

**INCH-POUND**

**MIL-STD-2003-3A(SH)**

**3 September 2009**

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**SUPERSEDING**

**DOD-STD-2003-3(SH)**

**24 June 1987**

**DEPARTMENT OF DEFENSE  
STANDARD PRACTICE  
ELECTRIC PLANT INSTALLATION  
STANDARD METHODS FOR  
SURFACE SHIPS AND SUBMARINES  
(PENETRATIONS)**



## MIL-STD-2003-3A(SH)

### 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 disseminates up-to-date information detailing requirements for standard installation methods employed for submarine and surface ship electrical distribution systems.

3. These criteria apply to work on a specific ship or ships only when invoked by the Ship Specifications or similar contractual documents.

4. These criteria are for application to new construction, conversion, and alteration of existing ships.

5. Considering the magnitude of this standard, along with the changing requirements imposed on the Electric Plant, it is inevitable that changes will be required to update these criteria. Therefore, as comments arise, they should be forwarded to Naval Sea Systems Command (NAVSEA) 05Z3 to keep this standard as current as possible through subsequent revisions. Revisions will be accomplished by the issuance of additional or revised figures to be inserted in the basic standard parts. Superseded pages may be retained for reference if so desired.

6. Comments, suggestions, or questions on this document should be addressed to Commander, Naval Sea Systems Command, ATTN: SEA 05M2, 1333 Isaac Hull Avenue, SE, Stop 5160, Washington Navy Yard DC 20376-5160 or emailed to [CommandStandards@navy.mil](mailto: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 <http://assist.daps.dla.mil>.

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## 1. SCOPE

1.1 Scope. This standard covers standard methods for swage tubes, stuffing tubes, and kickpipes on surface ships and submarines.

1.1.1 Application. These installation methods are to be used by all installing activities. These methods do not identify ship or type, but do establish minimum standards of acceptance for Naval ships. It is the responsibility of the user activity to determine which method satisfies their requirements. It does not authorize relaxation of any requirement specifically invoked by new construction, conversion, overhaul, or refurbishment contracts. In instances where deviated design requirements (for example, ship type, ship class, and so forth) conflict with the requirements of this standard, the requirements of this standard govern. Any deviation for electric plant installation identified in this standard is to be submitted to NAVSEA 05Z3 for resolution.

## 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-3041	-	Wrench, Open End Ratchet (TAC Pattern) for Tube Fitting, Electrical Cable Terminals, and Stuffing Tube Gland Nuts
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 Electric Cable)
MIL-S-24235	-	Stuffing Tubes, Metal, and Packing Assemblies for Electric Cables, General Specification for
MIL-S-24235/1	-	Stuffing Tubes, Metal, and Packing Assemblies for Electric Cables, Bulkhead, Pressureproof
MIL-P-24705	-	Penetrators, Multiple Cable, for Electric Cables, General Specification for

(Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch/> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

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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) DESIGN DATA SHEETS

- |           |   |
|-----------|---|
| DDS 100-1 | - Reinforcement of Openings in Structure of Surface Ships Other Than in Protective Planting |
| DDS 100-2 | - Openings in Decks and Bulkheads for Stuffing Tubes and Pipe                               |

(Copies of these documents are available from Commander, Naval Sea Systems Command, ATTN: SEA 05M2, 1333 Isaac Hull Avenue, SE, Stop 5160, Washington Navy Yard DC 20376-5160, or by email at [CommandStandards@navy.mil](mailto:CommandStandards@navy.mil) with the subject line "DDS request".)

## NAVAL SEA SYSTEMS COMMAND (NAVSEA) PUBLICATIONS

- |                      |  |
|----------------------|--|
| S9074-AR-GIB-010/278 | - Requirements for Fabrication Welding and Inspection, and Casting Inspection and Repair for Machinery, Piping, and Pressure Vessels |
|----------------------|--|

(Copies of this document are available from the Naval Logistics Library, 5450 Carlisle Pike, Mechanicsburg, PA 17055 or online at <http://nll.ahf.nmci.navy.mil>.)

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 F1836M | - Standard Specification for Stuffing Tubes, Nylon, and Packing Assemblies (Metric) |
|-------------|---|

(Copies of this document are available from ASTM International, 100 Barr Harbor Dr., P.O. Box C700, West Conshohocken, PA 19428-2959 or online at [www.astm.org](http://www.astm.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.

## 3. DEFINITIONS

3.1 Collective protective system (CPS). CPS is a system designed to inhibit the entry of chemical, biological, and radiological contaminants into collective protection zones on board ships. A collective protection zone is a section of the ship, which is defined by a physical boundary that inhibits the entry of CBR contaminants into the zone. A total protection zone is pressurized to 2 inches WG and its supply ventilation air is continuously filtered to remove chemical vapors and CBR particulate and aerosols.

3.2 Community stuffing tube for bulkheads. Community stuffing tube for bulkheads is a system of passing multiple cables through ballast tank bulkheads on submarines.

3.3 Kickpipe. Kickpipe is a pipe welded into the deck with a stuffing tube attached. Kickpipes provide protection of electrical cable at deck penetrations and are used to clear an obstruction or preserve alignment. Kickpipes may be aluminum, steel, stainless steel, or brass to suit the installation or standard pipe sizes to suit the required stuffing tube.

3.4 Metal stuffing tube. Metal stuffing tube is a system of passing single electrical cable through decks and bulkheads and entering enclosed equipment on Naval ships. Metal stuffing tubes are manufactured in accordance with MIL-S-24235. Stainless steel is an alternative material which should be considered for use in applications highly susceptible to corrosion.

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3.4.1 Nylon stuffing tube. Nylon stuffing tube is a system of passing single electrical cable through electrical equipment on Naval ships. Nylon stuffing tubes are manufactured in accordance with ASTM F1836M.

3.5 Multiple cable penetrator (MCP). MCP is a system of passing multiple cables through watertight and non-watertight bulkheads and decks in order to provide watertight, airtight, and firetight penetration of electrical cable.

3.6 Swage tube. Swage tube is a system of passing single cables through decks on Naval ships that combines the features of the stuffing tube and kickpipe.

#### 4. GENERAL REQUIREMENTS

4.1 Cable penetrations. Cable penetrations of pressure hulls, pressure-proof bulkheads, shielded bulkheads, ballistic bulkheads, false decks, riser boxes, decks, bulkheads and beams and other integral parts of the hull shall be in accordance with figures 3A1 through 3E7 and the requirements of DDS 100-1 and DDS 100-2.

4.1.1 Installation welding requirements. Unless otherwise specified on the individual figure, the welding of stuffing tubes, kickpipes, swage tubes, and multi-cable penetrators shall be in accordance with the requirements of NAVSEA S9074-AR-GIB-010/278.

4.1.2 Cable penetration of structure. Cable penetration of decks, bulkheads, beams, and other integral parts of the hull shall conform to DDS 100-1 and DDS 100-2. Stuffing tubes in accordance with MIL-S-24235/1 shall be installed for cable penetrations of pressure-proof submarine bulkheads and sonar domes, which are filled with water under normal operating conditions. Stuffing tubes in accordance with MIL-S-24235/1 may be cut in half and each half used for a separate penetration.

Metal stuffing tubes or multiple cable penetrators shall be used for cable penetrations of the following (Note: Multiple cable penetrators shall not be used for cable penetrations exposed to weather or in tanks.):

- a. CPS boundaries
- b. Watertight cable trunks
- c. Watertight bulkheads
- d. Bulkheads designed to withstand a waterhead
- e. The portion of bulkheads specified to be watertight to a certain height
- f. That portion of bulkheads below the height of the sill or the coaming of compartment accesses
- g. Bulkheads surrounding compartments subject to flooding by sprinkling (if watertight):
  1. Garbage disposal rooms
  2. Battery shops
  3. Medical operating rooms
  4. Medical wards

4.1.3 Cable penetration of decks and bulkheads forming boundaries of spaces containing volatile combustible or explosive materials. Metal stuffing tubes and back-to-back multi-cable penetrations in accordance with MIL-P-24705 shall be installed in decks and bulkheads forming the boundaries of spaces containing volatile combustible or explosive materials.

4.1.4 Cable penetration of decks, structural bulkheads, airtight bulkheads, and fume-tight bulkheads. Unless otherwise specified, cable penetration of decks, structural bulkheads, airtight bulkheads, and fume-tight bulkheads shall employ one of the following:

Note: All surface ship stuffing tubes installed shall show a minimum of two threads and a maximum of five threads on the gland nut after it is tightened.

- a. Airtight metal stuffing tubes or multiple cable penetrators.

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b. Fume-tight chaffing collars (for multiple cable penetrations) or nipples (for single cable penetrations) having a minimum collar length of three inches with a minimum annular area between the cable and the collar of one inch with the entire void area within the collar (this includes the area between the collar and the cable and the area between the cables) packed with plastic sealer.

4.1.5 Multiple (two or more) penetrations of nonstructural steel bulkheads (other than wire mesh or expanded metal), bends, web frames, transverse girders, and longitudinal girders. Unless otherwise specified, multiple cable penetrations of nonstructural steel bulkheads, bends, web frames, transverse girders, and longitudinal girders shall employ one of the following:

a. Metal stuffing tubes, multiple cable penetrators, nipples (for single cable penetrations) having a minimum length of two inches with a minimum annular area between the cable and the nipple of ¼ inch packed with plastic sealer

b. Banding collars (for multiple cable penetrations) having a minimum collar length of three inches with a minimum annular area between the cable and the collar of one inch with the entire void area within the collar (this includes the area between the collar and the cable and the area between the cables) packed with plastic sealer.

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.

4.1.6 Plastic sealer. After the cables are properly secured, plastic sealer electrical insulation (MIL-I-3064, Type HF) shall be used to seal the space around the cable as follows:

a. In cable clamps and bushings entering the top of an electrical enclosure and the side of an enclosure without a drip loop.

b. In bushings or nipples used for passing cables through light-tight and fume-tight bulkheads and to seal around cables as they enter stuffing tubes, kickpipes, and swage tubes as shown on the individual figures except that plastic sealer is not required when silicone (red or white) grommets are used. Where compartment air tests are required, it is recommended that plastic sealer be installed after the air test has been satisfactorily performed.

4.1.7 Cable penetrations spacing. The size of stuffing tube groups shall be limited to permit tightening of gland nuts in the group using stuffing tube wrench set, A-A-3041 and A-A-3042. Penetration is specified in DDS 100-2.

4.1.8 Stuffing tube packing. Stuffing tube packing shall be in accordance with MIL-DTL-16685, either the preformed (coil) Class 2 or bulk Class 1. When bulk packing is used, the first and last turns shall be part "A" (hard) and the intermediate turns shall be part "B" (soft) of Class 1. Reinforced neoprene packing, in accordance with MIL-G-15624, CL I, may be used as an alternate, asbestos-free, packing material (see figure 3B48).

4.1.9 Kickpipes. Kickpipes – aluminum, brass, stainless steel, or steel – shall be standard pipe sizes. Ends of pipe shall be chamfered and burrs existing on the inside wall shall be removed to prevent chafing of cable.

## 5. DETAILED REQUIREMENTS

(See figures.)

## 6. NOTES

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

6.1 Intended use. This section specifies the requirements for swage tubes, stuffing tubes, and kickpipe methods to be employed both on surface ships and submarines. Standard methods identified for electric plant installation are intended for new construction, conversion, and alteration of existing ships.

6.2 Acquisition requirements. Acquisition documents should specify the following:

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

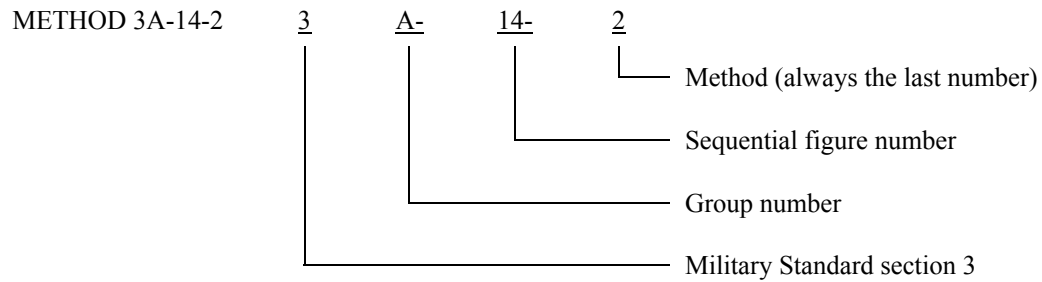
6.3 Designation of electric plant installation standard methods figures. The electric plant installation standard method MIL-STD-2003-3 contains drawings that depict standard methods that are applicable for general electric plant installation on both surface ships and submarines. Each drawing has been assigned a figure number. The methods shown on the figures are grouped together providing similar functions. These groups are:

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MIL-STD-2003-3 (Penetrations)

- Group A. Stuffing tubes, Submarines
- B. Stuffing tubes, Surface Ships
- C. Stuffing tubes, General
- D. Kickpipes
- E. Pressure Hulls, Submarines

The methods shown on the figures are identified by the following alphanumeric designation system:



Thus, Method 3A-14-2 identifies Method 2, sequential number 14 in Group A of MIL-STD-2003-3.

#### 6.4 Subject term (key word) listing.

Kickpipes

Multi-cable transits

Stuffing tubes

6.5 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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APPENDIX A

GROUP 3A – PENETRATIONS – STUFFING TUBES, SUBMARINES

A.1 SCOPE

A.1.1 Scope. This appendix describes the installation standard methods for stuffing tubes in submarines.

A.2. APPLICABLE DOCUMENTS

A.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.

A.2.2 Government documents.

A.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 SPECIFICATIONS

MMM-A-121	-	Adhesive, Bonding Vulcanized Synthetic Rubber to Steel
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COMMERCIAL ITEM DESCRIPTIONS

A-A-3041	-	Wrench, Open End Ratchet (TAC Pattern) for Tube Fitting, Electrical Cable Terminals, and Stuffing Tube Gland Nuts
A-A-3042	-	Socket, Open Detachable, Standard Wall, Octagon
A-A-59588	-	Rubber, Silicone

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-DTL-915	-	Cable, Electrical, for Shipboard Use, General Specification for
MIL-I-3064	-	Insulation, Electrical, Plastic-Sealer
MIL-PRF-8516	-	Sealing Compound, Synthetic Rubber, Electric Connectors and Electric Systems, Chemically Cured
MIL-DTL-16685	-	Packing, Material and Packing Preformed (Stuffing Tube for Electric Cable)
MIL-S-22698	-	Steel Plate, Shapes and Bars, Weldable Ordinary Strength and Higher Strength: Structural
MIL-C-24231	-	Connectors, Plugs, Receptacles, Adapters, Hull Inserts, and Hull Insert Plugs, Pressure-Proof, General Specification for
MIL-S-24235	-	Stuffing Tubes, Metal, and Packing Assemblies for Electric Cables, General Specification for
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-24235/5	-	Stuffing Tubes, Metal, and Packing Assemblies for Electric Cables, Ballast Tank

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MIL-S-24235/7	-	Stuffing Tubes, Metal, and Packing Assemblies for Electric Cables, for Cast Enclosures, Pressureproof
MIL-S-24235/8	-	Stuffing Tubes, Metal, and Packing Assemblies for Electric Cables, for Sheet Metal Enclosures, Pressureproof
MIL-S-24235/14	-	Stuffing Tubes, Metal, and Packing Assemblies for Electric Cables, for Sheet Metal Enclosures
MIL-P-24338	-	Pipe, Carbon Steel, Seamless
MIL-DTL-24640	-	Cables, Light-Weight, Electric, for Shipboard Use, General Specification for
MIL-DTL-24643	-	Cables and Cords, Electric, Low Smoke, for Shipboard Use, General Specification for

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-1689	-	Fabrication, Welding, and Inspection of Ships Structure
MIL-STD-2003	-	Electric Plant Installation Standard Methods for Surface Ships and Submarines

(Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch/> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

A.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) DRAWINGS

9000-S6202-51-L	-	
9000-S6202-5100L	-	
9000-S6202-73241	-	Cable Clamp, Type C A&D
9000-S6202-73899	-	
9000-S6202-1197101	-	Tube, Stuffing, PP for SS & TSP Type Cables
SS-302-1716060	-	
SS-302-1885724	-	Extended Body Stuffing Tube, Assembly & Details

(Copies of these documents are available from Commander, Portsmouth Naval Shipyard, ATTN: Code 280.1, Kittery, ME 03904.)

NAVAL SEA SYSTEMS COMMAND (NAVSEA) PUBLICATIONS

T9074-AD-GIB-010/1688	-	Fabrication, Welding and Inspection of Submarine Structure; Requirements
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(Copies of this document are available from the Naval Logistics Library, 5450 Carlisle Pike, Mechanicsburg, PA 17055 or online at <http://nll.ahf.nmci.navy.mil>.)

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A.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.

ASME INTERNATIONAL

ASME Y14.38 - Abbreviations and Acronyms for Use on Drawings and Related Documents

(Copies of this document are available from ASME International, 22 Law Drive, P.O. Box 2900, Fairfield, NJ 07007-2900 or online at [www.asme.org](http://www.asme.org).)

ASTM INTERNATIONAL

ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

ASTM B21/B21M - Standard Specification for Naval Brass Rod, Bar, and Shapes

ASTM B150/150M - Standard Specification for Aluminum Bronze Rod, Bar, and Shapes

ASTM B169/169M - Standard Specification for Aluminum Bronze Sheet, Strip, and Rolled Bar

(Copies of these documents are available from ASTM International, 100 Barr Harbor Dr., P.O. Box C700, West Conshohocken, PA 19428-2959 or online at [www.astm.org](http://www.astm.org).)

SAE INTERNATIONAL

SAE-AMS-P-83461 - Packing, Preformed, Petroleum Hydraulic Fluid Resistant, Improved Performance at 275Mdf (135Mdc)

SAE-AMS-S-8802 - Sealing Compound, Temperature Resistant, Integral Fuel Tanks and Fuel Cell Cavities, High Adhesion

(Copies of these documents are available from SAE World Headquarters, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or online at [www.sae.org](http://www.sae.org).)

A.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.

### A.3 REQUIRED EQUIPMENT AND MATERIALS

A.3.1 Required equipment and materials. The required equipment and materials for the proper installation of submarine stuffing tubes are as shown in the Appendix A methods.

### A.4 NOTES AND PROCEDURES

A.4.1 Dimensions. For figures and tables in this section, all dimensions are in inches unless otherwise noted.

A.4.2 Figures. Table 3AI provides information for the figures in this group.

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TABLE 3A1. Figures for submarine stuffing tubes installation.

<b>Figure number</b>	<b>Submarine stuffing tubes installation</b>	<b>Page</b>
3A1	Passing cables through pressure-proof bulkheads – submarine instructions for packing stuffing tubes manufactured in accordance with drawing 9000-S6202-73899 (figures 3A11 and 3A12)	11
3A2	Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors	13
3A3	Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors	14
3A4	Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors	15
3A5	Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors	16
3A6	Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors	17
3A7	Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors	18
3A8	Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors	19
3A9	Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors	20
3A10	MIL-S-24235/1 stuffing tubes for passing cables through pressureproof bulkheads (submarines)	21
3A11	Stuffing tubes for passing cable through pressure-proof bulkheads type 1 & 2 of drawing 9000-S6202-73899 (submarines)	24
3A12	Stuffing tubes for passing cable through pressure-proof bulkheads type 3 & 4 of drawing 9000-S6202-73899 (submarines)	25
3A13	MIL-S-24235/5 stuffing tube for passing cable through ballast tank partitions (submarines)	26
3A14	Passing cable through tanks (pipe extension) (submarines)	27
3A15	MIL-S-24235 stuffing tube for passing cables through shielded bulkheads (submarines)	28
3A16	Cables through elliptical bulkheads (submarines)	29
3A17	Method of changing sizes of installed bulkhead stuffing tubes types 1 to 4 of drawing 9000-S6202-73899 & 46-1 of drawing 9000-S6202-5100L (submarines)	31
3A18	Sealing plugs for blanking steel stuffing tubes (submarines)	32
3A19	Temporary plugging of steel stuffing tubes (submarines)	34
3A20	Bushing sleeves for drawing 9000-S6202-73899 stuffing tubes through steel shielded bulkheads	36
3A21	Size and details of adapters used for changing size of installed bulkhead stuffing tubes – 9000-S6202-73899 (submarines)	38
3A22	Size and details of adapter used for changing size of installed steel bulkhead MIL-S-24235 stuffing tubes (submarines)	39
3A23	Bushing sleeves for MIL-S-24235 stuffing tubes through steel shielded bulkheads	42

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TABLE 3AI. Figures for submarine stuffing tubes installation - Continued.

<b>Figure number</b>	<b>Submarine stuffing tubes installation</b>	<b>Page</b>
3A24	Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors	44
3A25	Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors	45
3A26	Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors	46
3A27	Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors	47
3A28	Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors	48
3A29	Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors	49
3A30	Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors	50
3A31	Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors	51

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**Instructions for packing existing stuffing tubes – submarines (see note 1)**

**NOTES:**

1. Stuffing tubes designed for cables in accordance with MIL-DTL-915, MIL-DTL-24640, and MIL-DTL-24643.
2. Tubes may be thrown out of line by welding; this is allowed up to  $\frac{1}{16}$ ".
3. Sealing compounds and activators are to be equal to any of the types listed in table 3A1-I. The individual activator with its compound shall be mixed in accordance with the manufacturer's instructions. See note 6.

TABLE 3A1-I. Sealing compounds.

Brand name	Curing agent or catalyst	Manufacturer's name
XK-263	AL-15B Activator	Acme Wire Company
MMM-EC 1239 or equal (SAE-AMS-S-8802 CL B-4)		Minnesota Mining and Manufacturing Co.
PR-1201-Q MIL-PRF-8516, Type II, Class III	PR-1201-QA	Products Research Company

4. After the cables are properly secured, plastic sealer (electrical insulation MIL-I-3064, Type HF) shall be used to seal the space around the cable within the gland nut, and also within the open end of stuffing tubes, after the tubes are packed.
5. Stuffing tubes with insufficient clearance for passing cables may be reamed in place, not exceeding 0.031".
6. Many thermosetting plastic ingredients have poor shelf life. It is recommended that activator and hardener over three months in storage be discarded and replaced.
7. Instructions contained herein are intended for use with presently installed tubes where it is necessary to:
  - a. Replace existing cables
  - b. Install undersized cables

**Instructions:**

1. Type 1 (see figure 3A11):
  - a. Both ends of tube may be packed with prefabricated packing in accordance with MIL-DTL-16685.
  - b. Both gland nuts shall be tightened to give the prefabricated packing an initial set. Then the gland nuts should be removed and a split gland ring (Method 3A-11-3) added to each end of the tube.
  - c. Both gland nuts shall be tightened. For cables with a minimum outside diameter, where the gland nut cannot be sufficiently tightened, additional split gland rings (Method 3A-11-3) may be added to each end of the tube. The gland nuts in the final tightened position shall have the undercut and 2 or 3 threads exposed.
2. Type 2 (see figure 3A11):
  - a. The tubes should be installed in the bulkhead with the air relief screw on the top and the 90-degree  $\frac{1}{8}$ " I.P.S. fitting on the bottom.
  - b. Same as 1(a) above.
  - c. Same as 1(b) above.
  - d. Same as 1(c) above.
  - e. With the air relief screw backed off and using a lever operated lubricating gun with a flexible hose, fill the center position of the stuffing tube with sealing compound. See table 3A1-I for material. When sealing compound exudes from the air relief screw, secure the screw and continue the sealing of the stuffing tube with an additional eight to fifteen strokes of the lubricating gun. The additional strokes are to make certain that the center portion of the tube is completely filled with the compound. Free or excessive leakage of the sealing compound around the gland nuts indicates that the tube has been improperly packed. Where this occurs, the tube end must be repacked.

FIGURE 3A1. Passing cables through pressure-proof bulkheads – submarine instructions for packing stuffing tubes manufactured in accordance with drawing 9000-S6202-73899 (figures 3A11 and 3A12).

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**Instructions (continued):**

3. Type 3 (see figure 3A12):
  - a. Same as 1(a) above.
  - b. Same as 1(b) above.
  - c. Same as 1(c) above.
4. Type 4 (see figure 3A12):
  - a. Same as 2(a) above.
  - b. Both ends of the tube shall be packed with a single ring, butt ended tight of flexible metallic packing (Navy symbol 1430) forced tightly into place, followed by one ring of sealing packing (MIL-DTL-16685, Composition B) and one tapered ring of retainer packing (MIL-DTL-16685, Composition A). These packing rings shall be set up tight using the spacer sleeve, which provides the cavity for the sealing compound. The purpose of the packing up to this point is to seal off the space around the cable within the pipe extension to prevent entry of the sealing compound.
  - c. Same as 1(a) above.
  - d. Same as 1(b) above.
  - e. Same as 1(c) above.
  - f. Same as 2(e) above.
5. General instructions (all types):
  - a. With gland nuts, rings and packing sets in place, care must be taken to properly guide the cable through the tube to prevent damage or injury to the packing sets.
  - b. On cables where the initial clearance between the packing set and the armor is not sufficient to allow the cable to be pulled through the stuffing tube with the packing set and gland nut in place, the packing sets may be stretched and the gland nut, ring, and packing allowed to ride free on the cable until the cable is pulled into position. The packing set may be stretched by the use of a smooth tapered rod.
  - c. Where welding room is available, installation shall be the same as Types 1 and 2. If backing plate is necessary, it shall be the diameter of the tube plus 1", thickness  $\frac{3}{16}$ ".
  - d. Welding shall be in accordance with NAVSEA T9074-AD-GIB-010/1688.

FIGURE 3A1. Passing cables through pressure-proof bulkheads – submarine instructions for packing stuffing tubes manufactured in accordance with drawing 9000-S6202-73899 (figures 3A11 and 3A12) - Continued.

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Cable			Nylon tube		MCP		Stuffing tube			Box conn.	Cable	
Type	Size OD		Size	Pack assy M19622	Insert block	Insert block	Surface size	Submarine			MIL-Spec	Slant sheet
	Min.	Max.						Size	Grommet			
DSS-2	0.370	0.390	2	17-0003	15/9		B	1	2-062	½	MIL-DTL-915	8
DSS-3	0.480	0.500	4T	19-0001	20/12	30/12	B	1	2-065	½	MIL-DTL-915	8
DSS-4	0.480	0.500	4T	19-0001	20/12	30/12	B	1	2-065	½	MIL-DTL-915	8
DSWS-4	0.770	0.800	5	20-0001	30/20		E	2	2-071	1	MIL-DTL-915	7
FSS-2	0.480	0.500	4T	19-0001	20/12	30/12	B	1	2-065	½	MIL-DTL-915	8
FSS-3	0.480	0.500	4T	19-0001	20/12	30/12	B	1	2-065	½	MIL-DTL-915	8
FSS-4	0.600	0.625	4T	19-0004	20/15	30/15	C	2	2-068	¾	MIL-DTL-915	8
JAS-250	1.260	2.480									MIL-DTL-915	9
MCSF-4	1.388	1.500	7	22-0002	60/38		P	6	2-099	1½	MIL-DTL-915	10
MSP	1.565	1.635	7	22-0003	60/40		R	7	2-101	2	MIL-DTL-915	67
MSPW	1.565	1.635	7	22-0003	60/40		R	7	2-101	2	MIL-DTL-915	66
MWF-7	0.480	0.500	3	18-0018	20/12	30/12	C	1	2-065	½	MIL-DTL-915	58
MWF-10	0.605	0.635	4T	19-0004	20/16	30/16	D	2	2-068	¾	MIL-DTL-915	58
MWF-14	0.605	0.635	4T	19-0005	20/16	30/16	D	2	2-068	¾	MIL-DTL-915	58
MWF-19	0.710	0.745	4T	19-0007	30/18		E	2	2-071	¾	MIL-DTL-915	58
MWF-24	0.800	0.836	5	20-0002	30/21		G	3	2-072	1	MIL-DTL-915	58
MWF-30	0.905	0.945	5	20-0005	30/24	40/24	J	3	2-074	1	MIL-DTL-915	58
MWF-37	1.005	1.045	5	20-0008	40/26		J	3	2-076	1¼	MIL-DTL-915	58
THOF-42	1.200	1.250	6	21-0004	40/30		L	4	2-094	1¼	MIL-DTL-915	6
THOF-400	2.680	2.800	9	24-0008		90/70	AA			3	MIL-DTL-915	6
THOF-500	2.920	3.100			120/75		BB			3½	MIL-DTL-915	6
TPUM-6	0.856	0.925	5	20-0004	30/23		G	3	2-074	1	MIL-DTL-915	79
TSP-11	0.680	0.730	4T	19-0007	30/17		D	2	2-070	¾	MIL-DTL-915	22
TSP-31	0.982	1.062	5	20-0008	40/26		J	4	2-090	1¼	MIL-DTL-915	22
TSPA-11	0.730	0.785	4T	19-0007	30/19		E	2	2-071	1	MIL-DTL-915	22
TSPA-31	1.032	1.112	5	20-0008	40/28		K	4	2-091	1¼	MIL-DTL-915	22
TSS-2	0.385	0.400	2	17-0003	20/10		A	1	2-062	½	MIL-DTL-915	8
TSS-3	0.480	0.500	4T	19-0001	20/12	30/12	B	1	2-065	½	MIL-DTL-915	8
TSS-4	0.480	0.500	4T	19-0001	20/12	30/12	B	1	2-065	½	MIL-DTL-915	8
1PR-A2OE	0.264	0.285	1	16-0005	15/7	20/7		1	2-061		MIL-DTL-915	81
1PR-16	0.380	0.400	2	17-0003	20/10			1	2-062		MIL-DTL-915	82
1O-16	0.380	0.400	2	17-0003	20/10			1	2-062		MIL-DTL-915	86
1SPR-16S	0.380	0.400	2	17-0003	20/10			1	2-062		MIL-DTL-915	89
1SWF-2	0.600	0.625	4T	19-0004	20/15	30/15	C	2	2-068	¾	MIL-DTL-915	47
1TR-16	0.380	0.400	2	17-0003	20/10			1	2-062		MIL-DTL-915	87
2SPR-16	0.630	0.650	4T	19-0004	20/16	30/16		2	2-039		MIL-DTL-915	84
2SWF-3	0.600	0.625	4T	19-0004	20/15	30/15	D	2	2-068	¾	MIL-DTL-915	48
2SWF-4	0.600	0.625	4T	19-0004	20/15	30/15	D	2	2-068	¾	MIL-DTL-915	48
2SWF-7	0.780	0.815	5	20-0002	30/20		F	3	2-072	¾	MIL-DTL-915	48
2SWF-24	1.190	1.250	6	21-0004	40/30			4	2-094		MIL-DTL-915	48
3PR-16	0.530	0.550	4T	19-0002	20/13	30/13		1	2-066		MIL-DTL-915	85
7PR-16	0.630	0.650	4T	19-0004	20/16	30/16		2	2-069		MIL-DTL-915	83
7SPR-16S	0.920	0.950	5	20-0005	30/24	40/24		3	2-074		MIL-DTL-915	88
7SS-2	0.600	0.625	4T	19-0004	20/15	30/15	C	2	2-068	¾	MIL-DTL-915	8
DX-3	0.223	0.241	1	16-0005	15/6	20/6	A	1	2-061	½	MIL-DTL-24640	1
DX-4	0.266	0.286	1	16-0005	15/7	20/7	A	1	2-061	½	MIL-DTL-24640	1

## NOTE:

1. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and BX connectors shown on figures 3A2 through 3A9 and 3A24 through 3A31 are for MIL-DTL-915, MIL-DTL-24640, and MIL-DTL-24643 cable.

FIGURE 3A2. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors.



