INCH-POUND

MIL-S-24622A
2 June 1989
SUPERSEDING
DOD-S-24622
3 December 1984

MILITARY SPECIFICATION

SOURCES, LIGHT EMITTING DIODE (LED), FIBER OPTIC, 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 establishes the general requirements for light emitting diode (LED) fiber optic sources. These optical sources contain optical windows or integrally attached pigtail fibers for coupling the source optical power into the fiber optic link. Pigtail fibers specified herein are mechanically and optically compatible with the fibers specified in DOD-F-49291.

1.2 Classification. Fiber optic sources covered by this specification should be classified by the sealing level types specified in 1.2.1, by the wavelength class specified in 1.2.2, and by the optical coupling style specified in 1.2.3 (see 3.1 and 6.1).

1.2.1 Sealing level type. The sealing level type is identified by one of the following type designators:

Type A: Hermetic
Type B: Nonhermetic

1.2.2 Wavelength class. The wavelength class is identified by one of the following class designators:

Class 1: Wavelength operation of 820-910 nanometers.
Class 2: Wavelength operation of 1250-1350 nanometers.
Class 3: Wavelength operation of 1400-1600 nanometers.

1.2.3 Optical coupling style. The optical coupling style should be identified by one of the following style designators:

Style 1: Pigtail fiber with 50/125 µm core/cladding diameter.
Style 2: Pigtail fiber with 100/140 µm core/cladding diameter.
Style 3: Optical window or lens.

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 55Z3), DOD Standardization Program and Documents Divisions, Department of the Navy, Washington, DC 20362-5101 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 6030

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

MILITARY

MIL-S-19491	-	Semiconductor Devices, Packaging Of.
MIL-S-24622/1	-	Sources, LED, Fiber Optic, 820-910 Nanometers Wavelength Range, Glass Pigtailed Type.
MIL-S-24622/2	-	Sources, LED, Fiber Optic, Type A, Class 1, Style T.
MIL-s-24622/3	-	Source, LED, Fiber Optic, 1290 Nanometers, Glass Pigtailed, Hermetically Sealed, Dual In-line Package (DIP).
MIL-F-49291	-	Fiber, Optical (metric), General Specification For.

STANDARDS

MILITARY

MIL-STD-104	-	Limits for Electrical Insulator Color.
MIL-STD-202	-	Test Methods for Electronic and Electrical Component Parts.
DOD-STD-347	-	Product Assurance Program Requirements For Fiber Optic Components.
MIL-STD-454	-	Standard General Requirements for Electronic Equipment.
MIL-STD-750	-	Test Methods for Semiconductor Devices.
MIL-STD-883	-	Test Methods and Procedures For Microelectronics.
MIL-STD-889	-	Dissimilar Metals.
MIL-STD-1285	-	Marking of Electrical and Electronic Parts.
MIL-STD-1678	-	Fiber Optic Test Methods and Instrumentation.

(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.)

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

3.2 Qualification. Fiber optic sources 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 4.4 and 6.3).

3.3 Product assurance requirements. The product assurance requirements of the fiber optic sources furnished under this specification shall be established and maintained in accordance with the procedures and requirements specified in DOD-STD-347 with details specified in 4.1.2.

3.4 Materials. The fiber optic source shall be constructed of material as specified herein or in the specification sheet (see 3.1). Materials used in source construction shall not give off toxic, corrosive, or explosive fumes when tested to conditions specified herein. Materials used shall have no adverse effect on the health of personnel when used for its intended purpose. Acceptance or approval of any constituent material shall not be construed as a guarantee of the acceptance of the finished product.

NOTE: Packages containing beryllia shall not be ground, sandblasted, machined, or have other operations performed on them which will produce beryllia or beryllium dust. Furthermore, beryllium oxide packages shall not be placed in acids that will produce fumes containing beryllium.

3.4.1 Metals. All metals shall be corrosion resistant type or shall be suitably plated or otherwise finished to prevent corrosion during service life under any of the environmental conditions specified by the document.

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

3.4.1.2 Fungus resistance. All materials used in sources designed to this specification shall be nonnutrient to fungus, as defined by requirement 4 of MIL-STD-454.

3.4.2 Recovered materials. Unless otherwise specified herein, all material incorporated in the products covered by this specification shall be new and shall be fabricated using materials produced from recovered materials to the maximum extent practicable without jeopardizing the intended use. The term "recovered materials" means materials which have been collected or recovered from solid waste and reprocessed to become a source of raw materials, as opposed to virgin raw materials. None of the above shall be interpreted to mean that the use of used or rebuilt products is allowed under this specification unless otherwise specifically specified.

3.5 Construction. Overall dimensions, dimensional tolerances, and physical characteristics for these sources shall be as specified (see 3.1). These sources shall be constructed with either a single pigtail fiber integrally attached to the light emitting diode (LED), or utilize an optical window or lens for optical coupling as specified (see 3.1).

3.5.1 Pigtail assembly.

3.5.1.1 Sheath. The fiber pigtail sheath material and construction shall provide the bend-restrictive property which prevents the pigtail assembly from exceeding the minimum bend radius of 10 millimeters (mm). Sheath materials shall be nonmetallic.

3.5.1.2 Strain relief. Strain relief shall be provided between the case body and the pigtail sheath. Metallic or nonmetallic materials may be used for strain relief construction. The overall length of the strain relief member shall not exceed 30 mm and shall provide a minimum bend radius of 20 mm under normal usage.

3.5.1.3 Pigtail fibers. Pigtail fibers shall be optical glass fibers as specified (see 3.1).

3.5.2 Lead conductors.

3.5.2.1 Lead finish. The finish system on all external leads or terminals shall conform to one of the following:

a. Hot solder dip. The hot solder dip shall be homgeneous with a minimum thickness of 60 microinches (1.52 µm) for round leads and, for other shapes, a minimum thickness at the crest of the major flats of 200 microinches (5.08 µm) solder (SN60 or SN63). In all cases, the solder dip shall exend up to and beyond the effective seating plane or to the glass seal for flush-mounted devices. The hot solder dip is applicable: (1) over a finish in accordance with 3.5.2.1b or 3.5.2.1c (2) over electroplated nickel or electroless nickel phosphorus, in accordance with 3.5.2.2, or (3) over the basis metal. When applied over the basis metal, hot solder dip shall cover the entire lead to the glass seal or point of emergence of the lead or metallized contact through the package wall.

b. Tin plate. As-plated tin shall be a minimum of 300 microinches thick and shall be dense, homogeneous and continuous. As-plated tin shall contain no more than 0.05 percent by weight co-deposited organic material measured as elemental carbon. Tin plate shall be fused after plating before or after burn-in by heating above its liquidus temperature. Fused tin plate shall be visually inspected after fusing and shall exhibit a dense, homogeneous and continuous coating. Fused tin plate shall be a minimum of 200 microinches thick when measured at the crest of major flats. This measurement shall be taken halfway between the seating plane and the tip of the lead. (This requirement is to avoid having the inspector select a nontypical portion of the lead on which to perform the measurement.) Fused tin plate is applicable: (1) over electroplated nickel or electroless nickel-phosphorous (only for rigid leads or package elements other than leads), in accordance with 3.5.2.2; or (2) over the basis metal.

As-plated tin need not be fused if the leads are subsequently hot solder dipped in complete accordance with 3.5.2.1a. Tin-lead plating may be used as an alternative to tin plate and shall have in the plated deposit two percent to 50 percent by weight lead (balance nominally tin) homogeneously co-deposited. As-plated tin-lead shall be a minimum of 300 microinches thick. As-plated tin-lead shall contain no more than 0.05 percent by weight co-deposited organic material measured as elemental carbon. Tin-lead plate is applicable: (1) over As-plated tin; (2) over electroplated nickel or electroless nickel phosphorous in accordance with 3.5.2.2; (3) over the basis metal. Tin-lead plating may be fused after plating before or after burn-in by heating above it liquidus temperature. Fused tin-lead shall be visually inspected after fusing, and shall exhibit a dense, homogenous and continuous coating. Fused tin-lead shall be a minimum of 200 microinches thick measured at the crest of the major flats. This measurement shall be taken halfway between the seating plane and the tip of the lead (This requirement is to avoid having the inspector select a nontypical portion of the lead on which to perform the measurement). The maximum carbon content for both tin and tin-lead plate (and minimum lead content in the tin-lead plate) on the As-plated finish shall be determined by the manufacturer on at least a weekly basis.

The visual inspection after fusing shall be conducted on a sampling basis by the manufacturer as an in-process control. Visual inspection of the fusing shall be performed at a frequency sufficient to assure uniform compliance with these requirements on the finished product. The determination of carbon and lead content may be made by any accepted analytical technique (e.g., for carbon: pyrolysis, infrared detection (using an IR212, IR244 infrared detector or equivalent); for lead: X-ray fluorescence, emission spectroscopy) so long as the assay reflects the actual content in the deposited finish.

c. Gold plate. Gold plating shall be a minimum of 99.7 percent gold, and only cobalt shall be used as the hardener. Gold plating shall be a minimum of 50 microinches (1.27 µm) and a maximum of 225 microinches (5.72 µm) thick. Gold plating shall be permitted over nickel plate or undercoating in accordance with 3.5.2.2.

