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MILITARY SPECIFICATION

CABLES, FIBER OPTICS, (METRIC), GENERAL SPECIFICATION FOR

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

1. SCOPE

1.1 Scope. This specification covers the general requirements and characteristics for cables utilizing optical fibers for signal transmission.

1.2 Classification. Cables covered by this specification consist of one or more single fiber, optical transmission elements with properties as specified (see 3.1) and shall be of the following categories:

1.2.1 Fiber optic cable configuration type. The fiber optic cable configuration type shall be designated by a single letter as indicated in table I.

TABLE I. Fiber optic cable configuration type

Cable configuration type	Designation
Buffered fiber 1/	1
OFCC 2/	2
Cable bundle 3/	3
Ribbon 4/	4

1/ Buffered fiber (see 6.5.2).
2/ OFCC - Optical fiber cable component (see 6.5.8).
3/ Cable bundle (see 6.5.3).
4/ Ribbon (see 6.5.9).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Naval Sea Systems Command, SEA 5523, Washington, DC 20362-5101, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A
FSC 6015

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

1.2.2 Class. The class designation shall be defined by the mode volume of the optical fiber.

MM Multimode
SM Single mode

1.2.3 Application. The application designation shall be defined by the intended application of the optical cable.

A. Airborne
B. Shipboard
G. Ground benign
S. Space
T. Ground tactical

2. APPLICABLE DOCUMENTS

2.1 Government documents.

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 shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

SPECIFICATIONS

MILITARY

MIL-C-572 - Cord, Yarns and Monofilaments Organic Synthetic Fiber.
MIL-S-901 - Shock test, H.I. (High Impact), Shipboard Machinery, Equipment and Systems, Requirements for.
MIL-H-5606 - Hydraulic Fluid, Petroleum Base, Aircraft, Missile and Ordinance.
MIL-T-5624 - Turbine Fuel, Aviation, Grades JP-4, JP-5 and JP-5/JP-8.
MIL-F-16884 - Fuel, Naval Distillate.
MIL-L-17331 - Lubricating Oil, Steam Turbine and Gear, Moderate Service.
MIL-H-17672 - Hydraulic Fluid, Petroleum, Inhibited.
MIL-L-23699 - Lubricating Oil, Aircraft Turbine Engine, Synthetic Base.
MIL-S-24235 - Stuffing Tube, Metal, and Packing Assemblies for Electrical Cables, General Specification for.
MIL-C-28688 - Cable, Fiber Optic, Packaging Of.
MIL-F-49291 - Fiber, Optical, (Metric) General Specification for.
MIL-C-85045 - Cables, Fiber Optic, General Specification For

(See supplement 1 for list of associated specifications).

STANDARDS

FEDERAL

FED-STD-228 - Cable and Wire, Insulated; Methods of Testing.
TT-P-645 - Primer, Paint, Zinc-molybdate, Alkyd Type.
TT-I-735 - Isopropyl Alcohol.
FED-STD-1037 - Glossary of Telecommunication Terms

MILITARY

MIL-STD-104	-	Limits for Electrical Insulation Color.
MIL-STD-129	-	Marking for Shipment and Storage.
MIL-STD-202	-	Test Methods for Electronic and Electrical Component Parts.
MIL-STD-285	-	Attenuation Measurements for Enclosures, Electromagnetic Shielding, for Electronic Test Purposes, Method of.
MIL-STD-454	-	Standard General Requirements for Electronic Equipment.
MIL-STD-790	-	Product Assurance Program Requirements for Electronic and Fiber Optic Parts Specifications.
MIL-STD-810	-	Environmental Test Methods and Engineering Guidelines.
MIL-STD-1285	-	Marking of Electrical and Electronic Parts.
DOD-STD-1678	-	Fiber Optics Test Methods and Instrumentation.
DOD-STD-2003	-	Electric Plant Installation Standard Methods for Surface Ships and Submarines.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Naval Publications and Forms Center, (ATTN: NPODS), 5801 Tabor Avenue, Philadelphia, PA 19120-5099.)

NAVAL ENGINEERING STANDARDS

NES-713	-	Determination of the Toxicity Index of the Products of Combustion from Small Specimens of Material.

(Copies of Naval Engineering Standards are available from the preparing activity, Navel Sea Systems Command, code 06KR22, Washington, D.C. 20362-5101.)

NATIONAL AERONAUTICAL AND SPACE ADMINISTRATION (NASA)

NHB 8060.1	-	Flammability, Odor, and Offgassing and Compatibility Requirements and Test Procedures for Materials in Environments That Support Combustion.

(Application for copies should be addressed to Office of Safety and Mission Quality, (Code QR), NASA Headquarters, Washington, DC 20546.)

NATIONAL SECURITY AGENCY

NASCEM 5204	-	Shielded Enclosures.

(Applications for copies should be addressed to National Security Agency (Code T2137), Fort George G. Meade, MD 20755-6000.)

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM-E-84	-	Standard Test Method for Surface Burning Characteristics of Building Materials.
ASTM-D-470	-	Crosslinked Insulations and Jackets for Wire and Cable, Methods of Testing.
ASTM-D-512	-	Standard Test Method for Chloride Ion in Water.
ASTM-E-595	-	Standard Test Method for total Mass loss and collected Volatile Condensable Materials From Outgassing in a Vacuum Environment.
ASTM-E-662	-	Specific Optical Density of Smoke Generated by Solid Materials, Test Method For.
ASTM-D-1141	-	Standard Specification for Substitute Ocean Water.
ASTM-D-2565	-	Standard Practice for Operating Xenon Arc-Type Light-Exposure Apparatus With and Without Water for Exposure of Plastics.
ASTM-D-3761	-	Standard Test Method for Total Fluorine in Coal by the Oxygen Bomb Combustion/Ion Selective Electrode Method.

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

ELECTRONIC INDUSTRIES ASSOCIATION (EIA) AND TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

	EIA-440	-	Fiber Optic Terminology.
*	EIA/TIA-455	-	Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices.
*	EIA-455-13	-	Visual and Mechanical Inspection of Fibers, Cables, Connectors and/or Other Fiber Optic Devices.
*	EIA-455-20	-	Measurement of Change in Optical Transmittance.
*	EIA/TIA-455-25	-	Impact Testing of Fiber Optic Cables and Cable Assemblies.
*	EIA-455-33	-	Fiber Optic Cable Tensile Loading and Bending Test.
*	EIA/TIA-455-39	-	Fiber Optic Cable Wicking Test.
*	EIA-455-41	-	Compressive Loading Resistance of Fiber Optic Cables.
	EIA-455-42	-	Optical Crosstalk in Fiber Optic Components.
*	EIA/TIA-455-46	-	Spectral Attenuation Measurement for Long-Length, Graded-Index Optical Fibers.
*	EIA-455-50	-	Light Launch Conditions for Long-Length Graded-Index Optical Fiber Spectral Attenuation Measurements.
*	EIA/TIA-455-78	-	Spectral Attenuation Cut-Back Measurement for Single Mode Optical Fibers.
*	EIA-455-81	-	Drip, filled Cables.
*	EIA-455-84	-	Jacket Self-Adhesion (Blocking) Test for Fiber Optic Cable.
*	EIA-455-91	-	Fiber Optic Cable Twist-Bend Test.
*	EIA-455-99	-	Gas Flame Test for Special Purpose Fiber Optic Cable.
	EIA-455-104	-	Fiber Optic Cable Temperature-Humidity Cycling.

* DoD adopted.

(Application for copies should be addressed to Electronic Industries Association/Telecommunications Industry Association (EIA/TIA, 2001 Pennsylvania Ave, NW, suite 800, Washington, D.C. 20006-1813.)

INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS, INC. (IEEE)

IEEE-STD-383	-	IEEE Standard for Type Test of Class IE Electric Cables, Field Splices and Connections for Nuclear Power Generating Stations.

(Application for copies should be addressed to Institute of Electrical and Electronics Engineers, Inc. (IEEE) 345 East 47th Street, New York, NY 10017.)

UNDERWRITERS LABORATORY (UL)

UL-910 - Standard for Safety Test for Flame Propagation and Smoke Density Values for Electrical and Optical Fiber Cables Used in Spaces Transporting Environmental Air.

(Application for copies should be addressed to: Underwriters Laboratories Inc. 333 Pfingsten Road,) Northbrook, IL 60062).

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

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated detail specifications, specification sheets, or MS standards), 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. Individual cable 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. The cable furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable qualified products list at the time of award of contract (see 4.5 and 6.3).

3.3 Materials. The cable shall be constructed of material as specified (see 3.1). Materials selected for cable usage shall be of a type and quality to assure compliance with the requirements of this specification, and shall be physically and chemically compatible for their intended use and throughout their intended lifetime. All combinations of materials used shall be nonnutrient to fungus and of a virgin nature. Where new or questionable material is being considered for use, the contractor shall furnish the toxicological data and formulations required to evaluate the safety of the material for the proposed use. When specified (see 3.1), materials and combinations of materials used in cable construction shall meet the requirements for toxic or explosive fumes produced by flame. Materials and combinations of materials used in cable construction shall have no adverse effect on the health of personnel or equipment when used for its intended purpose. Polyvinyl chloride material shall not be used.

3.3.1 Recovered materials. Recovered materials shall not be used in cable fabrication. Fiber material requirements shall be as specified in the latest revision of MIL-F-49291.

3.3.2 Optical fiber buffer, OFCC, Cable bundle, and ribbon. Materials used for the optical fiber buffer, OFCC, cable bundle and ribbon shall meet the requirements as specified (see 3.1). Fiber buffer in this specification shall refer to the additional protective layer over the coated optical fiber.

3.3.3 Filler. If used, filler material shall meet the requirements as specified (see 3.1). The fillers shall be evenly distributed, easily removable, and shall provide compactness and cross-sectional circularity to the finished cable.

3.3.3.1 Waterblocking material. Waterblocking material used in cable interstices shall be compatible with all other cable materials. Unless otherwise specified, the material shall be clear, nontacky, and nonirritating to the touch when not exposed to moisture. The material shall be free-stripping from the cable and components by hand and shall not require the use of chemicals or other mechanical means of removal. The material shall not interfere with any termination technique used with finished cable or components.

cable and components by hand and shall not require the use of chemicals or other mechanical means of removal. The material shall not interfere with any termination technique used with finished cable or components.

3.3.4 Strength members. Unless otherwise specified, strength members shall be polyacrylamide type PAA (as specified in MIL-C-572), glass fibers, or composites (see 3.1).

3.3.5 Jackets. Materials used for jackets (inner and outer) shall be as specified (see 3.1).

3.3.6 Cable nuclear survivability. When specified (see 3.1), material shall meet the nuclear vulnerability requirements specified in appendices to the individual specification sheets.

3.3.7 Materials for space applications. When specified, materials used in space flight applications shall meet the following additional material requirements.

3.3.7.1 Thermal vacuum outgassing. When specified and when tested in accordance with 4.8.5.1, all non-metallic materials shall not exhibit greater than 1.0% total mass loss and shall not produce greater than 0.1% collected volatile condensable materials.

3.3.7.2 Material flammability. When specified and when tested in accordance with 4.8.5.2, non-metallic materials shall be considered non-flammable or self-extinguishing if, less than 6 inches of the minimum use thickness sample is consumed and the time of burning does not exceed 10 minutes. There shall be no sparking, sputtering, or dripping of flaming particles from the test sample.

3.3.7.3 Odor. When specified and when tested in accordance with 4.8.5.3, non-metallic materials shall not rate greater than 2.5.

3.3.7.4 Toxicity (offgassing). When specified and tested in accordance with 4.8.5.4, all non-metallic materials shall not exceed a total hazard index of 0.5.

3.4 Design and construction. The design, construction, and physical dimensions of the complete cable and cable elements shall be as specified (see 3.1). The cable shall consist of one or more optical transmission elements individually surrounded by protective layers to provide performance and dimensional characteristics as specified (see 3.1). Unless otherwise specified (see 3.1), the cable shall be of a circular cross-section and concentric geometry. The surface of the jacket shall be dry and free from any coating, film, or treatment which would interfere with the bonding to the jacket of encapsulating or molding materials used in splicing and terminating. Unless otherwise specified (see 3.1), the short term minimum bend diameter shall be as listed in table II. The cable and the cable components shall be designed to comply with the specified properties while subject to specific operating and storage temperature ranges as specified (see 3.1).

TABLE II. Minimum short term bend diameter.

Application	Bend diameter to cable diameter
Ground tactical (T)	5X
Shipboard (B)	8X
Ground benign (G)	24X

3.4.1 Optical fibers. Optical fibers shall be in accordance with MIL-F-49291 and the applicable specification sheets (see 3.1). The optical fiber shall be coated with a material to preserve the high, pristine tensile strength of the glass fiber. The softening point of the fiber and coatings shall be not lower than 85°C. Coating and buffer material shall be readily removable by mechanical means.