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Cable			Nylon tube		MCP		Stuffing tube			Box conn.	Cable	
Type	Size OD		Size	Pack assy M19622	Insert block	Insert block	Surface size	Submarine			MIL-Spec	Slant sheet
	Min.	Max.						Size	Grommet			
DXOW-3	0.294	0.316	2	17-0001	15/8	20/8	A	1	2-062	½	MIL-DTL-24640	19
DXOW-4	0.328	0.354	2	17-0002	15/8	20/8	A	1	2-062	½	MIL-DTL-24640	19
DXW-3	0.239	0.257	1	16-0005	15/6	20/6	A	1	2-061	½	MIL-DTL-24640	19
DXW-4	0.281	0.303	1	16-0006	15/7	20/7	A	1	2-061	½	MIL-DTL-24640	19
FX-3	0.262	0.282	1	16-0006	15/7	20/7	A	1	2-061	½	MIL-DTL-24640	3
FX-4	0.311	0.335	2	17-0002	15/8	20/8	A	1	2-062	½	MIL-DTL-24640	3
FXOW-3	0.324	0.350	1	16-0006	15/8	20/8		1	2-062	½	MIL-DTL-24640	21
FXOW-4	0.366	0.394	2	17-0003	20/10			1	2-062	½	MIL-DTL-24640	21
FXW-3	0.266	0.286	1	16-0005	15/7	20/7	A	1	2-061	½	MIL-DTL-24640	21
FXW-4	0.315	0.339	2	17-0002	15/8	20/8	A	1	2-062	½	MIL-DTL-24640	21
MXCOW-7	0.340	0.366	2	17-0002	15/9	20/9	A	1	2-062	¾	MIL-DTL-24640	23
MXCOW-10	0.415	0.447	2	17-0004	20/11		B	1	2-063	½	MIL-DTL-24640	23
MXCOW-14	0.440	0.474	3	18-0018	20/12	30/12	B	1	2-064	½	MIL-DTL-24640	23
MXCOW-19	0.477	0.515	4T	19-0001	20/13	30/13	C	1	2-065	½	MIL-DTL-24640	23
MXCOW-24	0.557	0.601	4T	19-0003	20/15	30/15	C	2	2-068	¾	MIL-DTL-24640	23
MXCOW-30	0.584	0.630	4T	19-0005	20/16	30/16	C	2	2-068	¾	MIL-DTL-24640	23
MXCOW-37	0.622	0.670	4T	19-0005	30/17		D	2	2-069	¾	MIL-DTL-24640	23
MXCOW-44	0.697	0.751	4T	20-0001	30/19		E	2	2-071	1	MIL-DTL-24640	23
MXCOW-61	0.757	0.817	5	20-0002	30/20		F	3	2-072	1	MIL-DTL-24640	23
MXCW-7	0.295	0.319	2	17-0001	15/8	20/8	A	1	2-062	¾	MIL-DTL-24640	23
MXCW-10	0.375	0.405	2	17-0004	20/10		B	1	2-062	½	MIL-DTL-24640	23
MXCW-14	0.402	0.434	3	18-0018	20/11		B	1	2-063	½	MIL-DTL-24640	23
MXCW-19	0.440	0.474	3	18-0018	20/12	30/12	B	1	2-064	½	MIL-DTL-24640	23
MXCW-24	0.520	0.560	4T	19-0003	20/14	30/14	C	1	2-067	¾	MIL-DTL-24640	23
MXCW-30	0.547	0.589	4T	19-0003	20/14	30/14	C	1	2-067	¾	MIL-DTL-24640	23
MXCW-37	0.584	0.630	4T	19-0005	20/16	30/16	C	2	2-068	¾	MIL-DTL-24640	23
MXCW-44	0.656	0.708	4T	19-0006	30/17		D	2	2-070	¾	MIL-DTL-24640	23
MXCW-61	0.729	0.785	5	20-0001	30/19		E	2	2-071	1	MIL-DTL-24640	23
MXO-10	0.349	0.377	3	18-0018	15/9	20/9	A	1	2-062	¾	MIL-DTL-24640	8
MXO-14	0.380	0.410	2	17-0004	20/10		B	1	2-063	½	MIL-DTL-24640	8
MXSO-2	0.282	0.304	1	16-0005	15/7	20/7	A	1	2-061	¾	MIL-DTL-24640	10
MXSO-9	0.424	0.458	3	18-0018	20/11		B	1	2-064	½	MIL-DTL-24640	10
MXSO-21	0.552	0.596	4T	19-0004	20/15	30/15	C	2	2-068	½	MIL-DTL-24640	10
MXSO-37	0.644	0.694	4T	19-0007	30/17		D	2	2-070	½	MIL-DTL-24640	10
MXSOW-2	0.282	0.304	1	16-0005	15/7	20/7	A	1	2-061	¾	MIL-DTL-24640	10
MXSOW-9	0.424	0.458	3	18-0018	20/11		B	1	2-064	½	MIL-DTL-24640	10
MXSOW-21	0.552	0.596	4T	19-0004	20/15	30/15	C	2	2-068	½	MIL-DTL-24640	10
MXSOW-37	0.644	0.694	4T	19-0007	30/17		D	2	2-070	½	MIL-DTL-24640	10
TTX-3	0.296	0.320	2	17-0002	15/8	20/8	A	1	2-062	¾	MIL-DTL-24640	4
TTX-15	0.549	0.591	4T	19-0005	20/15	30/15	C	2	2-068	½	MIL-DTL-24640	4
TTXOW-1½	0.253	0.273	1	16-0004	15/6	20/6	A	1	2-061	¾	MIL-DTL-24640	24
TTXOW-3	0.333	0.359	2	17-0002	15/9	20/9	A	1	2-062	¾	MIL-DTL-24640	24
TTXOW-5	0.376	0.406	2	17-0003	20/10		B	1	2-063	½	MIL-DTL-24640	24

## NOTE:

1. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and BX connectors shown on figures 3A2 through 3A9 and 3A24 through 3A31 are for MIL-DTL-915, MIL-DTL-24640, and MIL-DTL-24643 cable.

FIGURE 3A3. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors.

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Cable			Nylon tube		MCP		Stuffing tube			Box conn.	Cable	
Type	Size OD		Size	Pack assy M19622	Insert block	Insert block	Surface size	Submarine			MIL-Spec	Slant sheet
	Min.	Max.						Size	Grommet			
TTXOW-15	0.556	0.600	4T	19-0004	20/15	30/15	C	2	2-068	½	MIL-DTL-24640	24
TTXOW-20	0.614	0.662	4T	19-0005	20/16	30/15	D	2	2-069	½	MIL-DTL-24640	24
TTXOW-30	0.717	0.772	5	20-0001	30/19		E	2	2-071	1	MIL-DTL-24640	24
TTXOW-40	0.823	0.887	5	20-0004	30/22	40/22	G	3	2-073	1	MIL-DTL-24640	24
TTXS-2	0.335	0.361	2	17-0003	15/9	20/9	A	1	2-062	⅜	MIL-DTL-24640	5
TTXS-4	0.393	0.424	2	17-0004	20/10		B	1	2-063	⅜	MIL-DTL-24640	5
TTXSO-2	0.386	0.416	2	17-0004	20/10		B	1	2-063	½	MIL-DTL-24640	5
TTXSO-6	0.506	0.546	4T	19-0003	20/13	30/13	C	1	2-066	¾	MIL-DTL-24640	5
TTXSO-8	0.587	0.633	4T	19-0005	20/15	30/16	D	2	2-068	¾	MIL-DTL-24640	5
TTXSO-10	0.627	0.675	4T	19-0006	30/17		D	2	2-069	¾	MIL-DTL-24640	5
TTXW-1½	0.181	0.195	1	16-0004	15/4	20/4	A	1	2-061	⅜	MIL-DTL-24640	24
TTXW-3	0.285	0.307	2	17-0001	15/7	20/7	A	1	2-061	⅜	MIL-DTL-24640	24
TTXW-5	0.331	0.357	2	17-0002	15/8	20/8	A	1	2-062	⅜	MIL-DTL-24640	24
TTXW-10	0.456	0.492	4T	19-0001	20/12	30/12	B	1	2-065	½	MIL-DTL-24640	24
TTXW-15	0.527	0.569	4T	19-0003	20/14	30/14	B	1	2-067	¾	MIL-DTL-24640	24
TTXW-20	0.577	0.621	4T	19-0005	20/15	30/15	C	2	2-068	¾	MIL-DTL-24640	24
TTXW-30	0.684	0.738	4T	19-0007	30/18		D	2	2-071	¾	MIL-DTL-24640	24
TTXW-40	0.790	0.852	5	20-0003	30/21		G	3	2-073	1	MIL-DTL-24640	24
TX-3	0.243	0.261	1	16-0005	15/6	20/6	A	1	2-061	⅜	MIL-DTL-24640	2
TX-4	0.288	0.310	2	17-0001	15/7	20/7	A	1	2-061	⅜	MIL-DTL-24640	2
TXOW-3	0.305	0.329	2	17-0002	15/8	20/8	A	1	2-062	⅜	MIL-DTL-24640	20
TXOW-4	0.343	0.369	2	17-0002	15/9	20/9	A	1	2-062	⅜	MIL-DTL-24640	20
TXW-3	0.246	0.266	1	16-0005	15/6	20/6	A	1	2-061	⅜	MIL-DTL-24640	20
TXW-4	0.292	0.314	2	17-0002	15/7	20/7	A	1	2-062	⅜	MIL-DTL-24640	20
1XMSO-7	0.344	0.370	2	17-0002	15/9	20/9	A	1	2-062	⅜	MIL-DTL-24640	7
1XMSO-16	0.471	0.507	4T	19-0002	20/12	30/12	C	1	2-065	½	MIL-DTL-24640	7
1XMSO-70	0.859	0.925	5	20-0006	30/23		J	3	2-074	1	MIL-DTL-24640	7
1XSOW-2	0.292	0.314	2	17-0001	15/7	20/7	A	1	2-062	⅜	MIL-DTL-24640	14
1XSOW-14	0.470	0.506	4T	19-0001	20/12	30/12	C	1	2-065	½	MIL-DTL-24640	14
1XSOW-20	0.542	0.584	4T	19-0003	20/14	30/14	C	1	2-067	½	MIL-DTL-24640	14
1XSOW-30	0.614	0.662	4T	19-0005	20/16	30/16	D	2	2-069	½	MIL-DTL-24640	14
2XAO-2	0.307	0.331	2	17-0001	15/8	20/8	A	1	2-062	⅜	MIL-DTL-24640	6
2XAO-7	0.392	0.422	2	17-0004	20/10		B	1	2-063	½	MIL-DTL-24640	6
2XAO-10	0.475	0.511	4T	19-0002	20/12	30/12	C	1	2-065	½	MIL-DTL-24640	6
2XAO-18	0.567	0.611	4T	19-0004	20/15	30/15	C	2	2-068	½	MIL-DTL-24640	6
2XAO-40	0.796	0.858	5	20-0004	30/21		G	3	2-073	¾	MIL-DTL-24640	6
2XO-6	0.305	0.329	2	17-0001	15/8	20/8	A	1	2-062	⅜	MIL-DTL-24640	12
2XO-18	0.417	0.449	3	18-0018	20/11		B	1	2-064	½	MIL-DTL-24640	12
2XO-24	0.473	0.509	4T	19-0002	20/12	30/12	C	1	2-065	½	MIL-DTL-24640	12
2XO-42	0.565	0.609	4T	19-0004	20/15	30/15	C	2	2-068	½	MIL-DTL-24640	12
2XO-60	0.641	0.691	4T	19-0006	30/17		D	2	2-070	¾	MIL-DTL-24640	12
2XO-77	0.728	0.785	5	20-0002	30/19		E	2	2-071	¾	MIL-DTL-24640	12
2XOW-6	0.336	0.363	2	17-0002	15/9	20/9	A	1	2-062	⅜	MIL-DTL-24640	17

## NOTE:

1. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and BX connectors shown on figures 3A2 through 3A9 and 3A24 through 3A31 are for MIL-DTL-915, MIL-DTL-24640, and MIL-DTL-24643 cable.

FIGURE 3A4. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors.

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APPENDIX A

Cable			Nylon tube		MCP		Stuffing tube			Box conn.	Cable	
Type	Size OD		Size	Pack assy M19622	Insert block	Insert block	Surface size	Submarine			MIL-Spec	Slant sheet
	Min.	Max.						Size	Grommet			
2XOW-18	0.468	0.504	4T	19-0002	20/12	30/12	C	1	2-065	½	MIL-DTL-24640	17
2XOW-24	0.546	0.588	4T	19-0004	20/14	30/14	C	1	2-067	½	MIL-DTL-24640	17
2XOW-42	0.646	0.686	4T	19-0006	30/17		D	2	2-070	½	MIL-DTL-24640	17
2XOW-60	0.744	0.802	5	20-0002	30/20		F	3	2-072	¾	MIL-DTL-24640	17
2XOW-77	0.840	0.906	5	20-0005	30/23		G	3	2-074	¾	MIL-DTL-24640	17
2XS-2	0.308	0.332	2	17-0002	15/8	20/8	A	1	2-062	⅜	MIL-DTL-24640	9
2XS-3	0.325	0.350	2	17-0002	15/8	20/8	A	1	2-062	½	MIL-DTL-24640	9
2XS-7	0.423	0.455	3	18-0018	20/11		B	1	2-063	½	MIL-DTL-24640	9
2XS-10	0.537	0.579	4T	19-0004	20/14	30/14	C	1	2-067	½	MIL-DTL-24640	9
2XS-14	0.582	0.627	4T	19-0005	20/15	30/15	D	2	2-068	½	MIL-DTL-24640	9
2XS-19	0.644	0.694	4T	19-0007	30/17		D	2	2-070	½	MIL-DTL-24640	9
2XS-24	0.758	0.818	5	20-0003	30/20		G	3	2-072	¾	MIL-DTL-24640	9
2XS-30	0.804	0.866	5	20-0004	30/21		G	3	2-073	¾	MIL-DTL-24640	9
2XSAOW-3	0.405	0.437	2	17-0004	20/11		B	1	2-063	½	MIL-DTL-24640	15
2XSAOW-7	0.510	0.550	4T	19-0002	20/13	30/13	C	1	2-066	½	MIL-DTL-24640	15
2XSAOW-10	0.631	0.681	4T	19-0006	30/17		D	2	2-070	½	MIL-DTL-24640	15
2XSAOW-14	0.689	0.743	5	20-0001	30/18		D	2	2-071	½	MIL-DTL-24640	15
2XSAOW-19	0.757	0.817	5	20-0003	30/20		F	3	2-072	¾	MIL-DTL-24640	15
2XSAOW-24	0.884	0.952	5	20-0006	30/24	40/24	J	3	2-075	¾	MIL-DTL-24640	15
2XSAOW-30	0.941	1.020	5	20-0007	30/24	40/24	J	3	2-076	1⅜	MIL-DTL-24640	15
2XSAOW-37	1.010	1.090	5	20-0010	40/26		K	4	2-090	1⅜	MIL-DTL-24640	15
2XSAW-3	0.368	0.396	2	17-0004	20/10		B	1	2-062	½	MIL-DTL-24640	15
2XSAW-7	0.461	0.497	4T	19-0001	20/12	30/12	B	1	2-065	½	MIL-DTL-24640	15
2XSAW-14	0.641	0.691	4T	19-0006	30/17		D	2	2-069	½	MIL-DTL-24640	15
2XSAWA-3	0.418	0.446	2	17-0004	20/11		B	1	2-063	½	MIL-DTL-24640	15
2XSAWA-7	0.511	0.547	4T	19-0001	20/13	30/13	C	1	2-066	½	MIL-DTL-24640	15
2XSAWA-14	0.691	0.741	4	19-0006	30/18		E	2	2-071	½	MIL-DTL-24640	15
2XSO-2	0.380	0.410	2	17-0004	20/10		B	1	2-063	½	MIL-DTL-24640	9
2XSO-7	0.474	0.510	4T	19-0002	20/12	30/12	C	1	2-065	½	MIL-DTL-24640	9
2XSO-10	0.594	0.640	4T	19-0005	20/16	30/16	D	2	2-069	½	MIL-DTL-24640	9
2XSO-14	0.636	0.686	4T	19-0006	30/17		D	2	2-070	½	MIL-DTL-24640	9
2XSO-19	0.709	0.765	5	20-0001	30/19		E	2	2-071	¾	MIL-DTL-24640	9
2XSO-30	0.869	0.937	5	20-0005	30/23		G	3	2-074	¾	MIL-DTL-24640	9
2XSOW-3	0.487	0.525	4T	19-0002	20/13	30/13	C	1	2-065	½	MIL-DTL-24640	16
2XSOW-7	0.606	0.656	4T	19-0005	20/16	30/16	D	2	2-069	½	MIL-DTL-24640	16
2XSOW-12	0.802	0.864	5	20-0004	30/21		G	3	2-073	¾	MIL-DTL-24640	16
2XSOW-19	0.938	1.010	5	20-0007	30/24	40/24	J	3	2-076	1⅜	MIL-DTL-24640	16
2XSOW-30	1.180	1.270	6	21-0005	40/32	60/32	M	5	2-095	1⅜	MIL-DTL-24640	16
2XSW-1	0.240	0.258	1	16-0005	15/6	20/6	A	1	2-051	⅜	MIL-DTL-24640	16
2XSW-3	0.436	0.470	3	18-0018	20/12	30/12	B	1	2-064	⅜	MIL-DTL-24640	16
2XSW-7	0.573	0.617	4T	19-0005	20/15	30/15	C	2	2-068	½	MIL-DTL-24640	16
2XSXO-4	0.333	0.359	2	17-0002	15/9	20/9	A	1	2-062	⅜	MIL-DTL-24640	13
3XS-7	0.601	0.647	4T	19-0005	20/16	30/16	D	2	2-069	½	MIL-DTL-24640	11
3XSOW-3	0.519	0.559	4T	19-0003	20/14	30/14	C	1	2-067	½	MIL-DTL-24640	18
3XSOW-7	0.659	0.711	4T	19-0007	30/17		D	2	2-070	½	MIL-DTL-24640	18
3XSOW-10	0.835	0.901	5	20-0005	30/22	40/22	G	3	2-074	¾	MIL-DTL-24640	18

## NOTE:

1. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and BX connectors shown on figures 3A2 through 3A9 and 3A24 through 3A31 are for MIL-DTL-915, MIL-DTL-24640, and MIL-DTL-24643 cable.

FIGURE 3A5. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors.

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APPENDIX A

Cable			Nylon tube		MCP		Stuffing tube			Box conn.	Cable	
Type	Size OD		Size	Pack assy M19622	Insert block	Insert block	Surface size	Submarine			MIL-Spec	Slant sheet
	Min.	Max.						Size	Grommet			
3XSOW-14	0.898	0.968	5	20-0006	30/24	40/24	J	3	2-075	¾	MIL-DTL-24640	18
3XSOW-19	1.010	1.090	5	20-0010	40/27		K	4	2-091	1⅝	MIL-DTL-24640	18
3XSOW-24	1.200	1.300	6	21-0005	40/32	60/32	M	5	2-095	1⅝	MIL-DTL-24640	18
3XSW-3	0.472	0.508	4T	19-0001	20/11		B	1	2-065	½	MIL-DTL-24640	18
3XSW-7	0.620	0.668	4T	19-0005	20/16	30/16	D	2	2-069	½	MIL-DTL-24640	18
3XSW-10	0.803	0.865	5	20-0004	30/21		G	3	2-073	¾	MIL-DTL-24640	18
3XSW-14	0.873	0.941	5	20-0005	30/23		G	3	2-074	¾	MIL-DTL-24640	18
7XW-3	0.315	0.339	2	17-0002	15/8	20/8	A	1	2-062	⅜	MIL-DTL-24640	22
7XW-4	0.374	0.404	2	17-0004	15/9		B	1	2-062	½	MIL-DTL-24640	22
LS1SAU-44	0.910	1.040	5	20-0006	30/24	40/24	J	3	2-074	1	MIL-DTL-24643	41
LS1SMU-5	0.465	0.500	4T	19-0001	20/12	30/12	B	1	2-065	½	MIL-DTL-24643	40
LS1SMWU-70	1.465	1.555	7	22-0008	60/38		P	6	2-100	2	MIL-DTL-24643	47
LS1SU-36	0.910	0.985	5	20-0005	30/24	40/24	J			1	MIL-DTL-24643	42
LS1SU-60	1.210	1.310	6	21-0004	40/32	60/32	M	5	2-096	1¼	MIL-DTL-24643	42
LS1SWU-2	0.430	0.455	2	17-0004	20/11		B	1	2-063	½	MIL-DTL-24643	30
LS1SWU-14	0.825	0.870	5	20-0003	30/22	40/22	G	3	2-073	1	MIL-DTL-24643	30
LS1SWU-20	0.970	1.030	5	20-0007	40/26		J	3	2-076	1¼	MIL-DTL-24643	30
LS1SWU-30	1.135	1.2	6	21-0003	40/30		L	4	2-094	1¼	MIL-DTL-24643	30
LS1S50MU-16	0.760	0.825	5	20-0002	30/20		G	3	2-072	¾	MIL-DTL-24643	28
LS1S50MU-20	0.835	0.905	5	20-0004	30/22	40/22	G	3	2-074	¾	MIL-DTL-24643	28
LS1S50MU-40	1.095	1.185	6	21-0001	40/30		L	4	2-094	1	MIL-DTL-24643	28
LS1S50MU-70	1.465	1.555	7	22-0001	60/38		P	6	2-100	1½	MIL-DTL-24643	28
LS1S50MUS-16	0.820	0.885	5	20-0004	30/22	40/22	G	3	2-073	¾	MIL-DTL-24643	28
LS1S50MUS-20	0.895	0.965	5	20-0005	30/24	40/24	J	3	2-075	¾	MIL-DTL-24643	28
LS1S50MUS-40	1.155	1.245	6	21-0003	40/30		L	4	2-094	1	MIL-DTL-24643	28
LS1S50MUS-70	1.525	1.615	7	22-0003	60/40		P	7	2-101	1½	MIL-DTL-24643	28
LS1S75MU-8	0.950	1.030	5	20-0007	40/26		J	3	2-076	1	MIL-DTL-24643	39
LS2AU-40	1.320	1.370	6	21-0005	40/34	60/34	M	5	2-096	1½	MIL-DTL-24643	27
LS2AUS-40	1.380	1.430	7	22-0001	60/36		N	6	2-098	1½	MIL-DTL-24643	27
LS2CS-6	0.400	0.430	2	17-0004	20/10		B	1	2-063	⅜	MIL-DTL-24643	58
LS2CS-18	0.550	0.590	4T	19-0003	20/14	30/14	C	1	2-067	½	MIL-DTL-24643	58

## NOTE:

1. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and BX connectors shown on figures 3A2 through 3A9 and 3A24 through 3A31 are for MIL-DTL-915, MIL-DTL-24640, and MIL-DTL-24643 cable.

FIGURE 3A6. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors.

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APPENDIX A

Cable			Nylon tube		MCP		Stuffing tube			Box conn.	Cable	
Type	Size OD		Size	Pack assy M19622	Insert block	Insert block	Surface size	Submarine			MIL-Spec	Slant sheet
	Min.	Max.						Size	Grommet			
LS2CS-42	0.750	0.800	5	20-0002	30/20		E	2	2-071	¾	MIL-DTL-24640	58
LS2CS-60	0.880	0.930	5	20-0005	30/23		G	3	2-074	¾	MIL-DTL-24640	58
LS2CS-77	1.000	1.070	5	20-0009	40/26		K	4	2-090	1	MIL-DTL-24640	58
LS2SJ-7	0.600	0.615	4T	19-0003	20/15	30/15	C	2	2-068	¾	MIL-DTL-24640	43
LS2SJ-9	0.525	0.545	4T	19-0001	20/13	30/13	C	1	2-066	½	MIL-DTL-24640	43
LS2SJ-11	0.447	0.460	2	17-0004	20/11		B	1	2-064	½	MIL-DTL-24640	43
LS2SJ-12	0.417	0.430	2	17-0002	20/10		A	1	2-063	½	MIL-DTL-24640	43
LS2SJ-14	0.337	0.350	1	16-0006	15/8	20/8	A	1	2-062	½	MIL-DTL-24640	43
LS2SJ-16	0.309	0.325	1	16-0004	15/8	20/8	A	1	2-062	½	MIL-DTL-24640	43
LS2SJ-18	0.295	0.310	1	16-0004	15/7	20/7	A	1	2-061	½	MIL-DTL-24640	43
LS2SJ-20	0.273	0.290	1	16-0001	15/7	20/7	A	1	2-061	½	MIL-DTL-24640	43
LS2SJ-22	0.261	0.275	1	16-0001	15/6	20/6	A	1	2-061	½	MIL-DTL-24640	43
LS2SU-3	0.480	0.520	4T	19-0001	20/13	30/13	C	1	2-065	½	MIL-DTL-24640	31
LS2SU-7	0.610	0.660	4T	19-0005	20/16	30/16	D	2	2-069	¾	MIL-DTL-24640	31
LS2SU-10	0.770	0.830	5	20-0002	30/21		F	3	2-072	1	MIL-DTL-24640	31
LS2SU-14	0.860	0.930	5	20-0004	30/23		G	3	2-074	1	MIL-DTL-24640	31
LS2SU-19	0.970	1.040	5	20-0007	40/26		J	3	2-076	1¼	MIL-DTL-24640	31
LS2SU-24	1.120	1.210	6	21-0001	40/30		L	4	2-094	1¼	MIL-DTL-24640	31
LS2SU-30	1.190	1.260	6	21-0004	40/32	60/32	M	5	2-095	1¼	MIL-DTL-24640	31
LS2SU-37	1.290	1.380	6	21-0004	40/34	60/34	M	5	2-097	1½	MIL-DTL-24640	31
LS2SU-44	1.460	1.550	7	22-0002	60/38		P	6	2-100	2	MIL-DTL-24640	31
LS2SU-61	1.660	1.740	8	23-0003	60/44		R	7	2-103	2	MIL-DTL-24640	31
LS2SUS-3	0.540	0.580	4T	19-0002	20/14	30/14	C	1	2-067	½	MIL-DTL-24640	31
LS2SUS-7	0.670	0.720	4T	19-0006	30/17		D	2	2-070	½	MIL-DTL-24640	31
LS2SUS-10	0.830	0.890	5	20-0004	30/22	40/22	G	3	2-073	¾	MIL-DTL-24640	31
LS2SUS-14	0.920	0.990	5	20-0006	30/24	40/24	J	3	2-075	¾	MIL-DTL-24640	31
LS2SUS-19	1.030	1.100	5	20-0008	40/26		K	4	2-091	1	MIL-DTL-24640	31
LS2SUS-24	1.180	1.270	6	21-0003	40/32	60/32	M	5	2-095	1	MIL-DTL-24640	31
LS2SUS-30	1.250	1.340	6	21-0004	40/34	60/34	M	5	2-096	1¼	MIL-DTL-24640	31
LS2SUS-37	1.350	1.440	6	21-0007	60/36		N	6	2-098	1¼	MIL-DTL-24640	31
LS2SUS-44	1.520	1.610	7	22-0003	60/40		P	7	2-101	1¼	MIL-DTL-24640	31
LS2SUS-61	1.720	1.800	8	23-0003	50/44		S	7	2-105	1½	MIL-DTL-24640	31

## NOTE:

1. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and BX connectors shown on figures 3A2 through 3A9 and 3A24 through 3A31 are for MIL-DTL-915F, MIL-DTL-24640, and MIL-DTL-24643 cable.

FIGURE 3A7. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors.

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APPENDIX A

Cable			Nylon tube		MCP		Stuffing tube			Box conn.	Cable	
Type	Size OD		Size	Pack assy M19622	Insert block	Insert block	Surface size	Submarine			MIL-Spec	Slant sheet
	Min.	Max.						Size	Grommet			
LS2SWAU-3	0.480	0.520	4T	19-0001	20/13	30/13	C	1	2-065	½	MIL-DTL-24643	32
LS2SWAU-7	0.610	0.660	4T	19-0005	20/16	30/16	D	2	2-069	¾	MIL-DTL-24643	32
LS2SWAU-10	0.770	0.830	5	20-0002	30/21		F	3	2-072	1	MIL-DTL-24643	32
LS2SWAU-14	0.860	0.930	5	20-0005	30/23		G	3	2-074	1	MIL-DTL-24643	32
LS2SWAU-19	0.970	1.040	5	20-0007	40/26		J	3	2-076	1¼	MIL-DTL-24643	32
LS2SWAU-24	1.120	1.210	6	21-0003	40/30		L	4	2-094	1¼	MIL-DTL-24643	32
LS2SWAU-30	1.190	1.280	6	21-0004	40/32	60/32	M	5	2-095	1¼	MIL-DTL-24643	32
LS2SWAU-37	1.290	1.380	6	21-0006	40/34	60/34	M	5	2-097	1½	MIL-DTL-24643	32
LS2SWAU-44	1.460	1.550	7	22-0002	60/38		P	6	2-100	2	MIL-DTL-24643	32
LS2SWAU-61	1.660	1.740	8	23-0003	60/44		R	7	2-103	2	MIL-DTL-24643	32
LS2SWL-7	0.860	0.910	5	20-0004	30/23		G	3	2-074	¾	MIL-DTL-24643	56
LS2SWU-1	0.240	0.255	1	16-0004	15/6	20/6	A	1	2-061	¾	MIL-DTL-24643	33
LS2SWU-3	0.670	0.710	4T	19-0005	30/18		D	2	2-070	½	MIL-DTL-24643	33
LS2SWU-7	0.860	0.910	5	20-0004	30/23		G	3	2-074	¾	MIL-DTL-24643	33
LS2SWU-12	1.130	1.200	6	21-0001	40/30		L	4	2-094	1⅝	MIL-DTL-24643	33
LS2SWU-19	1.292	1.380	6	21-0005	40/34	60/34	M	5	2-097	1⅝	MIL-DTL-24643	33
LS2SWU-24	1.500	1.590	7	22-0002	60/39		P	7	2-101	1½	MIL-DTL-24643	33
LS2SWU-30	1.670	1.760	8	23-0002	60/44		S	7	2-104	1¾	MIL-DTL-24643	33
LS2SWU-37	1.785	1.870	8	23-0003	60/46		S	8	2-106	1¾	MIL-DTL-24643	33
LS2SWU-61	2.205	2.300	9	24-0004	90/55		W			2⅝	MIL-DTL-24643	33
LS2U-10	0.450	0.480	3	18-0018	20/12	30/12	B	1	2-064	½	MIL-DTL-24643	45
LS2U-15	0.530	0.560	4T	19-0002	20/14	30/14	C	1	2-067	½	MIL-DTL-24643	45
LS2U-19	0.550	0.580	4T	19-0002	20/14	30/14	C	1	2-067	½	MIL-DTL-24643	45
LS2U-30	0.670	0.700	4T	19-0006	30/17		D	2	2-070	¾	MIL-DTL-24643	45
LS2U-45	0.830	0.870	5	20-0004	30/22	40/22	G	3	2-073	1	MIL-DTL-24643	45
LS2U-60	0.920	0.960	5	20-0005	30/24	40/24	J	3	2-075	1	MIL-DTL-24643	45
LS2UW-42	0.750	0.790	4T	19-0007	30/20		E	2	2-071	¾	MIL-DTL-24643	57
LS2UWS-42	0.800	0.840	5	20-0002	30/21		F	3	2-073	1	MIL-DTL-24643	57
LS2WAU-40	1.320	1.370	6	21-0005	40/34	60/34	M	5	2-096	1½	MIL-DTL-24643	46

## NOTE:

1. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and BX connectors shown on figures 3A2 through 3A9 and 3A24 through 3A31 are for MIL-DTL-915, MIL-DTL-24640, and MIL-DTL-24643 cable.

FIGURE 3A8. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors.

