METRIC

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SUPERSEDING
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MILITARY SPECIFICATION

INTERCONNECTION BOX, FIBER OPTIC, METRIC, GENERAL SPECIFICATION FOR

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

1. SCOPE

1 1 Scope This specification covers the performance requirements of fiber optic interconnection boxes The interconnection boxes are used to house splices, connectors, and couplers, and to provide a means of distributing cables and fibers to user equipment 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

1 2 Part or Identifying Number (PIN) The PIN shall consist of the letter "M" followed by the basic specification sheet number, and a sequentially assigned dash number (see 3 1)

Example

M24728/01 - 01

Basic specification sheet number

Dash number from specification sheet (see 3 1)

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

AMSC N/A

FSC 6099

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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)

SPECIFICATIONS

FEDERAL

QQ-A-596		Aluminum Alloy, Permanent and Semi-permanent, Mold Castings
TT-I-735	-	Isopropyl Alcohol

MILITARY

MIL-S-901	-	Shock Tests, HI (High Impact), Shipboard Machinery, Equipment and Systems, Requirements for Navy
MIL-H-5606	-	Hydraulic Fluid, Petroleum Base, Aircraft, Missile, and Ordnance
MIL-T-5624	-	Turbine Fuel, Aviation, Grades JP-4 and JP-5.
MIL-P-15024	-	Plate, Tags, and Bands for Identification of Equipment
MIL-P-15024/5	-	Plate, Identification
MIL-E-16400	-	Electronic, Interior Communication and Navigation Equipment, Naval Ship and Shore General Specification For
MIL-F-16884	-	Fuel, Naval Distillate
MIL-I-17214	-	Indicator, Permeability, Low-Mu (Go-no-go).
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-E-24142/6	-	Enclosures, Submersible (15 foot), Sizes 8 by 10 through 14 by 26
MIL-P-24705	-	Penetrators, Multiple Cable, for Electrical Cable, General Specification for
MIL-C-24712	-	Coatings, Powdered Epoxy (Metric)
DOD-C-85045	-	Cable, Fiber Optic, General Specification For

STANDARDS

FEDERAL

FED-STD-313	-	Material Safety Data Sheets, Preparation and Submission of

MILITARY

MIL-STD-108	-	Definitions of and Basic Requirements for Enclosures for Electric and Electronic Equipment.
MIL-STD-454	-	Standard General Requirements for Electronic Equipment
MIL-STD-810	-	Environmental Test Methods and Engineering Guidelines
MIL-STD-1285	-	Marking of Electrical and Electronic Parts.
MIL-STD-1344	-	Test Methods for Electrical Connectors.
MIL-STD-1472	-	Human Engineering Design Criteria for Military Systems, Equipment and Facilities
MIL-STD-167/1	-	Mechanical Vibrations Of Shipboard Equipment (Type I - Environmental and Type II - Internally Excited)
MIL-STD-1678	-	Fiber Optics Test Methods and Instrumentation.

(Unless otherwise indicated, copies of federal and military specifications, standards, and handbooks are available from the Standardization Documents Order Desk, Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

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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 Industry Association (EIA)

	EIA-455	-	Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices
*	EIA-455-4	-	Fiber Optic Connector/Component Temperature Life
*	EIA-455-13	-	Visual and Mechanical Inspection of Fibers, Cables, Connectors and/or Other Fiber Optic Devices
*	EIA-455-20	-	Measurement of Change in Optical Transmittance
*	EIA-455-36	-	Twist Test for Fiber Optic Cable Connecting Devices

* Has been adopted by DoD

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

Underwriters Laboratories (UL) Publications

*	UL-94	-	Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
	UL-1479	-	Fire Tests of Through-Penetration Fire Stops

* Has been adopted by DoD

(Application for copies should be addressed to Underwriters Laboratories Publications, Publication Stock, 333 Pfingsten Road, Northbrook, IL 60062.)