3.4.1.1 Number of fibers. The number of optical fibers in the cable shall be as specified (see 3.1).

3.4.2 Cable configuration. The detailed cable configuration shall be as specified (see 3.1) and shall be either a buffered fiber, an OFCC, a cable bundle or a ribbon cable (see 1.2.1).

3.4.2.1 Buffered fibers. Unless otherwise specified (see 3.1), the outer diameter of the buffered fiber shall be 900 microns (μm). The buffer design shall be tight buffer, and the concentricity of the buffer shall be greater than or equal to 0.65 for 900 μm buffered fibers.

3.4.2.1.1 Buffered fiber color coding. Individual fiber buffers shall be color-coded for identification by colors as shown in table III. The limits for all colors, except rose and aqua, shall be in accordance with MIL-STD-104, class 1. The limits for rose and aqua shall be in accordance with table IV.

3.4.2.2 Optical fiber cable component (OFCC). The OFCC dimensions and concentricity requirements shall be as specified (see 3.1). Since the OFCC contains a buffered fiber, the requirements of 3.4.2.1 shall also apply.

3.4.2.2.1 OFCC jacket color coding. Individual OFCC jackets shall be color-coded for identification by solid colors as shown in table III. The limits for all colors, except rose and aqua, shall be in accordance with MIL-STD-104, class 1. The limits for rose and aqua shall be in accordance with table IV.

3.4.2.3 Cable bundle jacket. The cable bundle jacket dimensions and concentricity requirements shall be as specified in the specification sheet (see 3.1). Since the cable bundle jacket contains buffered fibers, ribbons, or OFCC's the requirements of 3.4.2.1, 3.4.2.4, and 3.4.2.2 shall also apply.

3.4.2.3.1 Cable bundle jacket color coding. Individual cable bundle jackets shall be color-coded as shown in table III. The limits for all colors, except rose and aqua, shall be in accordance with MIL-STD-104, class 1. The limits of the rose and aqua shall be in accordance with table IV. In addition, the applicable color coding requirements for individual OFCC's, ribbons, and buffered fibers in 3.4.2.2.1, 3.4.2.4.1, and 3.4.2.1.1, respectively shall also apply.

3.4.2.4 Optical fiber ribbon (Type 4 only). The dimensional requirements and the number of fibers per ribbon for the optical fiber ribbons shall be as specified (see 3.1). A ribbon shall consist of a linear array of nominally contiguous fibers which are held between the adhesive faces of two pressure sensitive tapes or are bonded together with a matrix material. The ribbons shall have no crossovers, defective fibers or splices.

3.4.2.4.1 Ribbon fiber color coding. Each fiber in a ribbon shall be color-coded for identification by colors as shown in table III. The limits for all colors, except rose and aqua, shall be in accordance with MIL-STD-104, class 1. The limits for rose and aqua shall be in accordance with table IV.

3.4.2.4.2 Ribbon color coding. For identification purposes, individual ribbons shall have either have a printed legend (the number corresponding to position and an abbreviation corresponding to color) or be color-coded on one face or edge of the ribbon by solid colors as shown in table III. The limits for all colors, except rose and aqua, shall be in accordance with MIL-STD-104, class 1. The limits for rose and aqua shall be in accordance with table IV.

3.4.2.5 Binders. The dimensional requirements and the number of fibers, buffered fibers, or OFCC's for each binder shall be as specified (see 3.1).

3.4.2.5.1 Binder color coding. Individual binders shall be color-coded for identification by solid colors as shown in table III. The limits for all colors, except rose and aqua, shall be in accordance with MIL-STD-104, class 1. The limits for rose and aqua shall be in accordance with table IV.

3.4.3 Cable jacket. The cable jacket shall provide environmental and physical protection to the enclosed cable elements. The cable jacket shall be applied concentrically to the cable core to maintain circularity in the completed cable. Jacket dimensions and dimensional tolerances shall be as specified (see 3.1). The concentricity of the jacket shall be equal to, or greater than, 0.65. This requirement applies to primary layers, coatings, or underlying jackets. The jackets shall be easily removable without damage to other cable component members as specified in 3.6.18. The jackets shall be dry and free from any coating, film, or treatment that would tend to interfere with the bonding of it to encapsulating or molding materials used in splicing and terminating. All jackets shall be free of pinholes, blowouts, and bumps (see 4.7.1).

3.4.3.1 Cable and cable core component jacket colors. Unless otherwise specified (see 3.1), the color of the overall cable jacket shall be black. The individual OFCC jackets and cable bundle jackets shall be separately color-coded as specified in 3.4.2.2.1 and 3.4.2.3.1, respectively. The OFCC or other core component jacket, binders and the buffered fiber inside shall be color matched, unless otherwise specified. The ribbon fibers and ribbons shall be color-coded as specified in 3.4.2.4.1 and 3.4.2.4.2, respectively.

TABLE III. Identification color coding.

Element number	Identification color
1	Blue
2	Orange
3	Green
4	Brown
5	Gray (slate)
6	White
7	Red
8	Black
9	Yellow
10	Violet
11	Rose
12	Aqua

TABLE IV. Munsell color limits for color numbers eleven and twelve

Symbol	Munsell Notation	
	Rose	Aqua
Centroid	10 RP 8/6	10 B 8/6
H+	2.5 P 8/6	2.5 PB 8/6
H-	7.5 RP 8/6	
V-	10 RP 7/6	10 B 7/6
Other	10 RP 8/4	10 B 8/4

3.4.4 Fillers. Fillers may be used to provide firmness, roundness, and watertightness of finished cables. Fillers shall be made of electrically nonconducting material meeting the applicable requirements of 3.5, 3.6 and 3.7. Filler material shall be of a consistency so as to not induce attenuation during the cabling process and shall have physical properties so as to prevent changes in optical parameters when the cable is subjected to the physical and environmental tests specified (see 3.1). The fillers shall be removable in accordance with 3.6.18.

3.4.5 Strength and central members. The strength members shall consist of peripheral layers of nonelectrically conducting materials as specified (see 3.1). If a central member is specified (see 3.1), the central member shall be electrically nonconductive.

3.4.6 Cabling. Optical cables shall be cabled as specified (see 3.1). The length of lay shall be that required to meet the minimum specified bend radius, flexing and twist-bending requirements. Strength members, fillers, and central members may contain splices. Splices in the strength members, fillers, and central members shall be dimensionally indistinguishable within the manufacturer's tolerances from the unspliced components. The spliced strength shall be not less than the strength of the unspliced material.

3.4.6.1 Cable physical dimensions. When tested in accordance with 4.7.2.2.1 and 4.7.2.2.2, the physical dimensions of the finished cable shall be as specified (see 3.1).

3.4.6.2 Concentricity. When tested in accordance with 4.7.2.2.3, the concentricity of the finished cable, OFCC, buffered fiber(s), and cable bundle(s), shall be as specified (see 3.1). The concentricity shall be greater than or equal to 0.65, and shall apply to jackets and underlying jackets.

3.4.6.3 Cable mass per unit length. When tested in accordance with 4.7.2.2.4, the mass per unit length of a fully assembled cable shall not exceed the value specified (see 3.1).

3.4.6.4 Cable continuous lengths. Lengths shall be as specified (see 6.2). Fully assembled cable shall be continuous and shall not be repaired or spliced.

3.5 Optical performance requirements.

3.5.1 Attenuation rate. The attenuation rate of the fiber prior to cabling or application or other stresses shall be tested in accordance with 4.7.3.1. Unless otherwise specified (see 3.1), the change in attenuation rate of the optical fiber in the finished cable shall not exceed the values shown in Table V from the precabled coated fiber value. The attenuation rate at the wavelengths of operation of the finished cable shall be as specified (see 3.1).

TABLE V. Maximum change in attenuation rate.

Application	Fiber type	Change in attenuation rate (dB/km)
Tactical (T)	Multimode Single mode	≤ 0.5 dB/km ≤ 0.3 dB/km
Shipboard (B)	Multimode Single mode	≤ 1.0 dB/km ≤ 0.5 dB/km

3.5.2 Change in optical transmittance. The change in optical transmittance of the cabled fibers due to exposure to mechanical (environmental and physical) tests shall not exceed the values specified in table VI when tested in accordance with 4.7.3.2. The end resultant attenuation due to cumulative environmental and mechanical testing shall not exceed that specified (see 3.1).

TABLE VI. Maximum change in optical transmittance.

Fiber type	Change in optical transmittance	
	Mechanical (dB)	Environmental (dB/Km) 1/
Multimode (MM) Single mode (SM)	0.5 0.2	0.5 0.3

1/ The change in optical transmittance requirement for freezing water immersion is not normalized for one kilometer.

3.5.3 Crosstalk. When specified (see 3.1), the cable shall be tested in accordance with 4.7.3.3. The far end crosstalk between any two fibers shall be not greater than minus 60 dB below the active fiber optical output level.

3.6 Mechanical performance requirements.

3.6.1 Tensile loading and elongation. After testing a specimen of finished cable in accordance with 4.7.4.1, there shall be no evidence of cracking, splitting, or breaking of the cable components or elongation greater than 2 percent. Unless otherwise specified, the change in optical transmittance of each fiber shall not exceed 2.0 dB during the test and the value specified in 3.5.2 after testing.

3.6.1.1 Operating tensile load. When specified (see 3.1), cable shall be tested in accordance with 4.7.4.1.1. There shall be no evidence of cracking, splitting, or breaking of the cable components. The change in optical transmittance shall not exceed the value specified in 3.5.2 during or after the test.

3.6.2 Dynamic bend. When tested in accordance with 4.7.4.2, the finished cable shall reveal no jacket softening, surface damage (cracking, splitting, or other defect to permit jacket penetration), or identification marking impairment. The change in optical transmittance of each fiber shall not exceed the value specified in 3.5.2 during and after the test.

3.6.3 Low temperature flexibility (cold bend). When tested in accordance with 4.7.4.3, a post-test visual examination of the cable jacket shall reveal no cracking, splitting, or other failure permitting jacket penetration. The change in optical transmittance of each fiber shall not exceed the value specified in 3.5.2 after the test.

3.6.4 Cyclic flexing. When tested in accordance with 4.7.4.4, a post-test visual examination of the cable shall reveal no splitting, cracking, or crazing of the specimen jacket. The change in optical transmittance of each fiber shall not exceed the value specified in 3.5.2 during and after the test.

3.6.5 Crush. When tested in accordance with 4.7.4.5, a post-test visual examination of the cable jacket shall reveal no cracking, splitting, or other defects to permit jacket penetration. Cable exterior deformation shall not be considered as damage or cable failure. The change in optical transmittance shall not exceed the value specified in 3.5.2 during and after the test and the optical crosstalk shall meet the requirements of 3.5.3 during and after the test.

3.6.6 Cable twist bending. When tested in accordance with 4.7.4.6, finished cable specimens shall exhibit no evidence of degradation of jacket materials. The change in optical transmittance of each fiber shall not exceed the value specified in 3.5.2 during and after testing. A post-test visual examination shall reveal no jacket softening, surface damage (cracking, splitting, or other defect to permit jacket penetration), or any identification marking impairment which affects legibility.

3.6.7 Radial compression (for application B only). When specified and when tested in accordance with 4.7.4.7, the finished cable shall reveal no cracking, splitting, or other defects to permit jacket penetration. The change in optical transmittance of each fiber shall not exceed 0.1 dB during and after the test.

3.6.8 Impact. When tested in accordance with 4.7.4.8, the cable shall meet the following requirements: a visual examination of the cable jacket after the second impact shall reveal no damage (cracking, splitting or other defect to permit jacket penetration), and the change in optical transmittance shall not exceed the value specified in 3.5.2 after the test.

3.6.9 Corner bend. Unless otherwise specified (see 3.1), cables shall be tested in accordance with 4.7.4.9. A post-test visual examination shall reveal no cracking, splitting, or tearing of the cable. The change in optical transmittance shall not exceed the values specified in 3.5.2 during and after the test.

3.6.10 Knot. When specified (see 3.1), the cable shall be tested in accordance with 4.7.4.10. A post-test visual inspection shall reveal no cracking, splitting, or tearing of the cable. The change in optical transmittance shall not exceed the value specified in 3.5.2 during and after the test.

3.6.11 Pressure cycling (for application B only). When specified (see 3.1), during the test specified in 4.7.4.11, the change in optical transmittance for each fiber shall not exceed the values specified in 3.5.2.

3.6.12 Hosing (for application B only). When specified and when tested in accordance with 4.7.4.12, the requirements of 3.6.12.1 and 3.6.12.2 apply only to water-blocked cables.

3.6.12.1 Low pressure. When tested in accordance with 4.7.4.12.1, water leakage through the cable specimen shall be only axial and shall not exceed 35 milliliter (ml).

3.6.12.2 Hydrostatic. When tested in accordance with 4.7.4.12.2, the cable specimen shall permit no more than 1000 ml times the squared cable outer diameter (in cm) flow of axial water and no more than 5 mm slippage of cable internal parts (strength members, OFCCs, fillers etc).