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APPENDIX A

Cable			Nylon tube		MCP		Stuffing tube			Box conn.	Cable	
Type	Size OD		Size	Pack assy M19622	Insert block	Insert block	Surface size	Submarine			MIL-Spec	Slant sheet
	Min.	Max.						Size	Grommet			
LS3SF-7	1.000	1.040	5	20-0007	40/26		J	3	2-076	1	MIL-DTL-24643	44
LS3SJ-9	0.594	0.620	4T	19-0003	20/15	30/15	C	2	2-068	1/2	MIL-DTL-24643	43
LS3SJ-12	0.440	0.455	2	17-0003	20/11	0	B	1	2-063	3/8	MIL-DTL-24643	43
LS3SJ-14	0.353	0.370	2	17-0001	15/9	20/9	A	1	2-062	3/8	MIL-DTL-24643	43
LS3SJ-16	0.323	0.340	1	16-0005	15/8	20/8	A	1	2-062	3/8	MIL-DTL-24643	43
LS3SJ-18	0.308	0.325	1	16-0004	15/8	20/8	A	1	2-062	3/8	MIL-DTL-24643	43
LS3SJ-20	0.284	0.300	1	16-0004	15/7	20/7	A	1	2-061	3/8	MIL-DTL-24643	43
LS3SJ-22	0.271	0.285	1	16-0001	15/7	20/7	A	1	2-061	3/8	MIL-DTL-24643	43
LS3SU-3	0.650	0.700	4T	19-0005	30/17		D	2	2-070	3/4	MIL-DTL-24643	35
LS3SU-7	0.840	0.910	5	20-0004	30/22	40/22	G	3	2-074	1	MIL-DTL-24643	35
LS3SU-10	1.100	1.190	5	20-0010	40/29		L	4	2-094	1 1/4	MIL-DTL-24643	35
LS3SU-14	1.200	1.290	6	21-0003	40/32	60/32	M	5	2-095	1 1/4	MIL-DTL-24643	35
LS3SU-19	1.340	1.430	6	21-0007	60/35		N	6	2-098	1 1/2	MIL-DTL-24643	35
LS3SU-24	1.580	1.670	7	22-0003	60/41		R	7	2-102	2	MIL-DTL-24643	35
LS3SU-30	1.680	1.770	8	23-0002	60/44		S	7	2-103	2	MIL-DTL-24643	35
LS3SU-37	1.840	1.930	8	23-0005	60/48		T	8	2-107	2	MIL-DTL-24643	35
LS3SU-44	2.060	2.150	9	24-0001	60/53	90/53	V	9	2-109	2 1/2	MIL-DTL-24643	35
LS3SUS-3	0.710	0.760	4T	19-0005	30/19		E	2	2-071	3/4	MIL-DTL-24643	35
LS3SUS-7	0.900	0.970	5	20-0004	30/24	40/24	J	3	2-075	1	MIL-DTL-24643	35
LS3SUS-10	1.160	1.250	5	20-0010	40/31		L	4	2-094	1 1/4	MIL-DTL-24643	35
LS3SUS-14	1.260	1.350	6	21-0003	40/33	60/33	M	5	2-096	1 1/4	MIL-DTL-24643	35
LS3SUS-19	1.400	1.490	6	21-0007	60/37		P	6	2-099	1 1/2	MIL-DTL-24643	35
LS3SUS-24	1.640	1.730	7	22-0003	60/43		R	7	2-103	2	MIL-DTL-24643	35
LS3SUS-30	1.740	1.830	8	23-0002	60/45		S	7	2-105	2	MIL-DTL-24643	35
LS3SUS-37	1.900	1.990	9	23-0005	60/49		T	8	2-107	2	MIL-DTL-24643	35
LS3SUS-44	2.120	2.210	9	24-0001	60/55	90/55	W	9	2-110	2 1/2	MIL-DTL-24643	35
LS3SWU-3	0.615	0.655	4T	19-0006	20/16	30/16	D	2	2-069	3/4	MIL-DTL-24643	36
LS3SWU-7	0.880	0.940	5	20-0004	30/23		G	3	2-074	1	MIL-DTL-24643	36
LS3SWU-10	1.100	1.180	6	21-0002	40/28		L	4	2-094	1 1/4	MIL-DTL-24643	36
LS3SWU-14	1.200	1.280	6	21-0004	40/32	60/32	M	5	2-095	1 1/4	MIL-DTL-24643	36
LS3SWU-19	1.370	1.450	6	21-0007	60/36		N	6	2-098	1 1/2	MIL-DTL-24643	36
LS3SWU-24	1.640	1.76	8	23-0001	60/44		R	7	2-104	2	MIL-DTL-24643	36
LS3SWU-30	1.760	1.860	8	23-0003	60/46		S	8	2-106	2	MIL-DTL-24643	36
LS3SWU-37	1.890	1.990	8	23-0006	60/50	90/50	T	8	2-107	2	MIL-DTL-24643	36
LS3SWU-44	2.140	2.240	9	24-0003	90/55		V	9	2-110	2 1/2	MIL-DTL-24643	36
LS3SWUS-3	0.675	0.715	4T	19-0005	30/17		D	2	2-070	3/4	MIL-DTL-24643	36
LS3SWUS-7	0.940	1.000	5	20-0005	30/24	40/24	J	3	2-075	1	MIL-DTL-24643	36
LS3SWUS-10	1.160	1.240	5	20-0010	40/30		L	4	2-094	1 3/8	MIL-DTL-24643	36
LS3SWUS-14	1.260	1.340	6	21-0004	40/33	60/33	M	5	2-096	1 3/8	MIL-DTL-24643	36
LS3SWUS-19	1.430	1.510	6	21-0007	60/37		N	6	2-099	1 3/4	MIL-DTL-24643	36

## NOTE:

1. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and BX connectors shown on figures 3A2 through 3A9 and 3A24 through 3A31 are for MIL-DTL-915, MIL-DTL-24640, and MIL-DTL-24643 cable.

FIGURE 3A9. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors.

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METHOD 3A-10-1

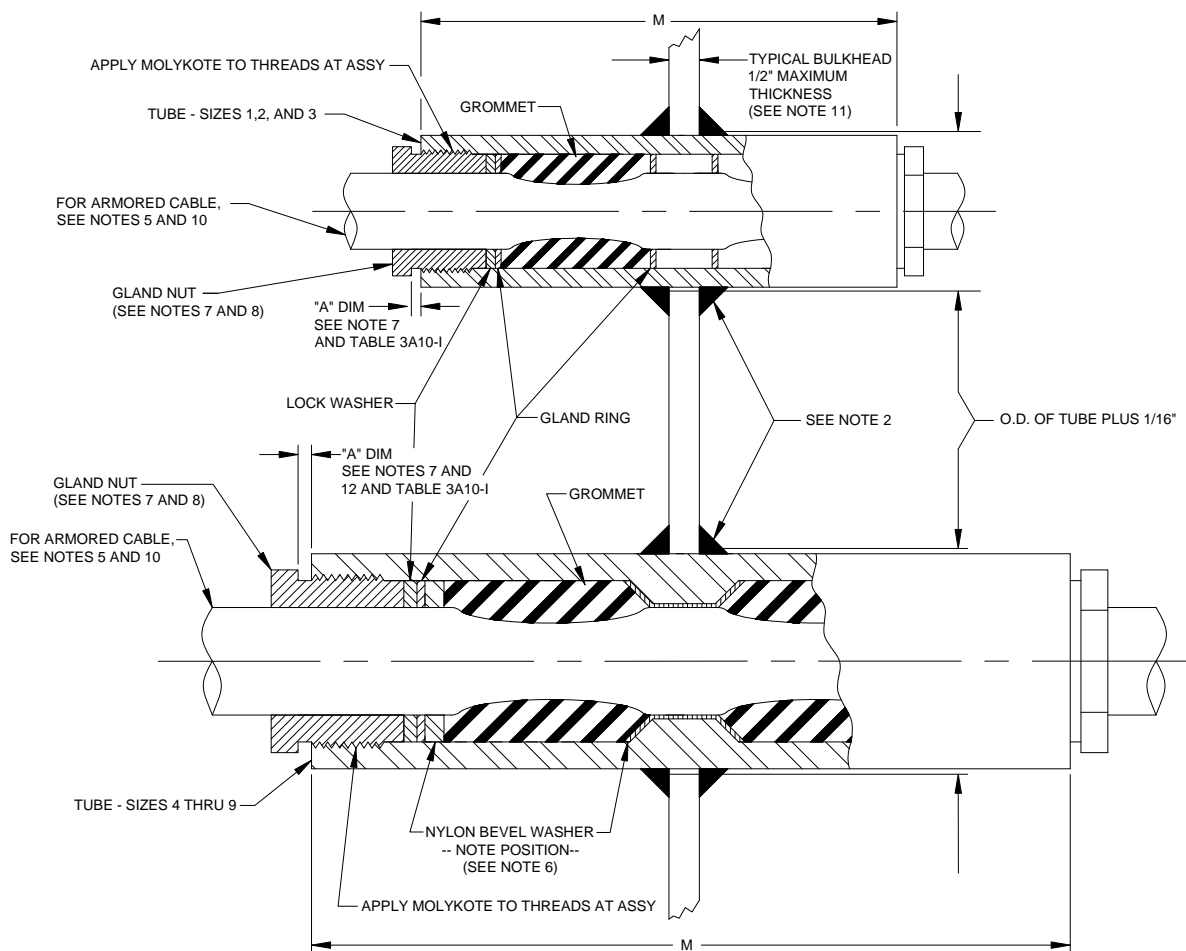


FIGURE 3A10. MIL-S-24235/1 stuffing tubes for passing cables through pressureproof bulkheads (submarines).



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NOTES:

1. Stuffing tubes are designed for cables in accordance with the following specifications (latest revisions): MIL-DTL-915, MIL-DTL-24640, and MIL-DTL-24643.
2. All welding shall comply with approved methods. All welding to or on HY-80 must comply with NAVSEA T9074-AD-GIB-010/1688.
3. Tubes may be thrown out of line by welding. This is permissible up to  $\frac{1}{16}$ ".
4. For non-nuclear bulkheads, grommets may be of neoprene (black). For nuclear bulkheads, grommets shall be of silicone (red or white).
5. To prevent water seepage with armored cable, use a mixture consisting of three (3) to four (4) parts by weight of silicone grease (DC-4 or DC-111; Dow Corning or equal) and one (1) part by weight of milled fiberglass (Owens Corning, Composite Materials, Fiberglas or equal). See note 10 for methods of applying this mixture to grommets or cable.
6. Care shall be taken to assemble the bevel washers in the position indicated hereon.
7. All gland nuts shall be tightened with a torque wrench using the following procedure:
  - a. Tighten gland nuts to an "A" dimension of approximately  $\frac{1}{4}$ " (two threads visible on gland nut) whenever possible without exceeding the maximum torque indicated in table 3A10-I for a particular tube size (this maximum torque restriction applies only to tube sizes 1 through 4 inclusive). If maximum torque is obtained before the  $\frac{1}{4}$ " spacing requirement is achieved, the "A" dimension shall not exceed  $\frac{3}{8}$ ".
  - b. In the event minimum torque (as indicated in table 3A10-I) is not obtained at  $\frac{1}{8}$ ", continue to tighten the gland nut until this torque is reached. If metal-to-metal contact is achieved without obtaining minimum torque, the gland nut shall be backed off, an additional split gland ring inserted in the stuffing tube, and the gland nut retightened. No more than two additional gland rings, inserted one at a time, shall be installed in each end of a tube to raise the torque value to the minimum specified in table 3A10-I.

TABLE 3A10-I. Gland nut torque values (see notes 7 and 12).

Tube size	Min.	Max.	Max. "A" dimension (inches)
1	17	30	$\frac{1}{4}$
2	20	35	$\frac{1}{4}$
3	40	80	$\frac{1}{4}$
4	50	100	$\frac{1}{4}$
5	60	No max.	$\frac{1}{8}$
6	70	No max.	$\frac{1}{8}$
7	100	No max.	$\frac{1}{8}$
8	110	No max.	$\frac{1}{8}$
9	125	No max.	$\frac{1}{8}$

FIGURE 3A10. MIL-S-24235/1 stuffing tubes for passing cables through pressureproof bulkheads (submarines) - Continued.

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NOTES (continued):

8. It is recommended that sockets (Type II, Class I, Style A, Form B, standard wall octagon) and wrench heads (Type I, Class I, Style A, open ratchet, crowfoot, multipurpose) manufactured in accordance with A-A-3041 and A-A-3042 be used with a suitable torque wrench (preferably a sensory signaling type) to tighten gland nuts. Torque values listed in table 3A10-I were obtained using sockets and wrench heads listed above.
9. Existing gland nuts manufactured to the canceled BUSHIPS Drawing 815-1197030 may be used providing care is taken to ensure a good fit between the gland nut and the applicable socket. Where possible, use gland nuts in accordance with MIL-S-24235/1 and MIL-S-24235/2. This is necessary to prevent deforming the gland nut corners and wedging of the socket on the gland nut, causing erroneous torque readings.
10. Methods for applying glass flock mixture:
  - a. Coat entire inner surface and leading edge of split grommet with mixture just prior to attachment to cable. Grommet should be attached just outside of tube to minimize loss of mixture.
  - b. Coat that portion of the cable that will eventually be under grommet (this shall be done just prior to pulling final few inches of cable into tube).
11. For bulkheads in excess of ½" but not greater than 1", tube body dimensions shall be modified as shown in table 3A10-II.

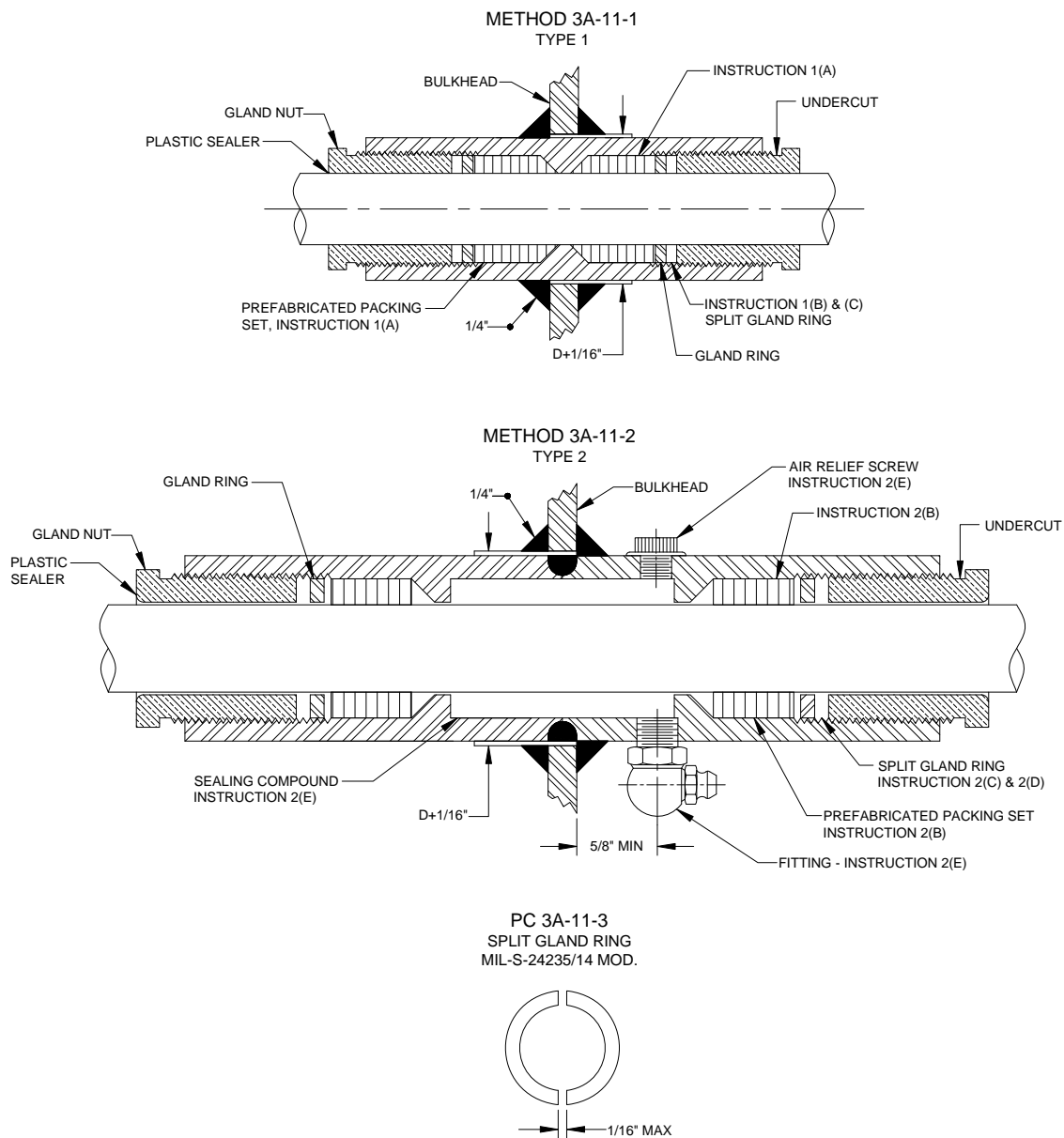
TABLE 3A10-II. Length modifications (inches).

<b>Tube size</b>	<b>Center section dimension</b>	<b>Tube length "m" dimension</b>
1	1¾	6½
2	1¾	7⅛
3	1¾	8
4	1¾	9⅜
5	1¾	10⅞
6	1¾	11½
7	1¾	12¼
8	1¾	12½
9	1¾	12¾

12. The "A" dimension for tube sizes 5 through 9 shown in table 3A10-I are desired dimensions. Variations from this dimension, up to a maximum "A" dimension of 5/6", can be approved locally at the discretion of the Naval Electrical Design Representatives provided all stuffing tube parts and the installed cable are first inspected to determine compliance with applicable specifications.
13. This method may be employed on surface ship sonar dome applications. Welding shall be in accordance with MIL-STD-1689.

FIGURE 3A10. MIL-S-24235/1 stuffing tubes for passing cables through pressureproof bulkheads (submarines) - Continued.

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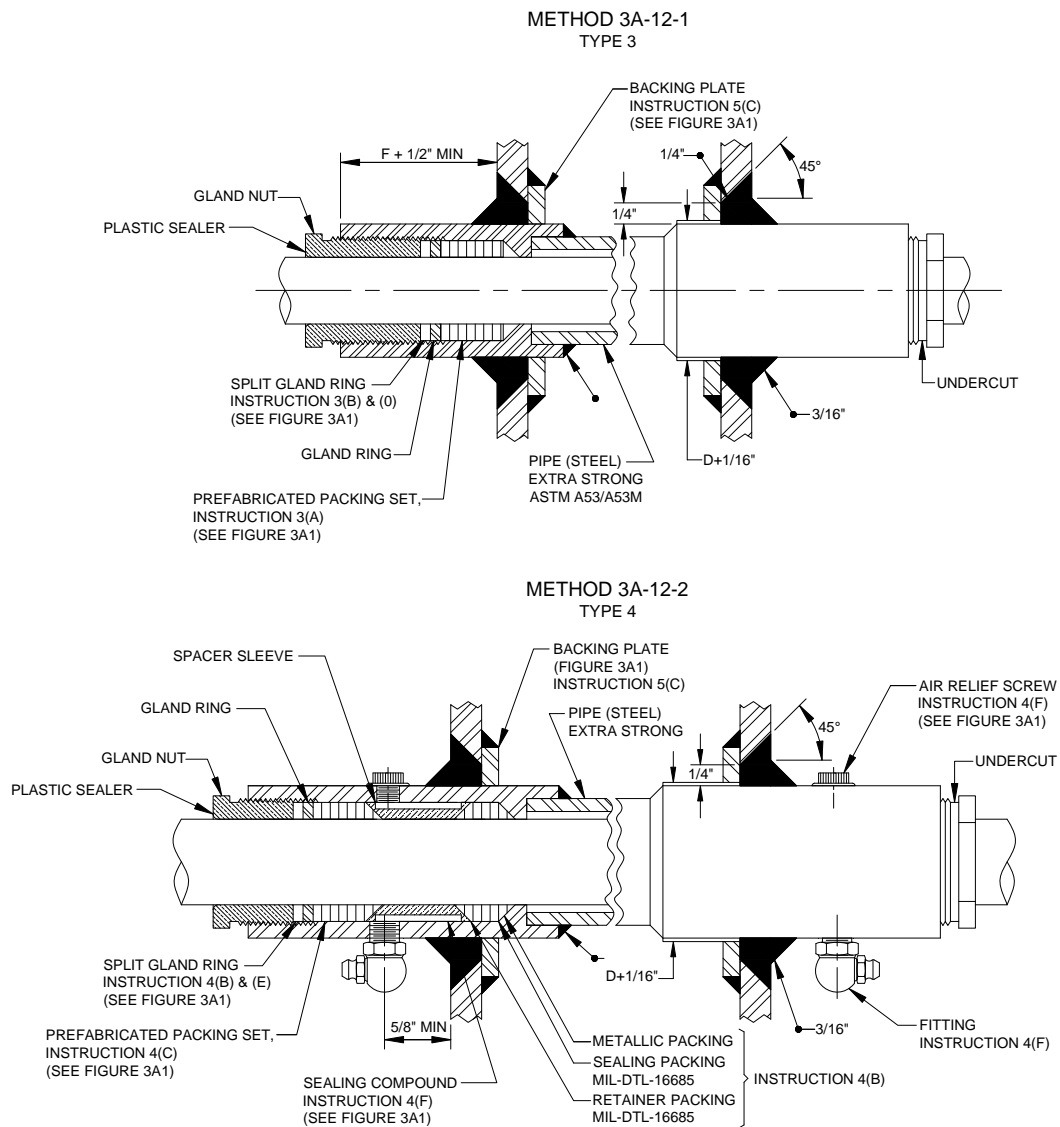


NOTE:

1. See figure 3A1 for instructions.

FIGURE 3A11. Stuffing tubes for passing cable through pressure-proof bulkheads type 1 & 2 of drawing 9000-S6202-73899 (submarines).

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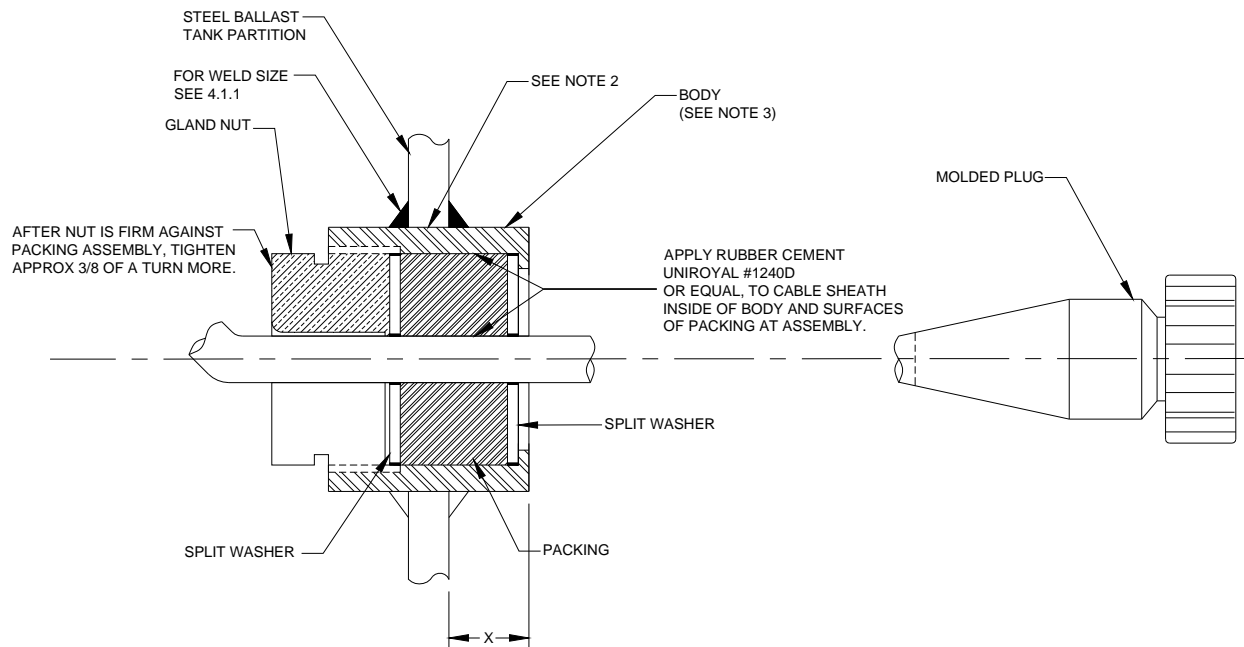
NOTE:

1. See figure 3A1 for instructions.

FIGURE 3A12. Stuffing tubes for passing cable through pressure-proof bulkheads type 3 & 4 of drawing 9000-S6202-73899 (submarines).

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METHOD 3A-13-1



NOTES:

1. Tubes may be thrown out of line by welding. This is permissible up to  $\frac{1}{16}$ ".
2. Hole diameter shall be outside diameter of tube plus  $\frac{1}{16}$ ".
3. Position stuffing tube so that gland nut is on the most accessible side of ballast tank partition.

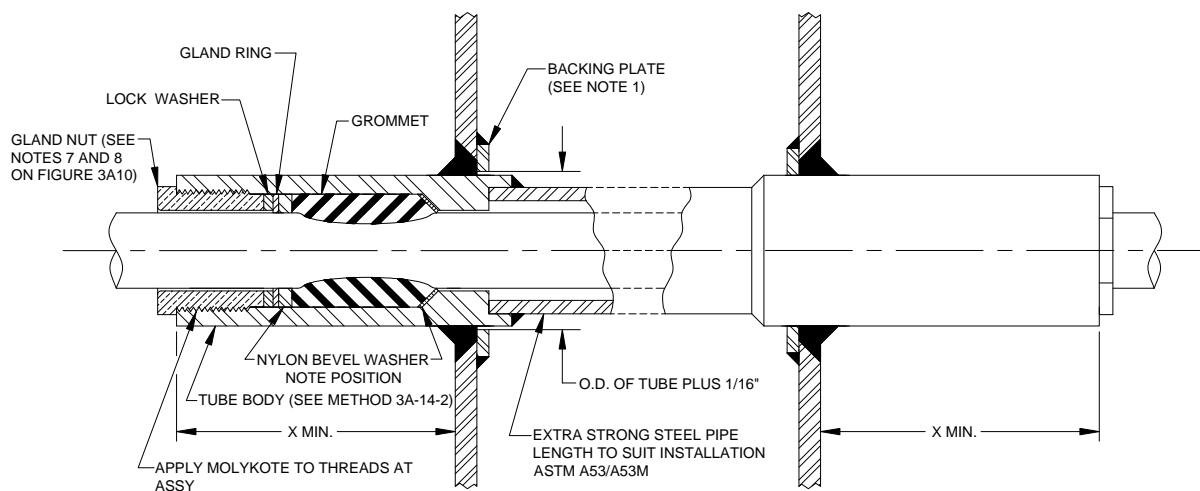
TABLE 3A13-I. Application table.

Stuffing tube sym. no.	Cable type	Molded plug MIL-C-24231	Dimension X
2425	TSS-4 DSS-3 DSS-4	713	$\frac{9}{16}$
2425.1	TSS-4 FSS-2	713.1	$\frac{3}{4}$
2425.2	FSS-4	713.1	$\frac{3}{4}$

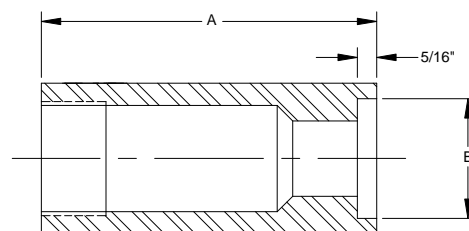
FIGURE 3A13. MIL-S-24235/5 stuffing tube for passing cable through ballast tank partitions (submarines).

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METHOD 3A-14-1



METHOD 3A-14-2  
SAME AS 1197030 EXCEPT AS SHOWN



NOTES:

1. When backing plate is used, it shall be the diameter of the tube plus  $1\frac{3}{16}$ " thick.
2. Notes on figure 3A10 apply.
3. Pipe shall be in accordance with ASTM A53/A53M.

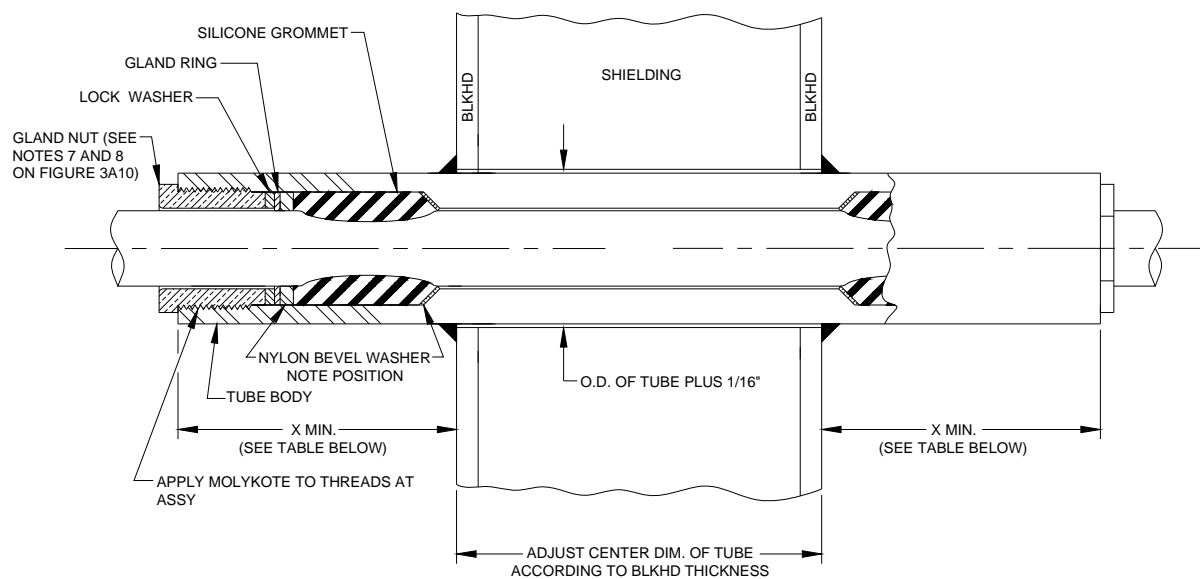
TABLE 3A14-I. Table of dimensions.

Tube size	Extra strong pipe	"X"	"A"	"B"
1	$\frac{3}{4}$	3	4	1.065
2	1	$3\frac{5}{16}$	$4\frac{5}{16}$	1.330
3	$1\frac{1}{4}$	$3\frac{3}{4}$	$4\frac{3}{4}$	1.675
4	$1\frac{1}{2}$	$4\frac{7}{16}$	$5\frac{7}{16}$	1.915
5	2	$5\frac{3}{16}$	$6\frac{3}{16}$	2.400
6	2	$5\frac{1}{2}$	$6\frac{1}{2}$	2.400
7	$2\frac{1}{2}$	$5\frac{7}{8}$	$6\frac{7}{8}$	2.906
8	3	6	7	3.648
9	3	$6\frac{1}{8}$	$7\frac{1}{8}$	3.546

FIGURE 3A14. Passing cable through tanks (pipe extension) (submarines).

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METHOD 3A-15-1



NOTE:

- Notes on figure 3A10 apply.

