

METRIC

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SUPERSEDING

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**DEPARTMENT OF DEFENSE
STANDARD PRACTICE**

**FIBER OPTIC CABLE TOPOLOGY INSTALLATION
STANDARD METHODS FOR SURFACE SHIPS AND
SUBMARINES
(CABLE PENETRATIONS)**

(PART 3 OF 7 PARTS)



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FOREWORD

1. This standard is approved for use by the Naval Sea Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

2. This standard provides detailed information and guidance to personnel concerned with the installation of fiber optic cable topologies (optical fiber cabling and associated components) on naval surface ships and submarines. The methods specified herein are not identifiable to any specific ship class or type except as noted. They are intended to standardize and minimize variations in installation methods to enhance the compatibility of the installations on all naval ships.

3. In order to provide flexibility in the use and update of the installation methods, this standard is issued in eight parts; the base standard and seven numbered parts as follows:

Part 1: Cables

Part 2: Equipment

Part 3: Cable Penetrations

Part 4: Cableways

Part 5: Connectors and Interconnections

Part 6: Tests

Part 7: Pierside Connectivity Cable Assemblies and Interconnection Hardware

4. 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 (copy DLGR_NSWC_FO_ENG@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>.

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1. SCOPE

1.1 Scope. This standard provides requirements and detailed methods of optical fiber cable penetrations through ship structure and equipment via stuffing tubes, swage tubes, multiple cable penetrators (MCPs), chafing collars, and nipples on surface ships and submarines.

1.2 Applicability. The installation requirements and methods in this document are intended to be used by all installing activities. These methods establish standards for installations in all naval ships and are not identifiable to any specific ship class or type, except as noted. The methods in this document are for new construction as well as for conversions, alterations, and repairs.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this standard. This section does not include documents cited in other sections of this standard 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, 4, or 5 of this standard, 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.

COMMERCIAL ITEM DESCRIPTIONS

A-A-3042 - Socket, Open Detachable, Standard Wall, Octagon

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-I-3064	- Insulation, Electrical, Plastic-Sealer
MIL-PRF-15624	- Gasket Material, Rubber, 50 Durometer Hardness (Maximum)
MIL-DTL-16685	- Packing, Material and Packing Preformed (Stuffing Tube for Electrical Cables)
MIL-S-24235/1	- Stuffing Tubes, Metal, and Packing Assemblies for Electric Cables, Bulkhead, Pressureproof
MIL-S-24235/2	- Stuffing Tube, Packing Assemblies for Pressureproof Bulkhead
MIL-S-24235/9	- Stuffing Tubes, Metal, and Packing Assemblies for Electric Cables, Brass and Steel, for Decks and Bulkheads with Pipe Protection
MIL-S-24235/10	- Stuffing Tubes, Metal, and Packing Assemblies for Electric Cables, Steel, for Decks and Bulkheads without Pipe Protection
MIL-S-24235/17	- Stuffing Tubes, Metal, and Packing Assemblies for Electric Cables, Swage Type, Steel and Aluminum, for Deck and Bulkheads with Pipe Protection
MIL-S-24235/18	- Stuffing Tubes, Metal, and Packing Assemblies for Electric Cables, Swage Type, Reduced Diameter, Steel and Aluminum, for Deck and Bulkheads with Pipe Protection
MIL-DTL-24705	- Penetrators, Multiple Cable, for Electric Cables, General Specification for

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DEPARTMENT OF DEFENSE STANDARDS

- MIL-STD-1678-1 - Fiber Optic Cabling Systems Requirements and Measurements (Part 1: Design, Installation and Maintenance Requirements) (Part 1 of 6 Parts)
- MIL-STD-2003-3 - Electric Plant Installation Standard Methods for Surface Ships and Submarines (Penetrations)
- MIL-STD-2042-2 - Fiber Optic Cable Topology Installation, Standard Methods for Surface Ships and Submarines (Equipment) (Part 2 of 7 Parts)

(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-AN-DPC-010/100-1 - Reinforcement of Openings in Structure of Surface Ships Other than in Protective Plating
- T9070-AN-DPC-020/100-2 - Openings in Decks and Bulkheads for Stuffing Tubes and Pipe

(Copies of these documents 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. These documents are 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.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- ANSI Z136.2 - Safe Use of Optical Fiber Communication Systems Utilizing Laser Diode and LED Sources

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

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

- TIA-440 - Fiber Optic Terminology

(Copies of this document are available online at www.tiaonline.org.)