3.5.2.2 Nickel plate or undercoating. Electroplated nickel undercoating or finishes from a sulfamate nickel bath is preferred and shall be 50 to 350 microinches (1.27 to 8.89 µm) thick measured on major flats or diameters. Electroless nickel undercoating or finishes, when allowed, shall be 50 to 100 microinches (1.27 to 2.54 µm) thick for lead and 50 to 250 microinches (1.27 µm to 6.35 µm) thick for package elements other than leads measured on major flats or diameters. The addition of organic addition agents is prohibited for either sulfamate or phosphorous nickel baths. Electroplate or electroless nickel plate (or combinations thereof) as well as nickel cladding may be used as the finish for package elements other than leads or terminals provided the corrosion resistance and environmental requirements are met. In all cases, electroplated nickel undercoating from a nickel sulfamate bath is preferred for lead and terminal finishes. Electroless nickel phosphorous shall not be used as the undercoating on flexible or semi-flexible leads (see 3.3.1 and 3.3.2 of method 2004 of MIL-STD-883) and shall be permitted only on rigid leads or package elements other than leads.

3.5.2.3 Polarity identification. Polarity identification shall be as specified (see 3.1).

3.6 Performance. Optical, electrical, and electro-optical requirements shall be as specified herein, and as specified (see 3.1) and shall be used to monitor the effects of the inspection requirements specified in 4.8. End-point parameters (see 6.6) are listed with requirement and test paragraphs specified in table V.

3.6.1 Peak optical wavelength. The peak optical wavelength of the source shall be as specified (see 3.1 and 4.7.1).

3.6.2 Peak optical wavelength drift. The drift of the peak wavelength due to temperature change shall not vary from the peak wavelength by more than the wavelength tolerance specified (see 3.1 and 4.7.2).

3.6.3 Spectral width. The spectral width and width tolerance about the peak wavelength shall be as specified (see 3.1 and 4.7.3).

3.6.4 Radiant power. The source radiant power coupled out of the fiber optic source shall be as specified (see 3.1 and 4.7.4).

3.6.5 Optical power amplitude stability. The stability of the radiant power shall be as specified (see 3.1 and 4.7.5).

3.6.6 Optical power angular distribution (radiation pattern). The angular distribution of radiant power shall be as specified (see 3.1 and 4.7.6).

3.6.7 Forward voltage. The acceptable level and variation in forward voltage shall be as specified (see 3.1 and 4.7.7).

3.6.8 Reverse current leakage. The acceptance level and variation in reverse current leakage shall be as specified (see 3.1 and 4.7.8).

3.6.9 Breakdown voltage. The acceptable breakdown voltage shall be as specified (see 3.1 and 4.7.9).

3.6.10 Thermal resistance. Acceptable level and level variation for source thermal resistance shall be as specified (see 3.1 and 4.7.10).

3.6.11 Pulse rise and fall times. The maximum acceptable rise and fall times for the optical pulses radiated from the pigtail fiber or optical window shall be as specified (see 3.1 and 4.7.11).

3.6.12 Frequency response. The frequency response of the radiated optical signals shall be as specified (see 3.1 and 4.7.12).

3.6.13 Signal linearity. When specified, the linearity (L) of the source optical signals shall contain less than the specified valve (see 3.1) of total harmonic signal components as compared to the fundamental signal carrier (see 4.7.13).

3.7 Environmental and mechanical requirements.

3.7.1 Internal visual (precap) inspection. The source shall meet the internal visual (precap) requirements as specified in table I (see 4.8.1).

3.7.2 Visual and mechanical inspection. The source shall meet the lot tolerance percent defective (LTPD) (see 6.6.4) requirement for visual and mechanical inspections specified in tables II and IV (see 4.8.2).

3.7.3 Physical dimensions. The dimensions and dimensional tolerances for these fiber optic sources shall be as specified (see 3.1 and 4.8.3).

3.7.4 High temperature (nonoperating) life. When tested in accordance with 4.8.4, the visual inspection of 4.8.2, the LTPD requirement of table III, and the end-point parameters and parameter limits as specified herein shall be met.

3.7.5 Thermal shock (temperature cycling). When tested in accordance with 4.8.5, there shall be no visible evidence of source marking impairment or other damage. The LTPD requirement of table III and the end-point parameters and parameter limits as specified herein shall be met.

3.7.6 Constant acceleration. When tested in accordance with 4.8.6, the source shall meet the LTPD requirement of table IV, and the end-point parameters and parameter limits as specified herein.

3.7.7 Steady-state power burn-in. The source shall meet the end-point parameters and parameter limits noted in table II for steady-state power burn-in and as specified herein (see 4.8.7).

3.7.8 Hermetic seal. The source shall meet the LTPD requirements of tables III and IV and shall not exceed the leak rates as specified herein (see 4.8.8).

3.7.9 Solderability. The source electrical leads shall meet the solderability criteria in method 2026 of MIL-STD-750 and meet the LTPD requirement specified in table III (see 4.8.9).

3.7.10 Resistance to solvents. The source shall meet the LTPD requirement specified in table III and the identification marking shall remain legible and intact (see 4.8.10).

3.7.11 Steady-state operation life (LTPD). The source shall meet the LTPD requirement specified in tables III and IV for steady-state operation life, and the end-point parameters and parameter limits as specified herein, and as specified (see 3.1 and 4.8.11).

3.7.12 Intermittent operation life (LTPD). The source shall meet the LTPD requirement specified in table III for intermittent operation life and the end-point parameters and parameter limits as specified herein, and as specified (see 3.1 and 4.8.12).

3.7.13 Decap internal visual verification. The source shall meet the LTPD requirement specified in table III for decap internal visual verification (see 4.8.13).

3.7.14 Bond strength. The source shall meet the LTPD requirement specified in table III for the applicable bond strength. Bond failure criteria shall be as stated in method 2037 of MIL-STD-750 (see 4.8.14).

3.7.15 Thermal shock (glass strain). The source shall meet the LTPD requirement specified in table IV for the stress requirement imposed on the fiber and glass seals (see 4.8.15).

3.7.16 Terminal strength. Terminal strength requirements for tension shall be applied to the optical pigtail of sources which have optical pigtails and lead fatigue requirement shall be applied to the external electrical leads of the optical source. The test condition, minimum acceptable tensile load and the duration of applications of this load shall be as specified (see 3.1). Evidence of breakage, loosening or relative motion between the terminal lead or pigtail and the source body shall constitute failure and part rejection. The LTPD requirements of table IV shall be met (see 4.8.16).

3.7.17 Moisture resistance. The source shall meet the LTPD requirement of table IV and the end-point parameter and parameter limits as specified herein (see 4.8.17).

3.7.18 Shock. The source shall meet the LTPD requirement of table IV and the end-point parameter and parameter limits as specified herein (see 4.8.18).

3.7.19 Vibration, variable frequency. The source shall meet the LTPD requirement of table IV and the end-point parameters and parameter limits as specified herein (see 4.8.19).

3.7.20 Salt atmosphere (corrosion). The source shall not exhibit illegible markings, flaking or pitting of the finish or corrosion that would interfere with the use of the device. The LTPD requirement of table IV shall be met (see 4.8.20).

3.7.21 Steady-state operation life. The source shall meet the lambda requirement specified in table IV and the end-point values specified herein, or as specified (see 3.1 and 4.8.21).

3.7.22 Neutron irradiation. When specified (see 3.1), the source shall be exposed to the neutron irradiation levels selected from table VI and the source shall meet the end-point parameters and parameter limits as specified (see 3.1 and 4.8.22).

3.7.23 Steady-state total dose irradiation. When specified (see 3.1), the source shall be exposed to the total ionizing level selected from table VI and the source shall meet the end-point parameters and parameter limits as specified (see 3.1 and 4.8.23).

3.7.24 Outgassing. When outgassing is required (see 3.1), the Total Mass Loss (TML) shall not exceed 1.0 percent and the Collected Volatile Condensable Material (CVCM) shall not exceed 0.1 percent when tested in accordance with 4.8.24.

3.8 Color. Optical source package color shall be as specified (see 3.1). Colors selected shall be in accordance with MIL-STD-104.

3.9 Marking.

3.9.1 Identification marking. Marking shall be in accordance with the requirements of this specification and associated specification sheets. The following marking shall be placed on each device and shall be legible at time of shipment:

a. Military part number (as specified, see 3.1).

b. JAN prefix (see 3.9.2).

c. Manufacturer's name, trademark, or identification (see 3.9.3).

d. Polarity marking (as specified, see 3.1).

e. Inspection lot identification code (see 3.9.4).

f. Special marking (see 3.9.5).

g. Electrostatic discharge sensitivity identifier (see 3.9.5.1).

h. Beryllium oxide identifier (see 3.9.5.2).

3.9.2 JAN brand. 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 acquired to, and meeting all of the criteria specified herein and in applicable specifications shall bear the certification mark "JAN" except that items too small to bear the certification mark "JAN" shall bear the letter "J". The "JAN" or "J" shall be placed immediately before the part number except that if such location would place a hardship on the manufacturer in connection with such marking, the "JAN" or "J" may be located on the first line above or below the part number. Items furnished under contracts or orders which either permit or require deviation from the conditions or requirements specified herein or in applicable specifications shall not bear "JAN" or "J". In the event an item fails to meet the requirements of this specification and the applicable specification sheets or associated 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".

3.9.3 Manufacturer's name, trademark, or identification. Fiber optic sources shall be marked with the name, abbreviation, or trademark of the manufacturer who has contracted under this specification to manufacture devices for the Government or its equipment manufacturers, and at whose plant the specified quality conformance inspection has been performed. The identification of the equipment manufacturer may appear on the device only if the equipment manufacturer is also the device manufacturer. The name or trademark of only the original manufacturer shall appear on the device or initial container. Rebranding shall not be permitted.