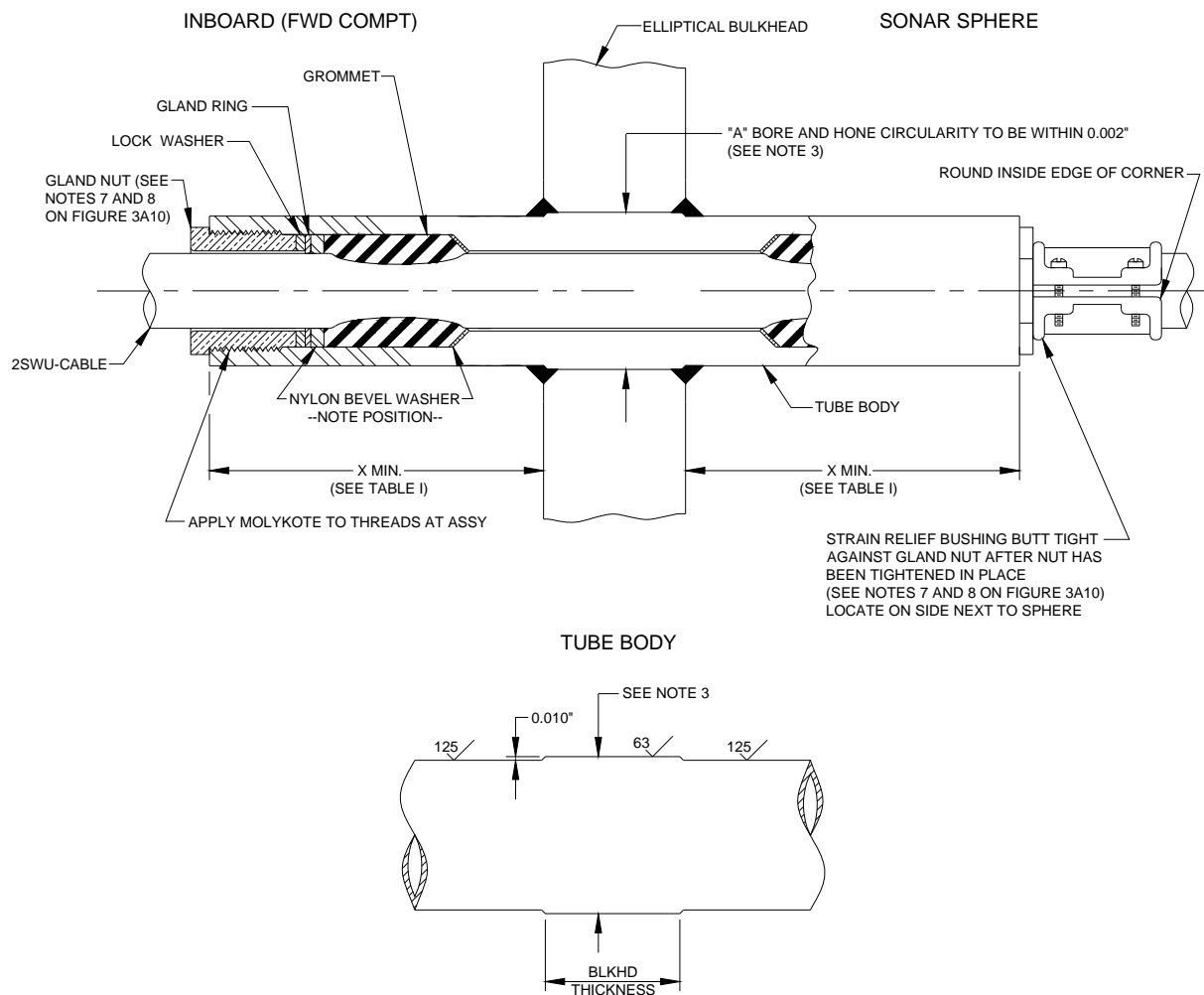
TABLE 3A15-I. Table of dimensions.

Tube size	Dimension "X"
1	3
2	$3\frac{5}{16}$
3	$3\frac{3}{4}$
4	$4\frac{7}{16}$
5	$5\frac{3}{16}$
6	$5\frac{1}{2}$
7	$5\frac{7}{8}$
8	6
9	$6\frac{1}{8}$

FIGURE 3A15. MIL-S-24235 stuffing tube for passing cables through shielded bulkheads (submarines).

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METHOD 3A-16-1



NOTES:

1. Notes on figure 3A10 apply.
2. Installation shall be in accordance with note 2 on figure 3A10. Tube spacing and weld joint efficiency shall be in accordance with NAVSEA T9074-AD-GIB-010/1688.
3. Provide an interface fit of 0.000" and 0.001" between "A" bore and tube body.
4. Bore and length dimensions (A and X) are based on 2 $\frac{5}{16}$ " thick elliptical bulkhead.
5. For correct strain relief bushing, see table 3A16-I below and NAVSEA 9000-S6202-73241.

FIGURE 3A16. Cables through elliptical bulkheads (submarines).



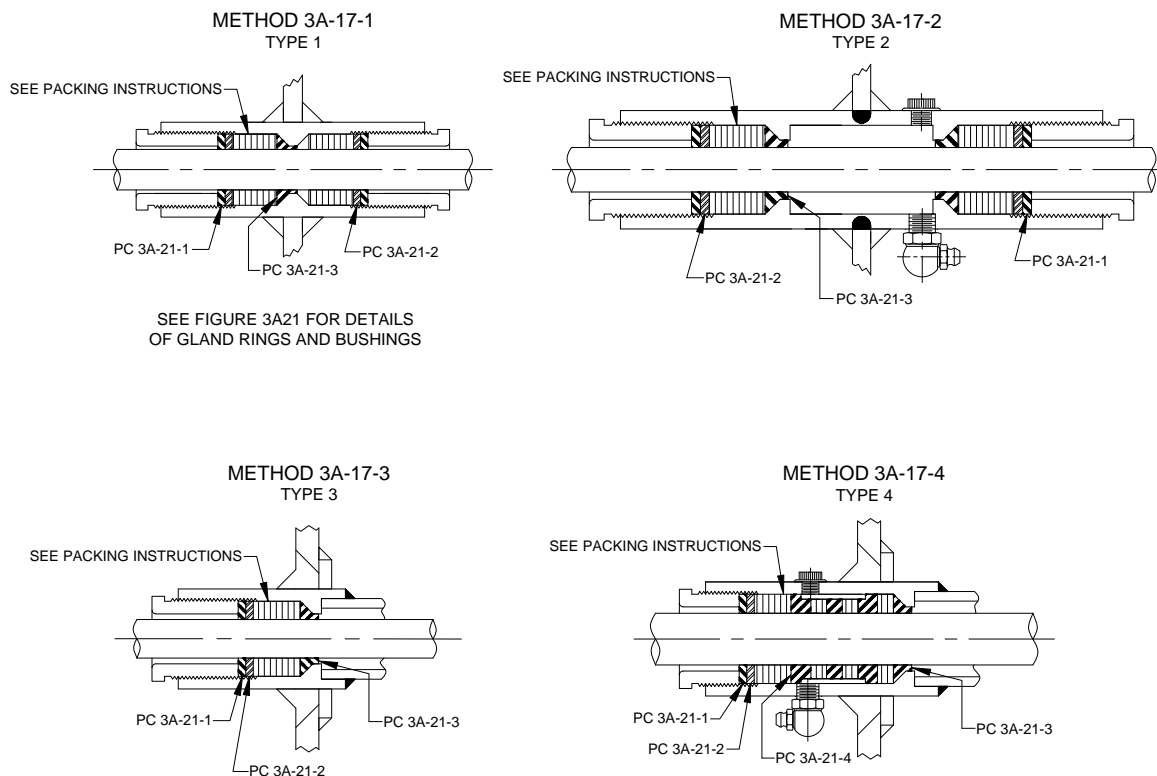
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TABLE 3A16-I. Bore and length dimensions and strain relief bushings.

Tube size	Strain relief bushing size	Dimension "X" (inches)	Dimension "A" (inches)
1		3¼	1.488 1.484
2		3 <sup>9</sup> / <sub>16</sub>	1.669 1.684
3		4 <sup>3</sup> / <sub>16</sub>	2.109 2.103
4		4 <sup>7</sup> / <sub>8</sub>	2.299 2.292
5		5 <sup>13</sup> / <sub>16</sub>	2.669 2.662
6	5	6 <sup>3</sup> / <sub>16</sub>	2.799 2.792
7	5	6 <sup>9</sup> / <sub>16</sub>	3.299 3.291
8	6a	7 <sup>1</sup> / <sub>8</sub>	3.924 3.916
9	6a	7 <sup>1</sup> / <sub>8</sub>	3.924 3.916

FIGURE 3A16. Cables through elliptical bulkheads (submarines) - Continued.

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**Method of changing installed bulkhead tubes to one size larger:**

Installed bulkhead stuffing tubes, types 1, 2, 3, & 4 of Drawing 9000-S6202-73899 and 46-1 of BUSHIPS drawing 9000-S6202-51-L may be modified to provide for cables requiring one size larger tube by reaming the tube body, gland nut, and the spacer sleeve to the "a" dimension and the gland ring to the "aa" dimension of the next larger size (see figure 3A21), except sizes "C" and "M" of types 3 and 4 which can be reamed only to 0.732" and 1.490" diameters respectively.

**Method of changing installed bulkhead tubes to smaller sizes:**

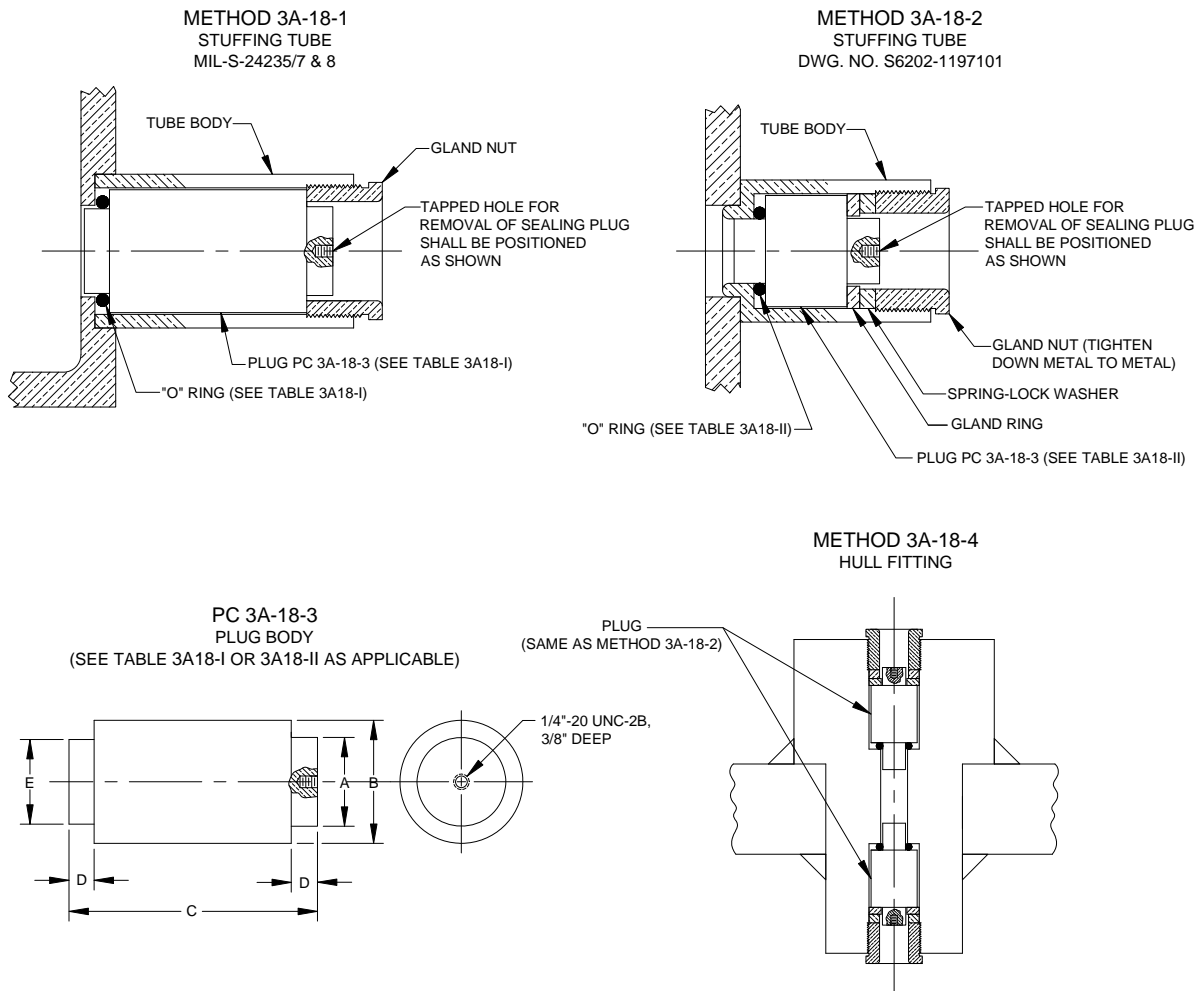
Installed bulkhead stuffing tubes, types 1, 2, 3, 4, and 46-1, may be modified to provide for cables requiring smaller size tubes by the use of the gland rings, bushings and spacer sleeves, PCs 3A211 & 3A212, 3A213, and 3A214 (figure 3A21) respectively in lieu of those furnished with the tubes.

**Instructions for packing:**

Tubes shall be packed in accordance with "instructions for packing stuffing tubes" (figure 3A1) except that the packing material, parts A and B, MIL-DTL-16685, of a suitable size and quantity shall be installed by hand in lieu of prefabricated packing set.

FIGURE 3A17. Method of changing sizes of installed bulkhead stuffing tubes types 1 to 4 of drawing 9000-S6202-73899 & 46-1 of drawing 9000-S6202-5100L (submarines).

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NOTES:

1. Sealing plugs covered by this figure are intended for temporary blanking of stuffing tubes installed prior to installation of cables.
2. Material for plug body to be brass, ASTM B21/B21M.
3. "O" rings shall be in accordance with SAE-AMS-P-83461.

TABLE 3A18-I. Table of dimensions – sealing plugs, method 3A-18-1.

M24235/7 & 8 tube size	A	B	C	D	E	"O" ring PC no. (see note 3)
A	$\frac{17}{32}$	$\frac{53}{64}$	$2\frac{1}{16}$	$\frac{1}{4}$	$\frac{17}{32}$	ARP 568-113
B	$\frac{23}{32}$	$1\frac{1}{32}$	$2\frac{7}{16}$	$\frac{5}{16}$	$\frac{23}{32}$	ARP 568-116
C	$\frac{31}{32}$	$1\frac{11}{32}$	$2\frac{13}{16}$	$\frac{5}{16}$	$\frac{31}{32}$	ARP 568-214
D	$\frac{31}{32}$	$1\frac{11}{32}$	$3\frac{7}{32}$	$\frac{5}{16}$	$\frac{31}{32}$	ARP 568-214
E	$1\frac{3}{16}$	$1\frac{37}{64}$	$2\frac{13}{16}$	$\frac{5}{16}$	$1\frac{3}{16}$	ARP 568-218
F	$1\frac{17}{32}$	2	$2\frac{13}{16}$	$\frac{5}{16}$	$1\frac{17}{32}$	ARP 568-223

FIGURE 3A18. Sealing plugs for blanking steel stuffing tubes (submarines).

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TABLE 3A18-II. Table of dimensions – sealing plugs, method 3A-18-2.

<b>S6202-1197101 tube sym. no.</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>“O” ring PC no. (see note 3)</b>
2446.1	0.500	0.867	2.077	0.625	0.500	ARP 568-112
2446.2	0.621	1.084	2.267	0.625	0.646	ARP 568-115
2446.3	0.725	1.302	2.449	0.625	0.711	ARP 568-211
2446.4	1.100	1.867	2.782	0.750	1.100	ARP 568-216

FIGURE 3A18. Sealing plugs for blanking steel stuffing tubes (submarines) - Continued.

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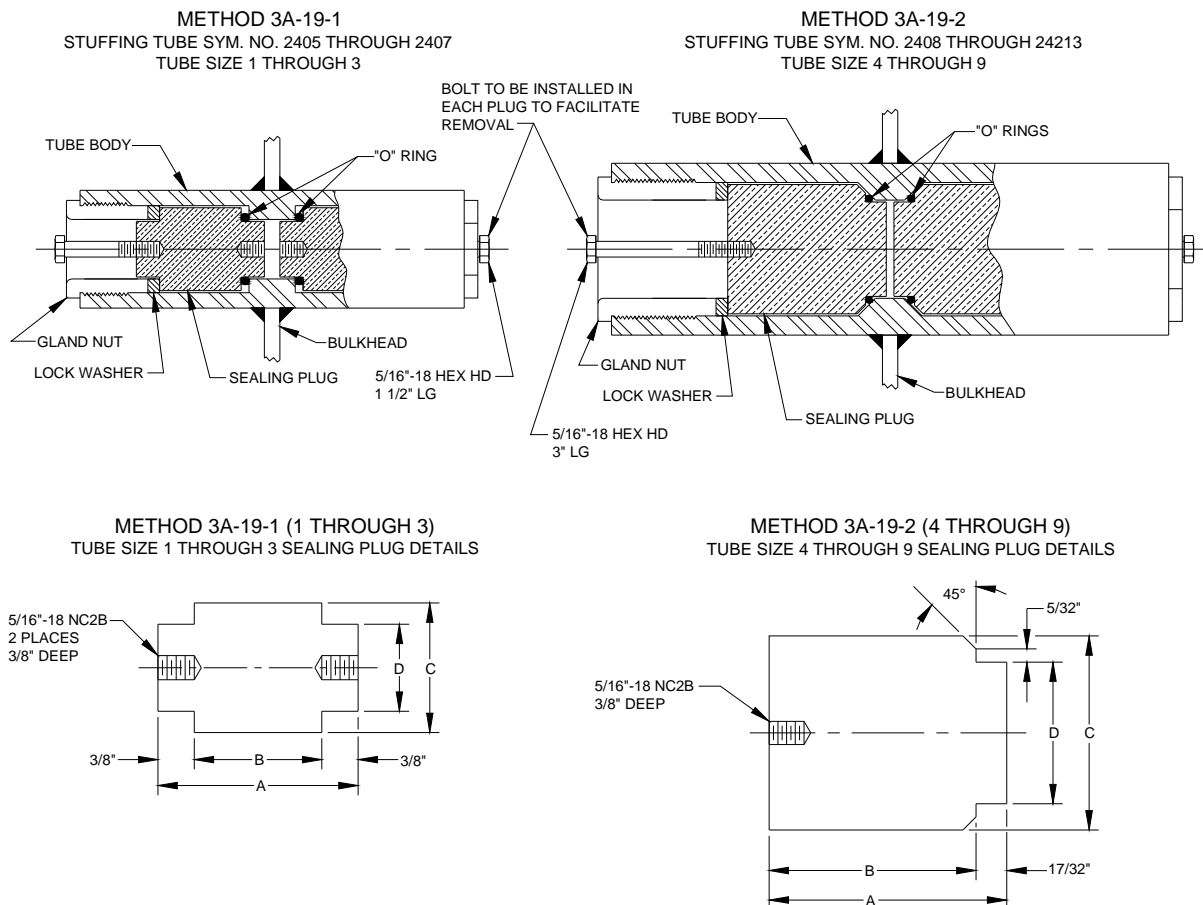


TABLE 3A19-I. Associated data and sealing plug dimensions.

Tube size	"O" ring size (2 required)	Sealing plug (2 required)	A	B	C	D
1	ARP 568-113	3A191-1	1 <sup>53</sup> / <sub>64</sub>	1 <sup>5</sup> / <sub>64</sub>	0.986	0.594
2	ARP 568-116	3A191-2	2 <sup>9</sup> / <sub>64</sub>	1 <sup>25</sup> / <sub>64</sub>	1.173	0.797
3	ARP 568-214	3A191-3	2 <sup>1</sup> / <sub>2</sub>	1 <sup>3</sup> / <sub>4</sub>	1.486	1.047
4	ARP 568-218	3A192-4	2 <sup>1</sup> / <sub>2</sub>	1 <sup>31</sup> / <sub>32</sub>	1.673	1.250
5	ARP 568-220	3A192-5	3 <sup>1</sup> / <sub>8</sub>	2 <sup>19</sup> / <sub>32</sub>	1.923	1.422
6	ARP 568-223	3A192-6	3 <sup>5</sup> / <sub>16</sub>	2 <sup>25</sup> / <sub>32</sub>	2.173	1.610
7	ARP 568-225	3A192-7	3 <sup>1</sup> / <sub>2</sub>	2 <sup>31</sup> / <sub>32</sub>	2.548	1.860
8	ARP 568-227	3A192-8	3 <sup>5</sup> / <sub>8</sub>	3 <sup>3</sup> / <sub>32</sub>	2.861	2.172
9	ARP 568-228	3A192-9	3 <sup>11</sup> / <sub>16</sub>	3 <sup>5</sup> / <sub>32</sub>	2.988	2.297

FIGURE 3A19. Temporary plugging of steel stuffing tubes (submarines).

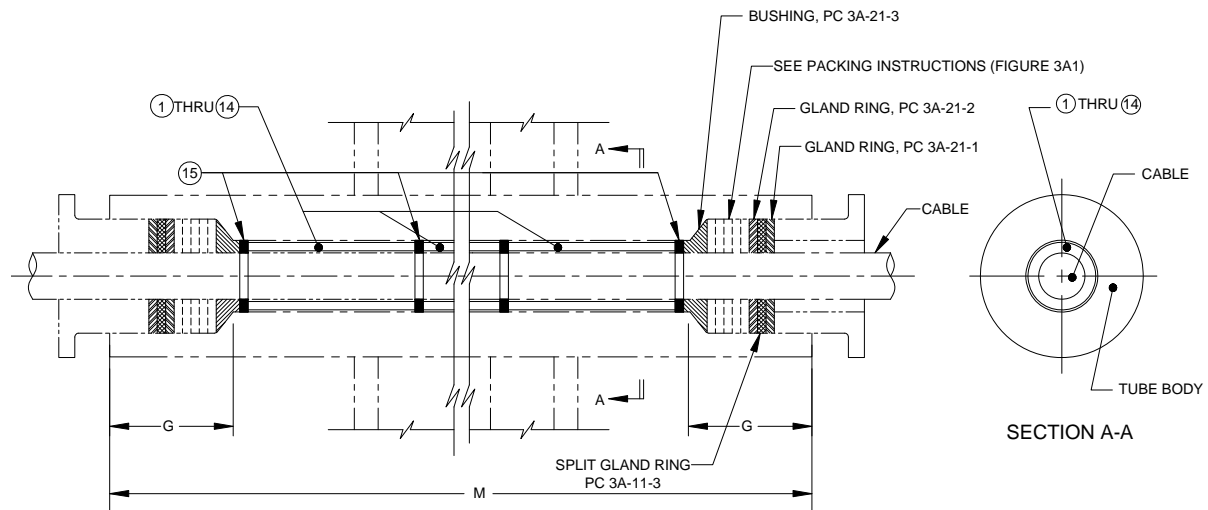
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## NOTES:

1. The pieces and methods shown on this figure are means of temporarily plugging an electrical fitting which, due to design changes, no longer has a specific cable assigned to it. Temporary plugging shall be used for any of the following conditions:
  - a. Fitting is so inaccessible as to prevent accomplishing a permanent patch.
  - b. Welding heat involved in permanent patching is liable to damage adjacent fittings and cable.
  - c. Immediate reuse is likely on another system.
2. At the time of final preparation for delivery of the ship, all unused cable fittings not in categories a, b, or c above shall be removed and patched permanently as indicated by the applicable hull structural plans for permanent patching of bulkhead and hull penetrations.
3. "O" rings shall be synthetic rubber in accordance with SAE-AMS-P-83461.
4. Use existing lockwashers and gland nuts.
5. Material for sealing plugs shall be brass.
6. Bolts shall remain installed until plug is removed.

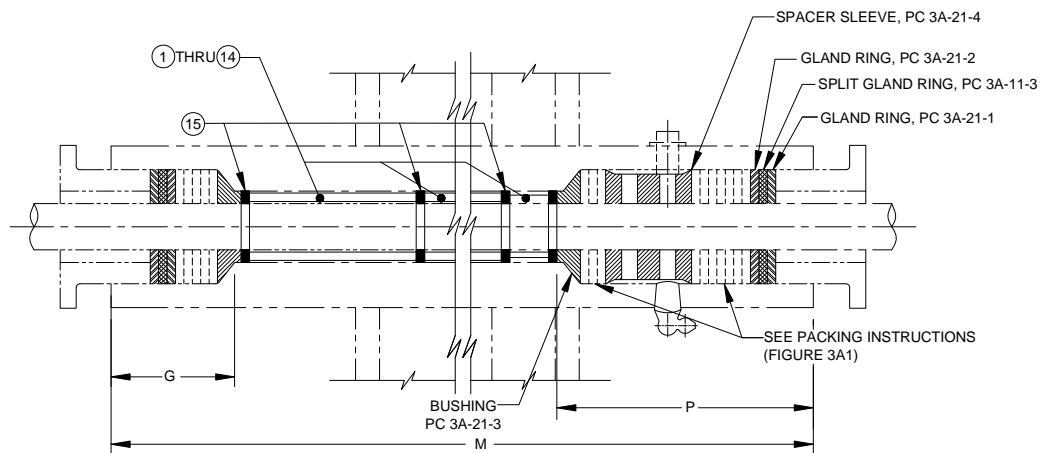
FIGURE 3A19. Temporary plugging of steel stuffing tubes (submarines) - Continued.

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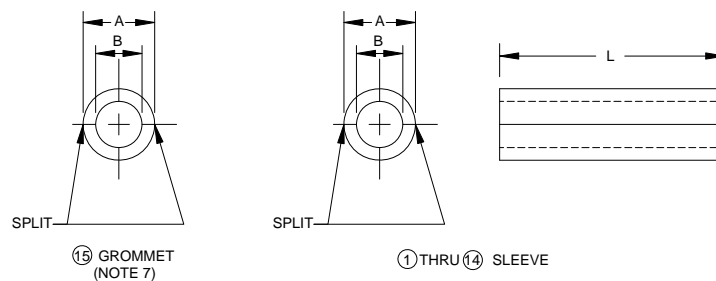
ASSEMBLY 1

SEE FIGURE 3A21 FOR DETAILS OF BUSHING, SLEEVE, AND GLAND RINGS



ASSEMBLY 2

(SAME AS ASSY 1 EXCEPT AS SHOWN)



NOTES:

1. This method and the drawings called out were applicable to S5W submarines only and are included in MIL-STD-2003 for historical purposes only. Any current use of this method shall be expressly approved by NAVSEA 08.
2. Deviation from this drawing is not permitted without prior written approval of NAVSEA 08 or the NAVSEA designated reactor plant design yard.

FIGURE 3A20. Bushing sleeves for drawing 9000-S6202-73899 stuffing tubes through steel shielded bulkheads.

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NOTES (continued):

3. Abbreviations are in accordance with ASME Y14.38.
4. The requirements of this drawing are not retroactive for existing bushed stuffing tubes.
5. Stuffing tube bushing sleeves in accordance with this figure shall be installed in bushed stuffing tubes through shielded bulkheads when the difference between the inner diameter of the stuffing tube throat and the outer diameter of the cable is  $\frac{1}{4}$ " or greater.
6. Stuffing tube bushing sleeves items 1 through 14 can be installed in one, two, or three sections as required to facilitate installation.
7. Stuffing tube bushing sleeves items 1 through 14 and grommets item 15 shall be installed in stuffing tube, and tube shall be packed in accordance with instructions on figure 3A1. The "A" and "B" dimensions of item 15 shall duplicate the "A" and "B" dimensions of items 1-14.
8. Grommet item 15 shall be manufactured from silicone sheet rubber, 0.25" thick in accordance with A-A-59588, CL 2G GR50 and shall be cemented to bushing items 1 through 14 prior to installation using adhesive in accordance with MMM-A-121.
9. Material for items 1 through 14 shall be steel bar round with cold finish or seamless carbon steel pipe in accordance with MIL-P-24338 may be substituted to facilitate machining provided that no deviations from the tolerances of table 3A20-I are made.
10. For dimensions not detailed herein, see drawings SS-302-1716060 and SS-302-1885724.

TABLE 3A20-I. Sleeve dimensions (see note 8).

Assy	Existing stuffing tube size	Sleeve item no.	Dim. “A”	Dim. “B”	Dim “L” (note 5)		
1	A	-	-	-			
	B	-	-	-			
	C	1	0.578	“B” = cable O.D. + 0.062	$\frac{(M-2G)-1}{3} = L$	When sleeve is installed in three sections.	$(M-2G)-0.5 = L$
	D	2	0.688		$\frac{(M-2G)-0.75}{2} = L$	When sleeve is installed in two sections.	When sleeve is installed in one section.
	E	2	0.750				
	F	3	0.781				
2	G	4	0.891		$\frac{M-(G+P)-1}{3} = L$	When sleeve is installed in three sections.	
	J	4	1.000	$\frac{M-(G+P)-0.75}{2} = L$	When sleeve is installed in two sections.		
	K	5	1.109	$M-(G+P)-0.5 = L$	When sleeve is installed in one section.		
	L	6	1.203				
	M	7	1.344				
	N	8	1.453				
	P	9	1.563				
	R	10	1.688				
	S	11	1.813				
	T	12	2.000				
	V	13	2.125				
	W	14	2.250				
					TOLERANCES		
					Fractional	=	1/32 inches
					Decimal	=	0.005 inches
					Angles	=	0°-30' degrees
					Unless otherwise noted		

FIGURE 3A20. Bushing sleeves for drawing 9000-S6202-73899 stuffing tubes through steel shielded bulkheads -  
Continued.



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TABLE 3A21-I. Table of dimensions.

Stuffing tube			Bushed down to stuffing tube size two tube sizes maximum without NAVSEA approval																
9-S 5100-1	S6202 73899	Tube size	A a = .406 aa = $\frac{3}{64}$ " x	B a = .515 aa = $\frac{3}{64}$ " x	C a = .640 aa = $\frac{5}{8}$ " x	D a = .750 aa = $\frac{7}{64}$ " x	E a = .812 aa = $\frac{13}{64}$ " x	F a = .843 aa = $\frac{7}{32}$ " x	G a = .953 aa = $\frac{61}{64}$ " x	J a = 1.062 aa = $1\frac{3}{64}$ " x	K a = 1.171 aa = $1\frac{5}{32}$ " x	L a = 1.265 aa = $1\frac{1}{4}$ " x	M a = 1.406 aa = $1\frac{5}{8}$ " x	N a = 1.515 aa = $1\frac{1}{2}$ " x	P a = 1.625 aa = $1\frac{39}{64}$ " x	R a = 1.750 aa = $1\frac{7}{64}$ " x	S a = 1.875 aa = $1\frac{55}{64}$ " x	T a = 2.062 aa = $2\frac{3}{64}$ " x	V a = 2.187 aa = $2\frac{11}{64}$ " x
Type	Type																		
46-1	1	3	A																
			B	0.500															
			C	0.625	0.625														
			D	0.735	0.735	0.735													
			E	0.797	0.797	0.797	0.797												
			F	0.828	0.828	0.828	0.828	0.828											
	2	4	G	0.938	0.938	0.938	0.938	0.938	0.938										
			J	1.047	1.047	1.047	1.047	1.047	1.047										
			K	1.156	1.156	1.156	1.156	1.156	1.156	1.156									
			L	1.250	1.250	1.250	1.250	1.250	1.250	1.250	1.250								
			M	1.391	1.391	1.391	1.391	1.391	1.391	1.391	1.391	1.391							
			N	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.500	1.500						
			P	1.610	1.610	1.610	1.610	1.610	1.610	1.610	1.610	1.610	1.610	1.610					
			R	1.735	1.735	1.735	1.735	1.735	1.735	1.735	1.735	1.735	1.735	1.735	1.735				
			S	1.860	1.860	1.860	1.860	1.860	1.860	1.860	1.860	1.860	1.860	1.860	1.860	1.860	1.860		
			T	2.047	2.047	2.047	2.047	2.047	2.047	2.047	2.047	2.047	2.047	2.047	2.047	2.047	2.047	2.047	
			V	2.172	2.172	2.172	2.172	2.172	2.172	2.172	2.172	2.172	2.172	2.172	2.172	2.172	2.172	2.172	2.172
			W	2.297	2.297	2.297	2.297	2.297	2.297	2.297	2.297	2.297	2.297	2.297	2.297	2.297	2.297	2.297	2.297

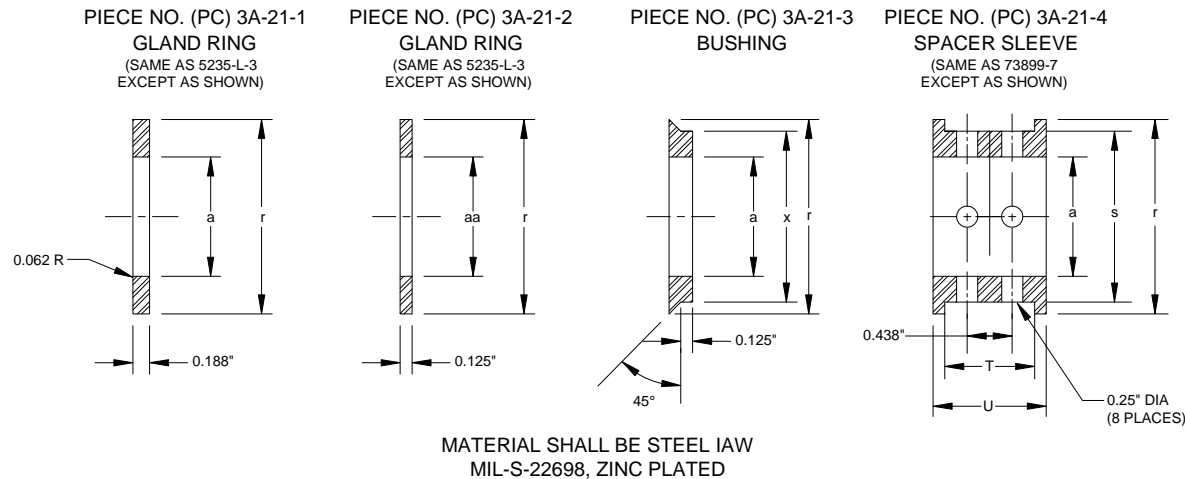


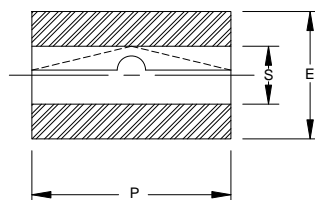
TABLE 3A21-I. Table of dimensions - Continued.

