MILITARY SPECIFICATION

INTERCONNECTION BOX, FIBER OPTIC, METRIC, GENERAL SPECIFICATION FOR

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

1. SCOPE

1.1 Scope. This specification covers the performance requirements for fiber optic interconnection boxes intended for use in Navy shipboard applications. The interconnection boxes are used to house splices, connectors, and couplers, and to provide a means of distributing cables and fibers to user equipment. The interconnection box is not designed to house electrical components. This specification covers the mechanical, chemical, and environmental conditions within which an interconnection box must operate and the means by which the interconnection box is to be tested for use in those environments.

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 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).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 55Z3, 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.

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SPECIFICATIONS

FEDERAL

TT-I-735 - Isopropyl Alcohol.

MILITARY

MIL-S-901 - Shock Tests, H.I. (High-Impact) Shipboard Machinery, Equipment and Systems, Requirements for.

MIL-H-5606 - Hydraulic Fluid, Petroleum Base; Aircraft, Missile, and Ordnance.

MIL-T-5624 - Turbine Fuel, Aviation, Grades JP-4, JP-5 and JP-5/JP-8 ST.

MIL-P-15024 - Plates, Tags and Bands for Identification of Equipment.

MIL-P-15024/5 - Plates, Identification.

MIL-E-16400 - Electronic, Interior Communication and Navigation Equipment, Naval Ship and Shore: General Specification for.

MIL-F-16884 - Fuel, Naval Distillate.

MIL-L-17331 - Lubricating Oil, Steam Turbine and Gear, Moderate Service.

MIL-E-17555 - Electronic and Electrical Equipment Accessories, and Provisioned Items (Repair Parts): Packaging of.

MIL-L-23699 - Lubricating Oil, Aircraft Turbine Engine, Synthetic Base.

MIL-E-24142 - Enclosures for Electrical Fittings and Fixtures, General Specification for.

MIL-I-24728/1 - Interconnection Box, Fiber Optic, Shipboard Submersible, 20.3 x 25.4 CM (Metric).

MIl-I-24728/2 - Interconnection Box, Fiber Optic, Shipboard Submersible, 30.5 x 43.2 CM.

STANDARDS

FEDERAL

FED-STD-313 - Material Safety Data, Transportation Data and Disposal Data for Hazardous Materials Furnished to Government Activities.

MILITARY

MIL-STD-130 - Identification Marking of US Military Property.

MIL-STD-167-1 - Mechanical Vibrations of Shipboard Equipment (Type I - Environmental and Type II - Internally Excited).

MIL-STD-454 - Standard General Requirements for Electronic Equipment.

MIL-STD-810 - Environmental Test Methods and Engineering Guidelines.

MIL-STD-1344 - Test Methods for Electrical Connectors.

MIL-STD-1472 - Human Engineering Design Criteria For Military Systems, Equipment and Facilities.

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(Application for copies should be addressed to the Naval Publications and Forms Center, (ATTN: NPODS), 5801 Tabor Avenue, Philadelphia, PA 19120-5099.)

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 (see 6.2).

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

455 - Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices.

455-4 - Fiber Optic Connector/Component Temperature Life. (DoD adopted)

455-12 - Fluid Immersion Test Procedure for Fiber Optic Connecting Devices.

455-13 - Visual and Mechanical Inspection of Fibers, Cables, Connectors and/or Other Fiber Optic Devices. (DoD adopted)

455-20 - Measurement of Change in Optical Transmittance. (DoD adopted)

455-36 - Twist Test for Fiber Optic Connecting Devices. (DoD adopted)

455-71 - Procedure to Measure Temperature - Shock Effects on Fiber Optic Components.

(Application for copies should be addressed to the Electronic Industries Association, 2001 Eye Street, NW, Washington DC 20006.)

UNDERWRITERS LABORATORIES (UL)

94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

1479 - Fire Tests of Through-Penetration Firestops.

(Application for copies should be addressed to Underwriters Laboratories, Publication Stock, 333 Pfingsten Road, Northbrook, Illinois 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 specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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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 First article. When specified (see 6.2), a sample shall be subjected to first article inspection (see 6.4) in accordance with 4.4.

3.3 Materials. Interconnection boxes shall be constructed of materials that will not produce toxic, corrosive, or explosive by-products and shall maintain their compliance with this specification for not less than 20 years. Materials shall be non magnetic and not have adverse effects upon operational or maintenance personnel under all operational and environmental conditions. They shall be of the lightest mass suitable for the intended purpose and shall not interfere with or degrade the fiber optic termination process. All specified materials are subject to a toxicological data and formulations review and/or inspection, for safety of the material, by the Government. Zinc castings shall not be used.

