt spray (corrosion). Mated cable-connector assemblies shall be tested in accordance with test condition I of TIA/EIA-455-16. After test exposure, the assemblies shall be externally cleaned and examined under 3 power magnification for salt penetration into the connector junction area and damage to external parts (see 3.11.25).

4.9.26 Altitude immersion. Mated connectors shall be tested in accordance with TIA-455-15. Cables used shall be in accordance with MIL-PRF-85045. Fibers used shall be in accordance with MIL-PRF-49291. The change in insertion loss shall be measured after the test (see 3.11.26).



Inches	mm
.12	3.1
.25	6.4
3.50	88.9
4.25	107.9
8.00	203.2

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Dimensions and tolerances are in accordance with ASME Y14.5M.

FIGURE 2. Vibration testing setup.

4.9.27 Fluid immersion (see 3.11.27). At least one mated cable-connector assembly shall be tested in accordance with EIA/TIA-455-12. Assemblies shall be immersed in each of the fluids listed in table VIII at the temperature specified for 24 hours. Each assembly shall be completely dried after each immersion. After testing, the assemblies shall be examined for fluid penetration into the shell body and connector junction region. Instead of optical transmittance, insertion loss shall be measured after the test (see 3.10.1).

TABLE VIII. Fluids and test temperature for immersion test.

Fluid	Applicable specification	Test temperature (°C)
Fuel oil	MIL-PRF-16884	33 to 37
Turbine fuel, JP-4	MIL-DTL-5624	20 to 25
Isopropyl alcohol	TT-I-735 (see 6.9)	20 to 25
Hydraulic fluid	MIL-PRF-5606 (see 6.5)	48 to 50
Lubricating oil	MIL-PRF-17331 MIL-PRF-23699	73 to 77 73 to 77
Coolant Fluid, Hydrolytically Stable, Dielectric	MIL-PRF-87252	20 to 25

4.9.28 Freezing water immersion (see 3.11.28). Mated connector assemblies shall be tested in accordance with method A, procedure 1 of EIA/TIA-455-98 with the following exception, use mated connector assemblies instead of continuous cable. The size of the water vessel shall be such that, when the mated connectors are placed in the vessel, the connectors are within 150 mm of the sides and bottom of the vessel, and within 150 mm of the surface of the water. The change in optical transmittance shall be monitored during and after the test in accordance with 4.8.5. At the completion of the test, the connectors shall be visually examined in accordance with 4.9.32. For exposure at -10 °C, the water is considered completely frozen when the water temperature reading is less than -1°C. The connector assemblies shall be externally cleaned, unmated, examined for water penetration into the connector, mated and optically tested for insertion loss in accordance with limits in 3.10.1.

4.9.29 Sand and dust (see 3.11.29). Mated cable connector assemblies shall be tested in accordance with EIA/TIA-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 air flow. 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. The connector coupling force and coupling torque (see 4.9.11 and 4.9.12) shall be measured after the test. The connector shall be visually examined in accordance with 4.9.32, after cleaning, at the conclusion of the test.

4.9.30 Ozone exposure (see 3.11.30). Mated cable-connector assemblies shall be tested in accordance with TIA-455-189. After test exposure, the assemblies shall be examined for damage.

4.9.31 Flammability (see 3.11.31). 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 4.8.5). 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) 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.

4.9.32 Visual examination. Each connector shall be visually examined in accordance with TIA/EIA-455-13. Attention shall be given to those assemblies that require a gasket to determine the condition of the gasket. Gaskets missing, twisted, buckled, kinked, or damaged in any way shall be cause for rejection. Each connector shall be visually inspected for the presence of compound between fiber termination end of insert and shell. Examinations shall include the following:

a) Workmanship meets the requirements of 3.13.

b) Design and construction meets the requirements of 3.4.1 thru 3.4.6 and the appropriate specification sheet (see 3.1).

c) Connectors meet the requirements of 3.5 and the appropriate specification sheet (see 3.1).

d) Backshell accessories meet the requirements of 3.6 and the appropriate specification sheet (see 3.1).

e) Protective covers and storage receptacles meet the requirements of 3.7 and the appropriate specification sheet (see 3.1).

f) Cable strength member terminations meet the requirements of 3.8 and the appropriate specification sheet (see 3.1).

g) Tools are included as required by 3.9 and the appropriate specification sheet (see 3.1).

h) Assembly instructions are included as required by 3.12 and the appropriate specification sheet (see 3.1).

4.10 Mud test (see 3.14). When specified (see 3.1), a mud bath consisting of a 50/50 mixture of potter's clay and sharp sand mixed with water (10% by weight) shall be contained in a vessel to a depth of 5 inches minimum. Two in-line connectors shall be mated and the insertion loss recorded in accordance with TIA-455-20. Decouple and immerse both connectors in the mud bath for 5 minutes minimum. Remove the connectors and clean with water (immersion in the water is allowed). Connectors may be cleaned and dried. Removal of the insert cap for termini cleaning is allowed, but further disassembly of the connectors during cleaning is not allowed. Re-mate and record the received signal using TIA-455-20. Insertion loss measured per 4.8.1 shall not exceed the limit specified in 3.14. Repeat the above test for a total of 10 times.