Tube size	r	s	T	U
A	0.750			
B	0.875			
C	1.000			
D	1.125			
E	1.125			
F	1.187			
G	1.375	1.187	1.000	1.250
J	1.500	1.312	1.000	1.250
K	1.625	1.437	1.187	1.437
L	1.687	1.500	1.187	1.437
M	1.875	1.687	1.187	1.437
N	1.937	1.750	1.187	1.437
P	2.062	1.875	1.187	1.437
R	2.187	2.000	1.187	1.437
S	2.562	2.375	1.187	1.437
T	2.750	2.562	1.187	1.437
V	2.875	2.687	1.187	1.437
W	3.000	2.812	1.187	1.437

FIGURE 3A21. Size and details of adapters used for changing size of installed bulkhead stuffing tubes – 9000-S6202-73899 (submarines).

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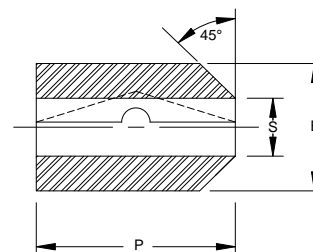
PIECE NO. (PC) 3A-22-1



GROMMET FOR TUBE SIZE 2 AND 3

1. SIMILAR TO M24235/2-061 THROUGH -076 EXCEPT FOR DIMENSIONS.

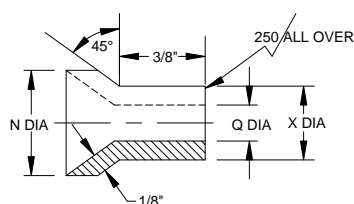
PIECE NO. (PC) 3A-22-2



GROMMET FOR TUBE SIZE 4 THROUGH 9

1. SIMILAR TO M24235/2-090 THROUGH -110 EXCEPT FOR DIMENSIONS.

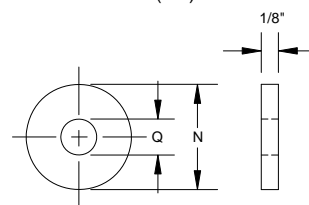
PIECE NO. (PC) 3A-22-3



BUSHING

1. MATL. AL. BRZ., ASTM B150/B150M AND ASTM B169/B169M.  
2. BREAK ALL SHARP CORNERS.

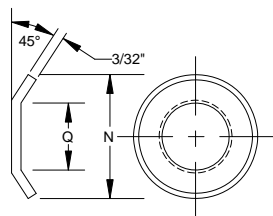
PIECE NO. (PC) 3A-22-4



GLAND RING

1. SIMILAR TO M24235/2-120 THROUGH -144 EXCEPT FOR DIMENSIONS.

PIECE NO. (PC) 3A-22-5



BEVEL WASHER

1. SIMILAR TO M24235/2-160 THROUGH 180 EXCEPT FOR DIMENSIONS.

NOTES:

1. This figure provides a method for adapting existing MIL-S-24235 stuffing tubes to accept cables assigned to smaller tube sizes. To determine dimensions required to adapt a stuffing tube for a particular cable, obtain the grommet number for the cable from the tables on figures 3A2 through 3A8. Enter table of dimensions at left with the existing tube size and packing symbol number. A dash indicates that particular stuffing tube size/packing assembly combination is either not applicable or not allowed.
2. Bushing, gland ring, bevel washer, and grommet shall be manufactured to the requirements of MIL-S-24235 except as shown on this drawing. Each item shall be marked with a piece number consisting of sym. no. and "(MOD)" (for example "2405.3 (MOD)").
3. Adapter assembly for stuffing tubes size 2 and 3 consists of four gland rings, PC 3A-22-4, and two grommets, PC 3A-22-1. Adapter assembly for stuffing tubes size 4 through 9 consists of two each: gland ring, PC 3A-22-4, grommet, PC 3A-22-2, bushing, PC 3A-22-3, and bevel washer, PC 3A-22-5.
4. Adapter assembly shall be installed in accordance with figure 3A10 for non-nuclear bulkheads.

FIGURE 3A22. Size and details of adapter used for changing size of installed steel bulkhead MIL-S-24235 stuffing tubes (submarines).

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NOTES (continued):

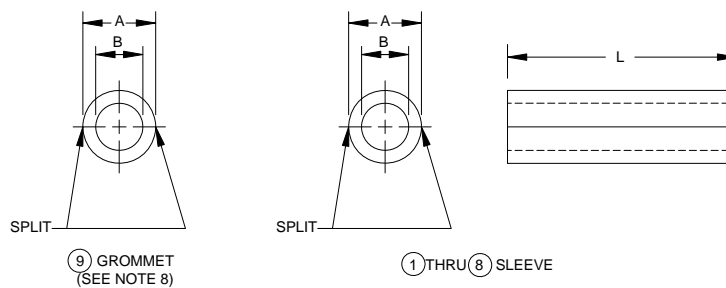
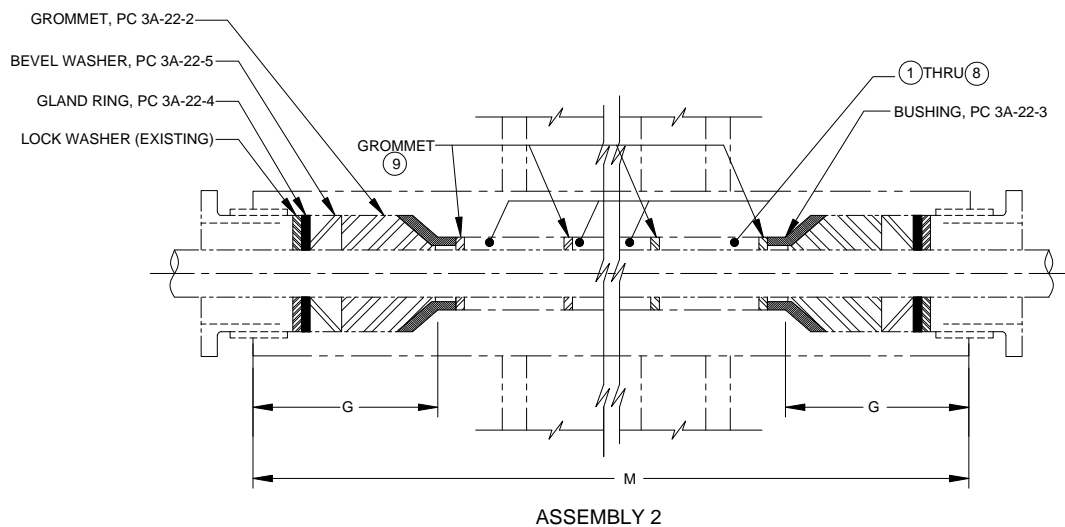
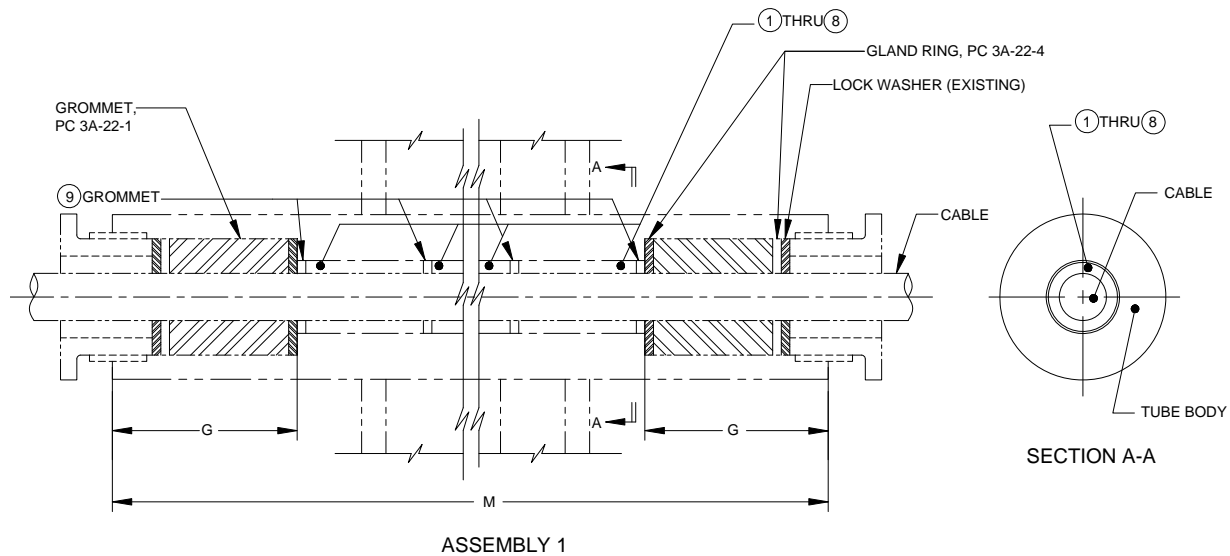
5. Use of adapter assemblies on nuclear bulkheads shall be in accordance with figure 3A23.
6. On non-nuclear bulkheads, step-down of two sizes is permitted without NAVSEA approval. Step-down of three or more sizes requires specific NAVSEA approval.

FIGURE 3A22. Size and details of adapter used for changing size of installed steel bulkhead MIL-S-24235 stuffing tubes (submarines) - Continued.

[illegible]

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NOTES:

1. This method and the drawings called out were applicable to S5W submarines only and are included in MIL-STD-2003 for historical purposes only. Any current use of this method shall be expressly approved by NAVSEA 08.
2. Any deviations from this figure are not permitted without prior written approval of NAVSEA 08 or the NAVSEA-designated reactor plant design yard.

FIGURE 3A23. Bushing sleeves for MIL-S-24235 stuffing tubes through steel shielded bulkheads.

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NOTES (continued):

3. Abbreviations are in accordance with ASME Y14.38.
4. The requirements of this figure are not retroactive for existing bushed stuffing tubes.
5. Stuffing tube bushing sleeves in accordance with this figure shall be installed in bushed stuffing tubes through shielded bulkheads when the difference between the inner diameter of the stuffing tube throat and the outer diameter of the cable is  $\frac{1}{4}$ " or greater.
6. Stuffing tube bushing sleeves items 1 through 8 can be installed in one, two, or three sections as required to facilitate installation.
7. Stuffing tube bushing sleeves items 1 through 8 and grommets item 9 shall be installed in stuffing tube, and tube shall be packed in accordance with instructions on figure 3A10. The "A" and "B" dimensions of item 9 shall duplicate the "A" and "B" dimensions of Items 1-8.
8. Material for items 1 through 8 shall be of steel bar, round with cold finish, or seamless carbon steel pipe in accordance with MIL-P-24338 may be substituted to facilitate machining provided that no deviations from the tolerances of table 3A23-I are made.
9. Grommet item 9 shall be manufactured from silicon sheet rubber 0.25" thick in accordance with A-A-59588, CL 2G GR50 and shall be cemented to bushing items 1 through 8 prior to installation using adhesive in accordance with MMM-A-121.
10. For dimensions not detailed herein, see MIL-S-24235 and figure 3A22.

TABLE 3A23-I. Sleeve dimensions (see note 7).

Assy	Stuffing tube size	Sleeve item no.	Dim. "A"	Dim. "B"	Dim. "L" (note 5)
1	1	-	-	"B" = cable O.D.+ 0.062	$(M-2G)-0.50 = L$ When sleeve is installed in one section.
	2	1	0.750		$\frac{(M-2G)-0.75}{2} = L$ When sleeve is installed in two sections.
	3	2	1.000		$\frac{(M-2G)-1.00}{3} = L$ When sleeve is installed in three sections.
2	4	3	1.203		$(M-2G)-1.25 = L$ When sleeve is installed in one section.
	5	4	1.375		$\frac{(M-2G)-1.50}{2} = L$ When sleeve is installed in two sections.
	6	5	1.563		$\frac{(M-2G)-1.75}{3} = L$ When sleeve is installed in three sections.
	7	6	1.813		
	8	7	2.125		
	9	8	2.250		

TOLERANCES

Fractional	±	$\frac{1}{32}$ inch
Decimal	±	0.005 inches
Angles	±	0°-30' degrees
Unless otherwise noted		

FIGURE 3A23. Bushing sleeves for MIL-S-24235 stuffing tubes through steel shielded bulkheads - Continued.

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Cable			Nylon tube		MCP		Stuffing tube			Box conn.	Cable	
Type	Size OD		Size	Pack assy M19622	Insert block	Insert block	Surface size	Submarine			MIL-Spec	Slant sheet
	Min.	Max.						Size	Grommet			
LS3SWUS-24	1.700	1.800	7	22-0003	60/40		S	7	2-105	2	MIL-DTL-24643	36
LS3SWUS-30	1.820	1.920	8	23-0004	60/48		T	8	2-107	2	MIL-DTL-24643	36
LS3SWUS-37	1.950	2.050	8	23-0006	60/52		T	8	2-108	2¾	MIL-DTL-24643	36
LS3SWUS-44	2.200	2.300	9	24-0003	90/55		W			2½	MIL-DTL-24643	36
LS3U-3	0.580	0.620	4T	19-0004	20/15	30/15	C	2	2-068	¾	MIL-DTL-24643	37
LS3U-7	0.760	0.810	5	20-0002	30/20		E	3	2-072	1	MIL-DTL-24643	37
LS3U-12	1.030	1.090	5	20-0009	40/26		K	4	2-091	1¼	MIL-DTL-24643	37
LS4NW-8	0.684	0.740	4T	19-0008	30/18		D	2	2-070	¾	MIL-DTL-24643	55
LS4SJ-14	0.380	0.395	2	17-0002	20/10		A	1	2-062	¾	MIL-DTL-24643	43
LS4SJ-16	0.346	0.360	2	17-0002	15/9	20/9	A	1	2-062	¾	MIL-DTL-24643	43
LS4SJ-20	0.303	0.320	1	16-0004	15/8	20/8	A	1	2-062	¾	MIL-DTL-24643	43
LS5KVTSGU-100	1.656	1.790	8	23-0002	60/44		S	7	2-105	2	MIL-DTL-24643	22
LS5KVTSGU-150	1.804	1.950	8	23-0005	60/48		T	8	2-107	2	MIL-DTL-24643	22
LS5KVTSGU-250	2.054	2.220	9	24-0002	90/55		W	9	2-110	2½	MIL-DTL-24643	22
LS5KVTSGU-350	2.266	2.450	9	24-0005	90/60		X			3	MIL-DTL-24643	22
LS5KVTSGU-400	2.405	2.600	9	24-0007	90/65		Y			3	MIL-DTL-24643	22
LS6SGU-100	1.480	1.600	8	23-0001	60/40		P	7	2-101	2	MIL-DTL-24643	19
LS6SGU-125	1.656	1.790	8	23-0004	60/44		S	7	2-105	2	MIL-DTL-24643	19
LS6SGU-150	1.813	1.960	8	23-0006	60/48		T	8	2-107	2	MIL-DTL-24643	19
LS6SGU-200	2.035	2.200	9	24-0003	60/54		W	9	2-109	2½	MIL-DTL-24643	19
LS7PS-6	0.717	0.775	4T	19-0007	30/19		E	2	2-071	1	MIL-DTL-24643	26
LS7SGU-3	0.504	0.545	4T	19-0002	20/13	30/13	C	1	2-066	½	MIL-DTL-24643	20
LS7SGU-4	0.550	0.595	4T	19-0003	20/15	30/15	C	2	2-068	¾	MIL-DTL-24643	20
LS8NW6	0.620	0.670	4T	19-0004	30/17		D	2	2-069	¾	MIL-DTL-24643	54
LSDCOP-1	0.235	0.250	1	16-0004	15/6	20/6	A	1	2-061	½	MIL-DTL-24643	2
LSDCOP-1½	0.300	0.315	1	16-0006	15/8	20/8	A	1	2-062	½	MIL-DTL-24643	2
LSDCOP-2	0.310	0.330	2	17-0001	15/8	20/8	A	1	2-062	½	MIL-DTL-24643	2
LSDHOF-3	0.405	0.425	2	17-0004	20/11		B	1	2-063	½	MIL-DTL-24643	3
LSDHOF-4	0.440	0.460	3	18-0018	20/11		B	1	2-064	½	MIL-DTL-24643	3
LSDHOF-6	0.490	0.510	4T	19-0001	20/12	30/12	B	1	2-065	½	MIL-DTL-24643	3
LSDHOF-9	0.540	0.570	4T	19-0003	20/14	30/14	C	1	2-067	½	MIL-DTL-24643	3
LSDHOF-14	0.675	0.705	4T	19-0007	30/18		D	2	2-070	¾	MIL-DTL-24643	3
LSDHOF-23	0.820	0.860	5	20-0003	30/21		G	3	2-073	1	MIL-DTL-24643	3
LSDHOF-30	0.920	0.960	5	20-0005	30/24	40/24	J	3	2-075	1	MIL-DTL-24643	3
LSDHOF-83	1.390	1.450	6	21-0007	60/36		N	6	2-098	1½	MIL-DTL-24643	3
LSDHOF-250	2.000	2.100	9	24-0002	60/52		V	8	2-108	2½	MIL-DTL-24643	3
LSDHOF-400	2.400	2.500	9	24-0006	90/60		Y			3	MIL-DTL-24643	3
LSDNW-3	0.361	0.390	2	17-0003	15/9		A	1	2-062	½	MIL-DTL-24643	48

## NOTE:

1. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and BX connectors shown on figures 3A2 through 3A9 and 3A24 through 3A31 are for MIL-DTL-915, MIL-DTL-24640, and MIL-DTL-24643 cable.

FIGURE 3A24. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors.

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Cable			Nylon tube		MCP		Stuffing tube			Box conn.	Cable	
Type	Size OD		Size	Pack assy M19622	Insert block	Insert block	Surface size	Submarine			MIL-Spec	Slant sheet
	Min.	Max.						Size	Grommet			
LSDNW-4	0.398	0.430	2	17-0004	20/10		B	1	2-063	½	MIL-DTL-24643	48
LSDNW-9	0.504	0.545	4T	19-0002	20/13	30/13	C	1	2-066	½	MIL-DTL-24643	48
LSDNW-14	0.564	0.610	4T	19-0004	20/15	30/15	C	2	2-068	½	MIL-DTL-24643	48
LSDNW-23	0.638	0.690	4T	19-0005	30/17		D	2	2-070	¾	MIL-DTL-24643	48
LSDNW-50	0.842	0.910	5	20-0004	30/23		G	3	2-074	1	MIL-DTL-24643	48
LSDNW-75	1.000	1.080	5	20-0009	40/26		K	4	2-091	1¼	MIL-DTL-24643	48
LSDNW-100	1.082	1.170	6	21-0002	40/28		L	4	2-093	1¼	MIL-DTL-24643	48
LSDPS-3	0.421	0.455	2	17-0003	20/11		B	1	2-063	½	MIL-DTL-24643	26
LSDPS-4	0.452	0.489	2	17-0004	20/12	30/12	B	1	2-064	½	MIL-DTL-24643	26
LSDPS-6	0.541	0.585	4T	19-0001	20/14	30/14	C	1	2-067	¾	MIL-DTL-24643	26
LSDPS-9	0.581	0.628	4T	19-0002	20/15	30/15	C	2	2-068	¾	MIL-DTL-24643	26
LSDPS-14	0.675	0.730	4T	19-0007	30/17		D	2	2-070	¾	MIL-DTL-24643	26
LSDRW	0.620	0.670	4T	19-0005	30/17		D	2	2-069	¾	MIL-DTL-24643	53
LSDSGU-3	0.362	0.391	2	17-0003	15/9		A	1	2-062	½	MIL-DTL-24643	15
LSDSGU-4	0.395	0.427	2	17-0004	20/10		B	1	2-063	½	MIL-DTL-24643	15
LSDSGU-9	0.503	0.544	4T	19-0002	20/13	30/13	C	1	2-066	¾	MIL-DTL-24643	15
LSDSGU-14	0.620	0.670	4T	19-0006	30/17		D	2	2-069	¾	MIL-DTL-24643	15
LSDSGU-23	0.722	0.781	5	20-0002	30/19		E	2	2-071	1	MIL-DTL-24643	15
LSDSGU-50	0.843	0.911	5	20-0004	30/23		G	3	2-074	1	MIL-DTL-24643	15
LSDSGU-75	0.993	1.074	5	20-0009	40/26		K	4	2-090	1¼	MIL-DTL-24643	15
LSDSGU-100	1.079	1.167	6	21-0001	40/28		K	4	2-093	1¼	MIL-DTL-24643	15
LSDSGU-200	1.464	1.583	7	22-0003	60/40		P	7	2-101	2	MIL-DTL-24643	15
LSDSGU-300	1.703	1.841	8	23-0004	60/46		S	8	2-106	2	MIL-DTL-24643	15
LSDSGU-400	1.914	2.069	9	24-0001	60/52		V	8	2-108	2½	MIL-DTL-24643	15
LSECM	1.290	1.370	6	21-0006	40/34	60/34	M	5	2-096	1½	MIL-DTL-24643	38
LSFHOF-3	0.460	0.480	3	18-0018	20/12	30/12	B	1	2-064	½	MIL-DTL-24643	3
LSFHOF-4	0.520	0.550	4T	19-0002	20/13	30/13	C	1	2-066	¾	MIL-DTL-24643	3
LSFHOF-9	0.630	0.660	4T	19-0005	20/16	30/16	D	2	2-069	¾	MIL-DTL-24643	3
LSFHOF-42	1.300	1.380	6	21-0006	40/34	60/34	M	5	2-097	1½	MIL-DTL-24643	3
LSFHOF-60	1.430	1.510	7	22-0002	50/38		N	6	2-099	2	MIL-DTL-24643	3
LFHOF-133	1.920	2.000	8	23-0006	60/50	90/50	T	8	2-107	2½	MIL-DTL-24643	3
LSFNW-3	0.413	0.447	3	18-0018	20/11		B	1	2-063	½	MIL-DTL-24643	50
LSFNW-4	0.475	0.513	4T	19-0001	20/13	30/13	B	1	2-065	¾	MIL-DTL-24643	50
LSFNW-9	0.583	0.630	4T	19-0004	20/16	30/16	C	2	2-069	¾	MIL-DTL-24643	50
LSFNW-23	0.768	0.830	5	20-0002	30/21		F	3	2-072	1	MIL-DTL-24643	50

## NOTE:

1. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and BX connectors shown on figures 3A2 through 3A9 and 3A24 through 3A31 are for MIL-DTL-915, MIL-DTL-24640, and MIL-DTL-24643 cable.

FIGURE 3A25. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors.



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Cable			Nylon tube		MCP		Stuffing tube			Box conn.	Cable	
Type	Size OD		Size	Pack assy M19622	Insert block	Insert block	Surface size	Submarine			MIL-Spec	Slant sheet
	Min.	Max.						Size	Grommet			
LSFPS-14	0.754	0.815	5	20-0002	30/20		F	3	2-072	1	MIL-DTL-24643	26
LSFSGU-3	0.413	0.447	2	17-0004	20/11		B	1	2-063	½	MIL-DTL-24643	17
LSFSGU-4	0.475	0.513	4T	19-0001	20/13	30/13	B	1	2-065	½	MIL-DTL-24643	17
LSFSGU-9	0.583	0.630	4T	19-0004	20/16	30/16	C	2	2-068	¾	MIL-DTL-24643	17
LSFSGU-23	0.823	0.890	5	20-0004	30/22	40/22	G	3	2-073	1	MIL-DTL-24643	17
LSFSGU-50	0.971	1.050	5	20-0008	40/26		J	4	2-090	1¼	MIL-DTL-24643	17
LSFSGU-75	1.147	1.240	6	21-0004	40/30		L	4	2-094	1¼	MIL-DTL-24643	17
LSFSGU-100	1.256	1.358	6	21-0006	40/34	60/34	M	5	2-096	1½	MIL-DTL-24643	17
LSFSGU-150	1.503	1.625	8	23-0001	60/40		R	7	2-101	2	MIL-DTL-24643	17
LSFSGU-200	1.684	1.820	8	23-0004	60/46		S	7	2-105	2	MIL-DTL-24643	17
LSMCOS-2	0.440	0.460	2	17-0004	20/11		B	1	2-064	½	MIL-DTL-24643	4
LSMCOS-4	0.490	0.510	4T	19-0001	20/12	30/12	B	1	2-065	½	MIL-DTL-24643	4
LSMCOS-5	0.375	0.390	2	17-0003	15/9		A	1	2-062	½	MIL-DTL-24643	4
LSMCOS-6	0.460	0.480	3	18-0018	20/12	30/12	B	1	2-064	½	MIL-DTL-24643	4
LSMCOS-7	0.575	0.595	4T	19-0004	20/15	30/15	C	2	2-068	¾	MIL-DTL-24643	4
LSMDU-6	0.925	1.000	5	20-0006	30/24	40/24	J	4	2-091	1¼	MIL-DTL-24643	5
LSMDU-14	1.290	1.395	6	21-0007	40/34	60/34	M	5	2-097	1½	MIL-DTL-24643	5
LSMDU-23	1.633	1.765	8	23-0003	60/44		S	7	2-104	2	MIL-DTL-24643	5
LSMDU-40	1.887	2.040	9	24-0001	60/50	90/50	T	8	2-108	2½	MIL-DTL-24643	5
LSMDU-60	2.155	2.330	9	24-0005	90/55		X			2½	MIL-DTL-24643	5
LSMHOF-7	0.465	0.500	4T	19-0001	20/12	30/12	B	1	2-065	½	MIL-DTL-24643	7
LSMHOF-10	0.540	0.585	4T	19-0003	20/14	30/14	C	1	2-067	¾	MIL-DTL-24643	7
LSMHOF-14	0.583	0.635	4T	19-0004	20/15	30/15	C	2	2-068	¾	MIL-DTL-24643	7
LSMHOF-19	0.650	0.705	4T	19-0006	30/17		D	2	2-070	¾	MIL-DTL-24643	7
LSMHOF-24	0.735	0.795	5	20-0001	30/20		E	2	2-071	1	MIL-DTL-24643	7
LSMHOF-30	0.775	0.835	5	20-0002	30/21		F	3	2-072	1	MIL-DTL-24643	7
LSMHOF-37	0.855	0.925	5	20-0004	30/23		G	3	2-074	1	MIL-DTL-24643	7
LSMHOF-44	0.925	1.000	5	20-0006	30/24	40/24	J	3	2-075	1¼	MIL-DTL-24643	7
LSMHOF-61	1.100	1.175	6	21-0001	40/28		L	4	2-093	1¼	MIL-DTL-24643	7
LSMMOP-5	0.282	0.305	1	16-0006	15/7	20/7	A	1	2-061	½	MIL-DTL-24643	8
LSMNW-7	0.370	0.400	2	17-0003	20/10		A	1	2-062	½	MIL-DTL-24643	51
LSMNW-10	0.457	0.495	3	18-0018	20/12	30/12	B	1	2-065	½	MIL-DTL-24643	51
LSMNW-14	0.494	0.535	4T	19-0001	20/13	30/13	C	1	2-066	½	MIL-DTL-24643	51
LSMNW-19	0.545	0.590	4T	19-0003	20/14	30/14	C	1	2-067	½	MIL-DTL-24643	51
LSMNW-24	0.633	0.685	4T	19-0005	30/17		D	2	2-070	¾	MIL-DTL-24643	51
LSMNW-30	0.670	0.725	4T	19-0007	30/17		D	2	2-070	¾	MIL-DTL-24643	51
LSMNW-37	0.726	0.785	5	20-0001	30/19		E	2	2-071	¾	MIL-DTL-24643	51
LSMNW-44	0.823	0.890	5	20-0004	30/22	40/22	G	3	2-073	1	MIL-DTL-24643	51

## NOTE:

1. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and BX connectors shown on figures 3A2 through 3A9 and 3A24 through 3A31 are for MIL-DTL-915, MIL-DTL-24640, and MIL-DTL-24643 cable.

FIGURE 3A26. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors.

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Cable			Nylon tube		MCP		Stuffing tube			Box conn.	Cable	
Type	Size OD		Size	Pack assy M19622	Insert block	Insert block	Surface size	Submarine			MIL-Spec	Slant sheet
	Min.	Max.						Size	Grommet			
LSMRI-D-1	0.069	0.075	1	16-0001			A	1	2-061		MIL-DTL-24643	9
LSMRI-D-2½	0.094	0.102	1	16-0001			A	1	2-061		MIL-DTL-24643	9
LSMRI-T-2½	0.094	0.102	1	16-0001			A	1	2-061	⅜	MIL-DTL-24643	9
LSMS-37	0.740	0.800	5	20-0001	30/20		E	2	2-071	1	MIL-DTL-24643	34
LSMSCS-7	0.507	0.544	4T	19-0002	20/13	30/13	C	1	2-066	½	MIL-DTL-24643	18
LSMSCS-10	0.635	0.682	4T	19-0005	30-17		D	2	2-070	¾	MIL-DTL-24643	18
LSMSCS-14	0.677	0.728	4T	19-0007	30/17		E	2	2-071	1	MIL-DTL-24643	18
LSMSCS-19	0.742	0.798	5	20-0002	30/20		F	2	2-071	1	MIL-DTL-24643	18
LSMSCS-24	0.850	0.915	5	20-0004	30/23		G	3	2-074	1	MIL-DTL-24643	18
LSMSCS-30	0.893	0.961	5	20-0005	30/24	40/24	J	2	2-069	1¼	MIL-DTL-24643	18
LSMSCS-37	0.986	1.065	5	20-0009	40/26		K	4	2-090	1¼	MIL-DTL-24643	18
LSMSCS-44	1.090	1.174	6	21-0002	40/28		L	4	2-093	1¼	MIL-DTL-24643	18
LSMSCS-61	1.216	1.310	6	21-0005	40/32	60/32	M	5	2-096	1½	MIL-DTL-24643	18
LSMSCS-91	1.429	1.540	7	22-0002	60/38		P	6	2-100	2	MIL-DTL-24643	18
LSMSCU-7	0.447	0.484	3	18-0018	20/12	30/12	B	1	2-064	½	MIL-DTL-24643	18
LSMSCU-10	0.575	0.622	4T	19-0004	20/15	30/15	C	2	2-068	¾	MIL-DTL-24643	18
LSMSCU-14	0.617	0.668	4T	19-0005	20/16	30/16	D	2	2-069	¾	MIL-DTL-24643	18
LSMSCU-19	0.682	0.738	4T	19-0007	30/18		D	2	2-071	¾	MIL-DTL-24643	18
LSMSCU-24	0.790	0.855	5	20-0003	30/21		G	3	2-073	1	MIL-DTL-24643	18
LSMSCU-30	0.833	0.901	5	20-0004	30/22	40/22	G	3	2-074	1	MIL-DTL-24643	18
LSMSCU-37	0.926	1.002	5	20-0006	30/24	40/24	J	3	2-076	1	MIL-DTL-24643	18
LSMSCU-44	1.030	1.114	5	20-0009	40/28		K	4	2-091	1¼	MIL-DTL-24643	18
LSMSCU-61	1.156	1.250	6	21-0003	40/30		L	4	2-094	1¼	MIL-DTL-24643	18
LSMSCU-91	1.369	1.480	7	22-0001	60/36		N	6	2-099	1½	MIL-DTL-24643	18
LSMU-14	0.365	0.400	2	17-0003	20/10		A	1	2-062	½	MIL-DTL-24643	29
LSMUS-14	0.425	0.460	2	17-0004	20/11		B	1	2-024	½	MIL-DTL-24643	29
LSPBTMU-5	0.499	0.540	4T	19-0002	20/13	30/13	C	1	2-066	½	MIL-DTL-24643	10
LSPBTMU-15	0.694	0.750	4T	19-0007	30/19		D	2	2-071	1	MIL-DTL-24643	10
LSPBTMU-30	0.907	0.980	5	20-0006	30/24	40/24	J	3	2-075	1	MIL-DTL-24643	10
LSPI-3	0.634	0.685	4T	19-0004	30/17		D	2	2-070	¾	MIL-DTL-24643	25
LSPI-7	0.833	0.900	5	20-0002	30/22	40/22	G	3	2-073	1	MIL-DTL-24643	25
LSPI-12	1.068	1.155	5	20-0009	40/28		K	4	2-093	1¼	MIL-DTL-24643	25
LSSHOF-3	0.195	0.210	1	16-0001	15/5	20/5	A	1	2-061	½	MIL-DTL-24643	3
LSSHOF-23	0.440	0.460	3	18-0018	20/11		B	1	2-064	½	MIL-DTL-24643	3
LSSHOF-60	0.570	0.600	4T	19-0004	20/15	30/15	C	2	2-068	¾	MIL-DTL-24643	3
LSSHOF-150	0.830	0.870	5	20-0003	30/22	40/22	F	3	2-073	1	MIL-DTL-24643	3
LSSHOF-200	0.940	0.980	5	20-0006	30/24	40/24	J	3	3-075	1	MIL-DTL-24643	3
LSSHOF-250	1.035	1.085	5	20-0009	40/26		K	4	2-091	1¼	MIL-DTL-24643	3

## NOTE:

1. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and BX connectors shown on figures 3A2 through 3A9 and 3A24 through 3A31 are for MIL-DTL-915, MIL-DTL-24640, and MIL-DTL-24643 cable.