3.6.13 Dripping. When specified (see 3.1), the cable shall be tested in accordance with 4.7.4.13. A post-test visual inspection of the lower vertical cable end shall reveal no evidence of globule formation nor shall any dripping be observed on the drip collector.

3.6.14 Cable jacket tear strength. When tested in accordance with 4.7.4.14, the cable jacket tear strength shall be not less than 60 newtons per centimeter (N/cm) of jacket thickness.

3.6.15 Cable jacket materials tensile strength and elongation. When tested in accordance with 4.7.4.15, the tensile strength of the cable jacket material shall be not less than 900 N/cm^2. The percent elongation shall be not less than 125 percent.

3.6.16 Cable abrasion resistance. When tested in accordance with 4.7.4.16, the cable shall withstand 250 cycles of scraping abrasion and 150 cycles of cable-to-cable abrasion. Unless otherwise specified, exposure of any layers below the cable jacket shall be considered failure.

3.6.17 Cable shrinkage. When tested in accordance with 4.7.4.17, the total shrinkage of the length of finished cable (and buffered fiber, OFCC, cable bundle jacket and ribbon, as specified (see 3.1)) shall be no greater than 6.35 mm.

3.6.18 Cable element removability. When tested in accordance with 4.7.4.18, finished cable jacket, OFCC jacket, cable bundle jacket, optical fiber buffer, and ribbon tape shall be easily and cleanly removable by mechanical means without damage to the cable or optical fibers or both. No surface scratches or defects to the optical fiber shall be visible under 10X magnification after the fiber buffer material has been removed. The cable waterblock or filler materials, if applicable, shall be flexible and easily removable from any part to which it is in contact through the use of fingers only. The presence of occasional particles or slivers of filler residue will be acceptable, provided that these can be removed by light brushing with the fingers or with a dry cloth. Filler material which leaves residue that is removable only by vigorous wiping or through the use of solvents shall not be acceptable.

3.6.19 Durability of identification marking. Identification marking, including stripping or banding when specified (see 3.1), when applied to the outer surface of the finished cable, shall be capable of withstanding the durability test specified in 4.7.4.19 for 500 cycles. This test shall not be required when the identification marking is under a clear jacket.

3.6.20 Ribbon delamination (Type 4 only) When tested in accordance with 4.7.4.20, the ribbon shall not delaminate.

3.7 Environmental performance requirements. The finished cable shall perform according to all the requirements herein and as specified (see 3.1) during the specified operating environments and after the specified storage environment. The operating temperature range and storage temperature range shall be as shown in table VII and as specified (see 3.1).

TABLE VII. Temperature ranges.

Application	Operating range (°C)	Storage range (°C)
Ground tactical (T)	-46 to +71	-54 to +85
Shipboard (B) - normal Shipboard (B) - extended	-28 to +65 -54 to +65	-62 to +71 -62 to +71
Ground benign (G)	-40 to +75	-40 to +75
Aircraft (A)	-46 to +125	-54 to +125
Space (S)	-60 to +85	-60 to +85

3.7.1 Temperature cycling. When tested in accordance with 4.7.5.1, a post-test visual examination shall reveal no jacket softening, surface damage, or identification marking impairment. Post-test cable outer diameter shall remain within plus or minus 10 percent of the pretest cable outer diameter. The change in optical transmittance of each fiber shall not exceed the values specified in 3.5.2 at the low and high temperatures during and after the test.

3.7.2 Thermal shock. When tested in accordance with 4.7.5.2, a post-test visual examination shall reveal no jacket softening, surface damage (cracking, splitting or other defects to permit jacket penetration), or identification marking impairment. Post-test cable outer diameter shall remain within 10 percent of the pretest cable outer diameter. The change in optical transmittance of each fiber shall not exceed the values specified in 3.5.2 after the test.

3.7.3 Humidity. When tested in accordance with 4.7.5.3, a post-test visual examination shall reveal no jacket softening, surface damage, or identification marking impairment. Post-test cable outer diameter shall remain within plus or minus 10 percent of the pretest cable outer diameter. The change in optical transmittance of each fiber shall not exceed the value specified in 3.5.2 during and after the test.

3.7.4 Storage temperature. When specified (see 3.1), the cable shall withstand the test specified in 4.7.5.4. The exterior surface of the test specimens shall show no cracks or defects. The change in optical transmittance of each fiber shall not exceed the value specified in 3.5.2 after the test.

3.7.5 Barometric pressure (reduced). When specified (see 3.1), the cable shall withstand the test specified in 4.7.5.5. The change in optical transmittance of each fiber shall not exceed the value specified in 3.5.2 during and after the test.

3.7.6 Cable life. When tested in accordance with 4.7.5.6, a post-test visual examination shall reveal no jacket softening, surface damage, or identification marking impairment. Post-test cable outer diameter shall remain within plus or minus 10 percent of the pretest cable outer diameter. The jacket tensile strength and elongation shall be not less than 75 percent of the initial value. The change in optical transmittance of each fiber shall not exceed the value specified in 3.5.2 after the test.

3.7.7 Freezing water immersion (ice crush). When specified (see 3.1), the cable shall withstand the test specified in 4.7.5.7. The change in optical transmittance of each fiber shall not exceed the value specified in 3.5.2 during and after the test.

3.7.8 Weathering. When specified and tested in accordance with 4.7.5.8, after the 1200 hours exposure, the cable jacket shall show no evidence of softening, gumminess or surface damage (cracking, splitting or other defects to permit jacket penetration). The jacket tensile strength and elongation shall be 75 percent of the initial value. Unless otherwise specified (see 3.1), the requirements of 3.5.2 shall be met after the test.

3.7.9 Fluid immersion. When tested in accordance with 4.7.5.9, the tensile strength and elongation retention properties of the cable jacket material shall be not less than 50 percent of the initial values. The finished cable shall reveal no cracks, splits, gumminess, or voids in the cable jacket. The outer diameter of the finished cable shall not deviate more than 10 percent. The cable jacket shall not be preconditioned before this test other than normal jacket processing.

3.7.10 Wicking. When specified for water tight cables (see 3.1) and when tested in accordance with 4.7.5.10, a post-test examination of the immersed end of the cable specimen shall reveal a water penetration of less than 5 millimeters (mm) from the cable end and a change in mass of less than 1 percent.

3.7.11 Jacket self-adhesion or blocking. When tested in accordance with 4.7.5.11, a post-test visual inspection shall reveal no areas of localized adhesion between contacting cable surfaces, the metal storage spool, or other areas that are of a more severe nature than a "mild" condition.

3.7.12 Flammability. When tested in accordance with 4.7.5.12, the requirements of 3.7.12.1, 3.7.12.2, or 3.7.12.3 apply only when specified (see 3.1).

3.7.12.1 Flammability (60° angle). When tested in accordance with 4.7.5.12.1, cables shall self-extinguish within 30 seconds. The distance of flame travel shall not exceed 10 cm and there shall be no ignition of the tissue paper.

3.7.12.2 Flame extinguishing. When tested in accordance with 4.7.5.12.2, cables shall be self-extinguishing and shall not burn to the top of the tray.

3.7.12.3 Smoke generation and flame propagation. When tested in accordance with 4.7.5.12.3, the cables shall meet the requirements of UL-910 for smoke generation and flame propagation.

3.7.13 Shock. When specified and tested in accordance with 4.7.5.13, the finished cable shall reveal no physical damage to the cable. Unless otherwise specified (see 3.1), the change in optical transmittance of each fiber shall not exceed the value specified in 3.5.2 during and after the test.

3.7.14 Gas flame. During the test specified in 4.7.5.14, the change in optical transmittance of each fiber shall not exceed the value specified in 3.5.2. This test shall be performed only when specified (see 3.1).

3.7.15 Water absorption. When tested in accordance with 4.7.5.15, the maximum water absorption of the finished cable or a sample of the external cable jacket material shall not be greater than 4.0 mg per square centimeter (mg/cm^2) of exposed cable surface area.

3.7.16 Paint susceptibility. When specified and tested in accordance with 4.7.5.16, the cable jacket shall show no signs of jacket weakening, cracking or other damage.

3.7.17 Tempest. When specified and tested in accordance with 4.7.5.17, the cable shall meet the requirements of NASCEM 5204, appendix A (NSA 65-5) and appendix B (NSA 65-6).

3.8 Chemical properties.

3.8.1 Acid gas generation. When tested in accordance with 4.8.1, the acid gas generation, expressed as acid equivalent, shall be not greater than 2.0 percent of the weight of the sample.

3.8.2 Halogen content. When tested in accordance with 4.8.2, the total halogen content of the cable shall be as specified (see 3.1).

3.8.3 Toxicity index. When tested in accordance with 4.8.3, the toxicity index shall not exceed 5.0

3.8.4 Fungus resistance. When tested in accordance with 4.8.4, all materials used in the construction of cables shall meet the requirements of MIL-STD-454, requirement 4. Materials not identified in MIL-STD-454, requirement 4 as fungus inert shall meet grade I classification of MIL-STD-810, method 508.

3.9 Identification marking. Except as otherwise specified in the procurement contract or in the specification sheet, the finished cable shall be identified by a marking applied to the outer surface of the cable or visible through the outer surface. When cable is to be used in an end item for the Government, omission of the identification marking of product shall be permissible only when so stated in the specification sheet for the cable or the Government contract for the end item. The identification marking shall consist of the following, at intervals of 0.25 to 1.5 meters, as measured from the beginning of one complete marking to the beginning of the succeeding complete marking.

a. Specification sheet part number.

b. Manufacturer's code designation.

c. The words "Fiber Optic Cable".

d. Date code (4 digit - week, year).

e. When specified (see 6.2), meter markings shall be included.

The identification marking shall be permanent and legible in accordance with the marking requirements of MIL-STD-1285. Identification marking shall be applied with the vertical axis of the printed characters lengthwise of the cable when the nominal diameter of the finished cable is 1.25 mm or smaller. The vertical axis of the printed characters may be either crosswise or lengthwise of the cable when the nominal diameter of the cable exceeds 1.25 mm. All characters shall be legible.

3.9.1 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 military specifications. Accordingly, items procured 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 detail specifications, the manufacturer shall remove 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 No. 504,860 for the certification mark "JAN".

3.10 Workmanship. All details of workmanship shall be in accordance with high grade fiber optic cable manufacturing practice. Cables shall be dimensionally uniform. The minimal level of visual examination to be performed shall be as specified in a through d and is not intended to restrict other pertinent workmanship examinations deemed necessary by the contractor (see 4.7.1):

a. Outer jacket shall be free of cuts, burnt areas, abrasions, holes, roughened areas, bulges, thin spots, and discontinuities.

b. Inner layers shall be free of cuts, holes, bulges, thin spots, and discontinuities.

c. Strength members shall be uniformly laid with no discontinuities.

d. Fillers and water sealant shall be uniformly distributed throughout the cable body.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. In cases where certain requirements and tests are applicable only when specified (see 3.1), these tests shall be conducted in the order shown when specified in the appropriate specification sheet (see 3.1). Tests which are not specified as applicable to a specified cable construction shall not be conducted. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.1.2 Product assurance program. A product assurance program shall be established and maintained in accordance with MIL-STD-790. Evidence of such compliance shall be verified by the qualifying activity of this specification as a prerequisite for qualification and continued qualification.

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

a. Qualification inspection (see 4.5).

b. Quality conformance inspection (see 4.6).

4.3 Inspection conditions. Unless otherwise specified (see 3.1), all inspections shall be performed in accordance with the test conditions specified in EIA-455. When cable construction utilizes spliced fibers, test samples shall be selected to include the fiber splices.

4.4 Materials inspection. Materials inspection shall consist of certification, supported by verifying data, that materials used in fabricating the delivered cable are in accordance with the requirements of 3.3 and as specified (see 3.1).

4.5 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. Group qualification shall be as specified in 4.5.1.1.

4.5.1 Sample unit length. Unless otherwise specified (see 3.1), the sample unit lengths shall be as specified in table VIII. The sample size shall consist of 6 sample units.

4.5.1.1 Extent of qualification. In instances where two or more specification sheets cover cables identical in materials and construction except for attenuation, or in instances where cable constructions include varying numbers of fibers, the cable configuration incorporating the lowest attenuation range and the largest number of fibers shall be submitted and shall meet all the requirements of this specification and the specification sheet (see 3.1). Qualification may be extended to include those cables with higher attenuation and fewer number of fibers provided the samples submitted in accordance with 4.5.1 meet all the requirements of the specification sheet.