3.3.1 Recovered materials. Unless otherwise specified herein, all material incorporated in the products covered by this specification shall be new. Products may be fabricated using raw materials produced from recovered bulk materials to the extent practicable if the intended use of the product is not jeopardized. The term "recovered materials" means materials which have been collected or recovered from solid waste and reprocessed to become part of a source of raw materials, as opposed to virgin raw materials. None of the above shall be interpreted to mean that the use of partially processed, assembled, used or rebuilt products are allowed under this specification.

3.3.2 Processes. Material processes shall be in accordance with MIL-E-24142.

3.3.2.1 Castings. Castings shall be in accordance with MIL-STD-454, requirement 21.

3.3.2.2 Corrosion protection and corrosion-resisting treatments. Unless otherwise specified in the specification sheet (see 3.1), corrosion resisting treatments shall not be applied to surfaces where contact between surfaces would cause gouging, binding, or the function of the interconnection box to be impeded. Corrosion protecting and corrosion resisting treatments shall be in accordance with MIL-STD-454, requirement 15, and as specified in MIL-E-16400.

3.3.2.3 Painting. The exterior and interior surfaces shall be painted in accordance with MIL-E-16400.

3.3.2.4 Welding, structural. Structural welding shall be in accordance with MIL-STD-454, requirement 13.

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3.3.3 Material Safety Data Sheet (see 6.8). The contracting activity shall be provided a Material Safety Data Sheet (MSDS) at the time of contract award. The MSDS shall be provided in accordance with the requirements of FED-STD-313. The MSDS shall be included with each shipment of the material covered by this specification.

3.4 Design and construction. The configuration and physical dimensions of the interconnection box shall be as specified herein and as specified in the specification sheets (see 3.1). The design and construction shall be in accordance with MIL-E-24142.

3.4.1 General. Interconnection boxes may include cast or fabricated construction in which construction welding shall be in accordance with MIL-STD-454, requirement 13. All flat sheets of metal shall be provided with a means of improving their rigidity, such that the requirements specified shall be met. All sharp edges and corners shall be broken and rounded.

3.4.2 Structural integrity (see 4.7.5.5). The completely assembled interconnection box shall have a resonance frequency not less than 50 hertz (Hz).

3.4.3 Enclosure. Interconnection boxes shall be designed such that all cables, cable components, fibers, connectors, splices, couplers, and mounting and stability supports for the above components entering, enclosed in or exiting the interconnection box are not damaged during the servicing of the interconnection or components or during installation of additional components. Covers of interconnection boxes may be either hinged or removable as specified in the specification sheet (see 3.1). When hinged covers are used, they shall be capable of being rigidly fixed in the open position for servicing of the enclosed components.

3.4.3.1 Degree of enclosure. Interconnection boxes shall be watertight (see 3.5.3.5).

3.4.4 Interconnection box mounting. Interconnection boxes shall have mounting pads on the rear surfaces of the enclosure. A minimum of two pads shall be above the center of gravity and additional pads positioned to transmit loads to the supporting structure. Additional mounting requirements shall be as specified in the specification sheet (see 3.1).

3.4.5 Cable-interconnection interface. The types and sizes of cables, used within an interconnection box, shall be as specified in the specification sheet (see 3.1). Fiber optic cables shall enter the interconnection boxes via cable feed-throughs (see 6.6.2). Cable feed-throughs shall not degrade the optical performance of fiber optic cables and shall be located as specified in the specification sheet (see 3.1). All types and sizes of fiber optic cables shall be capable of being spliced or connectorized inside an interconnection box.

3.4.6 Interconnect organization. Interconnection boxes shall have provisions for storing fiber splices and fiber optic connectors, as specified in the specification sheet (see 3.1), such that fiber splice organizers, optical patch panels or connectors may be moved into servicable positions without damage to any component, and their operational position shall induce no microbends or macrobends into any cable, Optical Fiber Cable Components (OFCC), or fiber. All

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buffered fibers, OFCC's, or fiber ribbons located between the input cables and the fiber organizers shall be routed along the side of the interconnection box, and shall be guided through wire troughs or bundled with wire wraps. Unless otherwise specified in the specification sheet (see 3.1), fiber optic interconnection boxes shall provide interconnection (see 6.6.3) capabilities for fiber distribution.

3.4.6.1 Fiber optic splices. The type and maximum number of fiber optic splices to be used within the fiber optic interconnection box shall be as specified in the specification sheet (see 3.1).

3.4.6.2 Fiber optic connectors. The type and maximum number of fiber optic connectors to be used within the interconnection box shall be as specified in the specification sheet (see 3.1).