American Society for Testing and Materials (ASTM)

*	ASTM B 209	-	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
*	ASTM B 221	-	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
*	ASTM D 1141	-	Standard Specification for Substitute Ocean Water
	ASTM D 3935	-	Standard Specification for Polycarbonate (PC) Unfilled and Reinforced Material

* Has been adopted by DoD

(Application for copies should be addressed to American Society for Testing and Materials, 191B Race Street, Philadelphia, PA 19103)

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

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated detail specifications, specification sheets, or MS standards), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained

3. REQUIREMENTS

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

3.2 Qualification. Fiber optic interconnection boxes 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 set of award of contract (see 4.4 and 6.4).

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 nonmagnetic and shall not interfere or degrade the performance of the components within under all operational and environmental conditions They shall be of the lightest mass

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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 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 Dissimilar metals in contact with each other shall be in accordance with MIL-STD-454, requirement 16

3 3 2 3 Finish

3 3 2 3 1 Interior and exterior surfaces The interconnection box interior and exterior surfaces shall be painted in accordance with MIL-E-16400 or coated with epoxy powder in accordance with MIL-C-24712

3 3 2 3 2 Box accessories Box accessories shall be as specified in the individual specification sheet (see 3 1)

3 3.2 4 Welding, structural Welding, brazing, and similar processes used in the manufacture of enclosures shall be performed so as to withstand all required tests

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 3 4 Nonmagnetic materials Unless otherwise specified (see 3 1), all parts shall be of nonferrous material or a material generally considered nonmagnetic The magnetic permeability shall be 2 0 or less after fabrication (see 4 6 9)

3 4 Design, construction, and physical dimensions The design, construction, and physical dimensions of the interconnection box shall be as specified herein and as specified in the specification sheets (see 3 1)

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 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 box 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 Interconnection boxes that weigh more than 68 kilograms shall be provided with lifting eyelets

3 4.2.1 Degree of enclosure. Interconnection boxes shall be submersible unless otherwise specified (see 3.5 3 5)

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3 4 3 Interconnection box mounting Interconnection boxes shall have mounting points on the rear surfaces of the enclosure A minimum of two points shall be above the center of gravity and additional points positioned to transmit loads to the supporting structure Additional mounting requirements shall be as specified in the specification sheet (see 3 1)

3 4 4 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 5 Interconnect organization Interconnection boxes shall have provisions for organizing 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 serviceable positions without damage to any component, and their operational position shall minimize microbends or macrobends in any cable, optical fiber cable component (OFCC), or fiber Unless otherwise specified, all buffered fibers, OFCC's, or fiber ribbons located between the input cables and the fiber organizers shall be routed along the sides 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 5 1 Fiber optic splices The type and maximum number of fiber optic splices to be used within the interconnection box shall be as specified in the specification sheet (see 3 1)

3 4 5 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 5.3 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 optic splice The design shall allow the physical rearrangement of splices The number and arrangement of splices shall be as specified in the specification sheet (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 5 4 Optical patch panels Optical patch panels (see 6 6 5) shall be used for mounting fiber optic connectors and adapters 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 5.5 Fiber bend radii Unless otherwise specified, fiber layout plans and fiber organizers shall limit the fiber bend radius, including buffered fibers, OFCC's, and fiber ribbons to a minimum of 25.4 mm

3.4.6 Fiber, splice, and connector identification. The interconnection box shall have splice or connector chart holders for holding splice or connector identification charts as specified in 3 4.6.1 and 3.4.6.2 All identification markings shall be permanent, clearly visible, and legible in accordance with the general marking requirements of MIL-STD-1285.

3.4 6.1 Fibers and splices A chart holder shall be provided on the inside of the cover as specified in the specification sheet (see 3 1)

3.4.6.2 Connectors. Connectors shall be identified by numbers corresponding to each connector. The numbers shall be silk-screened onto the optical patch panel and shall not be less than 3 mm in height A connector chart holder shall be provided on the inside of the cover, as specified in the specification sheet (see 3.1), and shall identify the organization of the optical patch panel.