4.5.1.2 Inspection routine. The sample shall be subjected to the qualification inspection specified in table VIII in the order shown. In cases where certain requirements and tests are applicable only when specified (see 3.1), these tests shall be conducted in the order shown when specified in the appropriate specification sheet (see 3.1). Tests which are not specified as applicable to a specific cable construction shall not be conducted. All sample units shall be subjected to the inspection of group I and II. Specimens shall be cut from each sample unit in lengths at least as long as specified in table VIII. Test specimens from each sample unit shall be subjected to the tests of group III through group V, inclusive, of table VIII; however, each test specimen shall be subjected to only one group of tests in addition to groups I and II. Test specimens for group VI shall be cut from undamaged test specimens from groups III, IV or V. Optical tests shall be performed on the sample when required in section 3 as specified by the individual test in section 4.

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

4.5.2 Retention of qualification. To retain qualification, the contractor shall forward a report at 12 and 36-month intervals to the qualifying activity. The qualifying activity shall establish the initial reporting date. The report shall consist of:

a. A summary of the results of the tests performed for inspection of product for delivery (group A and group B) indicating, as a minimum, the number of lots that have passed and the number that have failed. The results of tests of all reworked lots shall be identified and accounted for. Summary shall be submitted at 12 month intervals.

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

4.5.2.1 Failure to submit a report. Failure to submit the report within 60 days after the end of each 12 and 36 month period may result in loss of qualification for the product. In addition to the periodic submission of inspection data, the contractor shall immediately notify its qualifying activity at any time during the 12 and 36-month period that the inspection data indicate failure of the qualified product to conform to the requirements of the specification.

4.5.2.2 No production. In the event that no production occurred during the reporting period, a report shall be submitted certifying that the company still has the capabilities and facilities necessary to produce the item. If during two consecutive reporting periods there has been no production, the manufacturer will be required, at the discretion of the qualifying activity, to submit this qualified product for testing in accordance with the initial qualification inspection requirements of 4.5.1

TABLE VIII. Qualification inspection.

Inspection	Requirement Paragraph	Test Paragraph	Specimen quantity and length 1/ 2/
Group I			
Visual and mechanical	3.4, 3.6, 3.7 3.8,3.9	4.7.1	6 units 1 km each 3/
Attenuation rate	3.5.1	4.7.3.1	6 units 1 km each 4/
Group II			
Crosstalk	3.5.3	4.7.3.3	6 units 1 km each 4/
Tempest	3.7.17	4.7.5.17	1 unit 6 m 5/
Group III			
Temperature cycling	3.7.1	4.7.5.1	3 units 1 km each (2 on reel, 1 off reel)
Humidity	3.7.3	4.7.5.3	3 units 1 km each 6/
Storage temperature	3.7.4	4.7.5.4	3 units 1 km each 6/ (2 on reel, 1 off reel)
Low temperature flexibility (cold bend)	3.6.3	4.7.4.3	3 units 8 m each 7/
Cyclic flexing	3.6.4	4.7.4.4	6 units 5 m each 7/ (2 each from 3 cables, 2 units for each temperature)
Crush	3.6.5	4.7.4.5	2 units 5 m each 7/
Cable twist-bending	3.6.6	4.7.4.6	6 units 5 m each 7/ (2 each from 3 cables, 2 units for each temperature)
Impact	3.6.8	4.7.4.8	3 units 5 m each 7/ (1 each from 3 cables)
Barometric pressure (reduced)	3.7.5	4.7.5.5	1 unit 1 km 8/
Life (elevated temperature)	3.7.6	4.7.5.6	2 units 500 m each 9/
Tensile loading and elongation	3.6.1	4.7.4.1	3 units 150 m each 7/ (1 each from 3 cables)
Operating tensile loading	3.6.1.1	4.7.4.1.1	2 units 150 m each 9/ (1 each from 2 cables)
Freezing water immersion (ice crush)	3.7.7	4.7.5.7	2 units 30 m each 9/ (1 each from 2 cables)
Fungus	3.8.4	4.8.4	2 units 2 m each 9/ (1 each from 2 cables)
Knot	3.6.10	4.7.4.10	6 units 5 m each 7/ (2 each from 3 cables)
Cable element removability	3.6.18	4.7.4.18	3 units 2 m each 7/ (1 each from 3 cables)
Flammability (60° angle)	3.7.12.1	4.7.5.12.1	3 units 6 meters each 7/ (1 each from 3 cables)
Group IV			
Thermal shock	3.7.2	4.7.5.2	2 units 1 km each (1 on reel, 1 off reel)
Gas flame	3.7.14	4.7.5.14	1 unit 10 m 10/
Weathering	3.7.8	4.7.5.8	2 units 2 m each 11/ 12/ (1 each from 2 cables)
Fluid immersion	3.7.9	4.7.5.9	2 units (for each 11/ 12/ fluid required) 2 m (1 each from 2 cables)

See footnotes at end of table.

TABLE VIII. Qualification inspection - Continued.

Inspection	Requirements paragraph	Test paragraph	Specimen quantity and length 1/ 2/
Group IV continued			
Paint susceptibility	3.7.16	4.7.5.16	2 units 11/ (1 each from 2 cables)
Jacket self adhesion or blocking	3.7.11	4.7.5.11	2 units 30 m each 11/ (1 each from 2 cables)
Shock	3.7.13	4.7.5.13	1 unit 30 m 10/
Dynamic bend	3.6.2	4.7.4.2	2 units 150 m each 11/ (1 each from 2 cables)
Hosing: Low pressure	3.6.12.1	4.7.4.12.1	1 unit 2 m 10/
Hydrostatic	3.6.12.2	4.7.4.12.2	1 unit 1 m 10/
Radial compression	3.6.7	4.7.4.7	1 unit 10 m 10/
Pressure cycling	3.6.11	4.7.4.11	1 unit 30 m 10/
Corner bend	3.6.9	4.7.4.9	2 units 5 m each 11/ (1 each from 2 cables)
Group V			
Dripping	3.6.13	4.7.4.13	1 unit 20 cm 13/
Cable jacket tear strength	3.6.14	4.7.4.14	3 units 2 m each 14/
Cable jacket material tensile strength and elongation	3.6.15	4.7.4.15	5 units 15/
Cable abrasion resistance	3.6.16	4.7.4.16	3 units 2 m each 14/
Cable shrinkage	3.6.17	4.7.4.17	3 units 2 m each 14/
Durability of identification	3.6.19	4.7.4.19	3 units 2 m each 14/
Ribbon delamination	3.6.20	4.7.4.20	3 units 2 m each 14/
Smoke generation and flame generation	3.7.12.3	4.7.5.12.3	1 unit 100 m 16/
Flame extinguishing	3.7.12.2	4.7.5.12.2	1 unit 50 m 16/
Wicking	3.7.10	4.7.5.10	2 units 2 m each 14/
Water absorption	3.7.15	4.7.5.15	2 units 17/
Group VI			
Acid gas generation	3.8.1	4.8.1	1 unit 1 m
Halogen content	3.8.2	4.8.2	1 unit 1 m
Toxicity index	3.8.3	4.8.3	1 unit 1 m
Thermal vacuum outgassing	3.3.7.1	4.8.5.1	1 unit 1 m
Material flammability	3.3.7.2	4.8.5.2	1 unit 1 m
Odor	3.3.7.3	4.8.5.3	1 unit 1 m
Material toxicity (offgassing)	3.3.7.4	4.8.5.4	

See footnotes at end of table

TABLE VIII. Qualification inspection - Continued.

1/ Tolerance on 1 km lengths is plus or minus 2 percent provided results are normalized to 1 km.
2/ Tolerance on shorter lengths is plus or minus 10 percent.
3/ The visual and mechanical inspection shall only be conducted on a 2 m section of each sample
4/ The same samples as used in the visual and mechanical inspection shall be used.
5/ A specimen cut from the one of the visual and mechanical test samples shall be used.
6/ The same samples as used in the temperature cycling test shall be used.
7/ A specimen cut from each sample used in the temperature cycling test shall be used.
8/ One of the samples used in the temperature cycling test shall be used.
9/ A specimen cut from two of the samples used in the temperature cycling test shall be used.
10/ A specimen cut from one of the samples used in the thermal shock test shall be used.
11/ A specimen cut from each of the thermal shock test samples shall be used.
12/ Three jacket material samples as specified in 4.7.4.15 shall also be used in this test.
13/ A 30 cm specimen shall be cut from the 1 km sample.
14/ The specimens shall be cut from the 1 km sample.
15/ Jacket material samples as specified in 4.7.4.15 shall be used in this test.
16/ A specimen cut from the sample shall be used.
17/ Jacket material samples as specified in 4.7.5.15, gravimetric method.

4.6 Quality conformance inspection. Quality conformance inspection shall consist of the inspections and tests specified for group A inspection (table IX), group B inspection (table X), and group C inspection (table XII).

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

4.6.1.1 Unit of product. A unit of product shall be 1 km of cable of the same part number. If a production run is less than a unit of product, then the quantity produced shall be one unit of product.

4.6.1.2 Production unit. The production unit shall consist of the number of units of product produced on the same production line or lines and offered for inspection at one time. All of the units of product in the production unit submitted shall have been produced during the same production period with the same materials and processes.

4.6.1.3 Sample unit. A sample unit shall be a unit of product selected at random from the production unit without regard to quality.

4.6.1.4 Specimen. A specimen shall be an individual length of cable cut from the sample unit.

4.6.2 Group A inspection. Group A inspection shall consist of the inspections and tests specified in table IX. In cases where certain requirements and tests are applicable only when specified (see 3.1), these tests shall be conducted in the order shown when specified (see 3.1). Tests which are not specified in the basic specification or specific slash sheet as applicable to a specific cable construction shall not be conducted.

TABLE IX. Group A inspection.

Inspection	Requirement paragraph	Test paragraph
Visual and mechanical	3.4, 3.8, 3.9	4.7.1
Attenuation rate	3.5.1	4.7.3.1

4.6.2.1 Sampling plan. Group A inspection shall be performed on 100% of delivered product. There shall be no failures.

4.6.2.2 Disposition of sample units. Sample units from which a specimen has failed any of the group A inspection tests shall not be delivered on any order.

4.6.3 Group B inspection. Group B inspection shall consist of the inspections specified in table X. In cases where certain requirements and tests are applicable only when specified (see 3.1), these tests shall be conducted in the order shown when specified (see 3.1). Tests which are not specified in the basic specification or specific slash sheet as applicable to a specific cable construction shall not be conducted. Group B inspections shall be made on sample units that have passed the group A inspection.

TABLE X. Group B inspection.

Inspection	Requirement paragraph	Test paragraph
Crosstalk	3.5.3	4.7.3.3
Thermal shock	3.7.2	4.7.5.2
Dynamic bend	3.6.2	4.7.4.2

4.6.3.1 Sampling plan. Sample units shall be selected from those types covered by a single specification sheet in accordance with XI, three months after the date of notification of qualification and every three months thereafter, except when the total production in a three month period is less than 2 units of product (2 Km) inspection need not be made until either production is at least 2 units of products or a total of 12 months have elapsed since the inspection was performed in which case only one sample unit shall be tested.

TABLE XI. Sampling plan for group B inspection.

Units of product from 3 months' production	Sample unit size
2	1
3 To 8, inclusive	2
9 to 30, inclusive	3
31 to 80, inclusive	4
81 to 130, inclusive	5
131 to 180, inclusive	6
181 to 240, inclusive	7
241 to 300, inclusive	8
over 300	4 percent

4.6.3.2 Failures. Production units in which one or more sample units have failed a group B inspection test shall be rejected.

4.6.3.3 Rejected production units. If a production unit is rejected, the supplier may screen out the defective units of product (if possible), and resubmit for reinspection. Resubmitted production units shall be inspected using tightened sampling (see 4.6.3.2.1). Such production units shall be separate from new production units, and shall be clearly identified as reinspected production units.

4.6.3.4 Disposition of sample units. Sample units from which a specimen has failed any of the group B inspection tests shall not be delivered on any order, even though the production unit submitted is accepted.

4.6.4 Group C inspection. Group C inspection shall consist of the inspections specified in table XII. In cases where certain requirements and tests are applicable only when specified (see 3.1), these tests shall be conducted in the order shown when specified (see 3.1). Tests which are not specified in the basic specification or specific slash sheet as applicable to a specific cable construction shall not be conducted. Group C inspection shall be made on sample units selected from production units which have passed the groups A and B inspection.

4.6.4.1 Sampling plan. Sample units shall be selected from those types covered by a single specification sheet in accordance with table XIII, 12 months after the date of notification of qualification and every twelve months thereafter, except when the total production in a 12-month period is less than two units of product (2 km) inspection need not be made until either production is at least 2 units of product or a total of 36 months has elapsed since the inspection was performed in which case only one sample unit shall be tested.

TABLE XII. Group C inspection.