3.9.4 Inspection lot identification code. Fiber optic sources shall be marked by a code indicating the last week of sealing for the inspection lot accumulation period. The first two numbers in the code shall be the last two digits of the number of the year. The third and fourth numbers shall be two digits indicating the calendar week of the year. When the number of the week is a single digit, it shall be preceded by a zero. Reading from left to right or top to bottom, the code number shall designate the year and week. When more than one lot of a device type sealed within the same six-week period is submitted for quality conformance inspection, a lot identification suffix letter shall be chosen, consisting of a single capital letter, and shall appear on each fiber optic device immediately following the date code. This letter shall be chosen by the manufacturer so that each inspection lot is uniquely identified by the lot identification code and by the lot identification suffix letter, if one is required.

3.9.5 Special marking. If any special marking is used, it shall in no way interfere with or obscure the marking required in 3.9.1.

3.9.5.1 Electrostatic discharge (ESD) sensitivity identifier. When devices are found to be sensitive by the electrostatic discharge sensitivity test (see 4.4), the devices represented by the test shall be marked with the sensitive electronic device symbol specified in MIL-STD-1285. Manufacturers may, at their option, classify devices as sensitive without performing the ESD sensitivity test based on their own history, judgement, or performance. These untested devices shall be marked as specified above.

3.9.5.2 Beryllium oxide package identifier. If a semiconductor package contains beryllium oxide, the device shall be marked with the designation 'BeO'.

3.9.6 Marking legibility. Marking shall remain legible after all tests. Damage to marking on deliverable source test samples caused by mechanical fixturing in groups B and C nondestructive tests shall not be cause for lot rejection, but shall be remarked to insure legibility prior to shipment.

3.10 Workmanship. Optical sources shall be manufactured and processed in accordance with the requirements of this specification. The external surface of the source package, header or flange shall be finished and not have any depression or cavity, unless it is part of the original design. Burrs and sharp edges on the external package and leads shall be removed. External parts, elements or coatings shall not be blistered, cracked, softened or exhibit defects that adversely affect the storage, operation or environmental capabilities of these optical sources.

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. 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. The Government reserves the right to perform any of the inspections set forth in this 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 DOD-STD-347. Evidence of such compliance shall be verified by the qualifying activity of this specification as a prerequisite for qualification and continued qualification.

4.2 Inspections.

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

a. Qualification inspection (see 4.4).

b. Screening inspection (see 4.5).

c. Quality conformance inspection (see 4.6).

4.2.2 Inspection conditions. Unless otherwise specified herein, all inspections shall be performed in accordance with the test conditions specified in the "GENERAL REQUIREMENTS of MIL-STD-750.

4.2.3 Formation of inspection lots. Fiber optic sources to be inspected shall be assembled into an identifiable inspection lot or collection of inspection sublots.

4.2.3.1 Inspection lot. The total number of sources that the manufacturer submits at any one time for qualification or quality conformance inspection shall constitute an inspection lot. The inspection lot is submitted to determine compliance with the requirements of the specification sheet. Each inspection lot shall consist of sources of a single type or may consist of a collection of sublots of structurally identical sources (see 4.2.3.1.2) contained on a single specification sheet, manufactured on the same production line within a single plant through final seal by the same production technique, and to the same source design with the same material requirements within the same 6-week period. Lot identification shall be maintained from the time the lot is assembled to the time it is accepted or rejected.

4.2.3.1.1 Inspection sublot. An inspection sublot shall consist of a single source type contained on a single specification sheet, manufactured on the same production line through final seal by the same fabrication technique, and to the same source design with the same material requirements and within the same 6-week period. Sealing level type A and type B optical sources are not structurally identical and therefore are independent sublots.

4.2.3.1.2 Structurally identical source types. Structurally identical fiber optic sources are sources manufactured on the same production line through final seal by the same fabrication technique and to the same source design with the same material requirements, and differ only electrically. An example of such structurally identical sources are optical sources grouped into different current ratings.

4.2.3.2 Preservation of lot identity. During all screening, inspection and marking operations, each lot and sublot shall be kept segregated, secure, and traceable.

4.2.4 Sampling. Statistical sampling for qualification and quality conformance inspection shall be in accordance with the appendix of this specification.

4.2.5 Performance verification tests. Optical and electrical performance verification tests (see 4.7) shall be accomplished without any detrimental affect on the fiber optic sources.

4.2.6 Resubmitted lots. Resubmitted lots shall be kept separate from new lots and shall be clearly identified as resubmitted lots. When any lot submitted for qualification or quality conformance inspection fails any subgroup requirement of groups A, B, or C tests, it may be resubmitted once for that particular subgroup using tightened inspection criteria (as defined in the appendix of this specification). A second resubmission using tightened inspection criteria is permitted only if failure analysis is performed to determine the mechanism of failure for each failed source from the prior submissions and it is determined that failure is due to:

a. A defect that can be effectively removed by rescreening the entire lot, and that rescreen has been performed, or

b. Random type defects which do not reflect poor basic source design or poor basic processing procedures. In all instances where analysis of the failed sources indicates that the failure mechanism is due to poor basic processing procedures, a basic design fault, or nonscreenable defects, the lot shall not be resubmitted.

4.3 Materials inspection. Materials used in fabricating the delivered fiber optic sources shall be in accordance with the requirements of 3.4 and as specified (see 3.1).

4.4 Qualification inspection. Qualification inspection shall be performed at a laboratory satisfactory to the Government (see 6.3) on sample units produced with equipment and procedures normally used in production. Electrostatic discharge sensitivity testing shall be done in accordance with method 1020 of MIL-STD-750 and the applicable detail specification.

4.4.1 Inspection routine. For qualificaton, sources shall be subjected to screening tests (see 4.5) and inspections specified in groups A, B, and C for sealing level type A or B. All samples subjected to groups B and C must be chosen from a lot which has passed the requirements of group A. The following conditions apply:

a. The required LTPD sample from a sublot of each source type submitted, shall be tested for each group A subgroup.

b. A sample from one sublot shall be tested for each group B subgroup. A sample source from each sublot (each device type) shall be submitted to the design verification inspection (see 4.8.2 and 4.8.3).

c. A sample from one sublot shall be tested for each group C subgroup. At the option of the manufacturer, devices from table III, group B, subgroup 3, may be continued on in group C, subgroup 5, to achieve the specified requirements, or separate samples may be used.

4.4.2 End-points. End-point electrical and optical measurements (see 4.7 and table V) shall be taken and recorded before starting and after completion of all specified tests in the subgroups of groups B and C. Pre-test end-point failures shall be replaced by acceptable devices.

4.4.3 Variables data. Group A variables data and the pre-test and post-test groups B and C end-point variables data shall be included in the test report.

4.4.4 Data submitted. Data for all tests shall be recorded in sufficient detail to verify the test procedures and conditions applied.

4.4.5 Lot size. The qualification inspection lot shall be chosen by the manufacturer and the lot and each sublot shall contain at least twice the number of devices required for qualification.

4.4.5.1 Selection of samples. All samples shall be randomly selected from the qualification inspection lot. After a test has started, the manufacturer may add an additional quantity to the initial sample, but this addition may be done only once for any subgroup and the added samples shall be subjected to all the tests within that subgroup. The total samples (initial and added samples) shall determine the new acceptance number. The total defectives of the initial and second sample shall be additive and shall comply with the specified LTPD or lambda. The manufacturer shall retain sufficient devices from the qualification lot to provide for additional samples.

4.4.5.2 Identification of samples. The authorized Government Quality Assurance Representative may, at his option, mark or authorize the marking of each sample to be subjected to qualification testing in order to distinguish these devices from those not intended for qualification inspection.

4.4.6 Lot release. The lot from which the qualification samples are selected may be offered for delivery under contract after qualification approval has been granted provided screening and quality conformance requirements are satisfied.

4.4.7 Retention of qualification. To retain qualification, the manufacturer shall forward a report at 12-month intervals to the qualifying activity. The qualifying activity shall establish the initial reporting date. The report shall consist of a summary of the results of tests performed for quality conformance inspection (groups A, B, and C), including the number and mode of any subgroup failures. The summary shall include results of all quality conformance inspection tests performed on completed lots during the 12-month period. If the summary of the test results indicates nonconformance with specification requirements (see 4.6.2 and 4.6.3) 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. The results of tests of all reworked lots shall be identified and accounted for. Failure to submit the report within 60 days after the end of each 12-month period may result in loss of qualification for the product.

4.4.7.1 Nonproduction. 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 three consecutive reporting periods there has been no production of a sealing levels A or B or structurally identical types, the manufacturer may be required, at the discretion of the qualifying activity, to submit a representative product to appropriate testing in accordance with the qualification inspection requirements.

4.4.8 Test method deviation. Deviations from test methods or test circuits specified are allowed provided that it is demonstrated to the qualifying activity that such deviations in no way relax the requirements of this specification and that they are approved before testing is performed. For proposed electrical test deviations, schematic wiring diagrams of the test equipment shall be made available for checking by the qualifying activity.

4.5 Screening inspection. The fiber optic sources (100 percent) shall have been subjected to and passed, as applicable, all the screening tests (as specified in table I and 3.1) in the sequence shown and the applicable percent defective allowed (PDA) for the type of fiber optic source and sealing level (type A or B) specified. Sources which fail any test criteria in the screening sequence, shall be removed from the lot at the time of the observation or immediately at the conclusion of the test in which the failure was observed, and these devices shall not be shipped.

4.5.1 Burn-in acceptance criteria. Selected electrical and optical parameters shall be designated in the specification sheet (see 3.1) as interim and end-point measurements for the 100 percent burn-in of table I. These parameters may also be compared to determine whether the change during burn-in (delta) is indicative of a lot stability problem. The PDA for each inspection lot submitted to burn-in and interim (post burn-in) shall be 10 percent on all failures. Delta limits shall be as specified (see 3.1). When the PDA applies to delta limits, the delta parameter values measured after burn-in (100 pecent screening test) shall be compared with the delta parameter values measured prior to that burn-in.

