

DETAIL 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 fiber optic interconnection boxes (see 6.5.3). 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 fiber optic interconnection box is not designed to be used as a penetrating box between spaces. 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 consists of the letter “M” followed by the basic specification sheet number, and a sequentially assigned dash number (see 3.1).

<u>M</u>	<u>24728</u>	<u>/X</u>	-	<u>X</u>
Prefix for Military Specification	Specification Number	Spec Sheet No. (if applicable)		Dash number from specification sheet (see 3.1)

Example: M24728/1-001

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3 and 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

FEDERAL STANDARDS

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

Comments, suggestions, or questions on this document should be addressed to Commander, Naval Sea Systems Command, ATTN: SEA 05S, 1333 Isaac Hull Avenue, SE, Stop 5160, Washington Navy Yard DC 20376-5160 or emailed to CommandStandards@navy.mil, with the subject line “Document Comment”. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.dla.mil>.

DEPARTMENT OF DEFENSE SPECIFICATIONS

- MIL-DTL-901 - Shock Tests, H.I. (High Impact) Shipboard Machinery, Equipment, and Systems, Requirements for
- MIL-DTL-15024 - Plate, Tags, and Bands for Identification of Equipment, General Specification for
- MIL-P-15024/5 - Plate, Identification
- MIL-E-24142 - Enclosure for Electrical Fittings and Fixtures, General Specification for
- MIL-PRF-24712 - Coatings, Powdered, Thermosetting
- MIL-DTL-5541 - Chemical Conversion Coatings on Aluminum and Aluminum Alloys

(See ASSIST database for list of specification sheets.)

DEPARTMENT OF DEFENSE STANDARDS

- MIL-STD-167-1 - Mechanical Vibrations Of Shipboard Equipment (Type I – Environmental and Type II – Internally Excited)
- MIL-STD-276 - Impregnation of Porous Metal Castings and Powdered Metal Components
- MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests
- MIL-STD-889 - Dissimilar Metals
- MIL-STD-1285 - Marking of Electrical and Electronic Parts
- MIL-STD-1472 - Human Engineering
- MIL-STD-1678-2 - Fiber Optic Cabling Systems Requirements and Measurements (Part 2: Optical Measurements) (Part 2 of 6 Parts)
- MIL-STD-1678-3 - Fiber Optic Cabling Systems Requirements and Measurements, Physical, Mechanical, Environmental, and Material Measurements (Part 3 of 6 Parts)

DEPARTMENT OF DEFENSE HANDBOOKS

- MIL-HDBK-454 - General Guidelines for Electronic Equipment

(Copies of these documents are available online at <http://quicksearch.dla.mil/>.)

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

NAVAL SEA SYSTEMS COMMAND (NAVSEA) PUBLICATIONS

- T9070-AL-DPC-020/077-2 - NAVSEA Hazardous Material Avoidance Process

(Copies of this document are available online via Technical Data Management Information System (TDMIS) at <https://mercury.tdmis.navy.mil/> by searching for the document number without the suffix. Refer questions, inquiries, or problems to: DSN 296-0669, Commercial (805) 228-0669. This document is available for ordering (hard copy) via the Naval Logistics Library at <https://nll.ahf.nmci.navy.mil>. For questions regarding the NLL, contact the NLL Customer Service at nllhelpdesk@navy.mil, (866) 817-3130, or (215) 697-2626/DSN 442-2626.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

ASTM INTERNATIONAL

ASTM A342/A342M - Standard Test Methods for Permeability of Weakly Magnetic Materials

(Copies of this document are available online at <http://www.astm.org>.)

ELECTRONIC COMPONENTS INDUSTRY ASSOCIATION (ECIA)

EIA-364-32 - Thermal Shock (Temperature Cycling) Test Procedure for Electrical Connectors and Sockets

EIA-364-41 - Cable Flexing Test Procedure for Electrical Connectors

(Copies of these documents are available online at <http://www.ecianow.org>.)

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-455-4 - FOTP-4 Fiber Optic Component Temperature Life Test

TIA-455-13 - FOTP-13 Visual and Mechanical Inspection of Fiber Optic Components, Devices, and Assemblies

TIA-455-20 - FOTP-20 IEC 60793-1-46: Optical Fibers - Part 1 - 46: Measurement Methods and Test Procedures - Monitoring of Changes in Optical Transmittance

TIA-455-36 - FOTP-36 Twist Test for Fiber Optic Cable Connecting Devices

(Copies of these documents are available online at www.tiaonline.org.)