Inspection	Requirement paragraph	Test paragraph
Group I		
Tempest	3.7.17	4.7.5.17
Temperature cycling	3.7.1	4.7.5.1
Group II		
Humidity	3.7.3	4.7.5.3
Storage temperature	3.7.4	4.7.5.4
Low temperature flexibility (cold bend)	3.6.3	4.7.4.3
Cyclic flexing	3.6.4	4.7.4.4
Crush	3.6.5	4.7.4.5
Cable twist-bending	3.6.6	4.7.4.6
Impact	3.6.8	4.7.4.8
Group III		
Barometric pressure (reduced)	3.7.5	4.7.5.5
Life (elevated temperature)	3.7.6	4.7.5.6
Tensile loading and elongation	3.6.1	4.7.4.1
Operating tensile loading	3.6.1.1	4.7.4.1.1
Freezing water immersion (ice crush)	3.7.7	4.7.5.7
Fungus	3.8.4	4.8.4
Knot	3.6.10	4.7.4.10
Cable element removability	3.6.18	4.7.4.18
Flammability (60° angle)	3.7.12.1	4.7.5.12.1
Group IV		
Gas flame	3.7.14	4.7.5.14
Weathering	3.7.8	4.7.5.8
Fluid immersion	3.7.9	4.7.5.9
Paint susceptibility	3.7.16	4.7.5.16
Jacket self-adhesion or Blocking	3.7.11	4.7.5.11
Shock	3.7.13	4.7.5.13
Hosing	3.6.12	4.7.4.12
Low pressure	3.6.12.1	4.7.4.12.1
Hydrostatic	3.6.12.2	4.7.4.12.2
Radial compression	3.6.7	4.7.4.7
Pressure cycling	3.6.11	4.7.4.11
Corner bend	3.6.9	4.7.4.9

TABLE XII. Group C inspection - Continued.

Inspection	Requirement paragraph	Test Paragraph
Group V		
Dripping	3.6.13	4.7.4.13
Cable jacket tear strength	3.6.14	4.7.4.14
Cable jacket materials tensile strength and elongation	3.6.15	4.7.4.15
Cable abrasion resistance	3.6.16	4.7.4.16
Cable shrinkage	3.6.17	4.7.4.17
Durability of identification marking	3.6.19	4.7.4.19
Ribbon delamination	3.6.20	4.7.4.20
Smoke generation and flame propagation	3.7.12.3	4.7.5.12.3
Flame extinguishing	3.7.12.2	4.7.5.12.2
Wicking	3.7.10	4.7.5.10
Water absorption	3.7.15	4.7.5.15
Group VI		
Acid gas generation	3.8.1	4.8.1
Halogen content	3.8.2	4.8.2
Toxicity index	3.8.3	4.8.3
Thermal vacuum outgassing	3.3.7.1	4.8.5.1
Material flammability	3.3.7.2	4.8.5.2
Odor	3.3.7.3	4.8.5.3
Material toxicity (offgassing)	3.3.7.4	4.8.5.4

TABLE XIII. Sampling plan for group C inspection.

Units of product from 12 months' production	Sample unit size
2	1
3 to 8, inclusive	2
9 to 30, inclusive	3
31 to 80, inclusive	4
81 to 130, inclusive	5
131 to 180, inclusive	6
181 to 240, inclusive	7
241 to 300, inclusive	8
Over 300	4%

4.6.4.2 Failures. If one or more specimens fail to pass group C inspection, the production unit shall be considered to have failed.

4.6.4.3 Disposition of specimens. Specimens that have been tested to group C inspection shall not be delivered on the contract or purchase order.

4.6.4.4 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. Acceptance and shipment of the product shall be discontinued until corrective action, acceptable to the qualifying activity, 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 qualifying activity). 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 shall be furnished to the cognizant inspection activity and the qualifying activity.

4.6.5 Inspection of packaging. The sampling and inspection of the preservation, packing and container marking shall be in accordance with MIL-C-28688.

4.7 Methods of inspection. The use of equivalent test methods is allowed subject to the following conditions:

a. The use of an equivalent method is specified in this specification.

b. The manufacturer has conducted both test methods during qualification and has submitted complete test data to the Preparing Activity (PA).

c. The PA has approved the use of that method by that manufacturer.

4.7.1 Visual and mechanical examinations (see 3.4, 3.6, 3.7, 3.8, and 3.9). Visual and mechanical examinations shall be performed in accordance with Electronic Industries Association (EIA)-455-13 to verify that the design, construction, physical characteristics, dimensions, marking, and workmanship are in accordance with the applicable requirements. Visual examination shall be accomplished utilizing 10X magnification. Visual inspection for the color of the cable and the color of the fiber may be accomplished without magnification.

4.7.2 Fiber and cable construction inspections.

4.7.2.1 Fiber. Fiber used in cable constructions shall meet the requirements of MIL-F-49291.

4.7.2.2 Cable.

4.7.2.2.1 Cable and cable core component dimensions (see 3.4.6.1). Buffered fiber, OFCC, cable bundle, ribbon, and the finished cable dimensions shall be measured in accordance with FED-STD-228, method 1018.

4.7.2.2.2 Finished cable diameter (see 3.4.6.1). The diameter of finished cable shall be computed from the circumference measurement determined in accordance with EIA-455-55 or equivalent.

4.7.2.2.3 Concentricity (see 3.4.6.2). The concentricity of the buffer, OFCC jacket, cable bundle jacket, and finished cable jacket shall be determined by locating and recording the minimum and maximum wall thickness of the same cross section. The ratio of the minimum wall thickness to the maximum wall thickness is defined as concentricity.

4.7.2.2.4 Finished cable mass (see 3.4.6.3). The mass of 1 km of fiber optic cable shall be determined in accordance with FED-STD-228, method 8311.

4.7.3 Optical properties inspections. Unless otherwise specified (see 3.1), the optical requirements specified herein shall be met at the center wavelength of 1.300 µm with a plus or minus 0.020 µm tolerance.

4.7.3.1 Attenuation rate (see 3.5.1). The multimode fiber attenuation rate shall be measured in accordance with EIA-455-46. For multimode fibers, the source shall be noncoherent. Light launch conditions used during the attenuation rate measurements shall be made in accordance with EIA-455-50 and table XIV. The attenuation rate of each individual single mode fiber shall be measured in accordance with EIA-455-78.

TABLE XIV. Light launch conditions for attenuation rate tests.

Fiber type	Launch conditions
SM	30-mm diameter mandrel
MM	70/70 restricted or equivalent

Any optical power detection method may be used if the method is sufficiently sensitive to measure the differential optical power levels as specified in the individual mechanical and environmental requirements of section 3 herein, and if the method provides repeatable readings (less than 3 percent variation).

4.7.3.2 Change in optical transmittance (see 3.5.2). This test shall evaluate the change in optical transmittance of the fibers due to exposure of the cable to one or more inspection (environment and physical) tests.

4.7.3.2.1 Method. The change in optical transmittance of each fiber in the cable shall be measured in accordance with EIA-455-20, utilizing a monitor fiber to evaluate the change in transmittance due to exposure of the cable to environmental and physical tests. Any optical power detection method may be utilized if the method has the sensitivity to measure the differential optical power levels as specified in the individual mechanical test requirements of section 3, and if the method provides repeatable readings (less than 3 percent variation). A pretest optical power measurement shall be made and the specimen shall then undergo inspection testing. All optical power measurements, subsequent to the pretest measurement, shall be referenced to the pretest value and the change in dB calculated.

4.7.3.2.2 Guidelines. These types of measurements require highly stable optical devices (source and detector) and repeatability of loss at the device-to-fiber interface. Use of the same reference fiber for calibrating the light source power output just prior to making all the measurements on the cable specimen, will enhance the measurement accuracy.

4.7.3.3 Crosstalk (see 3.5.3). Fully assembled cable specimens shall be tested for crosstalk in accordance with EIA-455-42. When applicable, the crosstalk shall be determined between a minimum of three randomly selected fibers in a multi-fiber cable, using each selected fiber sequentially as the actively transmitting element, and measuring the far-end power output of all other fibers in the cable specimen. The center wavelength shall be 1.300 ± 0.020 μm, and the light launch conditions shall be as specified (see 4.7.3.1).

4.7.4 Mechanical properties inspections (see 3.6). Unless otherwise specified (see 3.1), for mechanical tests, the specimen length shall be as given in individual inspections. The change in optical transmittance shall be measured in accordance with 4.7.3.2. The change in optical transmittance shall be measured for all fibers in the cable or a total of 12 fibers, whichever is less. In large count fiber cables, at least one fiber per ribbon, cable bundle, or binder shall be monitored. Visual examination, where required, shall be conducted in accordance with 4.7.1.

4.7.4.1 Tensile loading and elongation (see 3.6.1). The tensile loading on both the OFCC and the finished cable shall be measured in accordance with EIA-455-33. A 45-newton preload shall be placed on the cable. The load shall be increased to 2500 newtons times the cable outer diameter in centimeters in 4 equal increments. Attenuation measurements on all fibers shall be determined in unstressed and stressed conditions. At the completion of this test, the cable jacket shall be visually examined in accordance with 4.7.1.

4.7.4.1.1 Operating tensile load (see 3.6.1.1). The operating tensile load of the finished cable shall be tested in accordance with EIA-455-33. A 45-newton preload shall be placed on the cable. The load shall be increased to 500 newtons times the cable outer diameter in centimeters and held for 72 hours. Attenuation measurements on all fibers shall be determined in unstressed and stressed conditions. At the completion of this test, the cable jacket shall be visually examined in accordance with 4.7.1.

4.7.4.2 Dynamic bend (see 3.6.2). The finished cable shall be pulled 90° over a sheave whose outside diameter is equal to the minimum bend diameter of the cable, rounded to the next higher centimeter. The cable shall be pulled at a rate of 9 meters per minute (m/min), with a minimum tensile load of 875 newtons for each centimeter of cable outer diameter. The cable core components shall be pulled and loaded as specified (see 3.1). Specimen length shall be 150 meters. Apparatus shall be used to permit pulling the entire specimen length over the sheave. Tensile load shall not be applied by friction devices in direct contact with the cable. Friction applied to the supply reel or spool is an acceptable technique. The change in optical transmittance shall be measured during and after the test. At the completion of the test, the cable jacket shall be visually examined in accordance with 4.7.1.

4.7.4.3 Low temperature flexibility (cold bend) (see 3.6.3). The low temperature flexibility characteristic shall be tested in accordance with DOD-STD-1678, method 2020, procedure III. The special test conditions and modifications to procedure III specified in a through e shall apply to these tests:

a. The mandrel diameter shall be equal to the minimum bend diameter of the cable.

b. The low conditioning temperature shall be the low operating temperature plus or minus 2°C.

c. The masses shall be as specified in the DOD-STD-1678, method 2020 test procedure table.

d. The total number of turns on the mandrel shall be three (six cable turns).

e. Visually examine the specimen under ten-power magnification.

4.7.4.4 Cyclic flexing (see 3.6.4). A length of finished cable shall be tested at 30 cycles per minute over a sheave whose outer diameter is equal to the cable minimum bend diameter rounded up to the nearest centimeter. The cyclic flexing test shall be performed in accordance with EIA-455-104. The test sample shall be conditioned at the test temperature before conducting each test for a duration not less than one hour. The change in optical transmittance shall be measured during and after the test. After completion of the test, the specimen shall be visually examined in accordance with 4.7.1. The test shall be conducted at the temperatures and for the number of cycles shown in table XV for the application specified.

TABLE XV. Cyclic flexing test limits.

Application	Number of cycles	Temperature
Ground tactical (T)	2000 2000 2000	minimum operating temperature 25 ± 2°C maximum operating temperature
Shipboard (B)	500 100	25 ± 2°C minimum operating temperature

4.7.4.5 Crush (see 3.6.5). Compressive loading testing shall be accomplished in accordance with EIA-455-41 for the finished cable. Unless otherwise specified (see 3.1), the following special test conditions shall apply:

a. The compressive load exposure shall be not less than 2000 N/cm times the cable outer diameter (in cm) held for 1 minute, and released.

b. The compressive loading rate shall be not less than 2000 N/min.

c. The change in optical transmittance shall be measured in accordance with 4.7.3.2 while the specimen is under load and after load removal. Visual inspection of the specimen shall be made under 10x magnification after load removal.

d. A break in any fiber caused by this test shall be a failure of the cable.

e. Optical crosstalk shall be monitored in accordance with 4.7.3.3.

4.7.4.6 Cable twist bending (see 3.6.6). A length of cable shall be tested over a sheave whose outside diameter is equal to the minimum bend diameter of the cable, rounded to the next higher centimeter for the number cycles and at the temperatures listed in table XVI for the specified application. Twist bending shall be accomplished in accordance with EIA-455-91. Unless otherwise specified (see 3.1), the test load shall be 100 newtons. The test sample shall be conditioned at the test temperatures before conducting each test for a duration not less than 1 hour. The change in optical transmittance shall be measured during and after the test. After the tests, the specimen shall be visually examined in accordance with 4.7.1.

TABLE XVI. Cable twist bending test limits.