4.5.2 Lots resubmitted for burn-in. Lots may be resubmitted for burn-in one time only and may be resubmitted only when the observed percentage of defectives does not exceed twice the specified PDA. Resubmitted lots shall contain only parts which were in the original lot. Resubmitted lots shall be kept separate from new lots and shall be inspected for all specified characteristics using a tightened inspection PDA of 3 percent. If the percent defective for the resubmitted lot exceeds the tightened inspection PDA, the entire resubmitted lot shall be unacceptable for any quality level. The delta criteria applying to such resubmitted lots snall be in accordance with the following procedure:

a. The screening (burn-in) shall be conducted and the delta drift values calculated. From this data the mean and standard deviation (sigma) shall be calculated.

b. Sources having delta drift values in excess of the mean ±3 sigma (calculated in step (a)) shall be removed from the lot and rejected.

c. The remaining souces shall then be submitted to the balance of the inspections as specified herein.

TABLE I. Screening inspections.

Screen inspection (100%)	MIL-STD-750 method	Exposure conditions 1/	Requirement paragraph	Test method paragraph
Internal visual (precap) inspection	2073	Ambient	3.7.1	4.8.1
High temperature (nonoperating) life (LTPD)	1032	24 hours minimum at T = +125°C for type A devices and +85°C for type B devices.	3.7.4	4.8.4
Thermal shock (temperature cycling)	1051	Test condition A-1, low temperature = -46°C, high temperature = +125°C for type A and +85°C for type B.	3.7.5	4.8.5
Constant acceleration	2006	Y direction at 20,000 G min at T_C = 25°C The one minute hold time requirement shall not apply.	3.7.6	4.8.6
Hermetic seal a. Fine leak rate 2/	1071	Type A only, condition G or H.	3.7.8	4.8.8 4.8.8.1
b. Gross leak rate		Type A and type B, condition C or D. Fluid temperature = +85°C.		4.8.8.2
Electrical and optical measurements		As specified.	3.6	4.7
Steady-state power burn-in	1038	Maximum rated I_F for 96 hours at T_J = 100°C min for type A and 70°C min for type B. Condition B.	3.7.7	4.8.7
Electrical and optical measurements		As specified but including all delta parameters as a minimum.	3.6	4.7
External visual and mechanical inspection 3/	2071	Ambient	3.7.2	4.8.2

1/ See requirement and test method paragraph for complete exposure conditions.

2/ Sealing level type B sources may omit this test.

3/ Visual and mechanical inspection shall be performed on all devices after marking has been completed.

4.6 Quality conformance inspection. Quality conformance inspection shall be conducted in accordance with the requirements of groups A, B, and C for the specified sealing level (type A and type B). Lot sampling shall be in accordance with the appendix of this specification. If a lot is withdrawn in a state of failing to meet quality conformance requirements and is not resubmitted, it shall be considered a failed lot and reported as such. Each lot shall be subjected to groups A and B inspection. Successful completion of group C quality conformance for a given sealing level type shall satisfy the group C requirements for the tested level and for sources represented by a structurally identical group. The grouping of structurally identical devices shall be as agreed between the manufacturer and the qualifying activity.

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

4.6.2 Corrective action. If six of ten consecutive lots or if three successive lots of a source type or structurally identical types are rejected for the same reason, corrective action acceptable to the qualifying activity shall be initiated. Failure to initiate corrective action shall result in removal of products from the qualified products list.

4.6.3 Nonconformance. Lots which fail subgroup requirements of groups A, B, or C may be resubmitted in accordance with the provisions of 4.2.6. However, if the lot is not resubmitted or fails resubmission, the lot shall not be shipped and the JAN marking shall be removed within 30 days. Samples from subsequent lots of the source types in the structurally identical device grouping represented by a failed group C inspection in the case of group C failures, shall then be subjected to all the tests of the subgroup in which the failure occurred, on a lot-by-lot basis until three successive lots pass the failed subgroup. The testing may then return to periodic testing. A source type which fails a group C inspection shall not be accepted until the type which failed successfully completes the failed group C subgroups. Other types from the same qualified group represented by the failed type may be accepted provided group C inspection requirements have been satisfied for those source types.

4.6.4 Group A inspection. Group A inspection shall be performed on each inspection lot and shall consist of visual and mechanical inspection, and electrical and optical test as specified in table II, and the applicable specification sheet (see 3.1). Group A inspection may be performed in any order. If an inspection lot is made up of a collection of sublots, each sublot shall pass group A inspection as specified.

4.6.5 Group B inspection. Group B inspection shall be performed on each lot. Group B shall be in accordance with table III and the applicable specification sheet (see 3.1) for the specified product sealing level (type A or type B). Testing of one source type sublot in any subgroup shall be considered as complying with the requirements for that subgroup for all types in the lot. Different source types may be used for each subgroup. This inspection shall be applied only to completed and fully marked sources from lots which have been subjected to and passed the group A requirements. All tests within a subgroup shall be performed in the order specified.

4.6.6. Group C inspection. Group C inspection shall be in accordance with table IV and shall include those tests specified which are performed periodically at 12-month intervals on at least one source type from each structurally identical device grouping (from the same or different specification sheet) in which the manufacturer has qualified source types. This inspection shall be applied only to completed and fully marked samples from lots that have satisfied the specified group A LTPD requirements. All tests within a subgroup shall be performed in the order specified.

TABLE II. Group A inspection. 1/

Subgroups	LTPD (N/C) 2/	LTPD
Subgroup 1 External visual and mechanical inspection (MIL-STD-750, method 2071)	15/0	5 3/
Subgroup 2 Electrical ad optical measurements at 25°C	116/0 4/ 5/	5 5/
Subgroup 3 Electrical and optical measurements at maximum and minimum rated temperatures		5 5/
Subgroup 4 Selected tests	LTPD = 10 3/ 6/	10 3/

1/ The specific parameters to be included for tests in each subgroup shall be as specified in the applicable specification sheet. Where no parameters have been specified in a particular subgroup or test within a subgroup, no group A testing is required for that subgroup or test to satisfy group A requirements. A single sample may be used for all subgroup testing. These tests are considered nondestructive and devices may be shipped.

2/ The LTPD allowed for space applications shall be in accordance with these acceptance numbers.

3/ For these subgroups, the maximum accept number (c) shall be two.

4/ All devices required by the specified LTPD shall be subjected to subgroups 2 and 3 combined.

5/ If a device in the sample fails one or more test(s) in the subgroup or subgroups being sampled, each and every additional device in the (sub) lot represented by the sample shall be tested for all tests for which the sample was selected. All failed devices shall be removed from the (sub) lot for final acceptance of that subgroup or subgroups, as applicable.

6/ All devices required by the specified LTPD shall be randomly selected from the devices subjected to subgroups 2 and 3, and shall be subjected to subgroup 4.

TABLE III. Group B inspection.

Inspection subgroups	MIL-STD-750 method 1/	Conditions	LTPD	Small lot quality conformance inspection (N/C)
Subgroup 1				
Solderability 2/ 3/ 4/	2026		15	6/0
Resistance to solvents	1022			
Subgroup 2				
Thermal shock (temperature cycling) 5/	1051			
Hermetic seal	1071			
a. Fine leak		Type A, test condition G or H	10	6/0
b. Gross leak		Type A and type B Test condition C or D fluid temp = +85°C		
Electrical and optical measurements	As specified			
Subgroup 3 6/				
Steady state operation life (LTPD) or	1027	340 hours, bias conditions as specified	5	12/0
Intermittent operation life (LTPD)	1037			
Electrical and optical measurements	As specified			
Subgroup 4				
Decap internal visual design verification 7/	2075		1 device/0 failures for each lot	1/0
Bond strength	2037	The sample shall include a min of 3 devices	10(c = 0) 8/	LTPD = 10 (C = 0) 8/

See footnotes at end of table.

TABLE III. Group B inspection - Continued.

Inspection subgroups	MIL-STD-750 method 1/	Conditions	LTPD	Small lot quality conformance inspection (N/C)
Subgroup 5				
Thermal resistance	4081		10	8/0
Subgroup 6				
High temperature (non-operating) life	1032		7	12/0
Electrical and optical measurements	As specified			

1/ See requirements and test method paragraphs for complete exposure conditions.

2/ Electrical reject devices from the same inspection lot may be used for all subgroups when electrical end point measurements are not required.

3/ Post burn-in electrical rejects may be used.

4/ The LTPD for solderability test applies to the number of leads inspected except in no case shall less than three devices be used to provide the number of leads required.

5/ T_{HIGH} shall not exceed the maximum T_{STG} of the detail specification.

6/ If a given inspection lot undergoing group B inspection has been selected to satisfy group C inspection requirements, the 340 hour life tests may be continued on test to 1,000 hours in order to satisfy the group C life test requirements. In such cases, either the 340 hour end point measurements must be made as a basis for group B lot acceptance or the 1,000 hours end point measurements shall be used as the basis for both group B and group C acceptance.

7/ Exceptions to these requirements may be necessary when device design or size makes decapping impractical.

8/ The sample shall satisfy the required LTPD or the small lot conformance inspection, whichever is less.

TABLE IV. Group C inspection.