UNDERWRITERS LABORATORIES (UL)

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

UL-1479 - Standard for Fire Tests of Penetration Firestops

(Copies of these documents are available online at <http://www.ul.com>.)

2.4 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein (except for related specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

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

3.2 Qualification. Fiber optic interconnection boxes furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.3 and 6.3).

3.3 Materials. Materials shall be suitable for the purpose intended for not less than 20 years, and where required herein, shall be as specifically described.

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

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

3.3.2.1 Castings. When required, porous castings shall be impregnated in accordance with MIL-STD-276. Guideline 21 of MIL-HDBK-454 may be used as guidance. Zinc castings shall not be used.

3.3.2.2 Corrosion protection and corrosion-resisting treatments. Unless otherwise specified in the applicable 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. Metals shall be corrosion-resistant, or should be coated or metallurgically processed to resist corrosion. Materials and processes for metallic parts shall be in accordance with applicable requirements in MIL-STD-889. Dissimilar metals in contact with each other shall be in accordance with MIL-STD-889.

3.3.2.3 Finish.

3.3.2.3.1 Interior and exterior surfaces. The interconnection box interior and exterior surfaces shall be class 1A conversion-coated in accordance with MIL-DTL-5541 before being epoxy powder coated in accordance with MIL-PRF-24712.

3.3.2.3.2 Box accessories. Box accessories shall be as specified in the applicable 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 Nonmagnetic materials. Unless otherwise specified in the applicable specification sheet (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 4.6.8).

3.3.4 Toxic and hazardous products and formulations. Materials used in the interconnection box shall not give off toxic or explosive fumes when exposed to flame. Materials used shall have no adverse effect on the health of personnel when used for their intended purpose. All specified materials are subject to a toxicological data and formulation review and inspection, for safety of the material, by the Government (see 4.2).

3.3.4.1 Toxicity. When evaluated in accordance with 4.2.1, the materials used in the interconnection box shall pose no serious or high risk to the health of personnel or the environment when used for their intended purpose (see 4.5 and 6.4).

3.3.4.2 Prohibited materials. The materials used in the interconnection shall not contain any chemicals categorized as "prohibited" in accordance with T9070-AL-DPC-020/077-2.

3.4 Design, construction, and physical dimensions. The design, construction, and physical dimensions of the interconnection box shall be as specified herein and in the applicable specification sheets (see 3.1).

3.4.1 General. Interconnection boxes may include cast or fabricated construction as specified in MIL-HDBK-454. 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, nor during the installation of additional components. Covers of interconnection boxes may be either hinged or removable as specified in the applicable 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. Unless otherwise specified (see 3.5.3.5), interconnection boxes shall be submersible.

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 applicable specification sheet (see 3.1).

3.4.4 Cable interconnection interface. Fiber optic cables shall enter the interconnection boxes via cable feed-throughs (see 6.5.2). Cable feed-throughs shall not degrade the optical performance of fiber optic cables and shall be located as specified in the applicable 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 applicable specification sheet (see 3.1), such that fiber splice organizers, optical patch panels (see 6.5.5), 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 in the applicable specification sheet (see 3.1), all buffered fibers, OFCCs, or fiber ribbons located between the input cables and the fiber organizers (see 6.5.4) 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 applicable specification sheet (see 3.1), fiber optic interconnection boxes shall provide interconnection 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 applicable 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 applicable specification sheet (see 3.1).

3.4.5.3 Fiber and splice organizers. 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 applicable specification sheet (see 3.1). Fiber and splice organizers shall be designed in removable units to provide additional storage capacity for fibers and splices, as specified in the applicable specification sheets (see 3.1).

3.4.5.4 Optical patch panels. Optical patch panels 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 in the applicable specification sheet (see 3.1), fiber layout plans and fiber organizers shall ensure the fiber bend radius, including buffered fibers, OFCCs, and fiber ribbons, is a minimum of 25.4 millimeters.

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 applicable 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 be not less than 3 millimeters in height. A connector chart holder shall be provided on the inside of the cover as specified in the applicable 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 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.

3.4.8 Mass (see 4.6.3.1). The total weight of an interconnection box shall be as specified in the applicable 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 applicable specification sheet (see 3.1).

3.4.10 Maintenance. Interconnection boxes shall require no preventive maintenance.

3.4.11 Stress relief. Metals used in 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 relieved” shall be stamped on the outside bottom of each complete unit in 6.35-millimeter 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 qualified 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 applicable component specification.