3.4.6.3 Fiber optic couplers. The type and maximum number of fiber optic couplers to be used within the interconnection box shall be as specified in the specification sheet (see 3.1).

3.4.6.4 Fiber and splice organizers (see 6.6.4). Splice organizers shall be universal or replaceable to accommodate and protect all types of fiber optic splices, both mechanical and fusion. Splice organizers shall identify each fiber splice. The design shall allow the physical rearrangement of splices. The number and arrangement of the splices shall be as specified in the specification sheets (see 3.1). Splice and fiber organizers shall be designed in removable units to provide additional storage capacity for fibers and splices, as specified in the specification sheets (see 3.1).

3.4.6.5 Optical patch panels. Optical patch panels (see 6.6.5) shall be used for mounting optical connectors and optical couplers. Both sides of a patch panel shall be accessible. The spacing between components shall be large enough to access individual components without tools. Individual connectors shall be clearly identifiable. The organization design shall allow for physical rearrangement of connectors, and a clearly defined fiber/OFCC layout pattern.

3.4.6.6 Fiber bend radii. Fiber layout plans and fiber organizers shall limit the fiber bend radius, including buffered fibers, OFCC's, and fiber ribbons, to a minimum of 40 millimeters (mm).

3.4.7 Fiber, splice, and connector identification. The interconnection box shall have markings for identification of individual fibers, splices, and connector ports. All identification markings shall be permanent, clearly visible and legible in accordance with the general marking requirements of MIL-STD-130. Identification markings shall be done on self-adhesive materials or directly on interconnection box surfaces as specified in 3.4.7.1 and 3.4.7.2.

3.4.7.1 Fibers and splices. Fibers and splices shall be identified on a self-adhesive splice chart as specified in the specification sheets (see 3.1).

3.4.7.2 Connectors. Connectors shall be identified by numbers corresponding to each connector. The numbers shall be silk-screened onto the optical patch panel and shall be not less than 6 mm in height. A self-adhesive connector chart, as specified in the specification sheets (see 3.1), shall identify the organization of the optical patch panel.

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3.4.8 Accessibility. Regardless of the method used for mounting an interconnection box (see 3.4.4), access to all parts of the interconnection box for fiber interconnection, splicing, maintenance, mounting and cable addition shall be from the front. Splices, fiber organizers, and individual connectors shall be accessed without the removal of, or damage to, other splices, fibers, and connectors. Hinged covers or panels shall remain in an open position. This position shall not restrict access to the box.

3.4.9 Weight (see 4.6.2.1). The total weight of an interconnection box shall be as specified in the specification sheets (see 3.1).

3.4.10 Size (see 4.6.2.2). The size of an interconnection box shall be as specified in the specification sheet (see 3.1). The size shall not exceed the size limitations as specified in MIL-E-16400.

3.4.11 Maintenance. Interconnection boxes shall require no preventive maintenance.

3.5 Performance requirements. The performance requirements shall be defined in terms of optical, mechanical, environmental, and chemical properties.

3.5.1 Optical properties.

3.5.1.1 Installation loss (see 4.6.3.1). The optical performance of a fiber optic component (connector, splice, or coupler) when installed in a fiber optic interconnection box shall not be degraded more than 0.20 decibel (dB) when referenced to its pre-installation insertion loss.

3.5.1.2 Change in optical transmittance (see 4.7.3.2). The change in the optical transmittance of a splice, connector, or coupler installed in the fiber optic interconnection box in a standard manner shall be not greater than the maximum specified value of change in optical transmittance from the component specification.

3.5.2 Mechanical properties.

3.5.2.1 Cable retention (see 4.6.4.1). The cable feed-throughs shall remain in place at all times. The interconnection box shall meet the requirements of 3.5.1.2 and show no damage.

3.5.2.2 Cable seal flexing (see 4.6.4.2). The strain relief mechanisms of the interconnection box shall not cause loss of environmental sealing nor cause visible damage to, or impair the operation of, the enclosed connectors and splices.

3.5.2.3 Cable twist (see 4.6.4.3). The interconnection box shall reveal no loss of environmental sealing, splitting, or show visible damage. The interconnection box shall meet the requirements as specified in 3.5.1.2.

3.5.2.4 Compression resistance (see 4.6.4.4). The interconnection box shall not deform more than 1 percent from its largest cross-sectional dimension. The interconnection box shall show no visible damage.

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3.5.2.5 Impact resistance (see 4.6.4.5). The interconnection box shall have no physical damage. The interconnection box shall meet the requirements as specified in 3.5.1.2.