Inspection subgroups	MIL-STD-750 method	Conditions 1/	LTPD	Small lot quality conformance inspection (N/C)
Subgroup 1				
Physical dimensions 2/	2066		15	6/0
Subgroup 2				
Thermal shock (glass strain)	1056	Test condition A	10	6/0
Terminal strength	2036	As specified		
Hermetic seal	1071			
a. Fine leak		Type A, test condition G or H		
b. Gross leak		Type A and B, Condition C or D, Fluid temperature = +85°C.		
Moisture resistance	1021	As specified		
Electrical and optical measurements				
External visual inspection	2071			
Subgroup 3				
Shock	2016	Non-operating, 1500 G's, 0.5 ms, 5 blows in each orientation: X1, Y1, and Z1		
Vibration	2056			
Constant acceleration	2006	One minute min in each orientation, X1, Y1, and Z1 at 20,000 G min T_C = 25°C		
Electrical and optical measurements				
Subgroup 4 2/				
Salt atmosphere (corrosion)	1041		15	6/0
Subgroup 5 3/				
Steady-state operation life (λ)	1026		λ = 10	λ = 10
Electrical and optical measurements				

1/ See requirements and test method paragraphs for complete exposure conditions.
2/ Electrical and optical reject devices from the same inspection lot may be used for all subgroups when electrical and optical end point measurements are not required.
3/ If a given inspection lot undergoing group B inspection has been selected to satisfy group C inspection requirements, the 340 hour life tests may be continued on test to 1,000 hours in order to satisfy the group C life test requirements. In such cases, either the 340 hour end-point measurements must be made as a basis for group B lot acceptance or the 1,000 hours end-point measurements shall be used for both groups B and C acceptance.

TABLE V. End points.

End-point electrical and optical measurements	Requirement paragraph	Test method paragraph
Peak optical wavelength	3.6.1	4.8.1
Peak optical wavelength drift	3.6.2	4.8.2
Spectral bandwidth	3.6.3	4.8.3
Radiant power	3.6.4	4.8.4
Optical power amplitude stability	3.6.5	4.8.5
Optical power angular distribution	3.6.6	4.8.6
Forward voltage	3.6.7	4.8.7
Reverse current leakage	3.6.8	4.8.8
Breakdown voltage	3.6.9	4.8.9
Thermal resistance	3.6.10	4.8.10
Pulse rise and fall times	3.6.11	4.8.11
Frequency response	3.6.12	4.8.12
Signal linearity	3.6.13	4.8.13

4.6.6.1 Group C sample selection. Samples for subgroups in group C shall be chosen at random from the first lot submitted for quality conformance inspections during the specified group C inspection interval. Testing of one source type for each subgroup shall be considered as complying with the requirements for that subgroup for all types represented from the same line. A different source type shall be tested at each successive inspection interval until all structurally identical sealing levels A or B qualified on the same or different specification sheet from the same qualified line have been tested. When none of the inspection lots passing group A of the first lot submitted contain the source type which is due to be tested, the samples for inspection shall be chosen from these types in the inspection lots being tested which have not been used for the longest time for group C inspection. The next lot which contains the skipped type shall be subjected to group C inspection as part of its quality conformance inspection.

4.6.7 Group B and group C end-points. Post-test end-points specified in the specification sheet shall be measured for each source of the sample after completion of all specified tests in the subgroup. Except as specified, all life test end-point test measurements, including operation and storage (see 4.8.4 and 4.8.5), shall be performed within 96 hours after sample units have been subjected to and removed from required tests. All other end-point test measurements shall be made within 168 hours. Additional measurements may be made at the discretion of the manufacturer. At the end of each group B and group C subgroup, end-point measurements shall include visual inspection without magnification to assure marking on each fiber optic source is legible and complete. Damage to marking caused by mechanical fixturing or handling during test shall not be cause for lot rejection, but devices so damaged shall be rejected or shall be individually remarked prior to shipment. End points to be used for performance assessment shall be selected from table V.

4.6.8 Procedure for lots held more than 24 months. Sources which have passed quality conformance inspection and have been held by manufacturers or contractors for a total time period (time held by manufacturer plus time held by contractors) exceeding 24 months shall be reinspected by the manufacturer for all specified group A inspection requirements prior to shipment (shipped devices shall have a stamped quality conformance inspection date or a reinspection date less than 24 months old). In case of lot failure during reinspection, the lot shall be subjected to 100 percent inspection for all failed parameters and characteristics. All sources that fail any of these tests shall be rejected.

TABLE VI. Radiation levels.

Radiation level		
Designation	Total ionizing dose (RAD(si)) 1/	Neutron Fluence (N/CM^2) 2/
M	3×10^3	2×10^{12}
D	10^4	2×10^{12}
R	10^5	10^{12}
H	10^6	10^{12}

1/ Test in accordance with MIL-STD-750, method 1019.

2/ Test in accordance with MIL-STD-750, method 1017.

4.6.9 Inspection of packaging. The sampling and inspection of the preservation, packing and container marking shall be in accordance with the requirements of MIL-S-19491.

4.7 Methods of inspection and tests. When performing any optic test on those fiber optic sources with fiber pigtails (see 3.1) cladding mode strippers shall be used.

4.7.1 Peak optical wavelength. Optical source peak wavelength shall be measured using a spectral radiometer. Measurement precision shall be better than ±1 nanometer with wavelength traceability (accuracy) better than ±0.1 percent of the peak wavelength (see 3.6.1).

4.7.2 Peak optical wavelength drift. Drift in optical source peak wavelength shall be measured using the spectral radiometer of 4.7.1. Values for peak wavelength shall be obtained at test temperatures of -46°C and +71°C, respectively, for both sealing level types A and B sources. Both peak wavelength values measured shall meet the drift limits as specified (see 3.1 and 3.6.2).

4.7.3 Spectral width. The spectral width of the optical source output radiation shall be measured using the spectral radiometer of 4.7.1. The wavelength difference between the plotted locations of the 50 percent of peak optical power amplitude shall be used as the basis for this measurement (see 3.6.3).

4.7.4 Radiant power. The radiant power shall be measured using procedure I, method 6010 of MIL-STD-1678. A large area radiation detector, sensitive and calibrated throughout the spectral range of the source output radiation, shall be used so that the radiated energy is detected (see 3.6.4).

4.7.5 Optical power amplitude stability. Optical power amplitude stability shall be measured using the instrument and method of 4.7.4. Values for the output power (P_O) shall be taken at ambient test temperatures of -46°C and +71°C, respectively. These measured output power values shall fall without the P_O limits specified (see 3.1 and 3.6.5).

4.7.6 Optical power angular distribution. The optical power angular distribution (radiation pattern) shall be measured in accordance with procedure I, method 6030 of MIL-STD-1678. The detector of 4.7.4 shall be used. The distance between the radiation aperture and the detector shall be at least 50 times the diameter of the detector active element. Cladding mode stripping shall be employed on those fiber optic sources possessing a fiber pigtail (see 3.1). The numerical aperture (NA) of the radiation plot shall be calculated and shall not exceed the limits as specified (see 3.1 and 3.6.6).

4.7.7 Forward voltage. Sources shall be tested in accordance with method 4011 of MIL-STD-750. The levels of forward test current and voltage and the continuous or intermittent (duty cycle and rate) nature of the test current shall be as specified (see 3.1 and 3.6.7).

4.7.8 Reverse current leakage. Sources shall be tested in accordance with method 4016 of MIL-STD-750. The acceptable range of reverse current (I_R) level shall be as specified for the specified value of reverse voltage (V_R) (see 3.1 and 3.6.8).

4.7.9 Breakdown voltage. Sources shall be tested for breakdown voltage in accordance with method 4021 of MIL-STD-750. The level of reverse current through the device during the test shall be as specified (see 3.1 and 3.6.9).

4.7.10 Thermal resistance. Sources shall be tested for thermal resistance in accordance with method 4081 of MIL-STD-750. The reference temperature shall be +100°C for type A devices and +70°C for type B devices. The forward current through the device during the test shall be as specified (see 3.1 and 3.6.10).

4.7.11 Pulse rise and fall times. Optical pulse rise and fall times shall be measured at the pulse modulation rate as specified (see 3.1). An oscilloscope shall be connected to the photodetector output to display the output pulse waveform. The pulse time between the 10 percent and 90 percent maximum power level of the pulse waveform shall be used to determine the rise and fall time characteristics (see 3.6.11).

4.7.12 Frequency response. The test for the frequency response of the source shall utilize a variable frequency sine wave signal generator, covering the frequency range as specified (see 3.1) to modulate the optical source. A photodetector, sensitive and calibrated throughout the spectral bandwidth range of the optical source, shall detect the optical output of the fiber optic source. The signal generator shall be scanned in frequency from 10 hertz up to a frequency where the detected output signal has dropped in amplitude by 3 dB. All nonlinearities in the test equipment shall be normalized out of the measurements obtained. The frequency at this reduced signal level shall be the optical source cut-off frequency (see 3.6.12).

4.7.13 Signal linearity. The optical source signal linearity shall be measured using the instrumentation of 4.7.12 with the addition of a spectrum analyzer connected to the photodetector output. The frequency, input signal level and source bias level to be utilized shall be as specified (see 3.1). The signal generator shall modulate the source in accordance with the specification sheet and the spectrum analyzer measure the fundamental and harmonic contents of the photodetector output signal. The ratio of total signal harmonic power content to signal fundamental power content shall be less than the acceptable level specified. Signal linearity in dB shall be equal to 10 log ratio of the harmonic to fundamental power levels measured (see 3.6.13).

4.8 Environmental and mechanical inspections.

4.8.1 Internal visual (precap) inspection. Sources shall be visually inspected prior to final capping in accordance with method 2073 of MIL-STD-750 (see 3.7.1).

4.8.2 Visual and mechanical inspection. Sources shall be visually and mechanically inspected in accordance with method 2071 of MIL-STD-750 (see 3.7.2).