3.5.1.2 Discontinuity (see 4.6.4.2). When measured, the change in optical transmittance of the qualified splice or connector installed in the fiber optic interconnection box in a standard manner shall meet the requirements contained in the applicable 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 at 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 shall they 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 splitting or loss of environmental sealing, nor shall it 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 applicable 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, physical deformation, or damage. All doors or hinged areas shall operate after testing. 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). Unless otherwise specified in the applicable specification sheet (see 3.1), the interconnection box shall show no evidence of salt penetration or corrosive effects.

3.5.3.5 Water pressure (see 4.6.6.5). Unless otherwise specified in the applicable specification sheet (see 3.1), the interconnection box examination shall reveal no penetration of water.

3.5.3.6 Fluid immersion (see 4.6.6.6). Unless otherwise specified in the applicable specification sheet (see 3.1), the interconnection box gasket shall reveal no cracks, splits, voids, excessive swelling or softening of material, peeling, or change characteristics in a manner that results in a loss of seal integrity.

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 and 3.5.1.2.

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

3.5.3.8 Shock (see 4.6.6.8). The interconnection box shall show no evidence of broken or displaced parts, cracks, or physical damage that would impair the intended operation of the box. Minor physical damage such as small cracks, minor yielding of structure, out-of-tolerance clearances, and similar damage shall not be cause for failure, unless such damage causes unacceptable impairment of the interconnection box performance (i.e., minor physical damage that limits ability to operate mechanical items or install and remove panels). The interconnection box shall meet the requirements of 3.5.1.1 and 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-throughs shall have an F rating not less than 1 hour.

3.5.3.10 Operating temperature (see 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 show no evidence of temperature susceptibility in regard 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 not listed as fungus inert in MIL-HDBK-454, Guideline 4 shall meet grade assignment ratings 0 or 1 as specified in MIL-STD-1678-3, Measurement 3401.

3.5.4.2 Flammability (see 4.6.7.2). The materials used in the construction of the interconnection box and accessories shall meet the rating criteria of materials classification V-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. 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-DTL-15024 and MIL-P-15024/5. Marking information shall include the PIN, Commercial and Government Entity (CAGE) code, manufacturer's name, and date of manufacture.

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 interconnected box and shall contain the following:

WARNING
UNTERMINATED OPTICAL CONNECTION 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. VERIFICATION

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

- a. Qualification inspection (see 4.4).
- b. Conformance inspection (see 4.5).

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

4.2.1 Toxicity and prohibited materials. When specified (see 3.1), a Health Hazard Assessment (HHA) will be conducted to ensure conformance to 3.3.4.1 and 3.3.4.2, as specified (see 6.2). The Navy and Marine Corps Public Health Center (NMCPHC) will evaluate the materials of the interconnection box using data provided by the manufacturer/distributor to the NMCPHC (see 3.3.4.1 and 6.4).

4.3 Inspection conditions. Unless otherwise specified (see 3.1), all inspections shall be performed in accordance with the test conditions specified herein.

4.4 Qualification inspection. Qualification inspection shall consist of performing the inspections and tests identified in [table II](#) on qualification samples specified in 4.4.1.

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	4.6.1	^{1/}
Group II			
Temperature life	3.5.3.1	4.6.1	^{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	^{3/}
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/}
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/}
NOTES: ^{1/} The same sample shall be used 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.			

4.4.1 Sample. One sample shall be submitted for each construction for which qualification approval is requested.

4.4.2 Inspection routine. The sample shall be subjected to the inspections specified in [table II](#) in the order shown. Any interconnection box failing any inspection shall constitute failure.

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 manufacturer shall verify in coordination with the qualifying activity the capability of manufacturing products which meet the performance requirements of this specification. Refer to the qualifying activity for the guidelines necessary to retain qualification to this particular specification. The manufacturer shall immediately notify the qualifying activity at any time that the inspection data indicates failure of the qualified product to meet the performance requirements of this specification.

4.4.4.1 Retention of qualification for group A inspections. At intervals of not more than 12 months after initial qualification, group A inspections for retention of qualification shall be performed on interconnection boxes, and shall include the examinations and tests of [table III](#). Sampling for group A inspection shall be as specified in 4.5.3.1.1. Manufacturers shall certify that there have been no material changes since initial qualification.