3.4.7 Accessibility. Regardless of the method used for mounting of an interconnection box (see 3.4.3), access to all parts of the interconnection box for fiber interconnection, splicing, maintenance, mounting, and cable additions 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 and panels shall be designed to remain in an open position This position should not restrict access to the box.

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3 4.8 Mass (see 4.6.3 1) The total weight of an interconnection box shall be as specified in the specification sheets (see 3.1)

3.4.9 Size (see 4 6 3.2) - 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 10 Maintenance Interconnection boxes shall require no preventive maintenance

3 4 11 Stress relief Metals used in the manufacture and assembly shall be treated or heat treated to prevent deterioration or failure due to stresses or other conditions resulting from working, forming, welding, and similar processes during the fabrication of these enclosures The words "stress reliefed" shall be stamped on the outside bottom of each complete unit in 0 25 inch high letters

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 Change in optical transmittance (see 4 6 4 1) 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 5 1) The cable feed-throughs shall remain in place in all times The interconnection box shall meet the requirements of 3.5 1 1 and show no damage

3 5.2.2 Cable seal flexing (see 4 6.5 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 5 3) The interconnection box shall reveal no loss of environmental sealing, splitting, or show visible damage, or rotation of cable jacket on the inside of the box

3 5.2 4 Compression resistance (see 4 6 5 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

3 5 2.5 Impact resistance (see 4 6 5 5) The interconnection box shall have no physical damage

3 5 3 Environmental properties The interconnection box shall meet the requirements specified herein during the specified operating environments and after the specified storage environments. 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 range

Operating (°C)	Storage (°C)
-54 to +65	-62 to +85
-55 to +125	-65 to +200

3.5.3.1 Temperature life (see 4 6 6 1) The interconnection box shall show no opening of seals, cracking, physical deformation, or damage

3.5.3.2 Thermal shock (see 4 6.6.2). The interconnection box shall show no opening of seals, cracking, deformation, or physical damage All doors or hinged areas shall operate afterwards All sliding surfaces such as slide trays shall continue to operate

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3.5.3.2 Thermal shock (see 4.6 6.2) The interconnection box shall show no opening of seals, cracking, deformation, or physical damage All doors or hinged areas shall operate afterwards. All sliding surfaces such as slide trays shall continue to operate

3 5.3.3 Temperature/humidity cycling (see 4 6 6 3) The interconnection box shall show no signs of corrosion products, entrapment of moisture, separation of bonded surfaces, deformation, or physical damage

3 5 3 4 Salt spray (corrosion) (see 4.6 6 4) The interconnection box shall show no evidence of salt penetration into the interconnection box or corrosive effects, unless otherwise specified

3 5.3 5 Water pressure (see 4 6 6 5) The interconnection box examination shall reveal no penetration of water unless otherwise specified

3.5 3 6 Fluid immersion (see 4 6 6 6) The interconnection box shall reveal no cracks, splits, voids, excessive swelling or softening of material, loss of legibility of identification marking, peeling, or deformation, unless otherwise specified

3.5.3 7 Vibration (see 4.6.6.7). 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 1.1

3.5.3.7.1 Structural integrity The completely assembled interconnection box shall not have a resonance frequency less than 50 Hz

3 5.3 8 Shock (see 4 6 6 8) 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 3.9 Flame spread (see 4.6 6 9) In accordance with the requirements of UL-1479, the cable feed-through shall have an F rating not less than 3 hours

3.5.3.10 Operating temperature. When tested in accordance with 4 6 6 10, a post-test visual inspection of the interconnection box shall reveal no defects or damage The body of the interconnection box shall not show evidence of temperature susceptibility in regards to this test. The interconnection box shall survive and show no signs of leakage or waterproof degradation, swelling, stretching or shrinking, or surface identification marking impairment The change in optical transmittance shall not exceed the allowable limits as specified during this exposure (see 3 5 1 1)