4.8.3 Physical dimensions. Sources shall be inspected in accordance with method 2066 of MIL-STD-750 for physical conformance with the requirements of this specification. Critical dimensions to be used in this inspection shall be as specified (see 3.1 and 3.7.3).

4.8.4 High temperature (nonoperating) life (LTPD). Optical sources shall be tested in accordance with method 1032 of MIL-STD-750 to determine compliance with the specified LTPD (see 6.6) for the nonoperating storage condition. Exposure time and temperature shall be 24 hours at +125°C (type A devices), and 24 hours at +85°C (type B devices) for the screening test of table I; and 360 hours at +125°C (type A devices) and 340 hours at +85°C (type B devices) for the group B quality conformance test of table III (see 3.7.4).

4.8.5 Thermal shock (temperature cycling). Sources shall be tested in accordance with test condition A-1 method 107 of MIL-STD-202, except that the lower test temperature shall be -46°C and the higher temperatures shall be +125°C for type A devices, and +85°C for type B devices. Source mounting for the test exposure shall be as specified (see 3.1 and 3.7.5).

4.8.6 Constant acceleration. Sources shall be tested in accordance with method 2006 of MIL-STD-750. A centrifugal force of 20,000 gravity units (g) shall be applied in the Y1 orientation only (see 3.7.6).

4.8.7 Steady-state power burn-in. Sources shall be tested in accordance with test condition B, method 1038 of MIL-STD-750. The source shall be operated at the maximum rated forward bias current for 96 hours at temperatures of +100°C and +70°C for type A and type B devices, respectively (see 3.7.7).

4.8.8 Hermetic seal (see 3.7.8).

4.8.8.1 Fine leak rate. Type A sources shall be tested in accordance with test condition G or H, method 1071 of MIL-STD-750. Type B source shall omit this test.

4.8.8.2 Gross leak rate. Type A sources shall be tested in accordance with test condition B or C, method 1071 of MIL-STD-750. Type B sources shall be tested only to gross leak step 1, test condition C, method 1071 of MIL-STD-750. Fluid test temperature shall be +85°C.

4.8.9 Solderability. All sources shall be tested in accordance with method 2026 of MIL-STD-750 (see 3.7.9).

4.8.10 Resistance to solvents. Sources shall be tested in accordance with method 1022 of MIL-STD-750 (see 3.7.10).

4.8.11 Steady-state operation life (LTPD). When specified, sources shall be tested in accordance with method 1027 of MIL-STD-750. The source shall be operated continuously at 100 percent of rated power output. The source mounting arrangement for testing shall be as specified (see 3.1 and 3.7.11).

4.8.12 Intermittent operation life (LTPD). When specified, sources shall be tested in accordance with method 1037 of MIL-STD-750. The source shall be operated at a 50 percent duty cycle from 100 percent rated power output to zero power output. The frequency of operation, the test duration, the test temperature (case or ambient) and the test mounting arrangement for the source shall be as specified (see 3.1 and 3.7.12).

4.8.13 Decap internal visual design verification. Sources shall be tested in accordance with method 2075 of MIL-STD-750. Particular attention shall be paid to the pigtail/die attachment region supported by photographic documentation, for those optical sources with pigtails (see 3.1 and 3.7.13).

4.8.14 Bond strength Sources shall be tested in accordance with test condition A, method 2037 of MIL-STD-750 (see 3.7.14).

4.8.15 Thermal shock (glass strain). Type A sources shall be tested in accordance with test condition A, method 1056 of MIL-STD-750. Type B sources shall be similarly tested but to a high temperature limit of +85°C. Distilled water shall be used as the immersion fluid (see 3.7.15).

4.8.16 Terminal strength. Sources shall be tested in accordance with method 2036 of MIL-STD-750. The applicable test conditions shall be as specified (see 3.1 and 3.7.16).

4.8.17 Moisture resistance. Sources shall be tested in accordance with method 1021 of MIL-STD-750. The stated initial conditioning (lead-fatigue) test of method 1021 shall be applied to the fiber pigtail and all electrical leads of the source (see 3.7.17).

4.8.18 Shock. Sources shall be tested in accordance with method 2016 of MIL-STD-750. The source shall be subjected to shocks of 1,500 g's for durations of 0.5 milliseconds each. Five shocks in each of the X1, Y1 and Z1 directions shall be given (see 3.7.18).

4.8.19 Vibration, variable frequency. Sources shall be tested in accordance with method 2056 of MIL-STD-750 (see 3.7.19).

4.8.20 Salt atmosphere (corrosion). Sources shall be tested in accordance with method 1041 of MIL-STD-750 (see 3.7.20).

4.8.21 Steady-state operation life. When specified, sources shall be tested in accordance with method 1026 of MIL-STD-750. The exposure time shall be 1,000 hours at the maximum rated temperature or as specified (see 3.1). Test mounting arrangements shall be as specified (see 3.1 and 3.7.21).

4.8.22 Neutron irradiation. When specified (see 3.1), sources shall be tested in accordance with method 1017 of MIL-STD-750 (see 3.7.22).

4.8.23 Steady state total dose irradiation. When specified (see 3.1), sources shall be tested in accordance with method 1019 of MIL-STD-750 (see 3.7.23).

4.8.24 Outgassing. When specified (see 3.1), the optical source outgassing characteristics shall be determined in accordance with ASTM test method E-595-77 (see 3.7.24).

an item. The equipment manufacturer

4.9 Workmanship. The connectors and accessories shall be visually inspected to verify that they meet the workmanship requirements of 3.10.

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-S-19491.

6. NOTES

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

6.1 Intended use. Optical sources specified herein and in the specification sheets are of the LED type and intended for use in general military fiber optic applications.

6.2 Acquisition requirements. Acquisition documents should 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).

c. Part number.

d. Lead or pigtail fiber length, material, finish, if other than that specified, or when a choice is required by the device application.

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List QPL No. 24622 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. The activity responsible for the qualified Products List is Naval Sea Systems Command, SEA 55Z3, DOD Standardization Program and Documents Division, Washington, DC 20362-5101; however, information pertaining to qualification of products may be obtained from Defense Electronics Supply Center, DESC-EQ, Dayton, Ohio 45444.

6.3.1 Application for qualification. Application for qualification tests must be made in accordance with SD-6, "Provisions Governing Qualification".

6.4 Security of completed devices. Marked sources which have passed all screening and quality conformance requirements should be retained in a secure area prior to shipment or delivery. Source inventory should be controlled by type, quantity, product assurance level, and transaction date. Provision should be made for surveillance by Government representatives. This requirement applies to the manufacturer and contractors.

6.5 Cross-reference of classifications. Military specification MIL-S-24622 required a sealing level designator, a wavelength designator, and a pigtail fiber designator to be included as a portion of the military part number. This revision of MIL-S-24622 removed these classification designators from the military part number and redefined them as follows:

a. Sealing level type A and type B are assigned for hermetic and nonhermetic devices, respectively.

b. Wavelength designations 08, 13, and 15 for wavelengths 820-910, 1250-1350, and 1400-1600, respectively, became wavelength class 1, class 2, and class 3.

c. Pigtail fiber designation A for 50/125 micrometers step index fiber and B for 50/125 micrometers graded index fiber became optical coupling style P1. Pigtail fiber designation C for 100/140 micrometers step index fiber and D for 100/140 micrometers graded index fiber became optical coupling style P2. Optical coupling style T was created to allow for transistor-outline metal can packages (TO-can).

All references to the classification of fiber optic sources should be provided in the title of individual specification sheets and not the military part number.

6.6 Definitions. Unless otherwise specified herein, the definition of terms should be in accordance with IEEE STD-812-1984.

6.6.1 End points. End points are the parameters and limits specified which should be met before and after the test exposure for optical source acceptance.

6.6.2 Lambda (λ). λ is a symbol defined as LTPD per 1,000 hours. This symbol is not to be confused with λ_p, the peak wavelength.

6.6.3 Linearity (L). The linearity of a continuous, periodic signal is represented by the ratio of the summation of the total harmonic power content of the signal to the power content of the signals fundamental frequency.

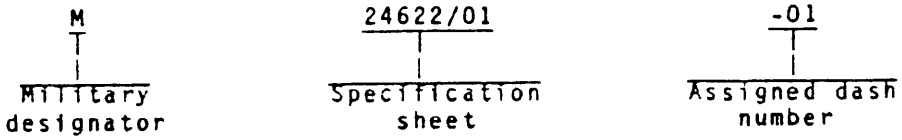
6.6.4 LTPD. LTPD (lot tolerance percent defective) is a method used for statistical sampling of parts being tested for qualification acceptance. LTPD has the form of a series where the numerical value selected represents the minimum percent of samples tested which rejects the inspection lot. Additional details are found in appendix C of MIL-S-19500.

6.6.5 Peak wavelength (λp). The peak wavelength is the emission wavelength at which the radiant intensity is a maximum.

6.6.6 Pigtail fiber. The pigtail is a short length of optical fiber integrally attached to the source package at the manufacturers plant, and aligned with the source's radiating elements for maximum optical power output.

6.6.7 Spectral bandwidth ($\Delta\lambda$). Given a plot of output radiant intensity versus wavelength from the fiber pigtail, the spectral bandwidth is the wavelength difference between locations on the plot where the radiant intensity is 50 percent of the peak emission wavelength intensity.