4.4.4.2 Retention of qualification for group B inspections. At intervals of not more than 12 months after initial qualification, group B inspections for retention of qualification shall be performed on interconnection boxes, and shall include the examinations and tests of [table V](#). Sampling for group B inspection shall be as specified in 4.5.3.2.1. Manufacturers shall certify that there have been no material changes since initial qualification.

4.4.4.3 Retention of qualification for group C inspections. At intervals of not more than 36 months after initial qualification, group C inspections for retention of qualification shall be performed on interconnection boxes and shall include the examinations and tests of [table VI](#). Sampling for group C inspection shall be as specified in 4.5.4.1. Manufacturers shall certify that there have been no material changes since qualification was granted.

4.4.5 Qualification by similarity. Interconnection 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). Also, refer to Appendix A for additional qualification-by-similarity information.

4.5 Conformance inspection.

4.5.1 Conformance inspection. Conformance inspection shall consist of the inspections and tests specified for groups A ([table III](#)), B ([table V](#)), and C ([table VI](#)).

4.5.2 Inspection of product for delivery. Inspection of the product for delivery shall consist of group 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, all of the same design as covered by the applicable 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.

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	4.6.1

4.5.3.1.1 Sampling plan. Unless otherwise specified (see 4.5.3.1.1.1), tests shall be performed on 100 percent of the product supplied under this specification.

4.5.3.1.1.1 Alternative sampling plan for group A inspection. If allowed by the qualifying activity, random sampling may be performed in lieu of 100 percent of product supplied under this specification. The number of samples for random sampling inspected per lot size is specified in [table IV](#). This random sampling alternative shall require an acceptance criterion of a zero nonconformance, regardless of sample size. If any nonconformance is found, then 100 percent inspection (see 4.5.3.1.1) shall be used.

TABLE IV. Alternate sampling plan for group A inspection. ^{1/}

Lot size	Sample size
0 to 1	1
2 to 8	2
9 to 15	3
16 to 25	5
26 to 50	8
51 to 90	13
91 to 150	20
151 to 280	32
281 to 500	50
501 to 1,200	80
1,201 to 3,200	125
3,201 and over	200
NOTE: ^{1/} The random sampling alternative and inspection by attributes are applicable for the specified conformance inspections only (see table III). For qualification and for initial validation of the process, inspection should be performed on 100 percent of samples with data supplied.	

4.5.3.1.2 Failures. One or more failures shall constitute group A inspection failure of the sample unit.

4.5.3.1.3 Disposition of sample units. Samples that have failed group A inspection shall not be shipped or submitted for group B inspection.

4.5.3.2 Group B inspection. Group B inspection shall consist of the inspection specified in [table V](#). Group B inspection shall be made on units that have passed group A inspection.

TABLE V. 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 inspection. There shall be no failures.

4.5.3.2.2 Disposition of sample units. Sample units that have failed group B inspection shall not be or submitted for group C inspection.

4.5.4 Group C inspection. Group C inspection shall consist of the inspections in [table VI](#). Group C samples shall have satisfactorily completed all group A and B inspections. After completion of group C inspection, the samples shall be resubjected to group A inspection. Refer to Appendix A for additional information regarding group C inspection.

4.5.4.1 Sampling plan. 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 inspection and sample units. Sample units that have failed group C inspection shall not be shipped.

TABLE VI. 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. For information regarding failure of group C inspection, see 6.8.

4.6 Methods of inspection.

4.6.1 Visual and mechanical inspection. Unless otherwise specified in the applicable specification sheet (see 3.1), visual and mechanical examinations shall be performed in accordance with TIA-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 performed without magnification.

4.6.2 Equivalent test methods. The use of equivalent test methods is allowed, provided that the preparing activity and the qualifying activity have approved the use of that equivalent test method by that manufacturer (see 6.2 and 6.9).

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 applicable sheet (see 3.1).

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 TIA-455-20 or by an equivalent method (see 4.6.2).

4.6.4.2 Discontinuity (see 3.5.1.2). The discontinuity of a splice, connector, or coupler shall be tested in accordance with MIL-STD-1678-2, Measurement 2104 using test equipment having a time resolution sufficient to resolve discontinuities of duration not less than 50 microseconds (μ s).

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 less, 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 EIA-364-41, 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 TIA-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. 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.
- b. 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. Unless otherwise specified in the applicable specification sheet (see 3.1), the impact point shall have a minimum radius of curvature of 50 millimeters. At the completion of the test, the interconnection box shall be visually examined in accordance with 4.6.1.