4.11 Fungus resistance (see 3.3.4.6). Connector materials not listed as fungus inert in guideline 4 of MIL-HDBK-454 (see 6.10) shall be tested in accordance with TIA/EIA-455-56 for a duration of 28 days.

4.12 Electromagnetic shielding. Electromagnetic shielding testing of receptacles 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 IX 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 m 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 XI. 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 XI.

Table IX. Electromagnetic effects test frequencies.

Field propagation	Test frequencies
Planewave	100 MHz 400 MHz 1 GHz
Microwave	10 GHz

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging shall be as specified in the contract or order (see 6.2). When packaging of material 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 specified herein are intended for use with low loss optical fiber cables in military, ground based, fiber-optic data transmission systems.

6.2 Acquisition requirements. Acquisition documents must specify the following:

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

b. Specification sheet number, title and date.

c. Part or Identifying Number (PIN).

d. Quantity of connectors required.

e. Inclusion of terminating tools, if desired (see 3.9).

f. Color (see 3.11.3).

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. 83526 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 Defense Supply Center, Columbus, Attn: DSCC-VQP, P. O. Box 3990, Columbus, OH 43218-3990, vqp.chief@dla.mil.

6.3.1 Conformity to qualified sample. It is understood that connectors supplied under the contract shall 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 shall constitute cause for rejection.

6.3.2 Provisions governing qualification SD-6. Copies of "Provisions Governing Qualification SD-6" may be obtained upon application to Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

6.4 Application information.

6.4.1 Fiber-optic test plugs. Fiber-optic test plugs are plug assemblies that are used to simulate short or long lengths of fiber. This can be accomplished in a number of different ways, i.e., fiber core match or mismatch, fiber numerical aperture match or mismatch, etc. The test plug is simply a fiber-optic connector plug, which uses a short length of the required fiber that is "looped back" in the backshell. These test plugs find applications in many system functions. The following is a partial list:

a. A test plug containing a fiber with characteristics like that of the deployment fiber can simulate a short length of fiber (low optical loss).

b. A test plug containing a fiber with characteristics unlike that of the deployment fiber can simulate a long length of fiber (high optical loss).

c. Using a combination of the above test plugs the user can evaluate the dynamic range of this system.

d. Can be used in field situations where an Optical Time Domain Reflectometer (OTDR) is not available to determine fault locations.

e. Allows system checkout to be performed without the actual deployment of cable assemblies.

6.5 Hydraulic fluid. MIL-PRF-5606 has been utilized successfully in the past.

6.6 Maintenance aging. MIL-HDBK-81969/46, MIL-HDBK-81969/47 and MIL-HDBK-81969/48 have provided satisfactory results for previous acquisitions.

6.7 Verification program. Evidence of compliance to a verification program established and maintained in accordance with MIL-STD-790 or comparable standard will 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 must 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.

6.8 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 must be the responsibility of the contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment must be in accordance with NCSL-Z540-1 or comparable standard.

6.9 Isopropyl alcohol. Federal Specification TT-I-735 has provided satisfactory results when utilized in the past.

6.10 Fungus resistance. It was found that utilization of requirement 4 of MIL-HDBK-454 yielded satisfactory results in the past.

6.11 Subject term (key word) listing.

Backshells
Cable, fiber optic
Covers, protective
Epoxies
Inserts
Optical performance requirements
Strain relief, cable
Termini
Test plugs

6.12 Environmentally preferable material. Environmentally preferable materials should be used to the maximum extent possible to meet the requirements of this specification. Table X lists the Environmental Protection Agency (EPA) top seventeen hazardous materials targeted for major usage reduction. Use of these materials should be minimized or eliminated unless needed to meet the requirements specified herein (see Section 3).

Table X. EPA top seventeen hazardous materials.

Benzene	Dichloromethane	Tetrachloroethylene
Cadmium and Compounds	Lead and Compounds	Toluene
Carbon Tetrachloride	Mercury and Compounds	1,1,1 - Trichloroethane
Chloroform	Methyl Ethyl Ketone	Trichloroethylene
Chromium and Compounds	Methyl Isobutyl Ketone	Xylenes
Cyanide and Compounds	Nickel and Compounds	

6.13 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

PROCEDURE FOR INTERMATEABILITY AND INTEROPERABILITY QUALIFICATION INSPECTION

A.1 SCOPE.

A.1.1 Scope. This appendix provides additional information on the intermateability and interoperability qualification inspections. When specified (see 3.1) this appendix is a mandatory part of intermateability and interoperability for this specification. The information contained herein is intended for compliance.

A.1.2 Applicability. This appendix applies to sample preparation, submittal and inspection under this specification for qualification to the requirements of intermateability and interoperability.

A.2 APPLICABLE DOCUMENTS.

A.2.1 Government documents.

A.2.1.1 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.

DEPARTMENT OF DEFENSE STANDARD

MIL-STD-2042 - Fiber Optic Cable Topology Installation Standard Methods For Naval Ships

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

A.3 QUALIFICATION SAMPLE.