6.7 Part or Identifying Number (PIN). The PIN to be used for fiber optic sources acquired to this specification is created as follows:



6.8 Subject term (key word) listing.

Fiber pigtail

LED (light-emitting diode)

Optical performance requirements

Sources

TO-CAN

6.9 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

APPENDIX

STATISTICAL SAMPLING, LIFE TEST PROCEDURES

10. SCOPE

10.1 Scope. This appendix contains statistical sampling and life test procedures used with fiber optic sources. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

20. APPLICABLE DOCUMENT

20.1 Government document.

20.1.1 Handbook. The following handbook forms a part of this appendix to the extent specified herein. Unless otherwise specified, the issues of this document shall be those listed in the issue of the Department of Defense Index of Specifications and Standards and supplement thereto, cited in the solicitation.

MILITARY

HANDBOOK

MIL-HDBK-53-1 - Guide for Attribute Lot Sampling Inspection and MIL-STD-105.

(Copies of the handbook required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

30. GENERAL

30.1 Definitions. The following definitions shall apply for all statistical sampling procedures:

a. LTPD series. The lot tolerance percent defective (LTPD) series is defined as the following decreasing series of LTPD or lambda (λ) values: 50, 30, 20, 15, 10, 7, 5, 3, 2, 1.5, 1, 0.7, 0.5, 0.3, 0.2, 0.15, 0.1.

b. Tightened inspection. Tightened inspection is defined as inspection performed using the next LTPD or lambda value in the LTPD series lower than that specified.

c. Acceptance number (c). The acceptance number is defined as an integer number associated with the selected sample size which determines the maximum number of defectives permitted for that sample size.

d. Rejection number (r). Rejection number is defined as one plus the acceptance number.

e. Lambda (λ). Lambda is defined as LTPD per 1,000 hours.

of procedure is not necessary. Hold whole number containing [illegible]

30.2 Symbols. The following symbols shall apply for all statistical sampling procedures:

a. LTPD - Lot Tolerance Percent Defective

b. λ - Lambda

c. c - Acceptance number

d. r - Rejection number

e. n - Sample size

40. STATISTICAL SAMPLING PROCEDURES AND TABLE - LTPD METHOD

40.1 General. Statistical sampling shall be conducted using the LTPD method. The LTPD method as specified herein is a double sampling plan which provides a high degree of assurance that a lot having a proportion defective equal to or greater than the specified LTPD value will not be accepted. The choice of any one procedure is optional. The procedures specified herein are suitable for all qualification or quality conformance requirements, but are not suitable if the objective of the inspection is to determine that the proportion defective in the lot represented is greater than the specified LTPD value since the assurance for that purpose is normally only 10 percent (see 6.3).

40.1.1 Selection of samples. Samples shall be randomly selected from the inspection lot or inspection sublots. (For an explanation of random sampling, see MIL-HDBK-H53, section 13.)

40.1.1.1 Identification of samples for quality conformance tests. The authorized Government Quality Assurance representative may, at his option, mark or authorize the marking of each sample to be subjected to qualification or quality conformance inspection in order to distinguish these units from those not intended for Government conformance inspection. This additional marking shall in no way interfere with or obscure the marking required (see 3.9).

40.1.2 Failures. Failure of a unit for one or more tests of a subgroup shall be charged as a single failure.

40.2 Single-lot sampling method. Quality conformance inspection information (sample sizes and number of observed defectives) shall be accumulated from a single inspection lot to demonstrate conformance to the individual subgroup criteria.

40.2.1 Sample size. The sample size for each subgroup shall be determined from table VI and shall meet the specified LTPD or lambda. The manuacturer may, at his option, select a sample size greater than that required; however, the number of failures permitted shall not exceed the acceptance number associated with the required sample size in table VI.

40.2.2 Acceptance procedure. For the first sampling, an acceptance number shall be chosen and the associated number of sampling devices for the specified LTPD selected and tested (see 40.2.1). If the observed number of defectives from the first sample is less than or equal to the preselected acceptance number, the lot shall be accepted. If the observed number of defectives exceeds the preselected acceptance number, an additional sample may be chosen such that the total sample complies with 40.2.3.

40.2.3 Additional sample. The manufacturer may add an additional quantity to the initial sample, but this may be done only once for any subgroup and the added samples shall be subjected to all the tests within the subgroup. The total sample size (initial and added samples) shall be determined by a new acceptance number selected from table VI.

40.2.4 Multiple criteria. Except where otherwise specified, when a subgroup contains more than one acceptance criterion, the entire sample for a subgroup shall be used for all criteria within the subgroup. In table VI, the acceptance number shall be that one associated with the largest sample size in the appropriate LTPD column which is less than or equal to the sample size used.

40.2.5 One-hundred percent inspection. Inspection of 100 percent of the lot shall be allowed, at the option of the manufacturer for any or all subgroups other than those which are considered "destructive." The maximum observed percent defective for the inspection lot shall not exceed the specified LTPD or λ value. Devices that fail any test shall be removed from the lot.

40.2.6 Disposition of failed lot. A lot that fails quality conformance inspection may, at the option of the manufacturer be screened for defectives or reworked and resubmitted for reinspection (see 4.6.3).

50. LIFE TEST

50.1 General. Life tests shall be conducted in accordance with the procedures in this section. Life tests performed on devices at or within their maximum ratings shall be considered nondestructive. If a lot is made up of a collection of sublots, each sublot shall pass all applicable electrical and optical end points as specified.

50.2 Selection of samples. Samples for life tests shall be selected at random from the inspection lot (see 40.1.1). The sample size for a 1,000 hour test shall be chosen by the manufacturer from table VI from the column under the specified λ. The acceptance number shall be the one associated with the particular sample size chosen.

50.3 Failures. Each source which exceeds one or more of the end-point limits specified for life test at any specified or other reading interval shall be considered a failure and shall not be considered acceptable at any subsequent reading interval. For the purpose of computing device hours, the test-time hours credited to a failed device shall not exceed the test time associated with the last measurement time that the device was observed to be within the specified end-point limits. If the sample fails, the test may be terminated at the discretion of the manufacturer.

50.4 Life-test time and sample size. Whenever a lambda (λ) is specified, the life-test time shall be 1,000 hours initially. Once a lot has passed the 1,000 hour test, life tests with minimums of 340 hours and maximums of 2,000 hours may be initiated for new lots provided that 180 days have not elasped since a 1,000 hour life test on the same sealing levels A or B on the same structurally identical group (see 4.2.3.1.2). If 180 days have elasped, the new lot shall pass a 1,000 hour life test. The sample size for a life-test time other than 1,000 hours shall be chosen according to the relationship of inverse proportionality between test time and sample size, such that the total unit test hours accumulated (sample sizes multiplied by test hours) equal the amount that would have been chosen for the 1,000 hour life test, had it been performed. The acceptance number shall also be determined from the sample size associated with the same 1,000-hour test, had it been performed. The lot shall be accepted if the number of failures at the end of the test period does not exceed the acceptance number.

50.5 Procedure to be used if number of observed failures exceeds the acceptance number. In the event that the number of failures observed on life test exceeds the acceptance number, the manufacturer shall choose one of the following options: (1) discontinued the life test, screen or rework and resubmit in accordance with 40.2.6, (2) add additional samples in accordance with 50.5.1, or (3) extend the test time to 1,000 hours in accordance with 50.5.2, if a test time less than 1,000 hours was originally chosen. Only one of these options shall be used for a given submission, and this option shall be used only once.

50.5.1 Additional samples. When this option is chosen, a new total sample size (initial plus added) shall be chosen by the manufacturer from table VI from the column under the specified λ. A quantity of additional units sufficient to increase the sample to the newly chosen total sample size shall be selected from the lot. A new acceptance number shall be determined and shall be the one associated with the new total sample size chosen. The added sample shall be subjected to the same life-test conditions and time period as the initial sample. If the total observed number of defectives (initial plus added) does not exceed the acceptance number for the total sample, the lot shall be accepted. If the observed number of defectives exceeds this acceptance number, the lot shall not be accepted but may be resubmitted (see 40.2.6).

50.5.2 Extension of life-test period. If a life test time period less than 1,000 hours is being used and the number of failures observed in the initial sample exceeds the acceptance number, the manufacturer may, in lieu of addition additional samples, choose to extend the test time of the entire initial sample to 1,000 hours and determine a new acceptance number from table VI. The new acceptance number shall be that one associated with the largest sample size in the specified column which is less than or equal to the sample size on test. A device which is a failure at the initial reading interval shall not be considered acceptable at the 1,000-hour reading interval. If the observed number of defectives at 1,000 hours does not exceed the new acceptance number, the lot shall be accepted. If the observed number of defectives exceeds this acceptance number, the lot shall not be accepted, but may be resubmitted (see 40.2.6).

50.5.3 Failure of life test. If a lot fails to meet life-test requirements (including resubmission in accordance with 40.2.6, if elected) such that it is eliminated or withdrawn from further quality conformance inspection consideration, then a 1,000-hour life test shall be required for the failed subgroup until three successive lots have passed. If group B or C (table III or IV) does not require 1,000-hour testing, then the specified life test, if other than 1,000 hours, shall be required for three successive lots.

TABLE VI. LTPD Sampling plans. 1/ 2/

Minimum size of sample to be tested to assure, with a 90 percent confidence, that a lot having percent-defective equal to the specified LTPD will not be accepted (single sample).