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 TIA-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 five cycles in accordance with EIA-364-32. 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. 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-1678-3, Measurement 3302. 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. The subcycle shall be included in the test.

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). A completely assembled interconnection box shall be immersed in water for 24 hours. Unless otherwise specified in the applicable specification sheet (see 3.1), the applied pressure shall be 0.1 megapascals (equivalent to a depth of 10.4 meters). The interconnection box shall be maintained at a temperature between 10 and 35 °C for the duration of the test. At the completion of the test, the interconnection box gasket shall be visually examined in accordance with 4.6.1.

4.6.6.6 Fluid immersion (see 3.5.3.6). The interconnection box gasket shall be immersed in each of the fluids identified in accordance with MIL-STD-1678-3, Measurement 3409 using test temperature range 1. Sample preconditioning shall be under ambient conditions. One immersion cycle shall be performed. The interconnection box gasket shall be completely dried after each immersion. At the completion of the test, the interconnection box gasket shall be visually examined.

4.6.6.7 Vibration (see 3.5.3.7). The interconnection box shall be tested in accordance with the type I vibration test of MIL-STD-167-1. During the test, the interconnection box shall be solidly mounted and shall be energized. The 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 applicable specification sheets (see 3.1), the change in optical transmittance shall be monitored continuously during and after the test. The equipment shall have a time resolution sufficient to resolve discontinuities of at least 50 microseconds (μ s) or longer (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-DTL-901, grade A, type A, class I. The use of simulated loads is not acceptable. Unless otherwise specified in the applicable specification sheet (see 3.1), the change in optical transmittance shall be monitored continuously during and after the test. The equipment shall have a time resolution sufficient to resolve discontinuities of 50 μ s or longer (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 (see 3.5.3.10). The interconnection box shall be subjected to the specified operating temperature extremes as shown in [table VII](#). The change in optical transmittance (see 4.6.4.1) shall be determined during each step of constant temperature.

TABLE VII. Operating temperature schedule.

Step		Duration
1	Maintain +25 $\pm$ 2 °C	1 hour
2	Ramp to high operating temperature	2 hours (max.)
3	Maintain high operating temperature	24 hours
4	Ramp +25 $\pm$ 2 °C	2 hours
5	Maintain +25 $\pm$ 2 °C	1 hour
6	Ramp to low operating temperature	2 hours (max.)
7	Maintain low operating temperature	24 hours
8	Ramp +25 $\pm$ 2 °C	2 hours (max.)
9	Maintain +25 $\pm$ 2 °C	1 hour

4.6.7 Chemical properties inspection.

4.6.7.1 Fungus resistance (see 3.5.4.1). Nonmetallic interconnection boxes and accessories composed of materials not listed as fungus inert in MIL-HDBK-454, Guideline 4 shall be tested in accordance with of MIL-STD-1678-3, Measurement 3401.

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 ASTM A342/A342M, shall not exceed the permeability limit specified (see 3.3.3).

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the military service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

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

6.1 Intended use. The fiber optic interconnection boxes covered by this specification are for use in naval shipboard applications where their performance characteristics are required. Existing stock of fiber optic interconnection boxes manufactured to MIL-I-24728A w/AMENDMENT 1 dated 01 June 1995 is acceptable for use until depleted.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Applicable specification sheet number, title, and date.
- c. Applicable PIN (see 1.2).
- d. Quantity of interconnection boxes required.
- e. Requirements for an HHA (see 4.2.1).
- e. Equivalent test methods, if other than as specified (see 4.6.2).
- f. Packaging requirements (see 5.1).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Products List QPL No. 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 orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Commander, Naval Sea Systems Command, ATTN: SEA 05S, 1333 Isaac Hull Avenue, SE, Stop 5160, Washington Navy Yard DC 20376-5160 or emailed to CommandStandards@navy.mil; however, information pertaining to qualification of products may be obtained from the agent for the qualifying activity: DLA Land and Maritime, ATTN: VQP, P.O. Box 3990, Columbus, OH 43218-3990. An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at <https://assist.dla.mil>.

6.4 Toxicity evaluation. The NMCPHC requires sufficient information to permit an HHA of the product. Upon completion of the HHA, a copy will be provided by the NMCPHC to the Government for evaluation. The HHA process is described on the NMCPHC's website, <http://www.med.navy.mil/sites/nmcpHC/industrial-hygiene/Pages/health-hazard-assessment.aspx>.

6.5 Definitions.

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

6.5.2 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.

6.5.3 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.