FIGURE 3A27. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors.

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Cable			Nylon tube		MCP		Stuffing tube			Box conn.	Cable	
Type	Size OD		Size	Pack assy M19622	Insert block	Insert block	Surface size	Submarine			MIL-Spec	Slant sheet
	Min.	Max.						Size	Grommet			
LSSHOF-500	1.380	1.450	7	22-0001	60/36		N	6	2-098	½	MIL-DTL-24643	3
LSSHOF-650	1.540	1.610	7	22-0003	60/40		P	7	2-101	2	MIL-DTL-24643	3
LSSHOF-800	1.600	1.670	8	23-0001	60/42		R	7	2-101	2	MIL-DTL-24643	3
LSSRW	0.370	0.400	2	17-0003	20/10		A	1	2-062	½	MIL-DTL-24643	53
LSSSF-300	1.020	1.100	5	20-0009	40/27		K	4	2-091	1	MIL-DTL-24643	11
LSSSGU-50	0.481	0.520	4T	19-0001	20/13	30/13	C	1	2-065	½	MIL-DTL-24643	14
LSSSGU-75	0.557	0.602	4T	19-0004	20/15	30/15	C	2	2-068	¾	MIL-DTL-24643	14
LSSSGU-100	0.619	0.669	4T	19-0005	20/16	30/16	D	2	2-069	¾	MIL-DTL-24643	14
LSSSGU-200	0.807	0.872	5	20-0003	30/22	40/22	G	3	2-073	1	MIL-DTL-24643	14
LSSSGU-300	0.926	1.001	5	20-0006	30/24	40/24	J	3	2-076	1¼	MIL-DTL-24643	14
LSSSGU-400	1.034	1.118	5	20-0010	40/27		K	4	2-092	1¼	MIL-DTL-24643	14
LSSSGU-650	1.268	1.371	6	21-0006	40/34	60/34	M	5	2-097	1½	MIL-DTL-24643	14
LSSSGU-800	1.374	1.485	7	22-0001	60/36		N	6	2-099	1½	MIL-DTL-24643	14
LSSSGU-1000	1.499	1.620	8	23-0001	60/40		P	7	2-101	2	MIL-DTL-24643	14
LSSSGU-1600	1.859	2.010	9	24-0001	60/49		T	8	2-108	2½	MIL-DTL-24643	14
LSSSGU-2000	2.044	2.210	9	24-0004	90/55		W	9	2-110	2½	MIL-DTL-24643	14
LSTCJU-4	0.400	0.430	2	17-0004	20/10		B	1	2-063	½	MIL-DTL-24643	21
LSTCJX-3	0.686	0.742	4T	19-0005	30/18		D	2	2-071	¾	MIL-DTL-24643	24
LSTCJX-7	0.909	0.983	5	20-0005	30/24	40/24	J	3	2-075	1	MIL-DTL-24643	24
LSTCJX-12	1.174	1.269	6	21-0003	40/32		M	5	2-095	1¼	MIL-DTL-24643	24
LSTCKX-1	0.422	0.456	2	17-0003	20/11		B	1	2-064	½	MIL-DTL-24643	24
LSTCKX-3	0.686	0.742	4T	19-0005	30/18		D	2	2-071	¾	MIL-DTL-24643	24
LSTCKX-7	0.909	0.983	5	20-0005	30/24	40/24	J	3	2-075	1	MIL-DTL-24643	24
LSTCKX-12	1.174	1.269	6	21-0003	40/32		M	5	2-095	1¼	MIL-DTL-24643	24
LSTCOP-2	0.325	0.345	2	17-0001	15/8	20/8	A	1	2-062	½	MIL-DTL-24643	2
LSTCTU-4	0.400	0.430	2	17-0004	20/10		B	1	2-063	½	MIL-DTL-24643	21
LSTCTX-1	0.324	0.350	2	17-0001	15/8	20/8	A	1	2-062	½	MIL-DTL-24643	24
LSTCTX-3	0.511	0.552	4T	19-0001	20/14	30/14	C	1	2-066	½	MIL-DTL-24643	24
LSTCTX-7	0.676	0.731	4T	19-0005	30/17		D	2	2-071	¾	MIL-DTL-24643	24
LSTCTX-12	0.892	0.964	5	20-0004	20/24	40/24	J	3	2-075	1	MIL-DTL-24643	24
LSTHOF-3	0.430	0.450	2	17-0004	20/11		B	1	2-064	½	MIL-DTL-24643	3
LSTHOF-4	0.460	0.480	3	18-0018	20/12	30/12	B	1	2-064	½	MIL-DTL-24643	3
LSTHOF-6	0.520	0.550	4T	19-0002	20/13	30/13	C	1	2-066	¾	MIL-DTL-24643	3
LSTHOF-9	0.570	0.600	4T	19-0004	20/15	30/15	C	2	2-068	¾	MIL-DTL-24643	3
LSTHOF-14	0.720	0.750	4T	19-0007	30/19		E	2	2-070	1	MIL-DTL-24643	3
LSTHOF-23	0.860	0.900	5	20-0004	30/22	40/22	G	3	2-073	1	MIL-DTL-24643	3
LSTHOF-42	1.200	1.250	6	21-0003	40/30		L	4	2-094	1¼	MIL-DTL-24643	3
LSTHOF-150	1.740	1.820	8	23-0004	60/46		S	7	2-105	2	MIL-DTL-24643	3
LSTHOF-250	2.140	2.240	9	24-0003	90/55		W	9	2-100	2½	MIL-DTL-24643	3
LSTHOF-400	2.680	2.800	9	24-0008		90/70	AA			3	MIL-DTL-24643	3
LSTHOF-500	2.920	3.100			120/75		BB			3½	MIL-DTL-24643	3
LSTHOF-600	2.980	3.150			120/80		BB			3½	MIL-DTL-24643	3
LSTNW-3	0.380	0.411	2	17-0003	20/10		B	1	2-063	½	MIL-DTL-24643	49
LSTNW-4	0.415	0.449	2	17-0004	20/11		B	1	2-063	½	MIL-DTL-24643	49

## NOTE:

1. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and BX connectors shown on figures 3A2 through 3A9 and 3A24 through 3A31 are for MIL-DTL-915, MIL-DTL-24640, and MIL-DTL-24643 cable.

FIGURE 3A28. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors.

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APPENDIX A

Cable			Nylon tube		MCP		Stuffing tube			Box conn.	Cable	
Type	Size OD		Size	Pack assy M19622	Insert block	Insert block	Surface size	Submarine			MIL-Spec	Slant sheet
	Min.	Max.						Size	Grommet			
LSTNW-9	0.578	0.625	4T	19-0004	20/15	30/15	C	2	2-068	¾	MIL-DTL-24643	49
LSTNW-14	0.620	0.670	4T	19-0005	30/17		D	2	2-069	¾	MIL-DTL-24643	49
LSTNW-23	0.703	0.760	4T	19-0008	30/19		E	2	2-071	1	MIL-DTL-24643	49
LSTNW-50	0.869	0.969	5	20-0005	30/24	40/24	J	3	2-075	1	MIL-DTL-24643	49
LSTNW-75	1.048	1.134	5	20-0010	40/28		K	4	2-093	1¼	MIL-DTL-24643	49
LSTNW-100	1.171	1.266	6	21-0004	40/32		M	5	2-095	1¼	MIL-DTL-24643	49
LSTNW-150	1.401	1.515	7	22-0001	60/38		N	6	2-099	1½	MIL-DTL-24643	49
LSTPNW-1½	0.217	0.235	1	16-0004	15/5	20/5	A	1	2-061	½	MIL-DTL-24643	52
LSTPNW-3	0.287	0.310	1	16-0006	15/7	20/7	A	1	2-061	½	MIL-DTL-24643	52
LSTPNW-5	0.338	0.365	2	17-0001	15/9	20/9	A	1	2-062	½	MIL-DTL-24643	52
LSTPNW-10	0.435	0.470	3	18-0018	20/11		B	1	2-064	½	MIL-DTL-24643	52
LSTPNW-15	0.490	0.530	4T	19-0001	20/13	30/13	C	1	2-065	½	MIL-DTL-24643	52
LSTPNW-20	0.532	0.575	4T	19-0002	20/14	30/14	C	1	2-067	¾	MIL-DTL-24643	52
LSTPNW-30	0.629	0.680	4T	19-0005	30/17		D	2	2-069	¾	MIL-DTL-24643	52
LSTPNW-40	0.708	0.765	4T	19-0008	30/19		E	2	2-071	1	MIL-DTL-24643	52
LSTPS-3	0.439	0.475	2	17-0004	20/12	30/12	B	1	2-064	½	MIL-DTL-24643	26
LSTPS-4	0.512	0.553	3	18-0018	20/14	30/14	C	1	2-066	½	MIL-DTL-24643	26
LSTPS-6	0.574	0.620	4T	19-0002	20/15	30/15	C	2	2-068	¾	MIL-DTL-24643	26
LSTPS-9	0.608	0.657	4T	19-0003	20/16	30/16	D	2	2-069	¾	MIL-DTL-24643	26
LSTPS-14	0.695	0.751	4T	19-0006	30/19		E	2	2-071	1	MIL-DTL-24643	26
LSTPS-23	0.801	0.866	5	20-0003	30/22		G	3	2-073	1	MIL-DTL-24643	26
LSTPS-30	0.915	0.989	5	20-0004	30/24	40/24	J	3	2-075	1	MIL-DTL-24643	26
LSTRW	0.567	0.710	4T	19-0005	30/18		D	2	2-070	¾	MIL-DTL-24643	53
LSTSGU-3	0.380	0.411	2	17-0003	20/10		B	1	2-063	½	MIL-DTL-24643	16
LSTSGU-4	0.415	0.449	2	17-0004	20/11		B	1	2-063	½	MIL-DTL-24643	16
LSTSGU-9	0.532	0.575	4T	19-0003	20/14	30/14	C	1	2-067	¾	MIL-DTL-24643	16
LSTSGU-14	0.664	0.718	4T	19-0007	30/17		D	2	2-070	¾	MIL-DTL-24643	16
LSTSGU-23	0.751	0.812	5	20-0003	30/20		E	3	2-072	1	MIL-DTL-24643	16

## NOTE:

1. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and BX connectors shown on figures 3A2 through 3A9 and 3A24 through 3A31 are for MIL-DTL-915, MIL-DTL-24640, and MIL-DTL-24643 cable.

FIGURE 3A29. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors.

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Cable			Nylon tube		MCP		Stuffing tube			Box conn.	Cable	
Type	Size OD		Size	Pack assy M19622	Insert block	Insert block	Surface size	Submarine			MIL-Spec	Slant sheet
	Min.	Max.						Size	Grommet			
LSTSGU-50	0.896	0.969	5	20-0005	30/24	40/24	J	3	2-075	1	MIL-DTL-24643	16
LSTSGU-75	1.049	1.134	5	20-0010	40/28		L	4	2-093	1¼	MIL-DTL-24643	16
LSTSGU-100	1.171	1.266	6	21-0004	40/32		M	5	2-095	1¼	MIL-DTL-24643	16
LSTSGU-150	1.401	1.515	7	22-0002	60/38		N	6	2-099	2	MIL-DTL-24643	16
LSTSGU-200	1.544	1.669	8	23-0001	60/42		R	7	2-101	2	MIL-DTL-24643	16
LSTSGU-300	1.810	1.957	8	24-0003	60/48		T	8	2-107	2	MIL-DTL-24643	16
LSTSGU-400	2.038	2.203	9	23-0006	60/54		W	9	2-110	2½	MIL-DTL-24643	16
LSTTOP-3	0.444	0.480	3	18-0018	20/12	30/12	B	1	2-064	½	MIL-DTL-24643	12
LSTTOP-5	0.546	0.590	4T	19-0003	20/14	30/14	C	1	2-067	¾	MIL-DTL-24643	12
LSTTOP-10	0.648	0.700	4T	19-0006	30/17		D	2	2-070	¾	MIL-DTL-24643	12
LSTTOP-15	0.768	0.830	5	20-0002	30/20		F	3	2-072	1	MIL-DTL-24643	12
LSTTRS-2	0.629	0.680	4T	19-0005	30/17		D	2	2-069	¾	MIL-DTL-24643	13
LSTTRS-4	0.685	0.740	4T	19-0007	30/18		D	2	2-071	¾	MIL-DTL-24643	13
LSTTRS-6	0.814	0.880	5	20-0003	30/22	40/22	G	3	2-073	1	MIL-DTL-24643	13
LSTTRS-8	0.916	0.990	5	20-0006	30/24	40/24	J	3	2-075	1¼	MIL-DTL-24643	13
LSTTRS-10	0.999	1.080	5	20-0009	40/26		K	4	2-091	1¼	MIL-DTL-24643	13
LSTTRS-12	1.017	1.100	5	20-0009	40/26		K	4	2-091	1¼	MIL-DTL-24643	13
LSTTRS-16	1.100	1.190	6	21-0001	40/30		L	4	2-094	1¼	MIL-DTL-24643	13
LSTTSU-1½	0.305	0.330	2	17-0001	15/8	20/8	A	1	2-062	½	MIL-DTL-24643	23
LSTTSU-3	0.416	0.450	2	17-0004	20/11		B	1	2-063	½	MIL-DTL-24643	23
LSTTSU-5	0.500	0.540	4T	19-0001	20/13	30/13	C	1	2-066	¾	MIL-DTL-24643	23
LSTTSU-10	0.624	0.675	4T	19-0004	30/17		D	2	2-069	¾	MIL-DTL-24643	23
LSTTSU-15	0.740	0.800	4T	19-0007	30/20		E	2	2-071	1	MIL-DTL-24643	23
LSTTSU-20	0.805	0.870	5	20-0002	30/22	40/22	G	3	2-073	1	MIL-DTL-24643	23
LSTTSU-30	0.999	1.080	5	20-0006	40/26		K	4	2-091	1¼	MIL-DTL-24643	23
LSTTSU-40	1.110	1.200	6	21-0002	40/30		L	4	2-094	1¼	MIL-DTL-24643	23
LSTTSU-50	1.295	1.400	6	21-0007	40/34	60/34	M	5	2-097	1½	MIL-DTL-24643	23
LSTTSU-60	1.341	1.450	7	22-0001	60/36		N	6	2-098	1½	MIL-DTL-24643	23

## NOTE:

1. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and BX connectors shown on figures 3A2 through 3A9 and 3A24 through 3A31 are for MIL-DTL-915, MIL-DTL-24640, and MIL-DTL-24643 cable.

FIGURE 3A30. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors.

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Cable			Nylon tube		MCP		Stuffing tube			Box conn.	Cable	
Type	Size OD		Size	Packing assy M19622	Insert block	Insert block	Surface size	Submarine			MIL-spec	Slant sheet
	Min.	Max.						Size	Grommet			
LSC5FS-4	0.240	0.360	1	16-0006	15/8	20/8	A	1	2-062	3/8	MIL-DTL-24643	59
LSC5FSW-4	0.240	0.380	1	16-0006	15/8	20/8	A	1	2-062	3/8	MIL-DTL-24643	59
LSC5OS-4	0.290	0.400	1	16-0006	20/10		A	1	2-062	3/8	MIL-DTL-24643	59
LSC5OSW-4	0.300	0.420	2	17-0002	20/10		A	1	2-063	1/2	MIL-DTL-24643	59
LSC5-4	0.220	0.270	1	16-0004	15/6	20/6	A	1	2-061	3/8	MIL-DTL-24643	60
LSC5W-4	0.230	0.290	1	16-0005	15/7	20/7	A	1	2-061	3/8	MIL-DTL-24643	60
LSC5P-4	0.230	0.280	1	16-0005	15/7	20/7	A	1	2-061	3/8	MIL-DTL-24643	61
LSC5POS-4	0.290	0.370	2	17-0002	15/9	20/9	A	1	2-062	3/8	MIL-DTL-24643	61
LSC5POSR-4	0.230	0.280	1	16-0005	15/7	20/7	A	1	2-061	3/8	MIL-DTL-24643	61
LSPB2SD-1	0.330	0.390	2	17-0002	15/9		A	1	2-062	1/2	MIL-DTL-24643	62
LSPB2SDW-1	0.345	0.405	2	17-0003	20/10		B	1	20-63	1/2	MIL-DTL-24643	62
LSPB2SDOS-1	0.440	0.500	4T	19-0001	20/12	30/12	B	1	2-065	1/2	MIL-DTL-24643	62
LSPB2SDOSW-1	0.450	0.530	3	18-0018	20/13	30/13	C	1	2-065	3/4	MIL-DTL-24643	62
LSYSGU-2½		0.535	4T	19-0001	20/13	30/13	C	1	2-066	3/4	MIL-DTL-24643	63
LSYSGU-4		0.580	4T	19-0001	20/14	30/14	C	1	2-067	3/4	MIL-DTL-24643	63
LSYSGU-7		0.640	4T	19-0003	20/16	30/16	C	2	2-069	3/4	MIL-DTL-24643	63
LSYSGU-10		0.730	4T	19-0007	30/17		D	2	2-070	3/4	MIL-DTL-24643	63
LSYSGU-16		1.000	5	20-0006	30/24	40/24	J	4	2-091	1½	MIL-DTL-24643	63
LSYSGU-42		1.170	6	21-0001	40/28		L	4	2-093	1½	MIL-DTL-24643	63
LSYSGU-65		1.310	6	21-0005	40/32	60/32	M	5	2-096	1½	MIL-DTL-24643	63
LSYSGU-85		1.450	6	21-0007	60/36		N	6	2-098	1½	MIL-DTL-24643	63
LSYSGU-100		1.600	8	23-0001	60/40		P	7	2-101	2	MIL-DTL-24643	63
LSYSGU-133		1.780	8	23-0002	60/44		S	7	2-105	2	MIL-DTL-24643	63
LSYSGU-165		1.880	8	23-0004	60/46		S	8	2-106	2	MIL-DTL-24643	63
LSTPSJ-1-24	0.154	0.186									MIL-DTL-24643	64
LSTPSJ-1-22	0.166	0.198									MIL-DTL-24643	64
LSTPSJ-1-20	0.184	0.216	1	16-0001	15/5	20/5	A	1	2-061	½	MIL-DTL-24643	64
LSTPSJ-1-18	0.204	0.236	1	16-0004	15/5	20/5	A	1	2-061	½	MIL-DTL-24643	64
LSTPSJ-1-16	0.218	0.250	1	16-0004	15/6	20/6	A	1	2-061	½	MIL-DTL-24643	64
LSTPSJ-1-14	0.246	0.276	1	16-0004	15/6	20/6	A	1	2-061	½	MIL-DTL-24643	64
LSTPSJ-2-24	0.230	0.290	1	16-0005	15/7	20/7	A	1	2-061	½	MIL-DTL-24643	64
LSTPSJ-2-22	0.255	0.315	2	17-0001	15/8	20/8	A	1	2-062	½	MIL-DTL-24643	64
LSTPSJ-2-20	0.355	0.415	2	17-0004	20/10		B	1	2-063	½	MIL-DTL-24643	64
LSTPSJ-2-18	0.360	0.420	2	17-0004	20/10		B	1	2-063	½	MIL-DTL-24643	64
LSTPSJ-2-16	0.390	0.450	3	18-0018	20/11		B	1	2-064	½	MIL-DTL-24643	64
LSTPSJ-2-14	0.435	0.495	4T	19-0001	20/12	30/12	B	1	2-065	½	MIL-DTL-24643	64
LSTPSJ-3-24	0.245	0.305	1	16-0005	15/7	20/7	A	1	2-061	3/8	MIL-DTL-24643	64
LSTPSJ-3-22	0.255	0.315	2	17-0001	15/8	20/8	A	1	2-062	½	MIL-DTL-24643	64
LSTPSJ-3-20	0.295	0.355	1	16-0006	15/8	20/8	A	1	2-062	½	MIL-DTL-24643	64
LSTPSJ-3-18	0.360	0.420	2	17-0004	20/10		B	1	2-063	½	MIL-DTL-24643	64
LSTPSJ-3-16	0.420	0.480	2	17-0002	20/12	30/12	B	1	2-064	½	MIL-DTL-24643	64
LS3C179DT	0.335	0.365	2	17-0002	15/9	20/9	A	1	2-062	½	MIL-DTL-24643	65
LS6C176DT	0.425	0.455	2	17-0004	20/11		B	1	2-063	½	MIL-DTL-24643	65
LS2OW-3	0.345	0.370	2	17-0002	15/9	20/9	A	1	2-062	½	MIL-DTL-24643	66
LS2OW-4	0.366	0.392	2	17-0002	15/9		A	1	2-062	½	MIL-DTL-24643	66
LS2OW-9	0.466	0.499	4T	19-0001	20/12	30/12	B	1	2-065	½	MIL-DTL-24643	66
LS2OW-14	0.639	0.686	4T	19-0006	30/17		D	2	2-070	¾	MIL-DTL-24643	66
LS2OW-23	0.743	0.797	5	20-0002	30/20		F	2	2-071	1	MIL-DTL-24643	66
LS2OW-50	0.894	0.959	5	20-0004	30/24	40/24	J	3	2-075	¾	MIL-DTL-24643	66
LS2OW-75	1.033	1.108	5	20-0008	40/28		K	4	2-091	1¼	MIL-DTL-24643	66
LS2OW-100	1.149	1.232	6	21-0001	40/30		L	4	2-094	1¼	MIL-DTL-24643	66
LS2OW-200	1.519	1.630	7	22-0003	60/40		R	7	2-101	2	MIL-DTL-24643	66
LS3OW-3	0.367	0.394	2	17-0002	15/9		A	1	2-062	½	MIL-DTL-24643	67
LS3OW-4	0.390	0.418	2	17-0004	20/10		B	1	2-063	½	MIL-DTL-24643	67
LS3OW-9	0.497	0.533	3	18-0018	20/13	30/13	C	1	2-065	½	MIL-DTL-24643	67
LS3OW-14	0.684	0.733	4T	19-0005	30/17		D	2	2-071	¾	MIL-DTL-24643	67
LS3OW-23	0.769	0.853	5	20-0003	30/21		G	3	2-073	1	MIL-DTL-24643	67
LS3OW-50	0.957	1.027	5	20-0006	40/26		J	3	2-076	1	MIL-DTL-24643	67
LS3OW-75	1.107	1.187	6	21-0001	40/30		L	4	2-094	1¼	MIL-DTL-24643	67
LS3OW-100	1.231	1.321	6	21-0004	40/32	60/32	M	5	2-096	1½	MIL-DTL-24643	67
LS3OW-200	1.630	1.748	8	23-0002	60/43		S	7	2-103	2	MIL-DTL-24643	67

FIGURE 3A31. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors.

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Cable			Nylon tube		MCP		Stuffing tube			Box conn.	Cable	
Type	Size OD		Size	Packing assy M19622	Insert block	Insert block	Surface size	Submarine			MIL-spec	Slant sheet
	Min.	Max.						Size	Grommet			
LS3OW-300	1.916	2.055	3	23-0006	60/52		T	8	2-108	2⅝	MIL-DTL-24643	67
LS3OW-400	2.190	2.349	9	24-0004	90/55		X			2¼	MIL-DTL-24643	67
LS4OW-3	0.412	0.442	2	17-0002	20/11		B	1	2-063	½	MIL-DTL-24643	68
LS4OW-4	0.537	0.469	3	18-0018	20/12	30/12	B	1	2-064	½	MIL-DTL-24643	68
LS4OW-9	0.559	0.600	4T	19-0003	20/15	30/15	C	2	2-068	¾	MIL-DTL-24643	68
LS4OW-14	0.772	0.828	5	20-0002	30/20		G	3	2-072	¾	MIL-DTL-24643	68
LS4OW-23	0.900	0.965	5	20-0006	30/24	40/24	J	3	2-075	1	MIL-DTL-24643	68
LS4OW-50	1.084	1.163	6	21-0001	40/26		K	4	2-093	1¼	MIL-DTL-24643	68
LS4OW-75	1.254	1.345	6	21-0003	40/33	60/33	M	5	2-096	1⅝	MIL-DTL-24643	68
LS4OW-100	1.396	1.498	7	22-0001	60/38		N	6	2-099	1½	MIL-DTL-24643	68
LS4OW-200	1.850	1.984	8	23-0006	60/50	90/50	T	8	2-107	2½	MIL-DTL-24643	68
LSC264-4	0.735	0.765	4T	19-0005	30/19		E	2	2-071	¾	MIL-DTL-24643	69

NOTE:

1. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and BX connectors shown on figures 3A2 through 3A9 and 3A24 through 3A31 are for MIL-DTL-915, MIL-DTL-24640, and MIL-DTL-24643 cable.

FIGURE 3A31. Cable assignment to steel, aluminum, and nylon stuffing tubes, MCP blocks, and box connectors - Continued.

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APPENDIX B

GROUP 3B – PENETRATIONS – STUFFING TUBES, SURFACE SHIPS

B.1 SCOPE

B.1.1 Scope. This appendix describes the installation standard methods for stuffing tubes in surface ships.

B.2. APPLICABLE DOCUMENTS

B.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.

B.2.2 Government documents.

B.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-3041	-	Wrench, Open End Ratchet (TAC Pattern) for Tube Fitting, Electrical Cable Terminals, and Stuffing Tube Gland Nuts
A-A-3042	-	Socket, Open Detachable, Standard Wall, Octagon

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-E-917	-	Electric Power Equipment, Basic Requirements
MIL-DTL-2726/68	-	Receptacle, Plug, Connector, Electrical, 10-Ampere, 125-Volt, 3-Phase, Grounded (Symbol No. 706.1)
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 Electric Cable)
MIL-S-22698	-	Steel Plate, Shapes and Bars, Weldable Ordinary Strength and Higher Strength: Structural
MIL-S-24235	-	Stuffing Tubes, Metal, and Packing Assemblies for Electric Cables, General Specification for
MIL-S-24235/1	-	Stuffing Tubes, Metal, and Packing Assemblies for Electric Cables, Bulkhead, Pressureproof
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



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- |                |   |  |
|----------------|---|--|
| 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-S-24235/19 | - | Stuffing Tubes, Metal, and Packing Assemblies for Electric Cables, Sealing Plug for Unused Stuffing Tubes  |

DEPARTMENT OF DEFENSE STANDARDS

- |                |   |   |
|----------------|---|---|
| MIL-STD-2003-4 | - | Electric Plant Installation Standard Methods for Surface Ships and Submarines (Cableways) |
|----------------|---|---|

(Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch/> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

**B.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) DESIGN DATA SHEETS

- |           |   |   |
|-----------|---|---|
| DDS 100-1 | - | Reinforcement of Openings in Structure of Surface Ships Other Than in Protective Planting |
| DDS 100-2 | - | Openings in Decks and Bulkheads for Stuffing Tubes and Pipe                               |

(Copies of these documents are available from Commander, Naval Sea Systems Command, ATTN: SEA 05M2, 1333 Isaac Hull Avenue, SE, Stop 5160, Washington Navy Yard DC 20376-5160, or by email at [CommandStandards@navy.mil](mailto:CommandStandards@navy.mil) with the subject line “DDS request”.)

NAVAL SEA SYSTEMS COMMAND (NAVSEA) PUBLICATIONS

- |                      |   |  |
|----------------------|---|--|
| S9074-AR-GIB-010/278 | - | Requirements for Fabrication Welding and Inspection, and Casting Inspection and Repair for Machinery, Piping, and Pressure Vessels |
|----------------------|---|--|

(Copies of this document are available from the Naval Logistics Library, 5450 Carlisle Pike, Mechanicsburg, PA 17055 or online at <http://nll.ahf.nmci.navy.mil>.)

**B.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 A36/A36M     | - | Standard Specification for Carbon Structural Steel   |
| ASTM A53/A53M     | - | Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless   |
| ASTM A106         | - | Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service   |
| ASTM A1008/A1008M | - | Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable |
| ASTM A1011/A1011M | - | Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength       |

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- ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
- ASTM F1836M - Standard Specification for Stuffing Tubes, Nylon, and Packing Assemblies (Metric)

(Copies of these documents are available from ASTM International, 100 Barr Harbor Dr., P.O. Box C700, West Conshohocken, PA 19428-2959 or online at [www.astm.org](http://www.astm.org).)

NATIONAL AEROSPACE STANDARDS COMMITTEE (NA/NAS)

- NASM 25027 - Nut, Self-Locking, 250 Deg F, 450 Deg F, and 800 Deg F

(Copies of this document are available from Aerospace Industries Association, 1250 Eye Street NW, Washington, DC 20005-3924 or online at [www.aia-aerospace.org](http://www.aia-aerospace.org).)

B.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.

### B.3 REQUIRED EQUIPMENT AND MATERIALS

B.3.1 Required equipment and materials. The required equipment and materials for the proper installation of surface ship stuffing tubes are as shown in the Appendix B methods.

### B.4 NOTES AND PROCEDURES

B.4.1 Dimensions. For figures and tables in this section, all dimensions are in inches unless otherwise noted.

B.4.2 Figures. Table 3BI provides information for the figures in this group.

TABLE 3BI. Figures for surface ship stuffing tubes.

Figure number	Surface ship stuffing tubes	Page
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TABLE 3BI. Figures for surface ship stuffing tubes - Continued.