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, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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3. DEFINITIONS

3.1 General fiber optics terms. Definitions for general fiber optics terms used in this standard are in accordance with TIA-440.

3.2 Other fiber optics terms. Definitions for other terms as they are used in this standard are given in the general standard MIL-STD-2042.

3.3 Acronyms. The following acronyms are used in this standard:

- a. BOF: Blown Optical Fiber
- b. CPS: Collective Protection System
- c. LED: Light Emitting Diode
- d. MCP: Multiple Cable Penetrator
- e. OFCS: Optical Fiber Communication System

4. GENERAL REQUIREMENTS

4.1 Cable penetrations. Optical fiber cable penetrations of ship structure shall be made by metal stuffing tubes, swage tubes, MCPs, chafing collars, or nipples. Cable penetrations into equipment shall be made by nylon stuffing tubes or integral MCPs in accordance with MIL-STD-2042-2.

4.1.1 Cable penetration of ship structure. Cable penetration of ship structure shall be in accordance with T9070-AN-DPC-010/100-1, T9070-AN-DPC-020/100-2, the methods described herein, and as follows:

a. Metal stuffing tubes or MCPs shall be used for the penetration of the following structures, except that only metal stuffing tubes shall be used to penetrate bulkheads or decks that are exposed to the weather:

- (1) Collective protection system (CPS) boundaries.
- (2) Watertight cable trunks.
- (3) Watertight decks.
- (4) Watertight bulkheads.
- (5) Bulkheads designed to withstand a waterhead.
- (6) The portion of a bulkhead specified to be watertight to a certain height.
- (7) The portion of a bulkhead below the height of the sill or the coaming of a compartment access.
- (8) Bulkheads surrounding compartments subject to flooding by sprinkling systems.
- (9) Garbage disposal rooms.
- (10) Battery shops.
- (11) Medical operating rooms.
- (12) Medical wards.

b. Metal stuffing tubes only shall be used to penetrate decks and bulkheads forming the boundaries of spaces containing volatile, combustible, or explosive material.

c. Metal stuffing tubes, MCPs or nipples, and chafing collars packed with plastic sealer shall be used for the following penetrations. The method selected shall satisfy the tightness requirements of the structure.

- (1) Decks (non-watertight).
- (2) Structural bulkheads.
- (3) Airtight bulkheads.
- (4) Fumetight bulkheads.

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(5) Multiple cable (two or more) penetrations through nonstructural steel bulkheads (other than mesh or expanded metal), bents, web frames, transverse girders, and longitudinal girders.

Cable penetrations of vertical non-tight structures within a compartment need not be sealed. However, all chaffing collars of the structures selected for sealing shall be sealed.

d. Metal stuffing tubes in accordance with MIL-S-24235/1 shall be used to penetrate pressure-proof submarine bulkheads and surface ship sonar domes that are filled with water under normal operating conditions. One half of the tube may be used to penetrate surface ship sonar domes only.

e. The size of the stuffing tube groups shall be limited to permit tightening of gland nuts in the group using a stuffing tube wrench set in accordance with A-A-3042, Type II, Class 1, Style A, Form B, standard wall octagon, open detachable socket. Penetration spacing shall be as specified in T9070-AN-DPC-020/100-2.

4.1.2 Plastic sealer. Plastic sealer, Type HF in accordance with MIL-I-3064, shall be used to seal the space around the cables in collars or nipples used for passing cables through light-tight and fume-tight bulkheads.

4.1.3 Kickpipes. Kickpipes shall be made of a material to suit the structure being penetrated and shall be compatible with the stuffing tube material. Pipe ends shall be chamfered and inside wall burrs shall be removed to prevent chafing of the cable jacket. Swage tubes in accordance with MIL-S-24235/17 or MIL-S-24235/18 may be used as an alternative to stuffing tubes in accordance with MIL-S-24235/9.

4.1.4 Multiple cable penetrators (MCPs). MCPs shall be in accordance with MIL-DTL-24705.

4.1.5 Metal stuffing tubes. Metal stuffing tubes shall be in accordance with MIL-S-24235/1, MIL-S-24235/2, MIL-S-24235/9, or MIL-S-24235/10.