3.5.3 Environmental properties. The interconnection box shall meet the requirements specified herein 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 I. The range shall be as specified in the specification sheets (see 3.1).

TABLE I. Temperature ranges.

Range	Operating (°C)	Storage (°C)
1	-54 to +65	-62 to +71
2	-28 to +65	-62 to +71

3.5.3.1 Temperature life (see 4.5.1). The interconnection box shall show no evidence of dimensional change, opening of seals, cracking, physical deformation, or damage. The interconnection box shall meet the requirements as specified in 3.5.1.2.

3.5.3.2 Thermal shock (see 4.5.2). The interconnection box shall show no evidence of dimensional change, opening of seals, cracking, deformation, or physical damage. All doors or hinged areas shall operate afterwards. All sliding surfaces such as splice trays, shall continue to operate.

3.5.3.3 Temperature-humidity cycling (see 4.5.3). The interconnection box shall show no signs of corrosion products, entrapment of moisture, separation of bonded surfaces, deformation, or physical damage. The interconnection box shall meet the requirements as specified in 3.5.1.2.

3.5.3.4 Salt spray (corrosion) (see 4.5.4). The interconnection box shall show no evidence of salt penetration into the interconnection box or corrosive effects.

3.5.3.5 Water pressure (see 4.5.5). The interconnection box examination shall reveal no penetration of indicator dye.

3.5.3.6 Inclination (see 4.5.6). The interconnection box shall hold the fiber and splice organizers in place. The interconnection box shall meet the requirements of 3.5.1.2.

3.5.3.7 Fluid immersion (see 4.5.7). The interconnection box shall reveal no cracks, splits, voids, swelling or softening of material, loss of identification marking, discoloration, peeling, or deformation.

3.5.3.8 Vibration (see 4.5.8). The interconnection box shall show no evidence of broken, deformed, or displaced parts, chips, cracks, or physical damage. The interconnection box shall meet the requirements of 3.5.1.2.

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3.5.3.9 Shock (see 4.5.9). The interconnection box shall show no evidence of broken, deformed, or displaced parts, chips, cracks, or other damage. The interconnection box shall meet the requirements of 3.5.1.2.

3.5.3.10 Flame spread (see 4.5.10). The cable feed-through shall have an F rating in accordance with UL 1479 of not less than 3 hours.

3.5.4 Chemical properties.

3.5.4.1 Fungus resistance (see 4.6.1). The interconnection box shall be in accordance with MIL-STD-454, requirement 4, for fungus-inert materials. Interconnection boxes that are not in accordance with requirement 4 of MIL-STD-454 shall meet grade 1 classification of MIL-STD-810, method 508.

3.5.4.2 Flammability (see 4.6.2). The materials used in the construction of the interconnection box shall meet the rating criteria of materials classification 94V-1 of UL 94.

3.6 Transportability. The splice operational performance specified herein shall not be affected following prolonged storage or shipment under environmental conditions for shipment and storage specified herein, and as required for packaging for shipment (see 5.1).

3.7 Identification markings. Identification markings of an interconnection box and components shall be done on fastened plates, self-adhesive materials, or on the box or component surfaces. These markings shall not be covered by components within the box.

3.7.1 Marking. The markings on the interconnection box shall be permanent and clearly visible and legible. The marking shall be in accordance with MIL-STD-454, requirement 67. When fastened plates are used for identification or information marking, their material types shall not degrade or interfere with the intended use of the material of the item on which the plates are fastened. Identification plates shall be in accordance with MIL-P-15024 and MIL-P-15024/5. Marking information shall include the part number, manufacturer's Commercial and Government Entity (CAGE), interconnection box code number, manufacturer's name, and date of manufacture.

3.7.2 Labeling. Labeling on the interconnection box shall be in accordance with MIL-STD-1472. A visible label shall be affixed to the outside of the removable portion or cover of the interconnection box and shall contain the following:

NOTICE
UNTERMINATED OPTICAL CONNECTIONS MAY
EMIT LASER RADIATION
DO NOT VIEW BEAM WITH OPTICAL INSTRUMENTS

A visible label shall be affixed to the inside of the removable portion or cover of the interconnection box and shall contain the following:

DANGER
INVISIBLE LASER RADIATION WHEN OPEN
AVOID DIRECT EXPOSURE TO THE BEAM

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3.8 Workmanship. Interconnection boxes and associated components shall be free from sharp edges, burrs, and other defects that will affect life, serviceability, or appearance.

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 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 inspections 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.

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

(a) First article inspection (see 4.4).
(b) Quality conformance inspection (see 4.5).

4.2.1 Toxicological data and formulation. The contractor shall have the toxicological product formulations and associated information available for review by the contracting activity to evaluate the safety of the material for the proposed use.