3.5.4 Chemical properties

3 5.4.1 Fungus resistance (see 4 6 7 1) Nonmetallic interconnection boxes and accessories shall be in accordance with MIL-STD-454, requirement 4, for fungus inert materials Interconnection boxes and accessories that are not in accordance with requirement 4 of MIL-STD-454 shall meet grade I classification of MIL-STD-810, method 508

3.5.4.2 Flammability (see 4 6.7.2) The materials used in the construction of the interconnection box and accessories material shall meet the rating criteria of materials classification 94V-1 of UL-94

3.6 Identification markings. Identification marking 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.

3.6.1 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 PIN, CAGE code, manufacturer's name, and date of manufacture

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3.6.2 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
AND AVOID DIRECT EXPOSURE TO THE BEAM

A visible label shall be affixed to the inside of the interconnection box and shall contain the following

DANGER
INVISIBLE LASER RADIATION
AVOID DIRECT EXPOSURE TO THE BEAM

3 7 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 section 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. Qualification 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 the applicable portions of the EIA-455

4.4 Qualification inspection Qualification inspection shall be performed at a laboratory acceptable to the qualifying activity, on sample units produced with equipment and procedures normally used in production

4.4.1 Sample. One interconnection box sample shall be submitted for each interconnection box construction for which qualification approval is desired

4.4 2 Inspection routine. The sample shall be subjected to the inspections specified in table II in the order shown. The sample unit shall be subjected to the inspections of group I The sample unit shall then be subjected to the group II and group III tests specified on the individual specification sheets 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

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4 4 3 Failures Any failures shall be sufficient cause for refusal to grant qualification approval

4.4 4 Retention of qualification To retain qualification, the contractor shall forward a report at least every 12 months to the qualifying activity The qualifying activity shall establish the initial reporting date. The report shall consist of

a A summary of the results of the tests performed for inspection of product for delivery (groups A and B) indicating as a minimum, the number of lots that have passed and the number that have failed and the group that has failed The results of tests of all reworked lots shall be identified and accounted for

b A summary of the results of the tests performed for periodic inspection (group C) shall be forwarded at least every 36 months, including the number and mode of failures The summary shall include results of all periodic inspection tests performed and completed during the 36 month period If the summary of the test results indicates nonconformance with specification requirements, the 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

Failure to submit the report within 30 days after the end of each 12 month reporting period may result in loss of qualification for the product In addition to the periodic submission of inspection data, the contractor shall immediately notify the qualifying activity at any time during this reporting period that the inspection data indicates failure of the qualified product to meet the requirements of this specification

In the event that no production occurred during the reporting period, a report shall be submitted certifying that the company still has the capabilities and facilities necessary to produce the item If during two consecutive reporting periods that has been no production, the manufacturer may be required, at the discretion of the qualifying activity, to submit the product (a representative product of each series, type, and class) to testing in accordance with the qualification inspection requirements and the reason for no production

4.4.5 Qualification by similarity Junction boxes of similar design may be granted qualification approval by the qualifying activity based on testing of one particular box design as specified in the applicable specification sheet (see 3 1)

4 5 Quality conformance inspection

4 5 1 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 2 Inspection of product for delivery Inspection of product for delivery shall consist of groups A and B inspections

4.5.3 Inspection lot. The inspection lot shall consist of the number of units of product, offered for inspection at one time, and all are of the same design as covered by one specification sheet (see 3.1) All of the units of product in the inspection lot submitted shall have been produced during the same production period with the same materials and processes

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TABLE II. Qualification inspection.