4.1.5.1 Stuffing tube packing. Packing for stuffing tubes that penetrate submarine pressure proof and surface ship ballistic bulkheads, and sonar domes filled with water under normal operating conditions shall be in accordance with MIL-S-24235/1. For all other metal stuffing tubes, packing shall be in accordance with either the preformed coil, MIL-DTL-16685, Class 2, or the bulk, MIL-DTL-16685, Class 1. When bulk packing is used, the first and last turns shall be composition A (hard) and the intermediate turns shall be composition B (soft). Reinforced neoprene packing in accordance with MIL-PRF-15624, Class 1 may be used as an alternate.

4.1.6 Chafing collars and nipples. Collar length shall be not less than 76 millimeters (3 inches) with a minimum radial distance between the cable and collar of 25 millimeters (1 inch). Nipple length shall be not less than 51 millimeters (2 inches), with a minimum radial distance between the cable and the nipple of 6 millimeters (0.25 inch).

4.1.7 Shielded compartment penetrations. Because optical fiber cables contain no metallic shields, normal compartment penetrations may not adequately maintain the shielding integrity of shielded compartments. Where the shielding integrity of the compartment must be maintained, special penetration methods may be required for optical fiber cables. Information on special penetration methods to maintain shielding integrity can be obtained from the Naval Surface Warfare Center, Dahlgren Division (NSWCDD) (see 6.4).

4.2 Safety precautions. The following safety precautions shall apply:

a. The classification of a laser is based on the ability of the optical beam to cause damage to the eye. Under normal operating conditions, an optical fiber communication system (OFCS) is inherently an eye-safe system; however, when an optical fiber connection is broken and optical viewing instruments are used, it is possible that hazardous energy can enter the eye. For this reason, four service group hazard classes have been devised to indicate the degree of hazard and required hazard control measures. Refer to ANSI Z136.2 for a full technical definition. The following laser safety precautions shall apply:

(1) Ensure personnel are familiar with the laser degree of hazard and the required control measures.

(2) Light generated by light emitting diodes (LEDs) and laser diodes may not be visible but may still be hazardous to the unprotected eye. Do not stare into the end of an optical fiber connected to an LED or laser diode, and do not stare into broken, severed, or disconnected optical cables.

(3) Do not view the primary beam or a specular reflection from an OFCS with an optical microscope, eye loupe, or other viewing instrument. The instrument may create a hazard due to its light gathering capability.

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b. Wear safety glasses when handling bare fibers. Always handle cable carefully to avoid personal injury. The ends of optical fibers may be extremely sharp and can lacerate or penetrate the skin or cause permanent eye damage if touched. If the fiber penetrates the skin, it most likely will break off, in which case the extraction of the fiber should be performed by trained medical personnel to prevent further complications.

c. Wash hands after handling bare fibers.

d. Do not eat or drink in the vicinity of bare optical fibers. Ingested optical fibers may cause serious internal damage.

e. Do not look into the end of a Blown Optical Fiber (BOF) tube. Always wear approved safety glasses when handling BOF tubes that may be connected to a pressure source.

4.3 Method improvement. Where the methods herein cannot be implemented, users shall submit proposed new methods or proposed modifications of existing methods, as specified (see 6.4).

4.4 Personnel qualifications. Fiber optic installers, supervisors, and Quality Assurance (QA) personnel shall meet Navy shipboard personnel proficiency requirements identified in MIL-STD-1678-1, Requirement 1306 for all fiber optic installations, modifications, and repairs.

4.5 Or equal. MIL-STD-2042 uses the term “or equal” to permit the use of parts, components, or tools that are equivalent and can perform the same function as the specified products. The use of the equivalent product is allowed as long as the same functional characteristics, performance, equipment safety, personnel safety, suitability for marine service, life cycle cost, maintenance cost, and supportability are attained, and agreement is obtained from NAVSEA (see 6.4). The request for agreement for the use of “equal” products shall include data that supports that functional and performance equivalence is retained.

5. DETAILED REQUIREMENTS

5.1 Penetration of ship structure (submarines). Optical fiber cables shall penetrate the ship structure of submarines in accordance with figures for submarine stuffing tubes installation in Appendix 3A of MIL-STD-2003-3, as modified (see 5.5). Figures for submarine stuffing tubes installation regarding cable assignment do not apply. Stuffing tube sizes for optical fiber cables shall be selected in accordance with Method 3A1, Procedure I of this standard.