4.3 Inspection conditions. Unless otherwise specified, all inspections shall be performed in accordance with the test conditions specified in applicable portions of EIA 455.

4.4 First article inspection. First article inspection shall consist of all the tests listed in table II and as specified in the specification sheets (see 3.1 and 6.3).

4.4.1 Sample. An interconnection box sample shall be submitted for each interconnection box construction for which first article approval is desired. The sample submitted shall be three interconnection boxes of the same part number.

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4.4.2 Inspection routine. The sample shall be subjected to the inspections specified in table II in the order shown. All sample units shall be subjected to the inspection of group I. The sample shall then be divided into three groups. The sample units shall then be subjected to the inspection for their particular group. After completion of sample testing, all units shall be resubjected to group I testing. Any interconnection box failing any inspection shall not be subjected to further inspection.

4.4.3 Failures. One or more failures shall be sufficient cause for refusal to grant first article approval.

TABLE II. First article inspection.

Inspection	Requirement	Test method	Sample size
Group I			
Visual and mechanical	3.4, 3.8	4.6.1.1	3
Structural integrity	3.4.2	4.6.5.5	1/
Weight	3.4.9	4.6.2.1	1/
Size	3.4.10	4.6.2.2	1/
Identification marking	3.7	4.6.1.1	1/
Installation loss	3.5.1.1	4.6.3.1	1/
Group II			
Temperature life	3.5.3.1	4.6.5.1	1
Thermal shock	3.5.3.2	4.6.5.2	2/
Temperature-humidity cycling	3.5.3.3	4.6.5.3	2/
Salt spray	3.5.3.4	4.6.5.4	2/
Inclination	3.5.3.6	4.6.5.6	2/
Fluid immersion	3.5.3.7	4.6.5.7	2/
Vibration	3.5.3.8	4.6.5.8	2/
Shock	3.5.3.9	4.6.5.9	2/
Water pressure	3.5.3.5	4.6.5.5	2/
Fungus resistance	3.5.4.1	4.6.6.1	1

See footnotes at end of table.

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TABLE II. First article inspection - Continued.

Inspection	Requirement	Test method	Sample size
Group III			
Cable retention	3.5.2.1	4.6.4.1	1
Cable seal flexing	3.5.2.2	4.6.4.2	3/
Cable twist	3.5.2.3	4.6.4.3	3/
Compression resistance	3.5.2.4	4.6.4.4	3/
Impact resistance	3.5.2.5	4.6.4.5	3/
Flammability	3.5.4.2	4.6.6.2	3/
Flame spread	3.5.3.10	4.6.5.10	3/

1/ The same sample shall be used as in the visual and mechanical inspection.
2/ The same sample shall be used as in the temperature life inspection.
3/ The same sample shall be used as in the cable retention inspection.

4.5 Quality conformance inspection. Quality conformance inspection shall consist of the inspections and tests specified for group A inspection (table III), group B inspection (table IV), and group C inspection (table V) (see 6.5).

4.5.1 Group A inspection. Group A inspections shall follow the order shown in table III.

TABLE III. Group A inspection.

Inspection	Requirement	Test method
Visual and mechanical	3.4, 3.8	4.6.1.1
Weight	3.4.9	4.6.2.1
Size	3.4.10	4.6.2.2
Identification marking	3.7	4.6.1.1

4.5.2 Group B inspection. Group B inspection shall consist of the inspections specified in table IV. Group B inspections shall be made on units that have passed the group A inspection.

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TABLE IV. Group B inspection.

Inspection	Requirement	Test method
Shock	3.5.3.9	4.6.5.9
Thermal shock	3.5.3.2	4.6.5.2
Cable retention	3.5.2.1	4.6.4.1
Cable seal flexing	3.5.2.2	4.6.4.2

4.5.3 Group C inspections. Group C inspections shall consist of the inspections in table V. Group C samples shall have satisfactorily completed all group A and group B inspections. After completion of group C inspections, the samples shall be re-subjected to group A inspection.

TABLE V. Group C inspection.

Inspection	Requirement	Test method
Structural integrity	3.4.2	4.6.5.5
Fungus resistance	3.5.4.1	4.6.6.1
Installation loss	3.5.1.1	4.6.3.1
Inclination	3.5.3.6	4.6.5.6
Cable twist	3.5.2.3	4.6.4.3
Compression resistance	3.5.2.4	4.6.4.4
Impact resistance	3.5.2.5	4.6.4.5
Temperature life	3.5.3.1	4.6.5.1
Temperature-humidity cycling	3.5.3.3	4.6.5.3
Salt spray	3.5.3.4	4.6.5.4
Fluid immersion	3.5.3.7	4.6.5.7
Vibration	3.5.3.8	4.6.5.8
Water pressure	3.5.3.5	4.6.5.5
Flammability	3.5.4.2	4.6.6.2
Flame spread	3.5.3.10	4.6.5.10

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4.5.3.1 Disposition of Group C inspections sample units. Sample units subjected to group C inspection shall not be delivered.