Inspection	Requirement paragraph	Test method paragraph	Sample size
Group I			
Visual and mechanical	3 4, 3 7	4 6 1	1
Structural integrity	3 5 3 7 1	4 6 1	1/
Mass	3 4 8	4 6 3 1	1/
Size	3 4 9	4 6.3 2	1/
Identification markings	3 6	3 4, 3 7	1/
Group II			
Temperature life	3 5 3 1	4 6 6 1	1
Thermal shock	3 5.3 2	4.6 6 2	2/
Operating temperature	3.5.3.10	4 6.6 10	2/
Temperature/ humidity cycling	3 5 3 3	4 6 6 3	2/
Salt spray	3 5.3 4	4 6 6 4	2/
Fluid immersion	3.5.3.6	4 6.6 6	2/
Shock	3.5.3.8	4.6.6.8	2/
Vibration	3.5.3.7	4.6.6.7	2/
Water pressure	3 5.3 5	4 6.6.5	2/
Fungus resistance	3.5.4 1	4.6.7.1	3/

See footnotes at end of table

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TABLE II Qualification inspection - Continued

Inspection	Requirement paragraph	Test method paragraph	Sample size
Group III			
Cable retention	3 5 2 1	4 6 5 1	1
Cable seal flexing	3 5 2.2	4 6 5 2	4/
Cable twist	3 5 2 3	4 6 5 3	4/
Compression resistance	3 5.2 4	4 6.5 4	4/
Impact resistance	3 5 2 5	4.6 5 5	4/
Flammability	3 5 4 2	4 6 7 2	4/
Flame spread	3 5 3 9	4.6 6 9	4/

1/ The same sample shall be used as in the visual and mechanical inspection
2/ The same sample shall be used in the temperature life inspection
3/ Interconnection box material samples may be used for this test
4/ The sample shall consist of a box penetrator mounted in a half inch steel bulkhead

4.5 3.1 Group A inspection Group A inspection shall follow the order shown in table III

TABLE III. Group A inspection

Inspection	Requirement paragraph	Test method paragraph
Visual and mechanical	3.4, 3.7	4.6.1
Mass	3 4.8	4.6.3 1
Size	3 4 9	4 6.3 2
Identification markings	3.6	3 4, 3 7

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4 5 3.1 1 Sampling plan. Tests shall be performed on 100 percent of the product supplied under this specification There shall be no failures

4 5 3 1 2 Rejected lots If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units (if possible), and resubmit them for inspection Resubmitted lots shall be inspected using tighter inspection Such lots shall be separate from new lots, and shall be clearly identified as reinspected lots

4 5 3 1 3 Disposition of sample units Samples that have failed group A inspection shall not be delivered on contract or purchase order or submitted for group B testing

4 5 3 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

TABLE IV Group B inspection

Inspection	Requirement paragraph	Test method paragraph
Group III		
Water pressure	3 5.3.5	4 6.6 5

4 5.3 2 1 Sampling plan Tests shall be performed on all the samples that have passed group A inspections There shall be no failures

4 5.3.2 2 Rejected lots If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units (if possible), and resubmit them for inspection Resubmitted lots shall be inspected using tighter inspection Such lots shall be separate from new lots, and shall be clearly identified as reinspected lots

4 5.3 2 3 Disposition of sample units Sample units that have failed group B inspections shall not be delivered on the contract

4 5 4 Group C inspection Group C inspection 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 resubjected to group A inspection

4 5.4 1 Sampling plan Every 36 months, three sample units which have passed group B inspection shall be selected

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

4 5.4.3 Disposition of group C inspections and sample units. Sample units that have failed group C inspection shall not be delivered on contract or purchase order.