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

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

6.6 Personal 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.

6.7 Safety data sheets. The contracting activity should be provided a safety data sheet (SDS) in accordance with the requirements of FED-STD-313. The SDS should be included with each shipment of the material covered by this specification. Contracting officers will identify those activities requiring copies of completed SDSs. Additional required Government information is contained in FED-STD-313. In order to obtain the SDS, FAR clause 52.223-3 must be in the contract.

6.8 Noncompliance. If a sample fails to pass group C inspection, the qualifying activity should be notified of the failure and corrective action should be taken 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 and processes, and which are considered subject to the same failure. Acceptance of the product should be discontinued until corrective action acceptable to the qualifying activity has been taken. After the corrective action has been taken, group C inspection should be repeated on additional sample units (including all inspection tests or the inspection test which the original sample failed, at the option of the qualifying activity). Group A and B inspections may be reinstituted; however, final acceptance should be withheld until the group C re-inspection has shown that the corrective action was successful. In the event of failure after re-inspection, information concerning the failure and corrective action taken should be furnished to the cognizant inspection activity and the qualifying activity.

6.9 Equivalent test methods. The use of equivalent test methods is allowed (see 4.6.2), provided that the manufacturer has conducted both test methods during qualification testing and has submitted complete test data to the preparing activity.

6.10 Subject term (key word) listing.

Cable assembly

Cable feed-throughs

Change in optical transmittance

Enclosure

Patch panel

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

QUALIFICATION RETENTION FOR ALTERNATE MATERIAL OR FABRICATION PROCESS

A.1 SCOPE

A.1.1 Scope. This appendix provides information for the qualification retention for alternate material or fabrication process. This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

A.2 QUALIFICATION BY SIMILARITY: ALTERNATE MATERIAL OR FABRICATION PROCESS

A.2.1 Alternate material or fabrication process. If an interconnection box or accessory is qualified, and that product with a change in materials or fabrication process passes the following tests, it shall be considered qualified with alternate material or fabrication process (see 4.4.5):

- a. Visual and mechanical
- b. Mass
- c. Size
- d. Identification markings
- e. Temperature life
- f. Thermal shock
- g. Operating temperature
- h. Temperature/humidity cycling
- i. Fluid immersion
- j. Vibration
- k. Shock
- l. Water pressure

A.2.2 Retention of qualification for group C inspections using alternate material or fabrication process. At intervals of not more than 36 months after initial qualification, group C inspections for retention of qualification shall be performed on interconnection boxes, and shall include the examinations and tests of [table A-I](#). Sampling for group C inspection shall be as specified in 4.5.4.1. Manufacturers shall certify that there have been no material changes since qualification was granted. If the test results indicate nonconformance with specification requirements, and 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.

MIL-DTL-24728B
APPENDIX A

TABLE A-I. Group C inspection based on qualification by similarity.

Inspection	Requirements paragraph	Test method paragraph	Specification sheet number										
			/1	/2	/3	/4	/5	/6		/8	/9	/10	/11
Temperature/ humidity cycling	3.5.3.3	4.6.6.3	X ^{1/}	X ^{1/}	X ^{1/}	X ^{1/}	X ^{1/}	X ^{1/}		X ^{2/}	X ^{1/}	X ^{1/}	X ^{1/}
Shock	3.5.3.8	4.6.6.8	X ^{3/}	X ^{3/}	X	X ^{3/}	X ^{3/}	X		X	X	X ^{4/}	X
NOTE: X = Test is applicable in group C for this interconnection box configuration. FOOTNOTES: ^{1/} Monitoring of optical performance is not required. The intent is to monitor/inspect for other types of interconnection box performance (see the applicable subparagraph of 3.5). ^{2/} Monitoring of optical performance is not required for the Tray Holder in this group C test. The intent is to monitor/inspect for other types of interconnection box performance (see applicable subparagraph of 3.5). Monitoring of optical performance is required for the Splice Tray in this group C test. ^{3/} Testing not required when the manufacturer is qualified for /3 and passes shock inspection. ^{4/} Testing not required when the manufacturer is qualified for /9 and passes shock inspection.													

CONCLUDING MATERIAL

Custodians:

Army – CR
Navy – SH
Air Force – 85

Preparing activity:

Navy – SH
(Project 6099-2017-001)

Review activities:

Army – AR, MI
Navy – AS, CG, MC, YD
Air Force – 19, 99
DLA – CC, GS
NASA – NA

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <https://assist.dla.mil>.