4.6 Methods of inspection.

4.6.1 General testing practice.

4.6.1.1 Visual and mechanical inspections. Unless otherwise specified in the specification sheet (see 3.1), visual and mechanical examinations shall be performed in accordance with EIA 455-13 to verify that the design, construction, physical characteristics, marking, and workmanship are in accordance with the applicable requirements. Visual inspection for interconnection box color may be checked without magnification.

4.6.1.2 Equivalent test methods. The use of equivalent test methods is allowed (see 3.1 and 6.2).

4.6.2 Design and construction inspection.

4.6.2.1 Weight (see 3.4.9). Interconnection boxes shall be weighed using scales with a minimum accuracy of 5 percent.

4.6.2.2 Size (see 3.4.10). Interconnection boxes shall be measured, using instruments with accuracies appropriate to the tolerances defined in the specification for the unit.

4.6.3 Optical properties inspection.

4.6.3.1 Installation loss (see 3.5.1.1). The installation loss of a fiber optic splice, connector, or coupler in the interconnection box shall be tested as follows. The connector, splice, or coupler shall be assembled to the cable or fiber and the insertion loss shall be measured using the test given by the component specification. Cables shall be assembled to the cable clamping devices. Optical transmittance shall be measured after the installation and the change in transmittance recorded.

4.6.3.2 Change in optical transmittance (see 3.5.1.2). The change in optical transmittance of a splice, connector, or coupler shall be measured in accordance with EIA 455-20 or by an equivalent method (see 4.6.1.2).

4.6.4 Mechanical properties inspection.

4.6.4.1 Cable retention (see 3.5.2.1). A fiber optic cable entering or exiting the interconnection box shall remain in place when pulled with an axial force equal to one-half its stated tensile strength or 450 newtons, whichever is smaller, for 30 minutes. The interconnection box shall be fully assembled during this test. The change in optical transmittance shall be measured during and after the test (see 4.6.3.2). At the completion of the test, the interconnection box shall be visually examined in accordance with 4.6.1.1.

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4.6.4.2 Cable seal flexing (see 3.5.2.2). Cable feed-throughs of an interconnection box shall be tested in accordance with MIL-STD-1344, method 2017, with the exception that the test sample shall be a cable feed-through assembled on a cable. At the completion of the test, the interconnection box shall be visually examined in accordance with 4.6.1.1.

4.6.4.3 Cable twist (see 3.5.2.3). Interconnection box cable feed-throughs shall be tested in accordance with EIA 455-36, for 50 cycles, with the exception that the test sample shall be an assembled cable feed-through. The tensile load shall be 50 newtons and the number of loads to be applied shall be one. The change in optical transmittance shall be measured during and after the test (see 4.6.3.2). At the completion of the test, the interconnection box shall be visually examined in accordance with 4.6.1.1.

4.6.4.4 Compression resistance (see 3.5.2.4). The interconnection box shall be tested as follows. A force of 890 newtons shall be applied uniformly over three mutually orthogonal sides and shall be maintained for 10 minutes. The test shall be performed at the maximum and minimum operating temperatures. At the completion of the test, the interconnection box shall be visually examined in accordance with 4.6.1.1.

4.6.4.5 Impact resistance (see 3.5.2.5). The interconnection box shall be subjected to an impact test. The loading and operating conditions shall be as specified (see 3.1). Unless otherwise specified (see 3.1), the impact point shall have a minimum radius of curvature of 50 mm. At the completion of the test, the interconnection box shall be visually examined in accordance with 4.6.1.1.

4.6.5 Environmental properties inspection.

4.6.5.1 Temperature life (see 3.5.3.1). The interconnection box shall be tested in accordance with EIA 455-4. The exposure time shall be 96 hours, and the test temperature shall be 105 degrees Celsius (°C). The change in optical transmittance shall be measured after the test (see 4.6.3.2). At the completion of the test, the interconnection box shall be visually examined in accordance with 4.6.1.1.

4.6.5.2 Thermal shock (see 3.5.3.2). The interconnection box shall be tested for 10 cycles in accordance with EIA 455-71, cycle schedule C. The high and low temperature shall correspond to the specified storage temperature extremes (see 3.5.3). Before and after the test, the interconnection box shall be visually examined in accordance with 4.6.1.1, and dimensionally measured in accordance with 4.6.2.2. Any changes shall be recorded. All movable components shall be operated after the test. Failure to operate shall be recorded.