5.2 Penetration of ship structure (surface ships) using steel or aluminum stuffing tubes. Optical fiber cables shall penetrate the ship structure of surface ships using steel or aluminum stuffing tubes in accordance with figures for surface ship stuffing tubes in MIL-STD-2003-3, Appendix 3B or figures for general purpose stuffing tubes in MIL-STD-2003-3, Appendix 3C, as modified (see 5.5). Figures for surface ship stuffing tubes in MIL-STD-2003-3 regarding MCPs, community stuffing tubes, deck outlets, and degaussing cable do not apply. Figures for general purpose stuffing tubes regarding nylon stuffing tubes and community stuffing tubes do not apply. Stuffing tube sizes for optical fiber cables shall be selected in accordance with Method 3A1, Procedure II of this standard.

5.3 Penetration of ship structure using multiple cable penetrators (MCPs). Optical fiber cables shall penetrate the ship structure using MCPs in accordance with figures for MCPs in MIL-STD-2003-3, Appendix 3B, as modified (see 5.5). Figures for any type of stuffing tubes, swage tubes, community tubes, deck outlets, and degaussing cable do not apply. MCP insert block sizes for optical fiber cables shall be selected in accordance with Method 3B1 of this standard.

5.4 Penetration of ship structure using kickpipes. Optical fiber cables shall penetrate the ship structure using kickpipes in accordance with figures for kickpipes in MIL-STD-2003-3, Appendix 3D, as modified (see 5.5). Figures regarding kickpipes for wooden decks do not apply. Stuffing tube sizes for optical fiber cable shall be in accordance with Method 3A1, Procedure II of this standard. Swage tubes may be used in place of kickpipes. Swage tube sizes for optical fiber cable shall be selected in accordance with Method 3A1, Procedure III of this standard.

5.5 Retention of the watertight seal. The optical fiber cable may lose some of its resiliency after being compressed. To ensure the watertight seal is achieved and maintained, the cap (stuffing tube) or bolt (MCP) shall be retightened approximately 24 hours after initial compression.

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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 methods for cable penetrations depicted in this standard have been developed, tested, and approved so that the shipboard fiber optic installations described can withstand the environmental and operational conditions aboard U.S. Navy vessels. They are intended primarily for new construction; however, they are applicable for conversion, alteration, or repair of existing ships.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this standard.

6.3 Standard method designation. To simplify the usage of this standard, an alpha-numeric designation system was developed to identify and locate a given method. The methods were grouped together by function as follows:

Group A: Cable penetrations via metal stuffing tubes

Group B: Cable penetrations via MCP

The designation system was completed as follows:

3	A	1	-	II
MIL-STD-2042 part number	Functional group	Method number within group	-	Alternate procedure within method

Thus, Method 3A1-II identifies the second alternate procedure for Method 1 of Group A in Part 3 (MIL-STD-2042-3) of MIL-STD-2042.

6.4 Proposed new methods or method modifications. As specified (see 4.3), proposed new methods or proposed modifications of existing methods should be submitted to [DLGR NSWC FO ENG@navy.mil](mailto:DLGR_NSWC_FO_ENG@navy.mil) or Department of the Navy, Naval Surface Warfare Center, Dahlgren Division, ATTN: Fiber Optic Engineering Manager, 17214 Avenue B, Suite 126, Dahlgren, VA 22448-5147.

6.5 Subject term (key word) listing.

Chafing collar

Collective protection system (CPS)

Kickpipes

Metal stuffing tubes

Multiple cable penetrator (MCP)

Nipple

Swage tubes

6.6 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.

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METHOD 3A1
CABLE PENETRATIONS VIA METAL STUFFING TUBES

1. SCOPE

1.1 Scope. These methods identify stuffing tube sizes used to pass optical fiber cables through decks and bulkheads. The methods for installation of the stuffing tubes are the same as those specified for electrical cables in MIL-STD-2003 (see 5.1 through 5.4).

2. DOCUMENTS APPLICABLE TO METHOD 3A1

2.1 General. The documents listed in this section are specified in Method 3A1 of this standard. This section does not include documents cited in other sections of this standard 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 Method 3A1 of this standard, 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.