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TABLE V. Group C inspection

Inspection	Requirement paragraph	Test method paragraph
Cable twist	3 5 2 3	4 6 5 3
Compression resistance	3 5 2 4	4 6 5 4
Impact resistance	3 5 2 5	4 6 5 5
Temperature life	3 5 3 1	4 6 6 1
Thermal shock	3 5 3 2	4 6 6 2
Operating temperature	3 5 3 10	4 6 6 10
Temperature/ humidity cycling	3 5 3 3	4 6 6 3
Salt spray	3 5 3 4	4 6 6 4
Fluid immersion	3 5 3 6	4 6 6 6
Shock	3 5 3 8	4 6 6 8
Vibration	3 5 3 7	4 6 6 7
Flammability	3.5 4 2	4.6.7 2
Flame spread	3.5.3 9	4.6.6.9

4.5.4 4 Noncompliance If a sample fails to pass group C inspection, the contractor shall notify the qualifying activity of the failure and take corrective action on the materials and processes, or both, as warranted, and on all units of product which can be corrected and which were manufactured under essentially the same conditions, with essentially the same materials, processes, and so forth, and which are considered subject to the same failure Acceptance of the product shall be discontinued until corrective action, acceptable to the qualifying activity has been taken. After the corrective action has been taken, group C inspection shall be repeated on additional sample units (all inspection tests or the inspection test which the original sample failed, at the option of the qualifying activity). Groups A and B inspections may be reinstituted, however, final acceptance shall be withheld until the group C reinspection has shown that the corrective action was successful In the event of failure after reinspection, information concerning the failure and corrective action taken shall be furnished to the cognizant inspection activity and the qualifying activity.

4.5 5 Inspection of packaging The sampling and inspection of the preservation, packaging, and container marking shall be in accordance with the requirements of MIL-E-17555

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4.6 Methods of inspection

4 6.1 Visual and mechanical inspection 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 2 Equivalent test methods The use of equivalent test methods is allowed subject to the following conditions

a The allowance of an equivalent method is specified in this specification

b The manufacturer has conducted both test methods during qualification testing and has submitted complete test data to the preparing activity

c The preparing activity has approved the use of that method by that manufacturer

4.6.3 Design and construction inspection

4 6 3 1 Mass (see 3 4 8) Interconnection boxes shall be weighed using scales with a minimum accuracy of 5 percent

4 6 3 2 Size (see 3 4 9) Interconnection boxes shall be measured, using instruments with accuracies appropriate to the tolerances defined in the specification for the unit

4 6 4 Optical properties inspection

4 6 4 1 Change in optical transmittance (see 3 5 1 1) 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 2)

4 6.5 Mechanical properties inspection

4 6.5.1 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 4 1) At the completion of the test, the interconnection box shall be visually examined in accordance with 4 6 1

4 6 5 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 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.

4.6.5.3 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 At the completion of the test, the interconnection box shall be visually examined in accordance with 4 6.1

4.6.5 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.

4 6.5.5 Impact (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

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4 6 6 Environmental properties inspection

4.6 6.1 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°C At the completion of the test, the interconnection box shall be visually examined in accordance with 4 6 1

4 6 6 2 Thermal shock (see 3 5.3.2) The interconnection box shall be tested for 5 cycles in accordance with MIL-STD-1344, method 1003 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 and dimensionally measured in accordance with 4.6 3 2 Any changes shall be recorded All moveable components shall be operated after the test Failure to operate shall be recorded

4.6.6 3 Temperature/humidity cycling (see 3 5.3.3). The interconnection box shall be fully assembled and tested in accordance with MIL-STD-1678, method 4030. The temperature range shall be the specified operating range, and the relative humidity shall be 95 percent At the completion of the test, the interconnection box shall be visually examined in accordance with 4 6 1

4 6 6 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

4 6 6.5 Water pressure (see 3.5 3 5) Interconnection boxes shall be tested in accordance with MIL-STD-108 for submersible or watertight enclosures as specified in the applicable specification sheets At the completion of the test, the interconnection box shall be visually examined in accordance with 4 6 1

4 6 6 6 Fluid immersion (see 3 5.3 6) The interconnection box shall be immersed in each of the fluids in table VI at the temperature specified for 24 hours Sample preconditioning shall be under ambient conditions One immersion cycle shall be performed 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

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/	ASTM D 1141	20 - 25
Seawater	---	20 - 25

1/ Monsanto's coolant 25 or equivalent.