4.6.5.3 Temperature-humidity cycling (see 3.5.3.3). The interconnection box shall be fully assembled and tested in accordance with MIL-STD-810, method 507, procedure III. The temperature range shall be the specified operating range, and the relative humidity shall be 95 percent. The change in optical transmittance shall be measured during and after the test (see 4.6.3.2). At the completion of the test, the interconnection box shall be visually examined in accordance with 4.6.1.1.

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4.6.5.4 Salt spray (corrosion) (see 3.5.3.4). The interconnection box shall be tested in accordance with MIL-STD-810, method 509, for 96 hours. Interconnection boxes shall be fully assembled during this test. At the completion of the test, the interconnection box shall be visually examined in accordance with 4.6.1.1.

4.6.5.5 Water pressure (see 3.5.3.5). A completely assembled interconnection box shall be immersed in an aqueous dye penetrant solution at an applied pressure of 0.1 megapascal (equivalent to a depth of 10.4 meters). The system shall be maintained at a temperature of 10 to 35 °C for 48 hours. At the completion of the test, the interconnection box shall be visually examined in accordance with 4.6.1.1.

4.6.5.6 Inclination (see 3.5.3.6). During this test, the interconnection box shall be fully functional as it would be during its normal operation aboard a ship. The interconnection box shall be made to oscillate, in one plane, around a vertical line. The oscillation angles shall be plus and minus 45 degrees. The test shall last for 2 hours at the rate of 5 cycles per minute. This test shall be repeated after rotating the interconnection box 90 degrees from its original orientation and about its vertical center line. The change in optical transmittance shall be measured during and after the test (see 4.6.3.2). At the completion of the test, the interconnection box shall be visually examined in accordance with 4.6.1.1.

4.6.5.7 Fluid immersion (see 3.5.3.7). The interconnection box shall be tested in accordance with EIA 455-12. The interconnection box shall be immersed in each of the fluids in table VI at the temperature specified for 24 hours. The interconnection box shall be completely dried after each immersion. At the completion of the test, the interconnection box shall be visually examined in accordance with 4.6.1.1.

TABLE VI. Immersion test fluids.

Fluids	Specification	Test temperature (°C)
Fuel oil	MIL-F-16884	33 - 37
Turbine fuel (JP-5)	MIL-T-5624	20 - 25
Isopropyl alcohol	TT-I-735	20 - 25
Hydraulic fluids	MIL-H-5606	48 - 50
Lubricating oils	MIL-L-17331 MIL-L-23699	73 - 77
Coolant 1/	-	20 - 25
Seawater	-	20 - 25

1/ Monsanto Coolanol 25, or equivalent.

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4.6.5.8 Vibration (see 3.5.3.8). The interconnection box shall be tested in accordance with type I vibration test of MIL-STD-167-1. During the test, the interconnection box shall be solidly mounted and shall be energized. Weights of the interconnection box or of its components shall not be substituted by dummy masses to simulate their reactions or effects. Unless otherwise specified in the specification sheets (see 3.1), the change in optical transmittance shall be monitored continuously during and after the test with equipment having a time resolution of at least 50 microseconds (μs) (see 4.6.3.2). At the completion of the test, the interconnection box shall be visually examined in accordance with 4.6.1.1.

4.6.5.9 Shock (see 3.5.3.9). The interconnection box shall be tested in accordance with MIL-S-901, grade A, type A, class I. The use of simulated loads is not acceptable. Unless otherwise specified in the specification sheets (see 3.1), the change in optical transmittance shall be monitored continuously during and after the test with equipment having a time resolution of at least 50 μs (see 4.6.3.2). At the completion of the test, the interconnection box shall be visually examined in accordance with 4.6.1.1.

4.6.5.10 Flame spread (see 3.5.3.10). The cable feed-throughs shall be tested in accordance with UL 1479.

4.6.6 Chemical properties inspection.

4.6.6.1 Fungus resistance (see 3.5.4.1). Interconnection boxes that do not meet the requirements of fungus-inert materials in accordance with MIL-STD-454, requirement 4, shall be tested for exposure to fungus in accordance with MIL-STD-810, method 508.

4.6.6.2 Flammability (see 3.5.4.2). A sample of every material used in the finished interconnection box shall be tested in accordance with UL 94.

4.6.7 Inspection of packaging. Sample packages and packs, and the inspection of the preservation, packing, and marking for shipment and storage shall be in accordance with the requirements of section 5 and the documents specified therein.