A.3.1 Test sample. Fiber-optic connector, backshell, and accessory samples complying with the specified requirements (see 3.1) shall be submitted for qualification. 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 either, previously qualified connectors or new connectors submitted for qualification testing. Manufacturers not producing mating connectors shall submit data substantiating that tests were performed with qualified counterpart connectors. For those tests specifying the use of mated connectors, optical and mechanical test assessment shall be made using the assigned counterpart connector for those test measurements as required.

A.3.2 Sample preparation. Connectors shall be fully assembled into cable-connector assemblies using the types of cable specified in the applicable connector specification sheet. Connector terminals shall be optically finished with termini properly seated within their inserts. For mated connectors full sealing capability shall be provided as specified. The two samples for Intermateability and interoperability testing shall be provided with backshell, strain relief cable clamp and termini to ST jumpers (see figure A-1) for each terminus. The termini to ST jumpers shall be provided on a single fiber cable with a 2 mm outer jacket having a minimum length 6 ft (1.8 meters). Cable assemblies for submission shall be fabricated per Part 5 of MIL-STD-2042. Termini are to be polished using the standard dome polish specified in part 5. Cable assemblies are to be constructed using multimode cable. The quantity of jumper assemblies provided shall be such to fully populate all connectors provided.

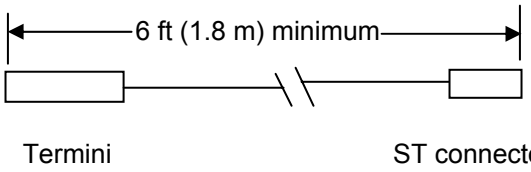


FIGURE A-1 Termini – ST jumper.

A.3.3 Sample submission. Contact Qualifying Activity (Defense Supply Center, Columbus, Attn: DSCC-VQP, P. O. Box 3990, Columbus, OH 43218-3990, vqp.chief@dla.mil) for submission instructions for intermateability and interoperability test samples.

A.3.4 Sample disposition. Test samples submitted shall be retained by the Government as standards for use during future intermateability and interoperability testing. For the purpose of maintaining test standard integrity and security of vendors to certain types of product exposure, test standards will not be loaned outside the Government test lab.

A.4 QUALIFICATION INSPECTIONS.

A.4.1 Intermateability. All combinations of fully populated connectors from all manufacturers shall be mated and tested for insertion loss in accordance with 4.8.1. Results shall not exceed the requirements of 3.10.1.

A.4.2 Interoperability. All interchangeable components (backshells, termini and other components as applicable) shall be removed from both qualified and submitted connector plugs and receptacles. At random, interchangeable components shall be inserted into and shall fully populate submitted connector plugs and receptacles (see examples in Tables A-I, A-II, A-III, and A-IV below). These tables are examples based on test variations for one certified device and one candidate device. As additional devices are certified, the amount of test variations will increase in order to test the candidate device to each certified device. If multiple qualified termini exist, all sources will be used at random during test. At random, connector assemblies shall be mated and insertion loss shall be measured in accord with 4.8.1. Results shall not exceed the requirements of 3.10.1.

TABLE A-I. Backshell interoperability test configuration.

Configuration number	Receptacle backshell	Plug backshell
1	Candidate	Candidate
2	Qualified	Candidate
3	Candidate	Qualified

Table A-II verifies connector interoperability using termini from previous qualified source(s) tested in both qualified and candidate plugs & receptacles. Test variation 4 is required for hermaphroditic connectors only.

Table A-II Connector interoperability test configuration.

Configuration number	Connector	Termini	Connector	Termini
1	Qualified Receptacle	Qualified	Candidate Plug	Qualified
2	Qualified Plug	Qualified	Candidate Receptacle	Qualified
3	Candidate Receptacle	Qualified	Candidate Plug	Qualified
4	Qualified Plug	Qualified	Candidate Plug	Qualified

Table A-III verifies insert cap interoperability using termini from previous qualified source(s). This test verifies interoperability between qualified connectors/candidate insert caps and candidate connectors/qualified insert caps. Test variation between qualified connectors/qualified insert caps and candidate connectors/candidate insert caps were verified by default during connector interoperability (Table A-II).

Table A-III Connector / insert cap test configuration.

Configuration number	Connector Insert Cap	Termini	Connector Insert Cap	Termini
1	Qualified Receptacle Candidate Insert Cap	Qualified	Candidate Plug Qualified Insert Cap	Qualified
2	Qualified Plug Candidate Insert Cap	Qualified	Candidate Receptacle Qualified Insert Cap	Qualified

Table A-IV verifies termini interoperability using connectors from previously qualified sources and both qualified and candidate termini.

Table A-IV Termini interoperability test configuration.

Configuration number	Connector Receptacle	Termini	Connector Plug	Termini
1	Qualified	Qualified	Qualified	Candidate
2	Qualified	Candidate	Qualified	Qualified
3	Qualified	Candidate	Qualified	Candidate

Custodians:
Army - CR
Navy - AS
Air Force - 11
DLA - CC

Review activities:
Army – MI
Navy - SH
Air Force - 19, 99
NASA - NA

Preparing activity:
DLA - CC

(Project number 6060-0152)

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/.