Maximum percent def (LTPD) or λ	50	30	20	15	10	7	5	3	2	1.5	1	0.7	0.5	0.3	0.2	0.15	0.1
Acceptance number (c) (r = c +1)	Minimum sample sizes (For device-hours required for life test, multiply by 1000)																
0	5 (1.03)	8 (0.64)	11 (0.46)	15 (0.34)	22 (0.23)	32 (0.16)	45 (0.11)	76 (0.07)	116 (0.04)	153 (0.03)	231 (0.02)	328 (0.02)	461 (0.01)	767 (0.007)	1152 (0.005)	1534 (0.003)	2303 (0.002)
1	8 (4.4)	13 (2.7)	18 (2.0)	25 (1.4)	38 (0.94)	55 (0.65)	77 (0.46)	129 (0.28)	195 (0.18)	258 (0.14)	390 (0.09)	555 (0.06)	778 (0.045)	1296 (0.027)	1946 (0.018)	2592 (0.013)	3891 (0.009)
2	11 (7.4)	18 (4.5)	25 (3.4)	34 (2.24)	52 (1.6)	75 (1.1)	105 (0.78)	176 (0.47)	266 (0.31)	354 (0.23)	533 (0.15)	759 (0.11)	1065 (0.080)	1773 (0.045)	2662 (0.031)	3547 (0.022)	5323 (0.015
3	13 (10.5)	22 (6.2)	32 (4.4)	43 (3.2)	65 (2.1)	94 (1.5)	132 (1.0)	221 (0.62)	333 (0.41)	444 (0.31)	668 (0.20)	953 (0.14)	1337 (0.10)	2226 (0.062)	3341 (0.041)	4452 (0.031)	6681 (0.018)
4	16 (12.3)	27 (7.3)	38 (5.3)	52 (3.9)	78 (2.6)	113 (1.8)	158 (1.3)	265 (0.75)	398 (0.50)	531 (0.37)	798 (0.25)	1140 (0.17)	1599 (0.12)	-2663 (0.074)	3997 (0.049)	5327 (0.037)	7994 (0.025)
5	19 (13.8)	31 (8.4)	45 (6.0)	60 (4.4)	91 (2.9)	131 (2.0)	184 (1.4)	308 (0.85)	462 (0.57)	617 (0.42)	927 (0.28)	1323 (0.20)	1855 (0.14)	3090 (0.085)	4638 (0.056)	6181 (0.042)	9275 (0.028)
6	21 (15.6)	35 (9.4)	51 (6.6)	68 (4.9)	104 (3.2)	149 (2.2)	209 (1.6)	349 (0.94)	528 (0.62)	700 (0.47)	1054 (0.31)	1503 (0.22)	2107 (0.155)	3509 (0.093)	5267 (0.062)	7019 (0.047)	10533 (0.031)
7	24 (16.6)	39 (10.2)	57 (7.2)	77 (5.3)	116 (3.5)	166 (2.4)	234 (1.7)	390 (1.0)	589 (0.67)	783 (0.51)	1178 (0.34)	1680 (0.24)	2355 (0.17)	3922 (0.101)	5886 (0.067)	7845 (0.051)	11771 (0.034

TABLE VI. LTPD Sampling plans - Continued. 1/ 2/

Minimum size of sample to be tested to assure, with a 90 percent confidence, that a lot having percent-defective equal to the specified LTPD will not be accepted (single sample)

Maximum percent def (LTPD) or λ	50	30	20	15	10	7	5	3	2	1.5	1	0.7	0.5	0.3	0.2	0.15	0.1
Acceptance number (c) (r = c +1)	Minimum sample sizes (For device-hours required for life test, multiply by 1000)																
8	26 (18.1)	43 (10.9)	63 (7.7)	85 (5.6)	128 (3.7)	184 (2.6)	258 (1.8)	431 (1.1)	648 (0.72)	864 (0.54)	1300 (0.36)	1854 (0.25)	2599 (0.18)	4329 (0.108)	6498 (0.072)	8660 (0.054)	12995 (0.036)
9	28 (19.4)	47 (11.5)	69 (8.1)	93 (6.0)	140 (3.9)	201 (2.7)	282 (1.9)	471 (1.2)	709 (0.77)	945 (0.58)	1421 (0.38)	2027 (0.27)	2842 (0.19)	4733 (0.114)	7103 (0.077)	9468 (0.057)	14206 (0.038)
10	31 (19.9)	51 (12.1)	75 (8.4)	100 (6.3)	152 (4.1)	218 (2.9)	306 (2.0)	511 (1.2)	770 (0.80)	1025 (0.60)	1541 (0.40)	2199 (0.28)	3082 (0.20)	5133 (0.120)	7704 (0.080)	10268 (0.060)	15407 (0.040)
11	33 (21.0)	54 (12.8)	83 (8.3)	111 (6.2)	166 (4.2)	238 (2.9)	332 (2.1)	555 (1.2)	832 (0.83)	1109 (0.62)	1664 (0.42)	2378 (0.29)	3323 (0.21)	5546 (0.12)	8319 (0.083)	11092 (0.062)	16638 (0.042)
12	36 (21.4)	59 (13.0)	89 (8.6)	119 (6.5)	178 (4.3)	254 (3.0)	356 (2.2)	594 (1.3)	890 (0.86)	1187 (0.65)	1781 (0.43)	2544 (0.3)	3562 (0.22)	5936 (0.13)	8904 (0.086)	11872 (0.065)	17808 (0.043)
13	38 (22.3)	63 (13.4)	95 (8.9)	126 (6.7)	190 (4.5)	271 (3.1)	379 (2.26)	632 (1.3)	948 (0.89)	1264 (0.67)	1896 (0.44)	2709 (0.31)	3793 (0.22)	6321 (0.134)	9482 (0.089)	12643 (0.067)	18964 (0.045)
14	40 (23.1)	67 (13.8)	101 (9.2)	134 (6.9)	201 (4.6)	288 (3.2)	403 (2.3)	672 (1.4)	1007 (0.92)	1343 (0.69)	2015 (0.46)	2878 (0.32)	4029 (0.23)	6716 (0.138)	10073 (0.092)	13431 (0.069)	20146 (0.046)
15	43 (23.3)	71 (14.1)	107 (9.4)	142 (7.1)	213 (4.7)	305 (3.3)	426 (2.36)	711 (1.41)	1066 (0.94)	1422 (0.71)	2133 (0.47)	3046 (0.33)	4265 (0.235)	7108 (0.141)	10662 (0.094)	14216 (0.070)	21324 (0.047)
16	45 (24.1)	74 (14.6)	112 (9.7)	150 (7.2)	225 (4.8)	321 (3.37)	450 (2.41)	750 (1.44)	1124 (0.96)	1499 (0.72)	2249 (0.48)	3212 (0.337)	4497 (0.241)	7496 (0.144)	11244 (0.095)	14992 (0.072)	22487 (0.048)

TABLE VI. LTPD Sampling plans - Continued. 1/ 2/

Minimum size of sample to be tested to assure, with a 90 percent confidence, that a lot having percent-defective equal to the specified LTPD will not be accepted (single sample)

Maximum percent def (LTPD) or λ	50	30	20	15	10	7	5	3	2	1.5	1	0.7	0.5	0.3	0.2	0.15	0.1
Acceptance number (c) (r = c +1)	Minimum sample sizes (For device-hours required for life test, multiply by 1000)																
17	47 (24.7)	79 (14.7)	118 (9.86)	158 (7.36)	236 (4.93)	338 (3.44)	473 (2.46)	788 (1.48)	1182 (0.98)	1576 (0.74)	2364 (0.49)	3377 (0.344)	4728 (0.246)	7880 (0.148)	11819 (0.098)	15759 (0.074)	23639 (0.049)
18	50 (24.9)	83 (15.0)	124 (10.0)	165 (7.54)	248 (5.02)	354 (3.51)	496 (2.51)	826 (1.51)	1239 (1.0)	1652 (0.75)	2478 (0.50)	3540 (0.351)	4956 (0.251)	8260 (0.151)	12390 (0.100)	16520 (0.075)	24780 (0.050)
19	52 (25.5)	86 (15.4)	130 (10.2)	173 (7.76)	259 (5.12)	370 (3.58)	518 (2.56)	8.64 (1.53)	1296 (1.02)	1728 (0.77)	2591 (0.52)	3702 (0.358)	5183 (0.256)	8638 (0.153)	12957 (0.102)	17276 (0.077)	25914 (0.051)
20	54 (26.1)	90 (15.6)	135 (10.4)	180 (7.82)	271 (5.19)	386 (3.65)	541 (2.60)	902 (1.56)	1353 (1.04)	1803 (0.78)	2705 (0.52)	3864 (0.364)	5410 (0.260)	9017 (0.156)	13526 (0.104)	18034 (0.078)	27051 (0.052)
25	65 (27.0)	109 (16.1)	163 (10.8)	217 (8.08)	326 (5.38)	466 (3.76)	652 (2.69)	1086 (1.61)	1629 (1.08)	2173 (0.807)	3259 (0.538)	4656 (0.376)	6518 (0.269)	10863 (0.161)	16295 (0.108)	21726 (0.081)	32589 (0.054)

1/ Sample sizes are based upon the Poisson exponential binomial limit.
2/ The minimum quality (approximate AQL) required to accept (on the average) 19 of 20 lots is shown in parantheses for information only.

CONCLUDING MATERIAL

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

Review activities:
Navy - AS, EC
Air Force - 11, 17, 19, 80, 90, 99
DLA - ES
Army - AV

User activities:
Navy - CG, MC
Air Force - 13, 14

Preparing activity:
Navy - SH

Agent:
DLA - ES

(Project 6030-0023)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-S-24622A	SOURCES, LED, FIBER OPTIC, GENERAL SPECIFICATION FOR

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
b. ADDRESS *(Street, City, State, ZIP Code)*	☐ USER
	☐ MANUFACTURER
	☐ OTHER *(Specify)*: _____

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
c. MAILING ADDRESS *(Street, City, State, ZIP Code)* – Optional	8. DATE OF SUBMISSION *(YYMMDD)*

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