DEPARTMENT OF DEFENSE SPECIFICATIONS

- MIL-DTL-16685 - Packing, Material and Packing Preformed (Stuffing Tube for Electrical Cables)
- MIL-S-24235/1 - Stuffing Tube, Metal, and Packing Assemblies for Electric Cables, Bulkhead, Pressureproof
- MIL-S-24235/2 - Stuffing Tube, Packing Assemblies for Pressureproof Bulkhead
- MIL-S-24235/9 - Stuffing Tubes, Metal and Packing Assemblies for Electric Cables, Brass and Steel, for Decks and Bulkheads with Pipe Protection
- MIL-S-24235/10 - Stuffing Tubes, Metal, and Packing Assemblies for Electric Cables, Steel, for Decks and Bulkheads without Pipe Protection
- MIL-S-24235/17 - Stuffing Tube, Metal, and Packing Assemblies for Electric Cables, Swage Type, Steel and Aluminum, for Deck and Bulkheads with Pipe Protection
- MIL-S-24235/18 - Stuffing Tube, Metal, and Packing Assemblies for Electric Cables, Swage Type, Reduced Diameter, Steel and Aluminum, for Deck and Bulkheads with Pipe Protection

2.3 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, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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3. PROCEDURES

3.1 Safety summary. The following safety precautions shall be observed during the passing of optical fiber cables through the installed stuffing tubes:

- a. Wear safety glasses when handling bare fibers.
- b. Do not touch the ends of fibers as they may be razor sharp. Wash your hands after handling bare fiber.
- c. Observe the warnings and cautions on equipment and materials.
- d. When visually inspecting an optical fiber, do not stare into the end of a fiber connected to a laser source or LED.
- e. Do not look into the end of a BOF tube. Always wear approved safety glasses when handling BOF tubes that may be connected to a pressure source.

3.2 Procedure I: Metal stuffing tubes for submarines. The following steps shall be performed:

Step 1. Select a steel stuffing tube from those shown in [tables 3A1-I](#) and [3A1-II](#).

TABLE 3A1-I. Steel stuffing tube sizes for optical fiber cable (submarines).

Cable type	Cable OD ^{1/} mm (inches) (nominal)	Tube size	Packing assembly	
			Part no. M24235/2 ^{2/}	Symbol no.
4-Fiber	8.1 (0.32)	1	-*002	2405.2
8-Fiber	11.1 (0.44)	1	-*003	2405.3
18-Fiber	14.3 (0.56)	1	-*007	2405.7
36-Fiber	20.8 (0.82)	3	-*013	2407.1
90-Fiber	38.5 (1.52)	6	-*040	2410.3
7-Tube ^{3/}	29.0 (1.14) to 31.5 (1.25)	4	-*034	2408.4

FOOTNOTES:

^{1/} Outer diameter (OD).

^{2/} The asterisk (*) represents item material. The material shall be neoprene (N) or silicone (S).

^{3/} Seven-tube (7-tube) BOF cables shall not be run through watertight bulkheads.

NOTE:

1. When installing the optical fiber cable in the stuffing tube, the optical fiber cable jacket shall be greased in the region where it will contact the stuffing tube. This prevents the optical fiber cable from buckling inside the stuffing tube when both ends of the stuffing tube are tightened down.

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TABLE 3A1-II. Steel stuffing tube data (submarines).

Grade steel		HY-80				HT			
		Tube size 1	Tube size 3	Tube size 4	Tube size 6	Tube size 1	Tube size 3	Tube size 4	Tube size 6
Stuffing tube assembly	Part number M24235/1	-001	-003	-004	-006	-101	-103	-104	-106
Part numbers of components	Tube body (1 required) M24235/1	-010	-012	-013	-015	-110	-112	-113	-115
	Gland nut (2 required) M24235/1	-019	-021	-022	-024	-019	-021	-022	-024
	Lock washer (2 required) M24235/1	-028	-030	-031	-033	-028	-030	-031	-033
Symbol number		2405 HY-80	2407 HY-80	2408 HY-80	2410 HY-80	2405 HT	2407 HT	2408 HT	2410 HT

Step 2. Refer to 5.1 for installation instructions.

3.3 Procedure II: Metal stuffing tubes for surface ships. The following steps shall be performed:

Step 1. Select a steel or aluminum stuffing tube from those shown in [tables 3A1-III](#) through [3A1-V](#).