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4 6.6.7 Vibration (see 3 5.3.7) 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 4 1) At the completion of the test, the interconnection box shall be visually examined in accordance with 4 6 1

4 6 6 8 Shock (see 3 5 3 8) 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 sheet (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 4 1) At the completion of the test, the interconnection box shall be visually examined in accordance with 4 6 1

4 6 6 9 Flame spread (see 3 5 3 9) The cable feed-throughs shall be tested in accordance with UL-1479

4 6 6 10 Operating temperature The operating temperature test shall be measured in accordance with method 4010 of MIL-STD-1678 over the operating temperature extremes The duration of the exposure at each temperature shall be 24 hours. The change in optical transmittance shall be measured during and after the test (see 3 5 1 1 and 3 5.3.10)

4 6 7 Chemical properties inspection

4 6 7 1 Fungus resistance (see 3 5 4 1) Interconnection boxes and accessory materials 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 7.2 Flammability (see 3 5 4 2) A finished interconnection box shall be tested in accordance with UL-94

4 6 8 Magnetic permeability The relative permeability, when checked with a low-mu indicator conforming to MIL-I-17214, shall not exceed the permeability limit specified (see 3 3 4)

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 2)

5 1 Preparation for delivery Preparation for delivery 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 be capable of protecting 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

5 3 Marking of packages Each shipping container shall be readily identifiable by the interconnection box identification number, the name of the 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)

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c Applicable specification sheet number, title, and date

d Applicable PIN (see 1.2)

e Quantity of interconnection boxes required

f Level of packaging required (see 5 1)

g Equivalent test methods, if other than as specified (see 4 6 2)

6 3 Data requirements

6 4 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 Number 24728) 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 56ZC, DOD Standardization Program and Documents Division, Washington, DC 20362, however, information pertaining to qualification of products may be obtained from Defense Electronics Supply Center, DESC-EQP, Dayton, OH 45444

6 5 Quality conformance Quality conformance inspections require contractual definition of the overall test program, including sample sizes and lot sizes, if appropriate (see 4 6)

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 (see 3 4 4) 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 (see 3 4 5) 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 (see 3 4 5 3) A fiber organizer is a container that stores all excess fibers in an orderly manner

6 6 5 Patch panel (see 3 4 5 4) 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 MSDS's. Additional required Government information is contained in FED-STD-313 In order to obtain the MSDS, FAR clause 52.223-3 must be in the contract.

6 9 Subject term (key word) listings

Cable assembly
Cable feed-throughs
Change in optical transmittance
Enclosure
Patch panel

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CONCLUDING MATERIAL

Custodians
Army - CR
Navy - SH
Air Force - 85

Review activities
Army - MI
Navy - EC, YD, AS
Air Force - 11, 17, 19, 80, 99
DLA - ES

User activities
Army - AR
Navy - CG, MC

Preparing activity
Navy - SH

Agent
DLA - ES

(Project 6099-0001)

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INSTRUCTIONS

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I RECOMMEND A CHANGE:	1 DOCUMENT NUMBER MIL-I-24728A	2 DOCUMENT DATE (YYMMDD) 23 July 1992

3. DOCUMENT TITLE
INTERCONNECTION BOX, FIBER OPTIC, METRIC, GENERAL SPECIFICATION FOR

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

5. REASON FOR RECOMMENDATION

6. SUBMITTER

a. NAME (Last, First, Middle Initial)	b. ORGANIZATION
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) (1) Commercial (2) DSN	e. DATE SUBMITTED YYYYMMDD

8. PREPARING ACTIVITY

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TECHNICAL POINT OF CONTACT: Karen Long, SEA 06KR222	703-602-8178	332-8178
c ADDRESS (Include Zip Code) NAVAL SEA SYSTEMS COMMAND ATTN: 55Z3 WASHINGTON, D.C. 20360-5101	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT. Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340	

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