Application	Number of cycles	Temperature
Ground tactical (T)	2000 2000 2000	minimum operating temperature 25 ± 2°C maximum operating temperature
Shipboard (B)	500 100	25 ± 2°C minimum operating temperature

4.7.4.7 Radial compression (see 3.6.7). The intent of this test is to determine the optical response of the finished cable to the radial compressive forces that are applied to the cable when it is installed in multicable transits. A cable specimen shall be fitted into three multicable transits of appropriate size in accordance with DOD-STD-2003. A radial force shall be applied to the cable within the multicable transits by installing the cable in accordance with the approved assembly drawing for the appropriate multicable transit. The minimum torque applied to the MCT clamp nuts shall be 5.6 kgm. Cable exterior deformation shall not be considered as damage or cable failure. The change in optical transmittance shall be measured during and after the test.

4.7.4.8 Impact (see 3.6.8). A length cable specimen shall be tested in accordance with EIA-455-25. The specimen shall be conditioned at the test temperature before conducting each test for a duration not less than 1 hour. The change in optical transmittance shall be monitored during and after testing. At the completion of the tests, the cable jacket shall be visually examined in accordance with 4.7.1. The test shall be conducted at the conditions listed in table XVII for the application specified:

TABLE XVII. Application test conditions.

Application	Number of cycles	Temperature
Ground tactical (T)	50 100 50	minimum operating temperature 25 ± 2°C maximum operating temperature
Shipboard (B)	50 20	25 ± 2°C minimum operating temperature

4.7.4.9 Corner bend (see 3.6.9). Corner bend tests shall be as specified in 4.7.4.9.1 and 4.7.4.9.2.

4.7.4.9.1 Test apparatus. The testing apparatus shall consist of a rigid surface having a 90° corner whose radius (R) is 5 times the cable outer radius, rounded to the next highest centimeter (for cable only) and 1.3 cm for cable core components (see figure 1). A clamp or other equivalent means shall prevent the cable from sliding over the surface during test performance. Another clamping device shall be provided to apply a tensile force to the cable.

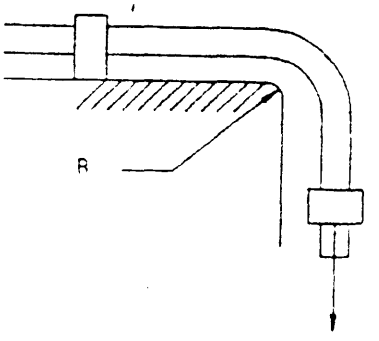


FIGURE 1. Corner bend test setup.

4.7.4.9.2. Testing procedure. The test specimen shall be secured to the testing surface and a force F = 1000 N/cm of cable outer diameter or 500 N, whichever is less, shall be applied, as shown, to the specimen for 1 minute. Visual inspection of the specimen shall be made after load removal using ten-power magnification. The change in optical transmittance shall be measured after 1 minute of loading and after unloading.

4.7.4.10 Knot (see 3.6.10). Knot testing shall be as specified in 4.7.4.10.1 and 4.7.4.10.2.

4.7.4.10.1 Test apparatus. The apparatus shall consist of clamps or other means of securing the cable and applying a tensile force to the cable and a mandrel with an outer diameter equal to the minimum bend diameter of the cable under test (see figure 2).

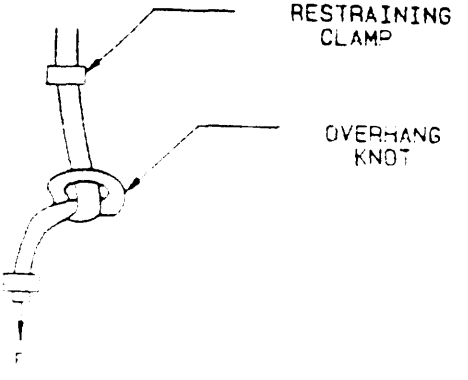


FIGURE 2. Knot test setup.

4.7.4.10.2 Test procedure. An overhand knot shall be loosely tied in the cable, the mandrel inserted into the loose knot so that the cable will firmly grasp the mandrel and a force of 1000 N/cm of cable outer diameter or 500 N, whichever is less, shall be applied to the specimen for 1 minute. Visual inspection of the specimen shall be made using ten-power magnification after load removal and the knot is untied.

4.7.4.11 Pressure cycling (see 3.6.11). The specimen shall be installed in a water pressure chamber with both ends brought out approximately 1 m through bulkhead stuffing tubes conforming to MIL-S-24235. The protruding ends of the specimen shall be prepared for attenuation testing. The specimen within the chamber shall be subjected to 24 pressure cycles. During each cycle, the gauge pressure of the chamber shall be raised to 7.0 MPa (1,000 lbf/in^2) and reduced to zero. For each cycle, the high pressure shall be held for 30 minutes and the zero pressure shall be held for 30 minutes. The change in optical transmittance (see 4.7.3.2) shall be measured continuously throughout the test on a minimum of three randomly selected fibers per specimen, when applicable.

4.7.4.12 Hosing (see 3.6.12). Hosing shall be as specified in 4.7.4.12.1 and 4.7.4.12.2.

4.7.4.12.1 Low pressure. A fully assembled cable specimen shall be tested in accordance with the procedure specified herein. One end of the specimen shall be placed in a terminal fitting which will allow water pressure to be applied directly to the exposed cross-sectional area of the end of the cable. Exposure of the sides of the cable to the water shall be kept to a minimum, and the fitting shall not exert radial compression against the cable. Unless otherwise approved by the qualifying activity, the sealer used for packing gland in the terminal shall be a metal alloy having a maximum melting point of 88°C. The specimen shall be subjected to a sea water pressure of 172 kilopascal (kPa) (25 pounds per square inch (lbf/in^2)) for a period of 6 hours at 23°C. The sea water shall be in accordance with ASTM-D-1141. Water leakage through the specimen shall be measured and shall not exceed the maximum leakage specified in 3.6.12.1.

4.7.4.12.2 Hydrostatic. A fully assembled cable specimen shall be tested in accordance with the procedure specified herein. One end of the specimen shall be fitted into the appropriate size of stuffing tube in accordance with MIL-S-24235. Water pressure of 7.0 MPa (1000 lbf/in^2) shall be applied to the stuffing tube end of the specimen for 6 hours. Water leakage through the specimen and slippage of the cable internal parts shall not exceed the values specified in 3.6.12.2.

4.7.4.13 Dripping (see 3.6.13). A fully assembled cable specimen shall be tested in accordance with EIA-455-81. The specimen shall be suspended vertically in an oven for a period of 6 hours at an oven temperature of 150 ± 3°C. The extent of fluid flow or dripping from the open cable end shall be reported. Visual inspection of the specimen shall be made using ten-power magnification.

4.7.4.14 Cable jacket tear strength (see 3.6.14). The tear strength of the finished cable shall be determined in accordance with FED-STD-228, method 3111.

4.7.4.15 Jacket material tensile strength and elongation (see 3.6.15). Unless otherwise specified (see 3.1), extruded flat specimens of the jacket material shall be tested in accordance with FED-STD-228, method 3021 and 3031, with 2.5 cm bend marks, 2.5 cm jaw separation, and a rate of travel of 25 cm/minute. The thickness of the specimen shall be measured using any micrometer.

4.7.4.16 Cable abrasion resistance (see 3.6.16).

4.7.4.16.1 Cable scraping resistance.

4.7.4.16.1.1 Test apparatus. The tester shall hold the test specimen firmly clamped in a horizontal position with the outer longitudinal surface of the specimen fully exposed. The tester shall rub an edge (A rotating drum with an abrading edge may be used) repeatedly over the upper surface of the specimen in such a position that the longitudinal axis of the edge and the specimen are at right angles to each other with edge and outer surface of specimen in contact. A weight added to a fixture above the rubbing edge shall control the force exerted normal to the surface of the jacket material. A motor-driven, reciprocating cam mechanism shall be used to deliver an accurate number of abrading strokes in a direction parallel to the longitudinal axis of the specimen. The number of cycles shall be measured by a counter. The length of the stroke shall be 5 cm and the frequency of the stroke shall be 30 cycles (60 strokes) per minute.

4.7.4.16.1.2 Test procedure. The specimen shall be clamped in the tester and a mass of 0.7 kg shall be carefully applied by the edge to the surface of the jacket. Five tests shall be performed on each specimen being moved forward 20 cm and rotated clockwise 90° along the longitudinal axis between each test. The test shall be discontinued when the specified number of cycles is attained for each of the five tests performed on the specimen.

4.7.4.16.2 Cable-to-cable abrasion.

4.7.4.16.2.1 Test apparatus. Cable-to-cable abrasion test apparatus and specimen relationship are shown on figures 3 and 4. The test apparatus shall consist of an electromagnetic transducer (driver) rigidly mounted on a heavy steel frame with the axial motion of the driver in a horizontal plane. The transducer shall drive a rocker arm via a spring steel bar. Mounted on this arm shall be a curved specimen holder upon which is mounted one of the cable (lower). The curvature of the upper surface of the specimen holder shall be an arc whose center is located at the pivot point of the rocker arm. The second (upper) specimen shall be mounted on the underside of a beam which is fastened to the frame through a thin, flexible nickel titanium alloy strip which shall serve as a hinge and allow the beam to be displaced only in a vertical direction. The beam and the driven specimen holder shall be positioned such that the two cable specimens form an included angle of 60°. The lower specimen holder shall be driven, by the transducer, at a rate of 1 Hertz and a peak-to-peak amplitude of 0.4 cm, along the bisector of the included angle. This symmetrical driving arrangement shall produce wear patterns of equal area on both specimens.

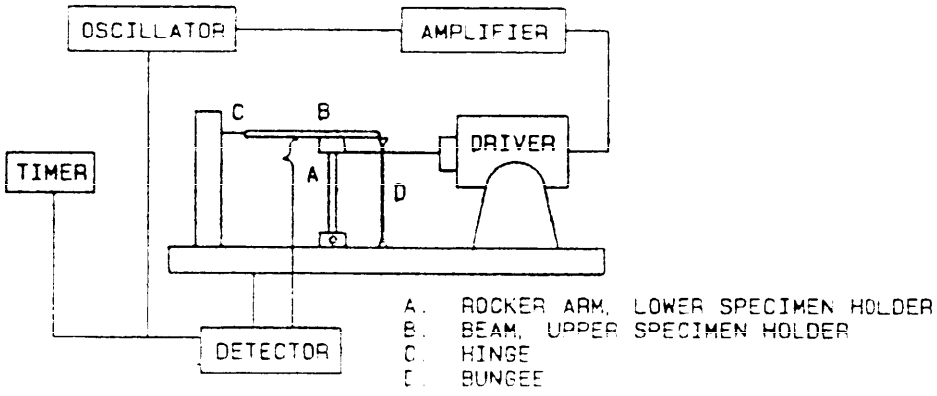


FIGURE 3. Abrasion resistance test apparatus.

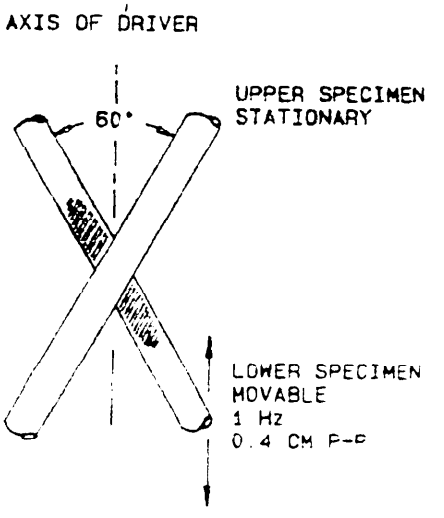


FIGURE 4. Abrasion resistance specimen relationships.

4.7.4.16.2.3 Test procedure. Test specimens shall be mounted as described above. The applied force between the two cable specimens shall be produced by one or more rubber bungees between the beam and the frame. The actual force shall be measured with a force gauge directly in line with the intersection of the two specimens. The force measurement shall be taken when a force just sufficient to separate the two specimens is achieved. The force shall be measured before and after the test, and the results shall be averaged. The average force determined in this manner shall be 10.0 ± 1.0 newtons. The end point of the test shall be when the specified number of cycles is attained for the specimen under test.

4.7.4.17 Cable shrinkage (see 3.6.17). A 30 cm specimen of cable shall be cut so that all components are flush at both ends. The specimen shall be aged at 150°C ± 3°C for 6 hours in an air-circulating oven. At the end of this period, the specimen shall be removed from the oven and allowed to return to room temperature. The length of the specimen shall again be measured and the shrinkage shall be calculated as the difference between the two measurements.

4.7.4.18 Cable element removability (see 3.6.18). This test is applicable to the materials used to fill the voids within or between cable bundles, optical fibers, between the cable core components, or between and around fiber ribbons. It is also applicable to filler material used to fill the voids between the cable core components, inner and outer jacket.