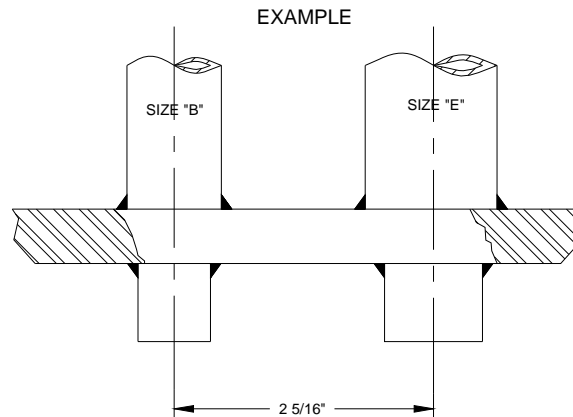
<b>Figure number</b>	<b>Surface ship stuffing tubes</b>	<b>Page</b>
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METHOD 3B-1-1  
HOLE SPACING IN DECKS AND BULKHEADS  
FROM DESIGN DATA SHEET DDS 100-2



NOTES:

1. The table referred to in the following notes is the hole-spacing table on figures 3B2, 3B3, and 3B4.
2. The dimensions shown in the hole-spacing table are suitable for the piercing of special treatment steel, high tensile protective plating, and medium steel decks and bulkheads.
3. This table may be used for all plate thicknesses not exceeding 3".
4. This table may also be used for aluminum decks and bulkheads where installation of stuffing tubes is required.
5. The values of the table are minimum permitted values, and may be increased as judged to be desirable for any particular application.
6. Use of this table does not require any increase in thickness of plating, or addition of doubler plates. The metal restored to a plate by the mounting of stuffing tubes or the passing of pipe is adequate compensation for the metal removed from the plate due to any drilling of holes in accordance with the table and limitations of note 2.
7. This table is applicable to the great majority of installations. Exceptions to the table are recognized when it is expedient to mount stuffing tubes on alternate sides of the plate being pierced, or as otherwise noted in this installation drawing.
8. For strength preservation of both medium and special treatment steel platings, stuffing tube hole spacings shall in no case be less than 1.8 mean diameters of any two adjacent holes. For medium steel calculations, for the hole diameters use the internal diameters of the extra strong kickpipes. For special treatment steel, use the actual drilled hole diameters given in column three of figure 3B2.
9. In locating a hole from a boundry structural member or cable support, the distance shall not be less than half the center-to-center spacing given in the table for two tubes of the required size.
10. This table does not impose any restrictions on how the holes shall be arranged as long as the restriction regarding minimum allowable spacing is not violated.
11. The spacings for tube sizes "A" through "Z" are sufficient for the use of the standard open ratchet wrenches, A-A-3041 and A-A-3042. Spacings for tube sizes "AA" and "BB" are sufficient for the use of 32 point box type crowfoot wrenches with square drive. This does not, however, exclude the use of other types of wrenches suitable for the purpose.

FIGURE 3B1. MIL-S-24235 stuffing tube and kickpipes minimum spacing (surface ships).

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**Hole spacing in decks and bulkheads**  
(Reproduced from Design Data Sheet DDS 100-2)

Spacing of holes for stuffing tubes and pipes This table also applicable to armor plate.																											
Nominal dia. of kickpipe (iron pipe size)	Drill for pipe (medium steel only)	Drill for pipe (special treatment steel)	Tube size	A	B	C	D	E	F	G	J	K	L	M	N	P	R	S	T	V	W	X	Y	Z	AA	BB	
3/8"	23/32"	0.406"	A	1 15/16"																							
1/2"	7/8"	0.515"	B	2"	2"																						
3/4"	1 3/32"	0.640"	C	2 1/16"	2 1/16"	2 1/16"																					
3/4"	1 3/32"	0.750"	D	2 1/4"	2 5/16"	2 3/8"	2 7/16"																				
1"	1 21/64"	0.812"	E	2 1/4"	2 5/16"	2 3/8"	2 1/2"	2 1/2"																			
1"	1 21/64"	0.843"	F	2 1/4"	2 5/16"	2 3/8"	2 1/2"	2 1/2"	2 1/2"																		
1"	1 21/64"	0.953"	G	2 3/4"	2 13/16"	2 7/8"	2 15/16"	3"	3"	3 1/16"																	
1 1/4"	1 45/64"	1.062"	J	2 3/4"	2 13/16"	2 7/8"	2 15/16"	3"	3"	3 3/16"	3 3/16"																
1 1/4"	1 45/64"	1.171"	K	2 3/4"	2 13/16"	2 7/8"	2 15/16"	3"	3"	3 3/16"	3 3/16"	3 3/16"															
1 1/4"	1 45/64"	1.265"	L	2 3/4"	2 13/16"	2 7/8"	2 15/16"	3"	3"	3 1/4"	3 1/4"	3 1/4"	3 1/4"														
1 1/2"	1 15/16"	1.406"	M	2 3/4"	2 13/16"	2 7/8"	2 15/16"	3"	3"	3 3/8"	3 3/8"	3 3/8"	3 3/8"	3 3/8"													
1 1/2"	1 15/16"	1.515"	N	3 5/16"	3 3/8"	3 7/16"	3 1/2"	3 9/16"	3 9/16"	3 11/16"	3 3/4"	3 13/16"	3 13/16"	3 15/16"	4"												
2"	2 13/32"	1.625"	P	3 5/16"	3 3/8"	3 7/16"	3 1/2"	3 9/16"	3 9/16"	3 11/16"	3 3/4"	3 13/16"	3 13/16"	3 15/16"	4 1/8"	4 1/8"											
2"	2 13/32"	1.750"	R	3 5/16"	3 3/8"	3 7/16"	3 1/2"	3 9/16"	3 9/16"	3 11/16"	3 3/4"	3 13/16"	3 13/16"	3 15/16"	4 1/8"	4 1/8"	4 1/8"										
2"	2 13/32"	1.875"	S	3 5/16"	3 3/8"	3 7/16"	3 1/2"	3 9/16"	3 9/16"	3 11/16"	3 3/4"	3 13/16"	3 13/16"	3 15/16"	4 5/16"	4 5/16"	4 5/16"	4 5/16"									
2 1/2"	2 29/32"	2.062"	T	3 5/16"	3 3/8"	3 7/16"	3 1/2"	3 9/16"	3 9/16"	3 13/16"	3 13/16"	3 13/16"	3 13/16"	3 15/16"	4 7/16"	4 7/16"	4 7/16"	4 7/16"	4 7/16"								
2 1/2"	2 29/32"	2.187"	V	3 11/16"	3 3/4"	3 13/16"	3 7/8"	3 15/16"	3 15/16"	4 1/16"	4 1/8"	4 3/16"	4 1/4"	4 5/16"	4 7/16"	4 1/2"	4 1/2"	4 11/16"	4 3/4"	4 13/16"							
2 1/2"	2 29/32"	2.312"	W	3 11/16"	3 3/4"	3 13/16"	3 7/8"	3 15/16"	3 15/16"	4 1/16"	4 1/8"	4 3/16"	4 1/4"	4 5/16"	4 1/2"	4 1/2"	4 1/2"	4 11/16"	4 3/4"	4 7/8"	4 7/8"						
3"	3 17/32"	2.500"	X	3 1 1/16"	3 3/4"	3 13/16"	3 7/8"	3 15/16"	3 15/16"	4 1/8"	4 1/8"	4 3/16"	4 1/4"	4 5/16"	4 11/16"	4 11/16"	4 11/16"	4 11/16"	4 11/16"	4 3/4"	5 1/16"	5 1/16"	5 1/16"				
3"	3 17/32"	2.609"	Y	3 1 1/16"	3 3/4"	3 13/16"	3 7/8"	3 15/16"	3 15/16"	4 1/8"	4 1/8"	4 3/16"	4 1/4"	4 5/16"	4 11/16"	4 11/16"	4 11/16"	4 11/16"	4 11/16"	4 3/4"	5 1/16"	5 1/16"	5 1/16"	5 1/16"			
3"	3 17/32"	2.781"	Z	3 1 1/16"	3 3/4"	3 13/16"	3 7/8"	3 15/16"	3 15/16"	4 1/8"	4 1/8"	4 3/16"	4 1/4"	4 5/16"	4 3/4"	4 3/4"	4 3/4"	4 3/4"	4 3/4"	5 1/8"	5 1/8"	5 1/8"	5 1/8"	5 1/8"	5 3/16"		
3"	3 3/32"	2.875"	AA	3 13/16"	3 7/8"	3 13/16"	4"	4"	4 1/32"	4 3/32"	4 1/4"	4 9/32"	4 7/16"	4 7/16"	4 15/32"	4 3/8"	4 19/32"	4 25/32"	4 31/32"	4 31/32"	5 1/16"	5 9/16"	5 9/16"	5 9/16"	5 17/32"		
3 1/2"	4 1/32"	3.157"	BB	4"	4 1/16"	4 1/8"	4 3/16"	4 3/16"	4 7/32"	4 11/32"	4 7/16"	4 15/32"	4 1/2"	4 5/8"	4 21/32"	5 1/16"	5 1/16"	5 1/16"	5 13/32"	5 13/32"	5 13/32"	5 31/32"	5 31/32"	5 31/32"	5 31/32"	6 13/32"	

NOTE:

- See figure 3B1 for notes.

FIGURE 3B2. MIL-S-24235 (other than /17 and /18 stuffing tube and pipe (steel) minimum spacing (surface ships).

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**Hole spacing in decks and bulkheads**  
(Derived from requirements of Design Data Sheet DDS 100-2)

Spacing of hole for swage tubes This table does not apply to armor plate.																													
Drill for swage tube M24235/17	Nominal outside dia. of swage tube	Tube size	A	B	C	D	E	F	G	J	K	L	M	N	P	R	S	T	V	W	X	Y	Z	AA	BB				
1 <sup>3</sup> / <sub>32</sub>	1 <sup>1</sup> / <sub>16</sub>	A	2 <sup>3</sup> / <sub>32</sub>																										
1 <sup>3</sup> / <sub>32</sub>	1 <sup>1</sup> / <sub>16</sub>	B	2 <sup>3</sup> / <sub>32</sub>	2 <sup>3</sup> / <sub>32</sub>																									
1 <sup>11</sup> / <sub>32</sub>	1 <sup>5</sup> / <sub>16</sub>	C	2 <sup>11</sup> / <sub>32</sub>	2 <sup>11</sup> / <sub>32</sub>	2 <sup>9</sup> / <sub>16</sub>																								
1 <sup>11</sup> / <sub>32</sub>	1 <sup>5</sup> / <sub>16</sub>	D	2 <sup>11</sup> / <sub>32</sub>	2 <sup>11</sup> / <sub>32</sub>	2 <sup>9</sup> / <sub>16</sub>	2 <sup>9</sup> / <sub>16</sub>																							
1 <sup>11</sup> / <sub>32</sub>	1 <sup>5</sup> / <sub>16</sub>	E	2 <sup>11</sup> / <sub>32</sub>	2 <sup>11</sup> / <sub>32</sub>	2 <sup>9</sup> / <sub>16</sub>	2 <sup>9</sup> / <sub>16</sub>	2 <sup>9</sup> / <sub>16</sub>																						
1 <sup>11</sup> / <sub>32</sub>	1 <sup>5</sup> / <sub>16</sub>	F	2 <sup>11</sup> / <sub>32</sub>	2 <sup>11</sup> / <sub>32</sub>	2 <sup>9</sup> / <sub>16</sub>	2 <sup>9</sup> / <sub>16</sub>	2 <sup>9</sup> / <sub>16</sub>	2 <sup>9</sup> / <sub>16</sub>																					
1 <sup>11</sup> / <sub>16</sub>	1 <sup>21</sup> / <sub>32</sub>	G	2 <sup>21</sup> / <sub>32</sub>	2 <sup>21</sup> / <sub>32</sub>	2 <sup>29</sup> / <sub>32</sub>	2 <sup>29</sup> / <sub>32</sub>	2 <sup>29</sup> / <sub>32</sub>	2 <sup>29</sup> / <sub>32</sub>	3 <sup>9</sup> / <sub>32</sub>																				
1 <sup>15</sup> / <sub>16</sub>	1 <sup>29</sup> / <sub>32</sub>	J	2 <sup>29</sup> / <sub>32</sub>	2 <sup>29</sup> / <sub>32</sub>	3 <sup>1</sup> / <sub>8</sub>	3 <sup>1</sup> / <sub>8</sub>	3 <sup>1</sup> / <sub>8</sub>	3 <sup>1</sup> / <sub>8</sub>	3 <sup>15</sup> / <sub>32</sub>	3 <sup>11</sup> / <sub>16</sub>																			
1 <sup>15</sup> / <sub>16</sub>	1 <sup>29</sup> / <sub>32</sub>	K	2 <sup>29</sup> / <sub>32</sub>	2 <sup>29</sup> / <sub>32</sub>	3 <sup>1</sup> / <sub>8</sub>	3 <sup>1</sup> / <sub>8</sub>	3 <sup>1</sup> / <sub>8</sub>	3 <sup>1</sup> / <sub>8</sub>	3 <sup>15</sup> / <sub>32</sub>	3 <sup>11</sup> / <sub>16</sub>	3 <sup>11</sup> / <sub>16</sub>																		
1 <sup>15</sup> / <sub>16</sub>	1 <sup>29</sup> / <sub>32</sub>	L	2 <sup>29</sup> / <sub>32</sub>	2 <sup>29</sup> / <sub>32</sub>	3 <sup>1</sup> / <sub>8</sub>	3 <sup>1</sup> / <sub>8</sub>	3 <sup>1</sup> / <sub>8</sub>	3 <sup>1</sup> / <sub>8</sub>	3 <sup>15</sup> / <sub>32</sub>	3 <sup>11</sup> / <sub>16</sub>	3 <sup>11</sup> / <sub>16</sub>	3 <sup>11</sup> / <sub>16</sub>																	
2 <sup>13</sup> / <sub>32</sub>	2 <sup>3</sup> / <sub>8</sub>	M	3 <sup>11</sup> / <sub>32</sub>	3 <sup>11</sup> / <sub>32</sub>	3 <sup>19</sup> / <sub>32</sub>	3 <sup>19</sup> / <sub>32</sub>	3 <sup>19</sup> / <sub>32</sub>	3 <sup>19</sup> / <sub>32</sub>	3 <sup>29</sup> / <sub>32</sub>	4 <sup>1</sup> / <sub>16</sub>	4 <sup>5</sup> / <sub>32</sub>	4 <sup>5</sup> / <sub>32</sub>	4 <sup>19</sup> / <sub>32</sub>																
2 <sup>13</sup> / <sub>32</sub>	2 <sup>3</sup> / <sub>8</sub>	N	3 <sup>11</sup> / <sub>32</sub>	3 <sup>11</sup> / <sub>32</sub>	3 <sup>19</sup> / <sub>32</sub>	3 <sup>19</sup> / <sub>32</sub>	3 <sup>19</sup> / <sub>32</sub>	3 <sup>19</sup> / <sub>32</sub>	3 <sup>29</sup> / <sub>32</sub>	4 <sup>1</sup> / <sub>16</sub>	4 <sup>5</sup> / <sub>32</sub>	4 <sup>5</sup> / <sub>32</sub>	4 <sup>19</sup> / <sub>32</sub>	4 <sup>19</sup> / <sub>32</sub>															
2 <sup>13</sup> / <sub>32</sub>	2 <sup>3</sup> / <sub>8</sub>	P	3 <sup>11</sup> / <sub>32</sub>	3 <sup>11</sup> / <sub>32</sub>	3 <sup>19</sup> / <sub>32</sub>	3 <sup>19</sup> / <sub>32</sub>	3 <sup>19</sup> / <sub>32</sub>	3 <sup>19</sup> / <sub>32</sub>	3 <sup>29</sup> / <sub>32</sub>	4 <sup>1</sup> / <sub>16</sub>	4 <sup>5</sup> / <sub>32</sub>	4 <sup>5</sup> / <sub>32</sub>	4 <sup>19</sup> / <sub>32</sub>	4 <sup>19</sup> / <sub>32</sub>	4 <sup>19</sup> / <sub>32</sub>														
2 <sup>13</sup> / <sub>32</sub>	2 <sup>3</sup> / <sub>8</sub>	R	3 <sup>11</sup> / <sub>32</sub>	3 <sup>11</sup> / <sub>32</sub>	3 <sup>19</sup> / <sub>32</sub>	3 <sup>19</sup> / <sub>32</sub>	3 <sup>19</sup> / <sub>32</sub>	3 <sup>19</sup> / <sub>32</sub>	3 <sup>29</sup> / <sub>32</sub>	4 <sup>1</sup> / <sub>16</sub>	4 <sup>5</sup> / <sub>32</sub>	4 <sup>5</sup> / <sub>32</sub>	4 <sup>19</sup> / <sub>32</sub>	4 <sup>19</sup> / <sub>32</sub>	4 <sup>19</sup> / <sub>32</sub>	4 <sup>19</sup> / <sub>32</sub>													
2 <sup>29</sup> / <sub>32</sub>	2 <sup>7</sup> / <sub>8</sub>	S	3 <sup>13</sup> / <sub>16</sub>	3 <sup>13</sup> / <sub>16</sub>	4 <sup>1</sup> / <sub>16</sub>	4 <sup>1</sup> / <sub>16</sub>	4 <sup>1</sup> / <sub>16</sub>	4 <sup>1</sup> / <sub>16</sub>	4 <sup>3</sup> / <sub>8</sub>	4 <sup>3</sup> / <sub>8</sub>	4 <sup>3</sup> / <sub>8</sub>	4 <sup>3</sup> / <sub>8</sub>	5 <sup>1</sup> / <sub>16</sub>	5 <sup>1</sup> / <sub>16</sub>	5 <sup>1</sup> / <sub>16</sub>	5 <sup>1</sup> / <sub>16</sub>	5 <sup>17</sup> / <sub>32</sub>												
3 <sup>3</sup> / <sub>16</sub>	3 <sup>1</sup> / <sub>8</sub>	T	4 <sup>3</sup> / <sub>32</sub>	4 <sup>3</sup> / <sub>32</sub>	4 <sup>5</sup> / <sub>16</sub>	4 <sup>5</sup> / <sub>16</sub>	4 <sup>5</sup> / <sub>16</sub>	4 <sup>5</sup> / <sub>16</sub>	4 <sup>21</sup> / <sub>32</sub>	4 <sup>7</sup> / <sub>8</sub>	4 <sup>7</sup> / <sub>8</sub>	4 <sup>7</sup> / <sub>8</sub>	5 <sup>11</sup> / <sub>32</sub>	5 <sup>11</sup> / <sub>32</sub>	5 <sup>11</sup> / <sub>32</sub>	5 <sup>11</sup> / <sub>32</sub>	5 <sup>13</sup> / <sub>16</sub>	6 <sup>1</sup> / <sub>16</sub>											
3 <sup>5</sup> / <sub>16</sub>	3 <sup>1</sup> / <sub>4</sub>	V	4 <sup>3</sup> / <sub>16</sub>	4 <sup>3</sup> / <sub>16</sub>	4 <sup>7</sup> / <sub>16</sub>	4 <sup>7</sup> / <sub>16</sub>	4 <sup>7</sup> / <sub>16</sub>	4 <sup>7</sup> / <sub>16</sub>	4 <sup>3</sup> / <sub>4</sub>	5	5	5	5 <sup>7</sup> / <sub>16</sub>	5 <sup>7</sup> / <sub>16</sub>	5 <sup>7</sup> / <sub>16</sub>	5 <sup>7</sup> / <sub>16</sub>	5 <sup>15</sup> / <sub>16</sub>	6 <sup>3</sup> / <sub>16</sub>	6 <sup>5</sup> / <sub>16</sub>										
3 <sup>9</sup> / <sub>16</sub>	3 <sup>1</sup> / <sub>2</sub>	W	4 <sup>7</sup> / <sub>16</sub>	4 <sup>7</sup> / <sub>16</sub>	4 <sup>15</sup> / <sub>32</sub>	4 <sup>15</sup> / <sub>32</sub>	4 <sup>15</sup> / <sub>32</sub>	4 <sup>15</sup> / <sub>32</sub>	5	5 <sup>1</sup> / <sub>4</sub>	5 <sup>1</sup> / <sub>4</sub>	5 <sup>1</sup> / <sub>4</sub>	5 <sup>11</sup> / <sub>16</sub>	5 <sup>11</sup> / <sub>16</sub>	5 <sup>11</sup> / <sub>16</sub>	5 <sup>11</sup> / <sub>16</sub>	6 <sup>5</sup> / <sub>32</sub>	6 <sup>7</sup> / <sub>16</sub>	6 <sup>17</sup> / <sub>32</sub>	6 <sup>25</sup> / <sub>32</sub>									
3 <sup>9</sup> / <sub>16</sub>	3 <sup>1</sup> / <sub>2</sub>	X	4 <sup>7</sup> / <sub>16</sub>	4 <sup>7</sup> / <sub>16</sub>	4 <sup>15</sup> / <sub>32</sub>	4 <sup>15</sup> / <sub>32</sub>	4 <sup>15</sup> / <sub>32</sub>	4 <sup>15</sup> / <sub>32</sub>	5	5 <sup>1</sup> / <sub>4</sub>	5 <sup>1</sup> / <sub>4</sub>	5 <sup>1</sup> / <sub>4</sub>	5 <sup>11</sup> / <sub>16</sub>	5 <sup>11</sup> / <sub>16</sub>	5 <sup>11</sup> / <sub>16</sub>	5 <sup>11</sup> / <sub>16</sub>	6 <sup>5</sup> / <sub>32</sub>	6 <sup>7</sup> / <sub>16</sub>	6 <sup>17</sup> / <sub>32</sub>	6 <sup>25</sup> / <sub>32</sub>	6 <sup>25</sup> / <sub>32</sub>								
4 <sup>1</sup> / <sub>16</sub>	4	Y	4 <sup>29</sup> / <sub>32</sub>	4 <sup>29</sup> / <sub>32</sub>	5 <sup>5</sup> / <sub>32</sub>	5 <sup>5</sup> / <sub>32</sub>	5 <sup>5</sup> / <sub>32</sub>	5 <sup>5</sup> / <sub>32</sub>	5 <sup>15</sup> / <sub>32</sub>	5 <sup>23</sup> / <sub>32</sub>	5 <sup>23</sup> / <sub>32</sub>	5 <sup>23</sup> / <sub>32</sub>	6 <sup>5</sup> / <sub>32</sub>	6 <sup>5</sup> / <sub>32</sub>	6 <sup>5</sup> / <sub>32</sub>	6 <sup>5</sup> / <sub>32</sub>	6 <sup>5</sup> / <sub>8</sub>	6 <sup>29</sup> / <sub>32</sub>	7 <sup>1</sup> / <sub>32</sub>	7 <sup>1</sup> / <sub>4</sub>	7 <sup>1</sup> / <sub>4</sub>	7 <sup>23</sup> / <sub>32</sub>							
4 <sup>1</sup> / <sub>16</sub>	4	Z	4 <sup>29</sup> / <sub>32</sub>	4 <sup>29</sup> / <sub>32</sub>	5 <sup>5</sup> / <sub>32</sub>	5 <sup>5</sup> / <sub>32</sub>	5 <sup>5</sup> / <sub>32</sub>	5 <sup>5</sup> / <sub>32</sub>	5 <sup>15</sup> / <sub>32</sub>	5 <sup>23</sup> / <sub>32</sub>	5 <sup>23</sup> / <sub>32</sub>	5 <sup>23</sup> / <sub>32</sub>	6 <sup>5</sup> / <sub>32</sub>	6 <sup>5</sup> / <sub>32</sub>	6 <sup>5</sup> / <sub>32</sub>	6 <sup>5</sup> / <sub>32</sub>	6 <sup>5</sup> / <sub>8</sub>	6 <sup>29</sup> / <sub>32</sub>	7 <sup>1</sup> / <sub>32</sub>	7 <sup>1</sup> / <sub>4</sub>	7 <sup>1</sup> / <sub>4</sub>	7 <sup>23</sup> / <sub>32</sub>	7 <sup>23</sup> / <sub>32</sub>						
4 <sup>1</sup> / <sub>16</sub>	4	AA	4 <sup>29</sup> / <sub>32</sub>	4 <sup>29</sup> / <sub>32</sub>	5 <sup>5</sup> / <sub>32</sub>	5 <sup>5</sup> / <sub>32</sub>	5 <sup>5</sup> / <sub>32</sub>	5 <sup>5</sup> / <sub>32</sub>	5 <sup>15</sup> / <sub>32</sub>	5 <sup>23</sup> / <sub>32</sub>	5 <sup>23</sup> / <sub>32</sub>	5 <sup>23</sup> / <sub>32</sub>	6 <sup>5</sup> / <sub>32</sub>	6 <sup>5</sup> / <sub>32</sub>	6 <sup>5</sup> / <sub>32</sub>	6 <sup>5</sup> / <sub>32</sub>	6 <sup>5</sup> / <sub>8</sub>	6 <sup>29</sup> / <sub>32</sub>	7 <sup>1</sup> / <sub>32</sub>	7 <sup>1</sup> / <sub>4</sub>	7 <sup>1</sup> / <sub>4</sub>	7 <sup>23</sup> / <sub>32</sub>	7 <sup>23</sup> / <sub>32</sub>	7 <sup>23</sup> / <sub>32</sub>					
4 <sup>9</sup> / <sub>16</sub>	4 <sup>1</sup> / <sub>2</sub>	BB	5 <sup>3</sup> / <sub>8</sub>	5 <sup>3</sup> / <sub>8</sub>	5 <sup>5</sup> / <sub>8</sub>	5 <sup>5</sup> / <sub>8</sub>	5 <sup>5</sup> / <sub>8</sub>	5 <sup>5</sup> / <sub>8</sub>	5 <sup>15</sup> / <sub>16</sub>	6 <sup>3</sup> / <sub>16</sub>	6 <sup>3</sup> / <sub>16</sub>	6 <sup>3</sup> / <sub>16</sub>	6 <sup>5</sup> / <sub>8</sub>	6 <sup>5</sup> / <sub>8</sub>	6 <sup>5</sup> / <sub>8</sub>	6 <sup>5</sup> / <sub>8</sub>	7 <sup>1</sup> / <sub>8</sub>	7 <sup>3</sup> / <sub>8</sub>	7 <sup>1</sup> / <sub>2</sub>	7 <sup>23</sup> / <sub>32</sub>	7 <sup>23</sup> / <sub>32</sub>	8 <sup>7</sup> / <sub>32</sub>	8 <sup>7</sup> / <sub>32</sub>	8 <sup>7</sup> / <sub>32</sub>	8 <sup>11</sup> / <sub>32</sub>				

## NOTES:

- See figure 3B1 for notes.
- See figure 3B4 for MIL-S-24235/18 spacing.

FIGURE 3B3. MIL-S-24235/17 swage tube (steel) minimum spacing (surface ships).

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**Hole spacing in decks and bulkheads**  
(Derived from requirements of Design Data Sheet DDS 100-2)

Spacing of hole for swage tubes This table does not apply to armor plate.																										
Drill for swage tube M24235/18	Nominal outside dia. of swage tube	Tube size	A	B	C	D	E	F	G	J	K	L	M	N	P	R	S	T	V	W	X	Y	Z	AA	BB	
7⁄8	0.840 (27⁄32)	A	1 31⁄32																							
7⁄8	0.840 (27⁄32)	B	1 31⁄32	2																						
1 3⁄32	1.050 (1⁄16)	C	1 31⁄32	2	2 1⁄6																					
1 3⁄32	1.050 (1⁄16)	D	2 7⁄32	2 1⁄4	2 5⁄16	2 3⁄8																				
1 23⁄64	1.315 (1 21⁄64)	E	2 7⁄32	2 1⁄4	2 5⁄16	2 3⁄8	2 13⁄32																			
1 23⁄64	1.315 (1 21⁄64)	F	2 7⁄32	2 1⁄4	2 5⁄16	2 3⁄8	2 13⁄32	2 1⁄2																		
1 23⁄64	1.315 (1 21⁄64)	G	2 21⁄32	2 23⁄32	2 25⁄32	2 27⁄32	2 7⁄8	2 29⁄32	2 31⁄32																	
1 45⁄64	1.660 (1 43⁄64)	J	2 21⁄32	2 23⁄32	2 25⁄32	2 27⁄32	2 7⁄8	2 29⁄32	2 31⁄32	3 3⁄16																
1 45⁄64	1.660 (1 43⁄64)	K	2 21⁄32	2 23⁄32	2 25⁄32	2 27⁄32	2 7⁄8	2 29⁄32	2 31⁄32	3 3⁄16	3 3⁄16															
1 45⁄64	1.660 (1 43⁄64)	L	2 21⁄32	2 23⁄32	2 25⁄32	2 27⁄32	2 7⁄8	2 29⁄32	2 31⁄32	3 3⁄16	3 3⁄16	3 3⁄16														
1 15⁄64	1.900 (1 29⁄32)	M	2 21⁄32	2 23⁄32	2 25⁄32	2 27⁄32	2 7⁄8	2 29⁄32	3	3 15⁄32	3 15⁄32	3 15⁄32	3 3⁄8													
1 15⁄16	1.900 (1 29⁄32)	N	3 1⁄4	3 3⁄16	3 3⁄8	3 7⁄16	3 15⁄32	3 1⁄2	3 9⁄16	3 19⁄32	3 11⁄16	3 23⁄32	3 13⁄16	3 27⁄32												
2 13⁄32	2.375 (2 3⁄8)	P	3 1⁄4	3 3⁄16	3 3⁄8	3 7⁄16	3 15⁄32	3 1⁄2	3 9⁄16	3 7⁄8	3 3⁄8	3 7⁄8	4 3⁄32	4 3⁄32	4 17⁄32											
2 13⁄32	2.375 (2 3⁄8)	R	3 1⁄4	3 3⁄16	3 3⁄32	3 13⁄32	3 17⁄32	3 17⁄32	3 9⁄16	3 7⁄8	3 7⁄8	3 7⁄8	4 3⁄32	4 3⁄32	4 17⁄32	4 17⁄32										
2 13⁄32	2.375 (2 3⁄8)	S	3 1⁄4	3 3⁄16	3 11⁄32	3 13⁄32	3 17⁄32	3 17⁄32	4 1⁄32	3 7⁄8	3 7⁄8	3 7⁄8	4 3⁄32	4 3⁄32	4 17⁄32	4 17⁄32	4 17⁄32									
2 15⁄16	2.875 (2 7⁄8)	T	3 9⁄16	3 9⁄16	3 25⁄32	4 25⁄32	4 1⁄32	4 1⁄32	4 1⁄32	4 11⁄32	4 11⁄32	4 11⁄32	4 19⁄32	4 19⁄32	5 1⁄32	5 1⁄32	5 1⁄32	5 1⁄2								
2 15⁄16	2.875 (2 7⁄8)	V	3 5⁄8	3 11⁄16	3 25⁄32	3 13⁄16	4 1⁄32	4 1⁄32	4 1⁄32	4 11⁄32	4 11⁄32	4 11⁄32	4 19⁄32	4 19⁄32	5 1⁄32	5 1⁄32	5 1⁄32	5 1⁄2	5 1⁄2							
2 15⁄16	2.875 (2 7⁄8)	W	3 5⁄8	3 11⁄16	3 25⁄32	3 13⁄16	4 1⁄32	4 1⁄32	4 1⁄32	4 11⁄32	4 11⁄32	4 11⁄32	4 19⁄32	4 19⁄32	5 1⁄32	5 1⁄32	5 1⁄32	5 1⁄2	5 1⁄2	5 1⁄2						
3 9⁄16	3.500 (3 1⁄2)	X	4 3⁄32	4 3⁄32	4 3⁄8	4 3⁄8	4 5⁄8	4 5⁄8	4 5⁄8	4 15⁄16	4 15⁄16	4 15⁄16	5 3⁄16	5 3⁄16	5 9⁄16	5 9⁄16	5 9⁄16	6 3⁄32	6 3⁄32	6 3⁄32	6 11⁄16					
3 9⁄16	3.500 (3 1⁄2)	Y	4 3⁄32	4 3⁄32	4 3⁄8	4 3⁄8	4 5⁄8	4 5⁄8	4 5⁄8	4 15⁄16	4 15⁄16	4 15⁄16	5 3⁄16	5 3⁄16	5 9⁄16	5 9⁄16	5 9⁄16	6 3⁄32	6 3⁄32	6 3⁄32	6 11⁄16	6 11⁄16				
3 9⁄16	3.500 (3 1⁄2)	Z	4 3⁄32	4 3⁄32	4 3⁄8	4 3⁄8	4 5⁄8	4 5⁄8	4 5⁄8	4 15⁄16	4 15⁄16	4 15⁄16	5 3⁄16	5 3⁄16	5 9⁄16	5 9⁄16	5 9⁄16	6 3⁄32	6 3⁄32	6 3⁄32	6 11⁄16	6 11⁄16	6 11⁄16			
3 9⁄16	3.500 (3 1⁄2)	AA	4 3⁄32	4 3⁄32	4 3⁄8	4 3⁄8	4 5⁄8	4 5⁄8	4 5⁄8	4 15⁄16	4 15⁄16	4 15⁄16	5 3⁄16	5 3⁄16	5 9⁄16	5 9⁄16	5 9⁄16	6 3⁄32	6 3⁄32	6 3⁄32	6 11⁄16	6 11⁄16	6 11⁄16	6 11⁄16		
4 1⁄16	4.000 (4)	BB	4 19⁄32	4 19⁄32	4 27⁄32	4 27⁄32	5 3⁄32	5 3⁄32	5 3⁄32	5 13⁄32	5 13⁄32	5 13⁄32	5 21⁄32	5 21⁄32	6 3⁄32	6 3⁄32	6 3⁄32	6 9⁄16	6 9⁄16	6 9⁄16	7 3⁄32	7 3⁄32	7 3⁄32	7 3⁄32	7 21⁄32	

NOTE:

- See figure 3B3 – Spacing of MIL-S-24235/17 for regular swage tubes.