5. PACKAGING

(The packaging requirements specified herein apply only for direct Government acquisition. For the extent of applicability of the packaging requirements of referenced documents listed in section 2, see 6.10).

5.1 Packaging. Packaging shall be in accordance with MIL-E-17555 and the requirements specified herein. The level of packing shall be as specified (see 6.2).

5.2 Packaging techniques. The shipping container shall protect the interconnection box from damage while stored in the outdoor environment. The shipping container shall be marked to indicate the side to be open. An instruction sheet shall be placed directly under the shipping container cover.

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5.3 Marking of packages. Each shipping container shall be readily identifiable by the interconnection box identification number, the name of manufacturer, the date of manufacture, and the gross weight.

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 interconnection boxes covered by this specification are for use in Naval shipboard applications, where their performance characteristics are required.

6.2 Acquisition requirements. Acquisition documents must specify the following:

(a) Title, number, and date of the specification.
(b) Issue of DODISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.1.1 and 2.2).
(c) Applicable specification sheet number, title, and date.
(d) Quantity of interconnection boxes required.
(e) When first article is required (see 3.2).
(f) Equivalent test methods, if other than as specified (see 4.6.1.2).
(g) Level of packaging required (see 5.1).
(h) Applicable part number (see 6.9).

6.3 Consideration of data requirements. The following data requirements should be considered when this specification is applied on a contract. The applicable Data Item Descriptions (DID's) should be reviewed in conjunction with the specific acquisition to ensure that only essential data are requested/provided and that the DID's are tailored to reflect the requirements of the specific acquisition. To ensure correct contractual application of the data requirements, a Contract Data Requirements List (DD Form 1423) must be prepared to obtain the data, except where DoD FAR Supplement 27.475-1 exempts the requirement for a DD Form 1423.

Reference Paragraph	DID Number	DID Title	Suggested Tailoring
4.4	DI-T-4902	First article inspection report	----

The above DID's were those cleared as of the date of this specification. The current issue of DoD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DID's are cited on the DD Form 1423.

6.4 First article. When first article inspection is required, the items should be a first article sample. The first article should consist of 3 units. The contracting officer should also include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results, and disposition of first articles. Invitations for bids should provide

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that the Government reserves the right to waive the requirement for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract. Bidders should not submit alternate bids unless specifically requested to do so in the solicitation.

6.5 Quality conformance. Quality conformance inspections require contractual definition of the overall test program, including sample sizes and lot sizes, when appropriate (see 4.5).

6.6 Definitions.

6.6.1 Cable assembly. A cable assembly is a cable that is terminated and ready for installation.

6.6.2 Cable feed-through. A cable feed-through is a mechanism that provides strain relief to a cable entering an interconnection box and may also be used to seal around the cable.

6.6.3 Fiber optic interconnection. Fiber optic interconnection is the connection of two optical fibers by means of a direct connection from one to the other, thus requiring no fiber optic jumpers.

6.6.4 Fiber organizers. A fiber organizer is a container that stores all excess fibers in an orderly manner.

6.6.5 Patch panel. A patch panel is a panel on which fiber optic connectors and couplers are mounted in an organized array for easy access.

6.7 Miscellaneous notes.

6.7.1 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 test examinations are not obtainable by other methods.

6.8 Material Safety Data Sheets. Contracting officers will identify those activities requiring copies of completed Material Safety Data Sheets prepared in accordance with FED-STD-313. The pertinent Government mailing addresses for submission of data are listed in FED-STD-313.

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6.9 Part or Identifying Number (PIN). Interconnection boxes should contain only the following:

D24728 / XX XXX

Interconnection box basic specification

Interconnection box specification sheet

Serial number

Examples:

D24728/01-001
D24728/02-002

6.10 Sub-contracted material and parts. The packaging requirements of referenced documents listed in section 2 do not apply when material and parts are acquired by the contractor for incorporation into the equipment and lose their separate identity when the equipment is shipped.

6.11 Subject term (key word) listing.

Cable assembly
Cable feed-throughs
Change in optical transmittance
Fiber optic communications
Fiber optic component
Fiber organizers
Fiber splices
Enclosure
Laser light radiation
Patch panel

Review activities:
Navy - EC, YD

Preparing activity:
Navy - SH
(Project 6099-N001)

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-I-24728(NAVY)	INTERCONNECTION BOX, FIBER OPTIC, METRIC, GENERAL SPECIFICATION FOR

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

(TO DETACH THIS FORM, CUT ALONG THIS LINE.)

DD FORM 82 MAR 1426 PREVIOUS EDITION IS OBSOLETE.

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