4.7.4.18.1 Specimens. A specimen shall consist of a length of completed cable approximately 1.0 meters long.

4.7.4.18.2 Procedure. All cable parts external to the cable core, such as cable jacket and strength member, shall be removed from one end of the specimen so as to expose the cable fibers and filler material for a distance of approximately 0.9 meter. Using fingers only (no hand tool), the filler shall be separated from the buffered fibers, cable core components, cable bundles, or fiber ribbon(s) for their fully exposed length. For cable bundles, approximately 40 cm of jacket shall be removed exposing the buffered fibers and cable core components, or both. The residual filler material on the buffered fiber or cable core component outer jackets, or both shall be removed using fingers only. For core components, approximately 20 cm of the outer jacket shall be removed exposing the core components core. The core component strength member shall be pushed back and removed exposing the inner jacket. The residual filler material on the core component inner jacket shall be removed using fingers only. For ribbons, approximately 20 cm of the tapes or matrix material shall be removed from the ribbon and fibers separated. Any residual material left on the fibers from the tapes shall be removed with a dry cotton cloth.

4.7.4.19 Durability of identification marking (see 3.6.19). The durability of product identification or markings applied to the cable for coding shall be evaluated at 20°C to 25°C

4.7.4.19.1 Durability testing apparatus. The marking durability tester shall be designed to hold a short specimen of finished cable firmly clamped in a horizontal position with the upper longitudinal surface of the specimen fully exposed. This instrument shall be capable of rubbing a small cylindrical steel mandrel, 0.60 mm ± 0.05 mm in diameter, repeatedly over the upper surface of the cable, in such position that the longitudinal axes of the mandrel and the specimen are at right angles to each other with their cylindrical surfaces in contact. A mass affixed to a jig above the mandrel shall control the force exerted normal to the outer surface of the jacket. A motor-driven, reciprocating cam mechanism and counter shall be used to deliver an accurate number of abrading strokes in a direction parallel to the axis of the specimen. The length of the stroke shall be 10 mm and the frequency shall be 120 strokes (60 stroking cycles) per minute.

4.7.4.19.2 Durability testing procedure. In performing the test, a specimen of cable shall be mounted in the specimen clamp and the mass of 500 grams shall be applied through the abrading mandrel to the marked surface. The counter is then set at zero and the drive motor started. The test shall continue for 500 cycles. The specimen shall be removed and visually examined in accordance with 4.7.1. Failure is defined as an erasure or obliteration to the point of illegibility of any marking contacted during the test exposure.

4.7.4.20 Ribbon delamination (see 3.6.20). A 30 cm sample of fiber ribbon shall be exposed to a temperature of 88 ± 2°C and relative humidity of 95 percent for 72 hours in a forced air oven. After this test exposure, the tape used in the ribbon shall not separate from the fibers.

4.7.5 Environmental tests (see 3.7). For environmental tests, the specimen lengths are given in the individual inspections. Change in optical transmittance measurements shall be made in accordance with 4.7.3.2. Measurements of the change in optical transmittance for environmental properties shall be made for all fibers in the cable or a total of 24 fibers, whichever is less. In large count fiber cables, at least two fibers per ribbon, cable bundle, or binder shall be tested. Visual examination of the specimen after exposure, where required, shall be conducted in accordance with 4.7.1.

4.7.5.1 Temperature cycling (see 3.7.1). The cable shall be tested in accordance with the steps listed in table XVIII. The change in optical transmittance shall be monitored continuously during and after the test

TABLE XVIII. Temperature cycling steps.

Step	Temperature (°C)	Duration (hours)
1	Room ambient	24
2	Ramp to the low operating temperature	2
3	Low operating temperature	8
4	Ramp to 25 ± 2	2
5	25 ± 2	6
6	Ramp to high operating temperature	1
7	High operating temperature	6
8	Ramp to 25 ± 2	1
9	25 ± 2	6
10	Repeat steps 2 through 9 four times for a total of five cycles	

4.7.5.2 Thermal shock (see 3.7.2). Thermal shock testing shall be in accordance with DOD-STD-1678, method 4020. The temperature extremes tested shall be the specified storage temperature extremes. The special test conditions and modifications to method 4020 specified in a through c shall apply to these tests:

a. Pretest and post-test measurements of the cable outer diameter shall be made and reported.

b. Visual inspection of the specimen shall be accomplished using ten-power magnification.

c. The change in optical transmittance shall be measured after the test.

4.7.5.3 Humidity (see 3.7.3). Humidity testing shall be accomplished in accordance with DOD-STD-1678, method 4030. The special test conditions and modifications to method 4030 specified in a and c shall apply to these tests:

a. Pretest and post-test measurements of the cable outer diameter shall be made and reported.

b. Visual inspection of the specimen shall be made using ten-power magnification.

c. The change in optical transmittance shall be measured after the test.

4.7.5.4 Storage temperature (see 3.7.4). The specimen shall be subjected to 240 hours minimum of exposure to the low temperature extreme plus or minus 2°C. Following the low temperature exposure, the specimen shall be exposed to room ambient temperature for a period of 24 hours, plus or minus 1 hour. The specimen shall then be exposed for 240 hours minimum to the high operating extreme plus or minus 2°C. Following the high temperature test, the specimen shall be exposed to room ambient temperature for a period of 24 hours, plus or minus 1 hour. The change in optical transmittance, in accordance with 4.7.3.2, shall be measured after the test. After the test, the specimen shall be visually examined using the ten-power magnification.

4.7.5.5 Barometric pressure (reduced) (see 3.7.5). The cable shall be subjected to the test of MIL-STD-202, method 105, test condition C, with mounting the same as that in normal service. Altitude exposure shall be 1 hour, minimum. The change in optical transmittance in accordance with 4.7.3.2 shall be measured following the test.

4.7.5.6 Cable life (see 3.7.6). Flat extruded jacket material shall be tested in accordance with MIL-STD-202, method 108 at the temperature and duration listed in table XIX for that particular material. Fully assembled cable samples shall be tested in accordance with MIL-STD-202, method 108 for 240 hours at 110°C. The change in optical transmittance shall be measured after the test. The special test conditions specified in a through c shall apply:

a. Pretest and post-test measurements of the cable outer diameter shall be made and reported.

b. Visual inspection of the jacket shall be made using ten-power magnification.

c. The tensile strength and elongation of the aged extruded flat jacket material shall be determined in accordance with 4.7.4.15 after the test.

TABLE XIX. Cable life test conditions.

Jacket material	Aging conditions
Thermoplastic	240 hours @ 110°C
Thermoset	240 hours @ 110°C

4.7.5.7 Freezing water immersion (ice crush) (see 3.7.7). The specimen shall be tested in accordance with DOD-STD-1678, method 4050, except the specimens shall be off reel and loosely coiled and shall be completely immersed in water. The vessel containing the water need not be sealed. Where radiant power is to be measured, the induced attenuation test of 4.7.3.2 shall be performed.

4.7.5.8 Weathering (see 3.7.8). Flat extruded jacket material and the finished cable shall be tested in accordance with ASTM-D-2565, using conditions specified in table XX. A 10 meter length of cable shall be used. After completion of the test exposure the finished cable shall be visually examined and the flat extruded jacket material shall be tested for jacket material tensile strength and elongation in accordance with 4.7.4.15.

TABLE XX. Conditions for weathering tests

Conditions	
Xenon arc lamp Borosilicate glass filters irradiance	6000 Watts 0.35 Watts per square meter at 340 nm
Procedure	
Exposure - arc lamp on	18 hours Black panel temp 63 ± 2°C Relative humidity 50 ± 2 percent (Water is sprayed onto the specimen for 18 minutes every 2 hours)
arc lamp off	6 hours Temperature 25 ± 2°C Relative humidity 90 to 95 percent
Total exposure	1200 hours

4.7.5.9 Fluid immersion (see 3.7.9).

4.7.5.9.1 Cable jacket material. Specimens of flat extruded cable outer jacket material shall be immersed in each of the fluids as specified (see 3.1) for the time and at the temperature specified. The size of each specimen shall be in accordance 4.7.4.15. The specimen shall then be removed, blotted to remove excess fluid, and suspended in the air at room temperature for not less than 3 hours, 30 minutes nor more than 4 hours, 30 minutes. The tensile strength and elongation of each specimen shall then be determined in accordance with 4.7.4.15.

4.7.5.9.2 Finished cable. One specimen of finished cable shall be immersed in each of the fluids specified (see 3.1) for the time and at the temperature specified. A 2-meter length of cable shall be immersed such that the two ends are exposed to the atmosphere. After each 24 hour immersion, the specimen shall be removed, blotted to remove excess fluid, and suspended in air at room temperature for not less than 3 hours, 30 minutes and not more than 4 hours, 30 minutes. After the test, the cable shall be tested for diameter change.

4.7.5.10 Wicking (see 3.7.10). Wicking characteristics shall be tested in accordance with EIA-455-39. The visual examination shall be made using ten-power magnification.

4.7.5.11 Jacket self-adhesion or blocking (see 3.7.11). Blocking characteristics shall be tested in accordance with EIA-455-84 to quality the cable jacket self-adhesion property. The cable specimen shall be conditioned at the high storage temperature plus or minus 2°C for a period of 48 hours prior to testing for blocking. After the test exposure, the specimen shall be visually examined using ten-power magnification.

4.7.5.12 Flammability (see 3.7.12). Cables shall be tested in accordance with 4.7.5.12.1, 4.7.5.12.2, and 4.7.5.12.3 as specified (see 3.1).

4.7.5.12.1 Flammability (60 angle). Cables shall be subjected to the test of DOD-STD-1678, method 5010. A post-test visual examination shall insure compliance with the requirements of 3.7.12.1.

4.7.5.12.2 Flame extinguishing. Cables shall be subjected to the vertical flammability test of IEEE-STD-383. Specimen length and quantity shall be as specified in IEEE-STD-383. Specimen shall be tested using a ribbon gas burner. The information specified in a through c shall be reported:

a. Flame temperature.

b. Period of time between burner shut off and cessation of flame on the specimen.

c. Overall distance of specimen jacket damage above the burner.

4.7.5.12.3 Smoke generation and flame propagation (see 3.7.12.3). Cable shall be tested for smoke generation and flame propagation in accordance with the Steiner Tunnel Test as described in UL-910.

4.7.5.13 Shock (see 3.7.13). A 30-meter minimum length of cable shall be used for this test. The specimen shall be subjected to grade A, type A, class I shocks as specified by MIL-S-901. Not less than 1 meter of the test specimen shall be mounted to simulate shipboard installation in a cable tray (see DOD-STD-2003, section 4). After completion of the test, the cable shall be visually examined in accordance with 4.7.1. The change in optical transmittance shall be monitored during and after exposure using equipment having a time resolution of 50 microsecond (μs) or better.

4.7.5.14 Gas flame (see 3.7.14). The gas flame test shall be conducted in accordance with EIA-455-05 with the exception that change in optical transmittance (see 3.5.2) shall be monitored during the exposure.

4.7.5.15 Water absorption (see 3.7.15). Water absorption shall be determined using the gravimetric method of ASTM-D-470 with a water temperature of 71 ± 1°C for a continuous 3 day period. The exposed surface area of the finished cable or cable jacket specimen shall not be less than 5 square cm and not greater than 10 square cm.

4.7.5.16 Paint susceptibility (see 3.7.16). A Two meter sample of finished cable shall be wrapped around a mandrel having an outer diameter equal to the minimum bend diameter of the cable. This cable mandrel assembly shall be painted using paint in accordance with TT-P-645 and allowed to dry for 120 hours. After drying the cable sample shall be removed from the mandrel and visually examined.

4.7.5.17 Tempest (see 3.7.17). The cable shall be tested for conformance to Tempest requirements in accordance with MIL-STD-285.

4.8 Chemical tests.

4.8.1 Acid gas generation (see 3.8.1). The total emission of any soluble acids (pH less than 3) shall be determined as follows. The required apparatus is shown on figure 5. A weighed sample of the finished cable, approximately 2.5 cm long, shall be placed in a silica boat which is put into the center of a silica tube, 26 to 60 cm long with 3.7 to 15.3 cm of internal diameter. The silica tube shall be placed in the tube furnace. An air supply, derived from a blower or compressed air cylinder, at the rate of 1 liter per minute, plus or minus 5 percent, shall be passed through the silica tube and then through four absorber flasks each containing 150 ml of deionized water. The furnace heating shall be commenced and the temperature of the tube and sample shall be raised to 800°C plus or minus 10°C over a period of approximately 40 minutes and then held at temperature for a further 40 minutes. During the heating period, acid gases produced will be carried over into the absorber flasks by the air flow. On completion of the heating cycle, the fluids in the absorber flasks shall be titrated against 0.1 normal sodium hydroxide solution using Congo Red as an indicator. The total titer indicates the total soluble acids; 1.0 ml of 1.0 normal sodium hydroxide solution is equivalent to 3.65 mg of acid expressed as acid equivalent relative to hydrochloric acid.