TABLE 3A1-III. Aluminum and steel stuffing tube sizes for optical fiber cable (surface ships).

Cable type	Cable OD mm (inches) (nominal)	Tube size MIL-S-24235/9 and /10	Packing assembly MIL-DTL-16685
4-Fiber	8.1 (0.32)	A	Classes 1 and 2
8-Fiber	11.1 (0.44)	B	Classes 1 and 2
18-Fiber	14.3 (0.56)	C	Classes 1 and 2
36-Fiber	20.8 (0.82)	F	Classes 1 and 2
90-Fiber	38.5 (1.52)	P	Classes 1 and 2
7-Tube	29.0 (1.14) to 31.5 (1.25)	L	Classes 1 and 2
19-Tube	50.8 (2.00)	T	Classes 1 and 2

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TABLE 3A1-IV. Steel stuffing tube data for decks and bulkheads without pipe protection.

Tube type		Without pipe protection						
Tube size		A	B	C	F	L	P	T
Stuffing tube assembly	Part number M24235/10	-01	-02	-03	-06	-10	-13	-16
	Tube body (1 required) M24235/10	-31	-32	-33	-36	-40	-43	-46
Part numbers of components	Gland nut (1 required) M24235/9	-061	-062	-063	-066	-70	-73	-076
	Gland ring (1 required) M24235/9	-181	-182	-183	-186	-190	-193	-196
Symbol number		1600	1601	1602	1605	1609	1612	1615

TABLE 3A1-V. Steel stuffing tube data for decks and bulkheads with pipe protection.

Tube type		With pipe protection						
Tube size		A	B	C	F	L	P	T
Stuffing tube assembly	Part number M24235/9	-121	-122	-123	-126	-130	-133	-136
	Tube body (1 required) M24235/9	-151	-152	-153	-156	-160	-163	-166
Part numbers of components	Gland nut (1 required) M24235/9	-061	-062	-063	-066	-070	-073	-076
	Gland ring (1 required) M24235/9	-181	-182	-183	-186	-190	-193	-196
Symbol number		1570	1571	1572	1575	1579	1582	1585

Step 2. Refer to 5.2 for installation instructions.

3.4 Procedure III: Swage type stuffing tubes. The following steps shall be performed:

Step 1. Select swage type aluminum or steel stuffing tubes from those shown in [tables 3A1-VI](#) through [3A1-XIII](#).

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TABLE 3A1-VI. Swage type aluminum stuffing tube data for bulkheads.

Tube type		Bulkheads						
Tube size		A	B	C	F	L	P	T
Stuffing tube assembly	Part number M24235/17	-031	-032	-033	-036	-040	-043	-046
	Tube body (1 required) M24235/17	-151	-152	-153	-156	-160	-163	-166
Part numbers of components	Gland nut (1 required) M24235/17	-241	-242	-243	-246	-250	-253	-256
	Gland ring (1 required) M24235/17	-271	-272	-273	-276	-280	-283	-286
Symbol number		1731	1732	1733	1736	1740	1743	1746

TABLE 3A1-VII. Swage type aluminum stuffing tube data for decks.

Tube type		Decks						
Tube size		A	B	C	F	L	P	T
Stuffing tube assembly	Part number M24235/17	-091	-092	-093	-096	-100	-103	-106
	Tube body (1 required) M24235/17	-211	-212	-213	-216	-220	-223	-226
Part numbers of components	Gland nut (1 required) M24235/17	-241	-242	-243	-246	-250	-253	-256
	Gland ring (1 required) M24235/17	-271	-272	-273	-276	-280	-283	-286
Symbol number		1791	1792	1793	1796	1800	1803	1806

TABLE 3A1-VIII. Swage type steel stuffing tube data for bulkheads.

Tube type		Bulkheads						
Tube size		A	B	C	F	L	P	T
Stuffing tube assembly	Part number M24235/17	-001	-002	-003	-006	-010	-013	-016
	Tube body (1 required) M24235/17	-121	-122	-123	-126	-130	-133	-136
Part numbers of components	Gland nut (1 required) M24235/9	-061	-062	-063	-066	-070	-073	-076
	Gland ring (1 required) M24235/9	-181	-182	-183	-186	-190	-193	-196
Symbol number		1701	1702	1703	1706	1710	1713	1716

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TABLE 3A1-IX. Swage type steel stuffing tube data for decks.

Tube type		Decks						
Tube size		A	B	C	F	L	P	T
Stuffing tube assembly	Part number M24235/17	-061	-062	-063	-066	-070	-073	-076
	Tube body (1 required) M24235/17	-181	-182	-183	-186	-190	-193	-196
Part numbers of components	Gland nut (1 required) M24235/9	-061	-062	-063	-066	-070	-073	-076
	Gland ring (1 required) M24235/9	-181	-182	-183	-186	-190	-193	-196
Symbol number		1761	1762	1763	1766	1770	1773	1776

TABLE 3A1-X. Reduced diameter swage type aluminum stuffing tube data for bulkheads.

Tube type		Bulkheads						
Tube size		A	B	C	F	L	P	T
Stuffing tube assembly	Part number M24235/18	-031	-032	-033	-036	-040	-043	-046
	Tube body (1 required) M24235/18	-151	-152	-153	-156	-160	-163	-166
Part numbers of components	Gland nut (1 required) M24235/17	-241	-242	-243	-246	-250	-253	-256
	Gland ring (1 required) M24235/17	-271	-272	-273	-276	-280	-283	-286
Symbol number		1871	1872	1873	1876	1880	1883	1886

TABLE 3A1-XI. Reduced diameter swage type aluminum stuffing tube data for decks.

Tube type		Decks						
Tube size		A	B	C	F	L	P	T
Stuffing tube assembly	Part number M24235/18	-091	-092	-093	-096	-100	-103	-106
	Tube body (1 required) M24235/18	-211	-212	-213	-216	-220	-223	-226
Part numbers of components	Gland nut (1 required) M24235/17	-241	-242	-243	-246	-250	-253	-256
	Gland ring (1 required) M24235/17	-271	-272	-273	-276	-280	-283	-286
Symbol number		1941	1942	1943	1946	1950	1953	1956

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TABLE 3A1-XII. Reduced diameter swage type steel stuffing tube data for bulkheads.

Tube type		Bulkheads						
Tube size		A	B	C	F	L	P	T
Stuffing tube assembly	Part number M24235/18	-001	-002	-003	-006	-010	-013	-016
	Tube body (1 required) M24235/18	-121	-122	-123	-126	-130	-133	-136
Part numbers of components	Gland nut (1 required) M24235/9	-061	-062	-063	-066	-070	-073	-076
	Gland ring (1 required) M24235/9	-181	-182	-183	-186	-190	-193	-196
Symbol number		1821	1822	1823	1826	1830	1833	1836

TABLE 3A1-XIII. Reduced diameter swage type steel stuffing tube data for decks.

Tube type		Decks						
Tube size		A	B	C	F	L	P	T
Stuffing tube assembly	Part number M24235/18	-061	-062	-063	-066	-070	-073	-076
	Tube body (1 required) M24235/18	-181	-182	-183	-186	-190	-193	-196
Part numbers of components	Gland nut (1 required) M24235/9	-061	-062	-063	-066	-070	-073	-076
	Gland ring (1 required) M24235/9	-181	-182	-183	-186	-190	-193	-196
Symbol number		1911	1912	1913	1916	1920	1923	1926

Step 2. Refer to 5.1 for installation instructions.

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METHOD 3B1
CABLE PENETRATIONS VIA MCPs

1 SCOPE

1.1 Scope. This method identifies MCP insert block sizes used to pass optical fiber cables through decks and bulkheads. The methods for installation of the MCP and insert blocks are the same as those specified for electrical cables in MIL-STD-2003-3 (see 5.1 through 5.4).

2. DOCUMENTS APPLICABLE TO METHOD 3B1

2.1 General. The documents listed in this section are specified in Method 3B1 of this standard. This section does not include documents cited in other sections of this standard 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 Method 3B1 of this standard, 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.