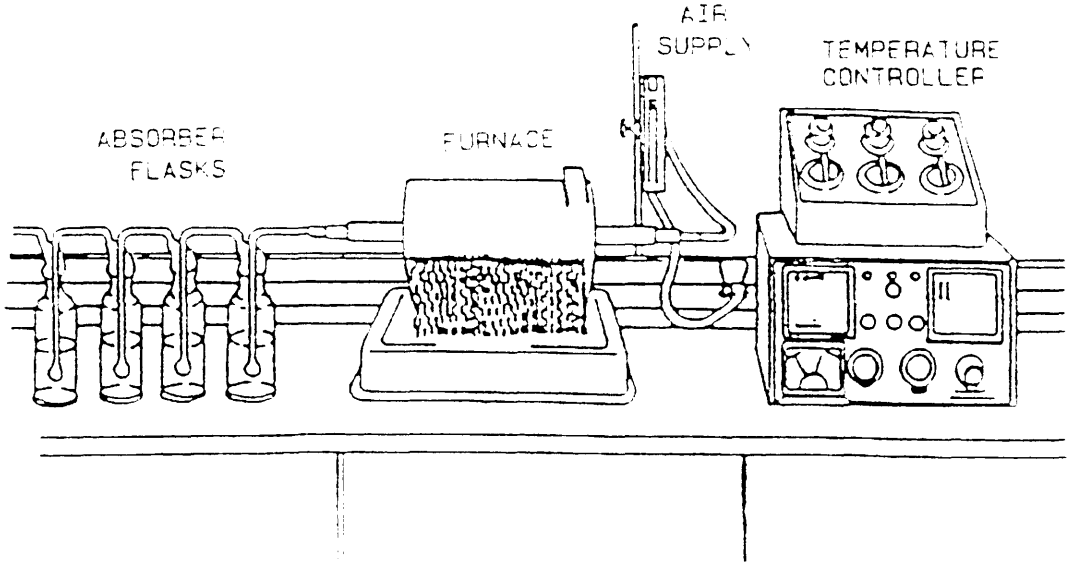


FIGURE 5. Acid gas generation test apparatus.

4.8.2 Halogen content (see 3.8.2). To determine the total halogen content, the cable specimen shall be tested as follows:

a. Fluorine - Approximately 1 gram of combustible finished cable shall be combusted in an oxygen flask to convert fluorine to fluoride. Fluoride shall be determined by ion selective electrode technique (Orion EA 940 Ion Analyzer, or equal in accordance with ASTM D 3761.

b. Chlorine - Approximately 1 gram of combustible finished cable shall be combusted in an oxygen flask to convert chlorine to chloride. After combustion, the specimen shall be mixed with mercuric thiocyanate and ferric ammonium sulfate to develop a color. The colored solution shall be measured for absorbance at 0.470 micrometers and compared to a calibration curve to obtain the amount of chloride present in accordance with ASTM D 512, method C.

c. Bromine - Approximately 1 gram of combustible finished cable shall be combusted in an oxygen flask to convert bromine to bromide. After combustion, the specimen shall be mixed with fluorescein and chloramine T to develop a color. The colored solution shall be measured for absorbance at 0.522 micrometers and compared to a calibration curve to obtain the amount of bromide present.

d. Iodine - Approximately 1 gram of combustible finished cable shall be combusted in an oxygen flask to convert iodine to iodide. After combustion, the specimen shall be oxidized with potassium permanganate and acidified with phosphoric acid. Potassium iodide and starch shall be added to develop a color. The colored solution shall be measured for absorbance at 0.575 micrometer and compared to a calibration curve to obtain the amount of iodide present.

4.8.3. Toxicity index (see 3.8.3). The toxicity index of the finished cable shall be tested in accordance with NES-713. An 8 cm length of cable shall be prepared in the following manner. Coat the ends of the exposed cable core material with a high temperature ceramic cement and allow 72 hours to cure. This capping procedure should eliminate dripping of the core materials during testing. Support the cement caps with a rigid clamping device to hold the caps in place during testing. Position the cable sample above the flame source at a 45° angle and apply the flame so that it is centered on the cable sample. The combustion gases shall be chemically analyzed using calorimetric gas reaction tubes.

4.8.4 Fungus resistance (see 3.8.4). Cables and materials used in the construction of cable that are not identified as fungus inert in MIL-STD-454, requirement 4 shall be tested in accordance with MIL-STD-810, method 508. The cable specimen length shall be 2 meters.

4.8.5 Materials tests for space applications.

4.8.5.1 Thermal vacuum outgassing (see 3.3.7.1). Non-metallic materials shall be tested in accordance with ASTM-E-595.

4.8.5.2 Material flammability (see 3.3.7.2). Material samples shall be tested in accordance with NASA Handbook (NHB) 8060.1, test 1.

4.8.5.3 Odor (see 3.3.7.3). Material samples shall be tested in accordance with NHB 8060.1, test 6.

4.8.5.4 Toxicity (offgassing) (see 3.3.7.4). Material samples shall be tested in accordance with NHB 8060.1, test 7.

5 PACKAGING

(The packaging requirements specified herein apply only for direct Government acquisition. For the extent of applicability of the packaging requirements of the referenced documents listed in section 2, see 6.2.)

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-C-28688.

5.2 Reels and spools. The cable on each reel or spool shall have both ends readily available for testing without unwinding. The reel or spool shall have an inner diameter greater than two times the minimum bend radius of the cable.

5.3 Marking of reels and spools. In addition to the marking specified in MIL-STD-129, each reel or spool shall be marked with the length of individual continuous lengths of cable wound thereon. A warning label shall be applied to each reel to advise personnel to exercise caution in the handling of optical fibers. This label shall alert personnel to avoid skin puncture and contact with the eyes. In addition, interior packages and exterior shipping containers shall be marked in accordance with MIL-STD-129. The identification marking shall contain the following information:

CABLE, FIBER OPTICS
Specification sheet part no. _____
Specification MIL-C-85045
Length: _____ meters
Size:
Date of manufacture: _____
Name of manufacture: _____

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 cables covered by this specification are intended for use in the following applications as specified (see 3.1) where their performance characteristics are required.

a. Fixed plant. Used in systems in fixed locations including indoor, outdoor aerial, direct burial, duct, and undersea applications.

b. Tactical. Concerned with use in non-vehicular and mobile militarized systems.

c. Space. Which involves use in vehicles and/or systems deployed in outer space.

d. Avionics. Involving use in aircraft or missile systems.

e. Shipboard. Involving use in systems deployed in a mobile marine environment (on board or in tow).

f. Ground vehicle. Involving use in land vehicular systems.

g. Other specialized military applications.

6.1.1 Temperature rating. Temperature ratings as specified in specification sheets pertaining to this specification represent the maximum permissible operating temperature range of the cable.

6.1.2 Materials compatibility. The jacketing systems of the fiber optic cables covered by this specification may be degraded by certain fluids or compounds. If such degradation occurs, the fluids or compounds and the conditions necessary for failure shall be added to the specification sheet as a precautionary note.

6.1.2.1 Compatibility note. The insulation systems of polyvinylidene fluoride jacketed cables of this specification may be degraded by contact with hydraulic fluids of the phosphated ester type at high temperature. Cables of this specification with polyvinylidene fluoride jackets are not recommended for applications where they will be in contact with hydraulic fluids of phosphate ester types at temperatures above 50°C.

6.2 Acquisition requirements. Acquisition documents must specify the following:

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

b. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1 and MIL-C-85045E)

c. Title, number, and date of the applicable specification sheet.

d. Complete cable part number.

e. Jacket and fiber color required (see 3.4.2 and 3.4.3).

f. Applicable marking of reels and spools (see 5.3).

g. Level of packaging and packing required (see 5.1).

h. Minimum acceptable continuous cable length (see 3.1 and 5.3).

i. Total quantity of cable required.

j. Meter marking requirements (see 3.1 and 3.8).

k. Equivalent test methods, if other than as specified (see 4.7).

l. Length of cable per reel (see 5.2).

m. Data required.

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 the applicable Qualified Products List QPL-85045, whether or not such products have actually been so listed by that date. The attention of 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 purchase orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Naval Sea Systems Command, SEA 55Z3, Washington, DC 20362-5101, however, information pertaining to qualification of products may be obtained from the Defense Electronics Supply Center, ATTN: DESC-EQ, Dayton, OH 45444-5000.

6.3.1 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, PA 19120.

6.3.2 Conformity to qualified sample. It is understood that cable supplied under 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.

6.3.3 Forwarding of qualification samples. Samples and the manufacturer's certified test reports shall be forwarded to the testing laboratory designated in the letter of authorization from the activity responsible for qualification (see 6.3). Samples will be plainly identified by securely attached, durable tags marked with the following information:

a. Sample for qualification test.

b. "MIL-C-85045E".

c. Specification sheet part number.

d. Manufacturer's name and code number.

e. Manufacturer's part number.

f. Comprehensive description and prime manufacturer's name and formulation number of the base materials from which the product is made. (This information will not be divulged by the Government.)

g. Place and date of manufacture of sample.

h. Submitted by (name) (date) for qualification tests in accordance with the requirements of MIL-C-85045 under authorization (reference authorizing letter).

6.4 Personnel safety. Care should be taken when handling the very fine (small diameter) optical fibers to prevent skin puncture or contact of fiber with the eye area. Also, direct viewing of the optical terminal face of a terminated cable, while it is propagating optical energy, is not recommended unless the radiation is in the visible portion of the optical spectrum, of low power, and needed to perform test examinations not obtainable by other methods.

6.5 Definitions. The following definitions of terms in this document are generally accepted by the optical fiber cable manufacturing industries. EIA-440 and FED-STD-1037 may be used as additional references for definitions of terms related to fiber optics.

6.5.1 Binder. A binder is a string or tape which ties together a number of fibers, buffered fibers or OFCC's.

6.5.2 Buffered fiber. A buffered fiber is a coated optical fiber augmented with an additional coating or buffer jacket to protect the fiber and render it more visible and manageable.

6.5.3 Cable bundle. A cable bundle is a number of fibers, buffered fibers, ribbons, or OFCC's, grouped together in the cable core within a common protective layer.

6.5.4 Cable bundle jacket. A cable bundle jacket is the material which forms a protective layer around a bundle of fibers, buffered fibers, ribbons or OFCC's.

6.5.5 Cable core. Cable core is the part of the cable interior to the outermost jacket.

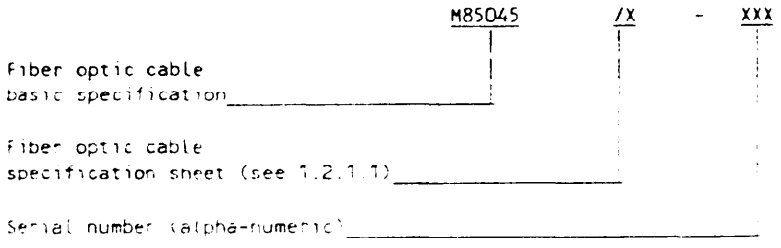
6.5.6 Cable core component. Cable core component is a part of the cable core, such as a buffered fiber, OFCC, cable bundle, ribbon, and perhaps other parts.

6.5.7 Minimum bend radius. Minimum bend radius is the minimum radius at which a cable may be bent for extended periods of time with no degradation in optical performance.

6.5.8 OFCC. An OFCC is a buffered fiber augmented with a concentric layer of strength members and an overall jacket.

6.5.9 Ribbon. A ribbon fiber optic cable is a cable made up of optical fibers arrayed and maintained in this lateral position by various means.

6.6 Part or Identifying Number (PIN). The PIN shall be constructed in accordance with the following:



Example: M85045/2-001

6.7 Subject term (key word listing).

Aperture, numerical
Armor sheathing
Attenuation
Bandwidth
Cable
Crosstalk
Diameter, cable
Dielectric construction
Flammability
Optical fiber

6.8 Changes from previous issue. Asterisks (or vertical lines) are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

CONCLUDING MATERIALS

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

Review activities:
Army - AR, AV, MI
Navy - EC, OS
Air Force - 13, 17, 19, 80, 90, 99
DLA - ES
NASA - NA

User activity:
Air Force - 14

Preparing activity:
Navy - SH

Agent:
DLA - ES

(Project 6015-0025)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-C-85045E	2. DOCUMENT DATE (YYMMDD) 92-05-21

3. DOCUMENT TITLE
CABLES, FIBER OPTICS, (METRIC), GENERAL SPECIFICATION FOR

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) AUTOVON (If applicable)	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY

a. NAME Technical Point of Contact: Karen Long NSEA 51J1	b. TELEPHONE (Include Area Code) (1) Commercial: (703) 602-0137 (2) AUTOVON: 332-0137
c. ADDRESS (Include Zip Code) Commander Naval Sea Systems Command Attn: SEA 55Z3 Washington, DC 20362-5101	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340

DD Form 1426, OCT 89 — Previous editions are obsolete. — 198/290