DEPARTMENT OF DEFENSE SPECIFICATIONS

- | | | |
|------------------|---|---|
| MIL-DTL-24705/1 | - | Penetrators, Multiple Cable, Electric Cable, Rectangular Metal Frame, Square-Faced Blocks |
| MIL-PRF-85045/17 | - | Cable, Fiber Optic, Eight Fibers, Enhanced Performance, Cable Configuration Type 2 (OFCC), Application B (Shipboard), Cable Class SM and MM |
| MIL-PRF-85045/18 | - | Cable, Fiber Optic, Four Fibers, Enhanced Performance, Cable Configuration Type 2 (OFCC), Application B (Shipboard), Cable Class SM and MM |
| MIL-PRF-85045/20 | - | Cable, Fiber Optic, Thirty-Six Fibers, Enhanced Performance, Cable Configuration Type 2 (OFCC), Application B (Shipboard), Cable Class SM and MM |
| MIL-PRF-85045/22 | - | Cable, Fiber Optic, Eighteen Fibers, Standard and Enhanced Performance, Cable Configuration Type 2 (OFCC), Application B (Shipboard), Cable Class SM and MM |

DEPARTMENT OF DEFENSE STANDARDS

- | | | |
|----------------|---|--|
| MIL-STD-2003-3 | - | Electric Plant Installation Standard Methods for Surface Ships and Submarines (Penetrations) |
|----------------|---|--|

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

2.3 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, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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3. PROCEDURES

3.1 Safety summary. The following safety precautions shall be observed during the passing of optical fiber cables through the installed MCPs:

- a. Wear safety glasses when handling bare fibers.
- b. Do not touch the ends of bare fibers as they may be razor sharp. Wash your hands thoroughly after handling bare fiber.
- c. Observe warnings and cautions on equipment and materials.
- d. When visually inspecting an optical fiber, do not stare into the end of a fiber connected to a laser source or LED.
- e. Do not look into the end of a BOF tube. Always wear approved safety glasses when handling BOF tubes that may be connected to a pressure source.

3.2 Procedure I: M24705/1 insert blocks. The following steps shall be performed:

Step 1. Select MCP insert blocks from those shown in [table 3B1-I](#).

TABLE 3B1-I. MCP data and insert block sizes for optical fiber cable.

Cable type	4-fiber	8-fiber	18-fiber	36-fiber	90-fiber	Single-tube	7-tube		19-tube
Cable OD mm (inches) nominal	8.1 (0.32)	11.1 (0.44)	14.3 (0.56)	20.8 (0.82)	38.5 (1.52)	11.1 (0.44)	29.0 (1.14)	31.5 (1.25)	50.8 (2.00)
Primary insert block part number M24705/1-BN	1508	2011	2014	3021	6039	2011	4029	4032	6051
Alternate insert block part number M24705/1-BN	2008	N/A	N/A	N/A	N/A	N/A	N/A	6032	N/A

Step 2. Refer to 5.3 for installation instructions.

3.2 Procedure II: Peel away style insert blocks. The following steps shall be performed:

Step 1. Select peel away style MCP insert blocks from those shown in [table 3B1-II](#).

TABLE 3B1-II. Peel away MCP data and insert block sizes for optical fiber cables.

Cable type	M85045/18 4-fiber	M85045/17 8-fiber	M85045/22 18-fiber	M85045/20 36-fiber
Cable OD mm (inch), nominal	8.1 (0.32)	11.1 (0.44)	14.3 (0.56)	20.8 (0.82)
Primary insert block P/N, (Roxtec P/N, or equal [see 4.5])	RM15w40	RM20w40	RM20w40	RM40 10-32
Peel away layers from each side, nominal. No core.	3	6	8	7

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Step 2. Separate the selected block for each cable into two halves.

NOTE: If MCP insert blocks are being used to fill out the MCP space (i.e., not being used for active cable entrance), do not separate block into two halves; remove the solid core, or remove any layers. These blocks can be used for future growth.

Step 3. Remove the black core and discard.

Step 4. Remove the recommended number of layers from each half of the insert block as specified in [table 3B1-II](#) and discard.

NOTE: Layers alternate colors (blue and black); each is considered a single layer.

NOTE: The recommended practice is to remove a single layer at a time.

NOTE: In the event that too many layers have been peeled away, do not try to reinsert layers. Discard material and begin again.

Step 5. Immediately before the blocks will be used, liberally apply tallow to the inside and outside surfaces of the peel away style blocks.

Step 6. Refer to 5.3 for installation instructions. Treat the prepared peel away style blocks the same as the typical insert blocks shown in the methods of MIL-STD-2003-3.

Preparing activity:
Navy – SH
(Project SESS-2014-007)

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>.