FIGURE 3B4. MIL-S-24235/18 reduced diameter swage and kickpipe minimum spacing (surface ships).



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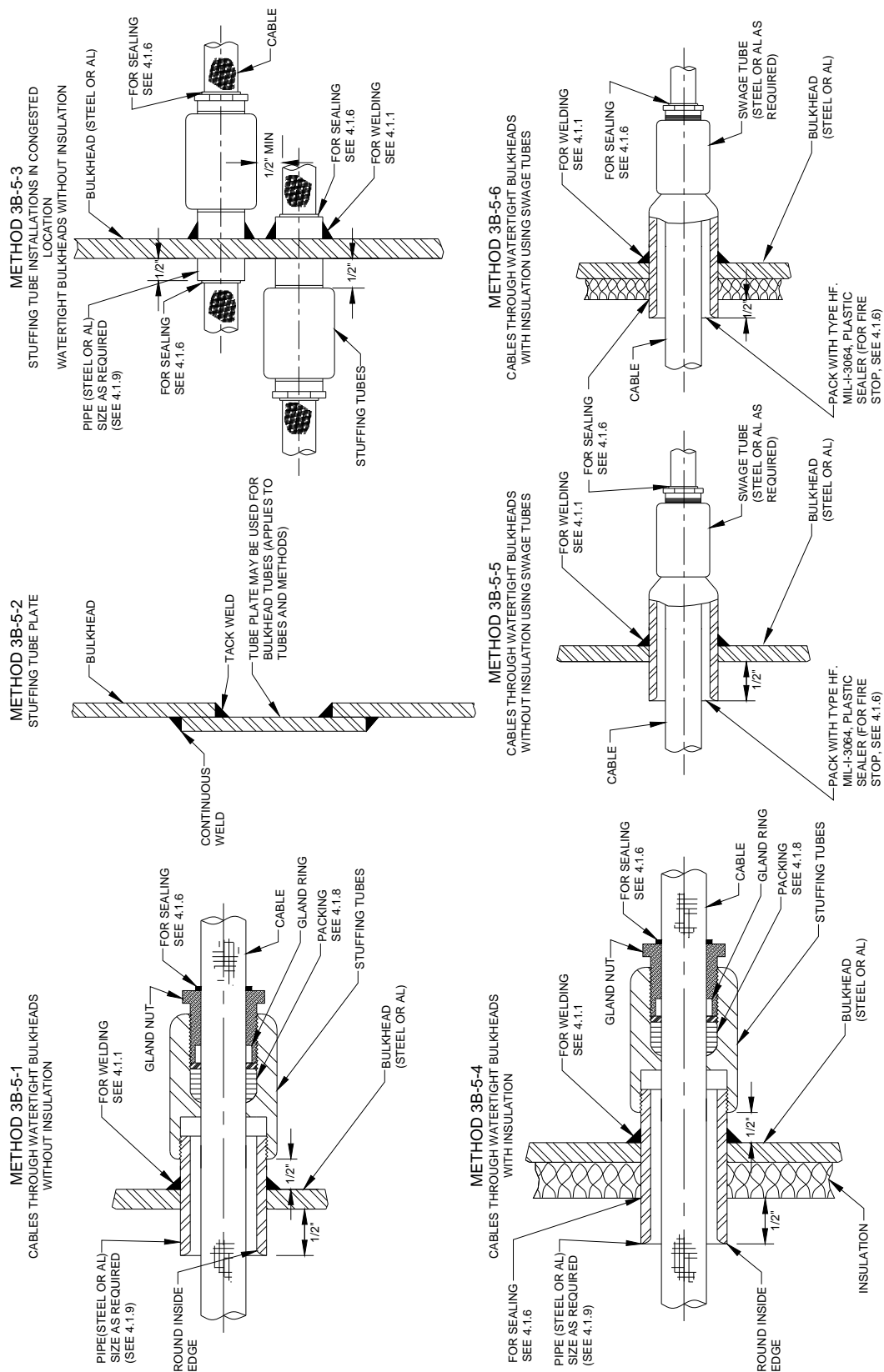


FIGURE 3B5. MIL-S-24235 stuffing tubes for steel or aluminum bulkheads (surface ships).

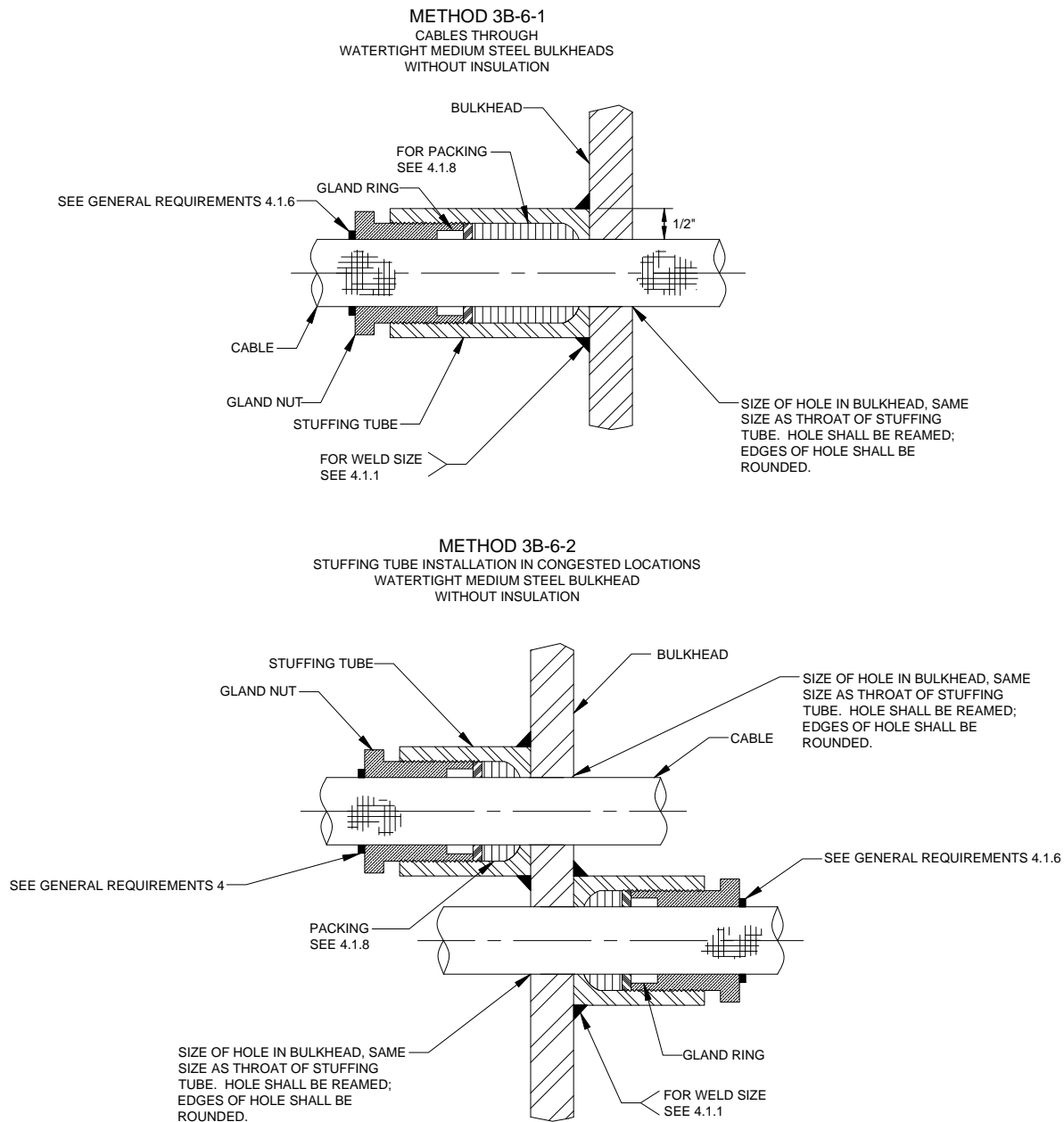
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NOTES:

1. Pipes used in conjunction with stuffing tubes shall be welded on one side of the bulkhead penetrated except for the following types of bulkheads where welds on both sides are required:
  - a. Ballistic bulkheads
  - b. Shell plating
  - c. Torpedo defense system bulkheads
  - d. Penetrations exposed to weather or wet spaces
2. Plastic sealer is only required on kick pipes, stuffing tubes, etc. when exposed to the elements (penetrates the skin of the ship).

FIGURE 3B5. MIL-S-24235 stuffing tubes for steel or aluminum bulkheads (surface ships) - Continued.

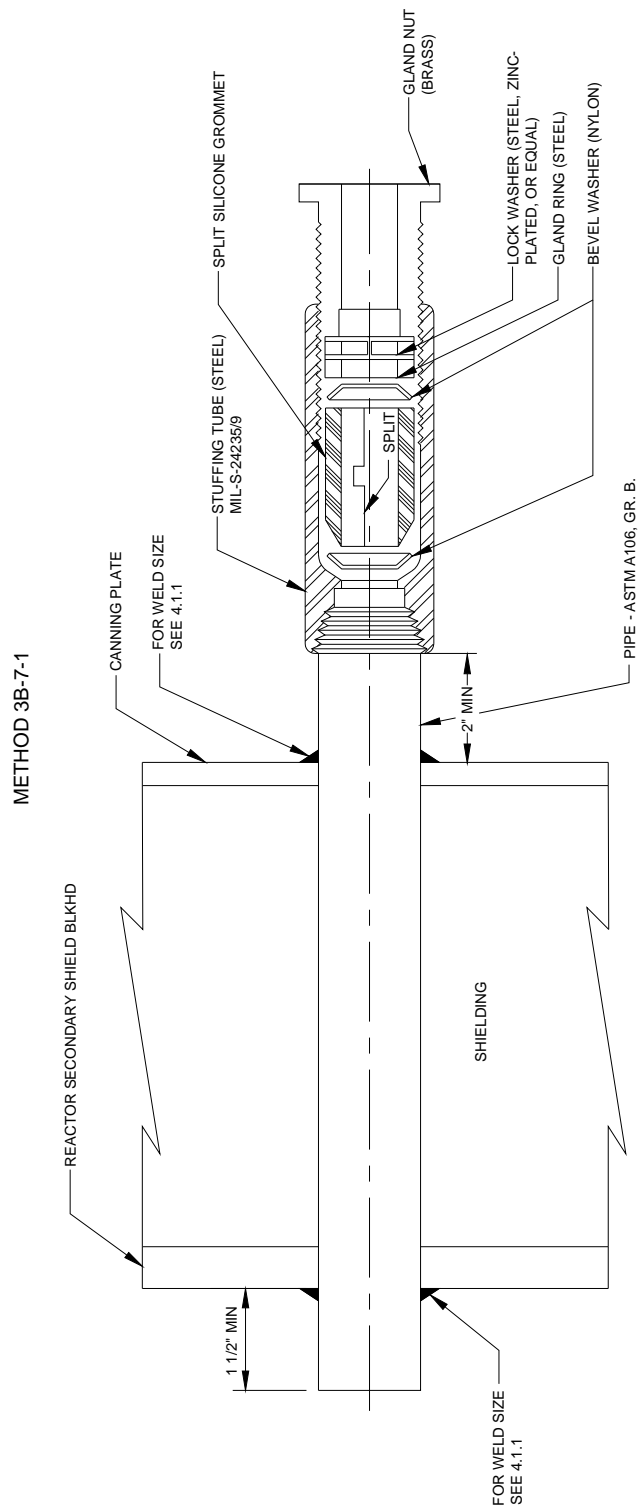
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NOTE: Plastic sealer is only required on kick pipes, stuffing tubes, etc. when exposed to the elements (penetrates the skin of the ship).

FIGURE 3B6. MIL-S-24235 stuffing tubes for steel or aluminum bulkheads (surface ships).

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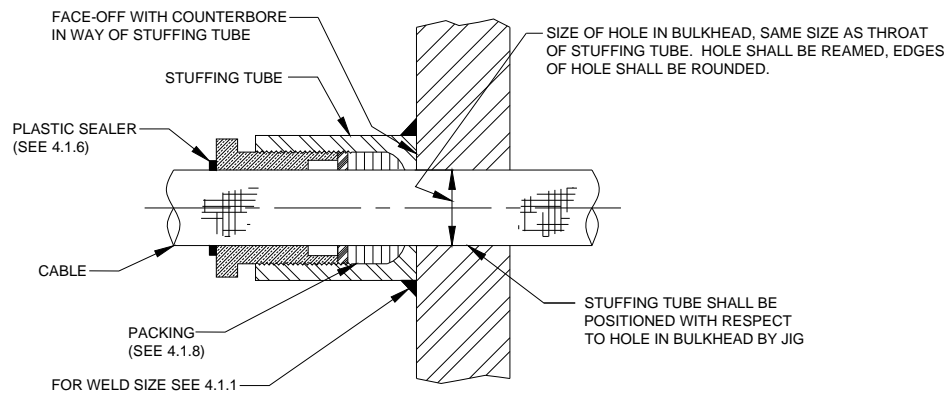


NOTE: Plastic sealer is only required on kick pipes, stuffing tubes, etc. when exposed to the elements (penetrates the skin of the ship).

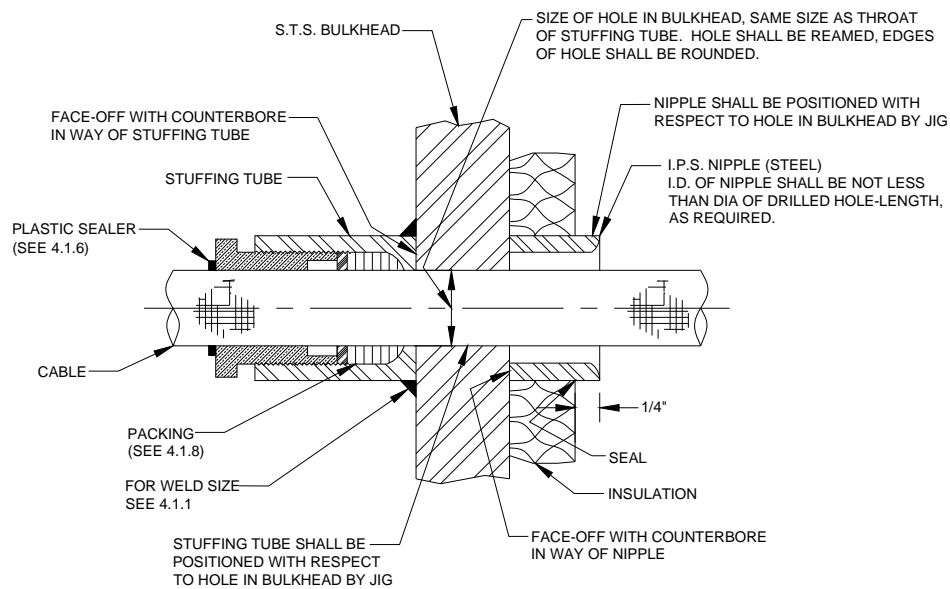
FIGURE 3B7. MIL-S-24235 stuffing tubes through shielded bulkheads (surface ships).

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METHOD 3B-8-1  
CABLES THROUGH S.T.S. BULKHEADS  
WITHOUT INSULATION



METHOD 3B-8-2  
CABLES THROUGH S.T.S. BULKHEADS  
WITH INSULATION



NOTE: Plastic sealer is only required on kick pipes, stuffing tubes, etc. when exposed to the elements (penetrates the skin of the ship).

FIGURE 3B8. MIL-S-24235 stuffing tubes for ballistic bulkheads (surface ships).

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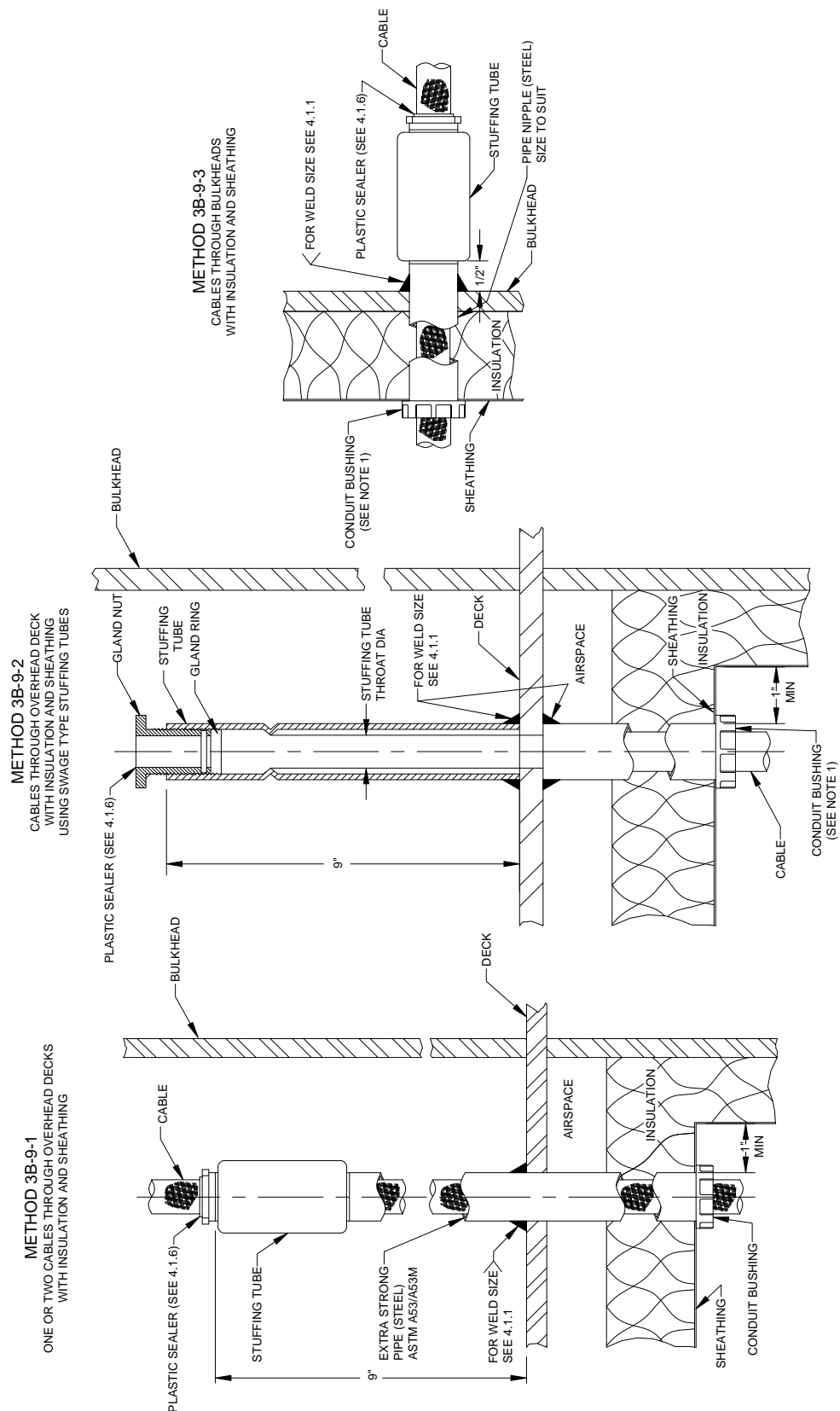


FIGURE 3B9. MIL-S-24235 stuffing tubes through acoustical spaces (surface ships).

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NOTES:

1. Pipe nipples and ends of kick pipes shall be threaded for installation of conduit bushing.
2. Plastic sealer is only required on kick pipes, stuffing tubes, etc. when exposed to the elements (penetrates the skin of the ship).

FIGURE 3B9. MIL-S-24235 stuffing tubes through acoustical spaces (surface ships) - Continued.

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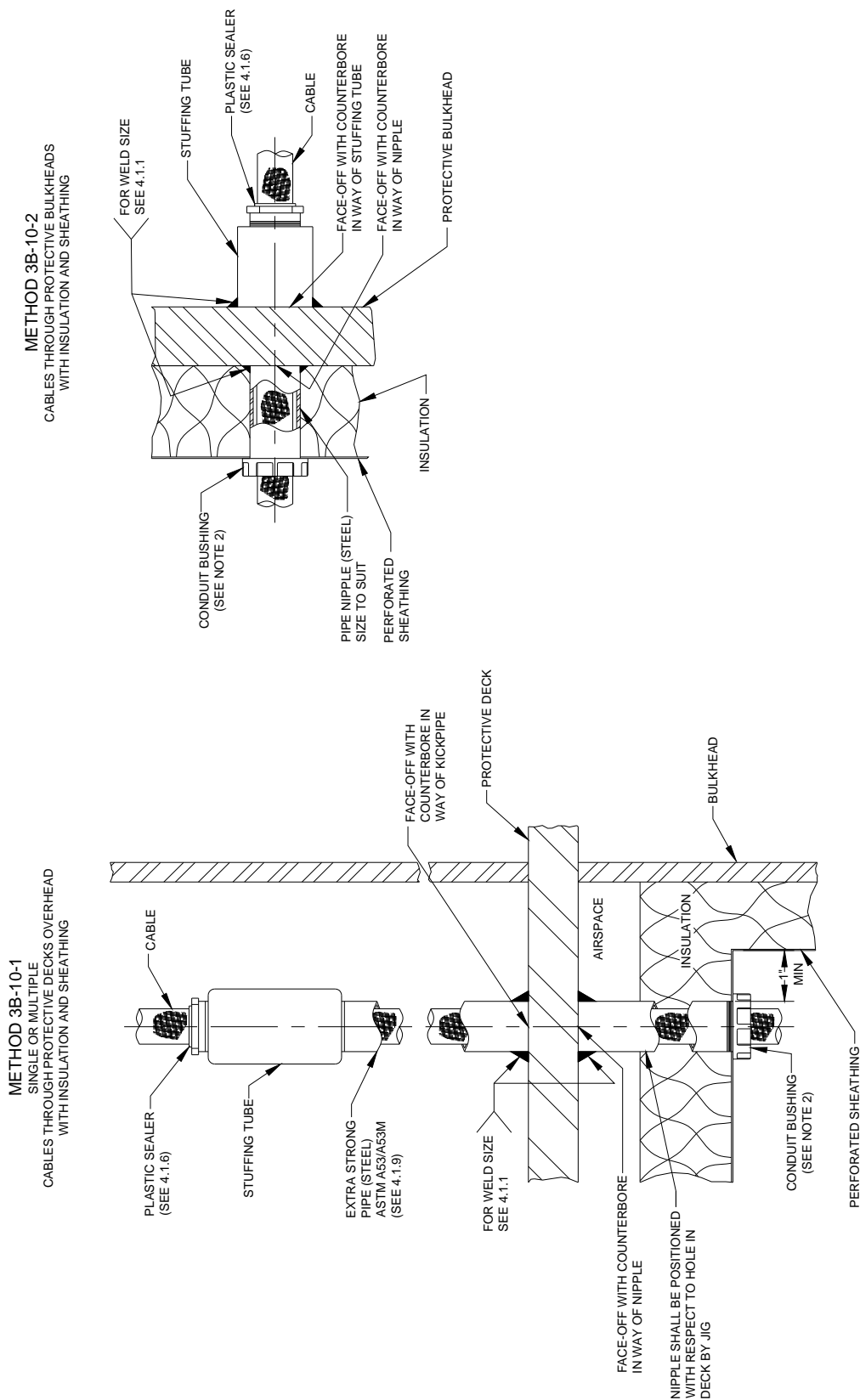


FIGURE 3B10. MIL-S-24235 stuffing tubes through acoustical spaces (surface ships).



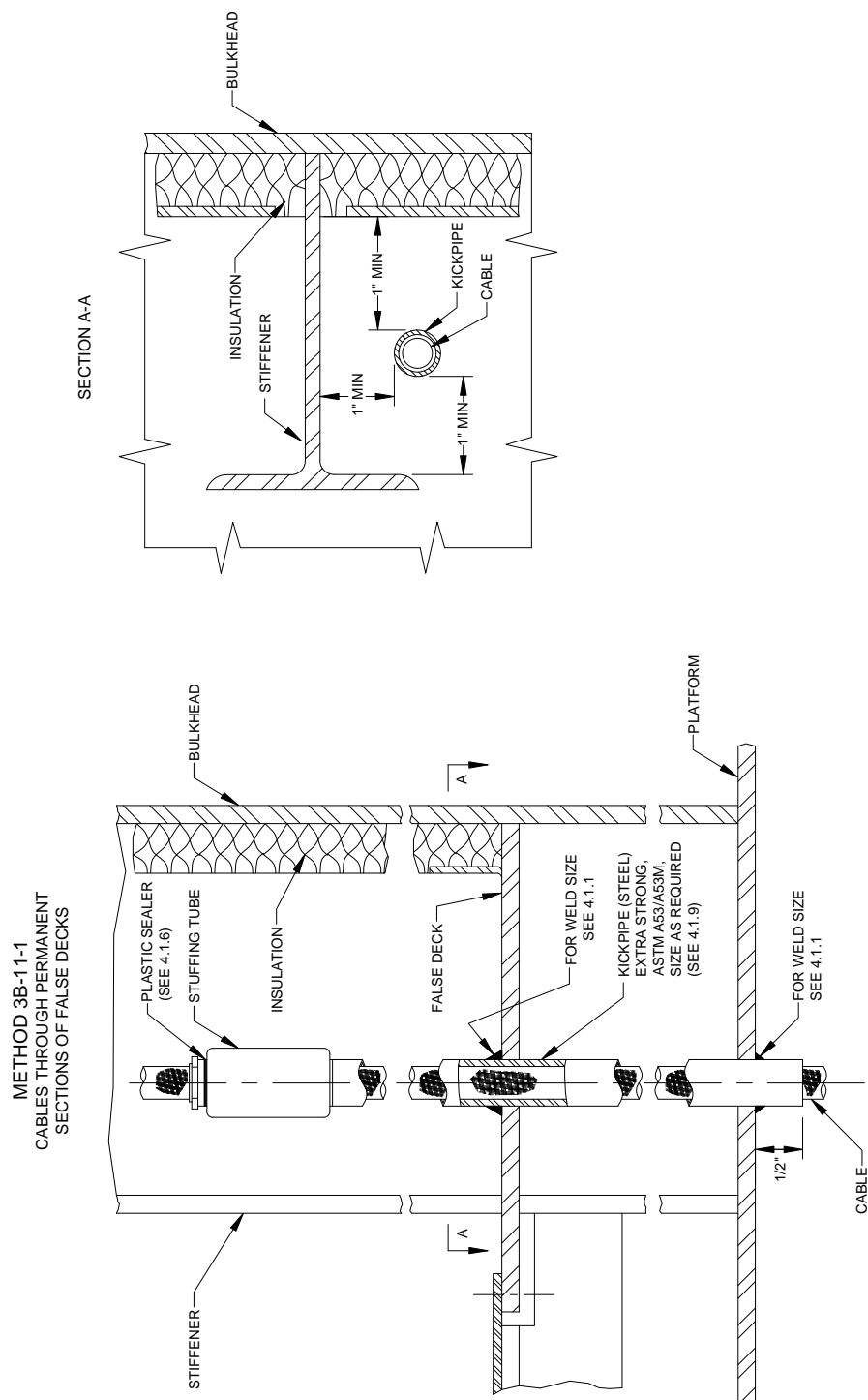
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NOTES:

1. Pipes used in conjunction with stuffing tubes shall be welded on both sides of the bulkhead for the following types of bulkheads:
  - a. Ballistic bulkheads
  - b. Shell plating
  - c. Torpedo defense system bulkheads
  - d. Penetrations exposed to weather or wet spaces
2. Pipe nipples shall be threaded for installation of conduit bushing.
3. Plastic sealer is only required on kick pipes, stuffing tubes, etc. when exposed to the elements (penetrates the skin of the ship).

FIGURE 3B10. MIL-S-24235 stuffing tubes through acoustical spaces (surface ships) - Continued.

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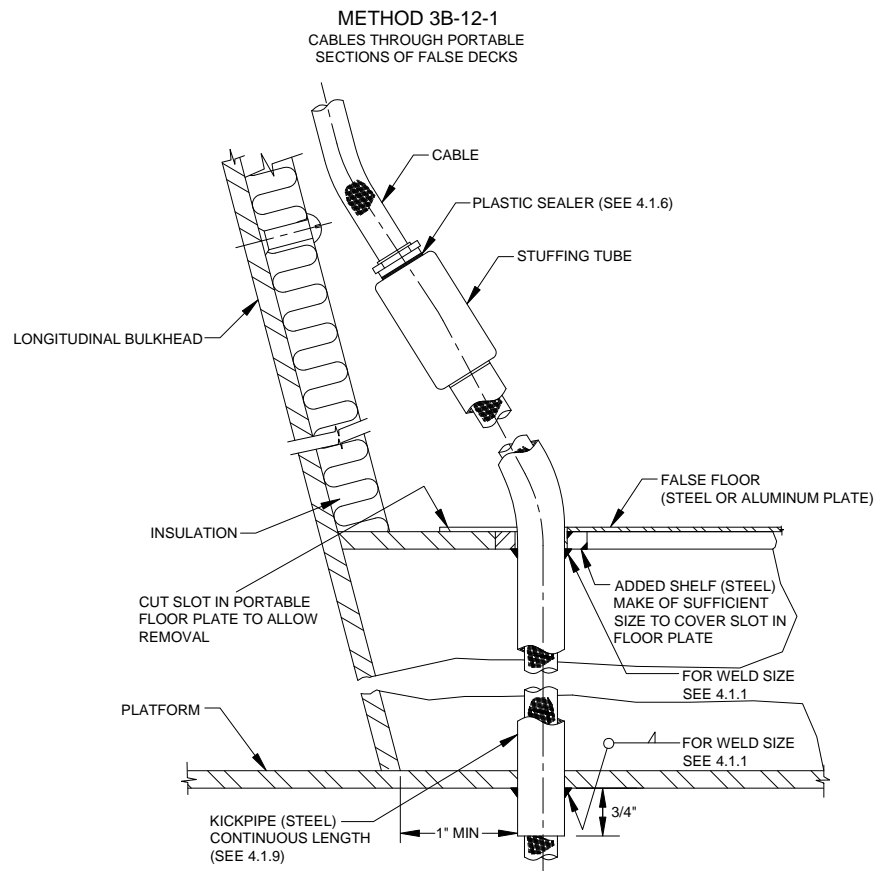


NOTE:

1. The kickpipe can either be straight or bent to suit installation requirements.

FIGURE 3B11. MIL-S-24235 stuffing tubes through permanent sections of false decks (surface ships).

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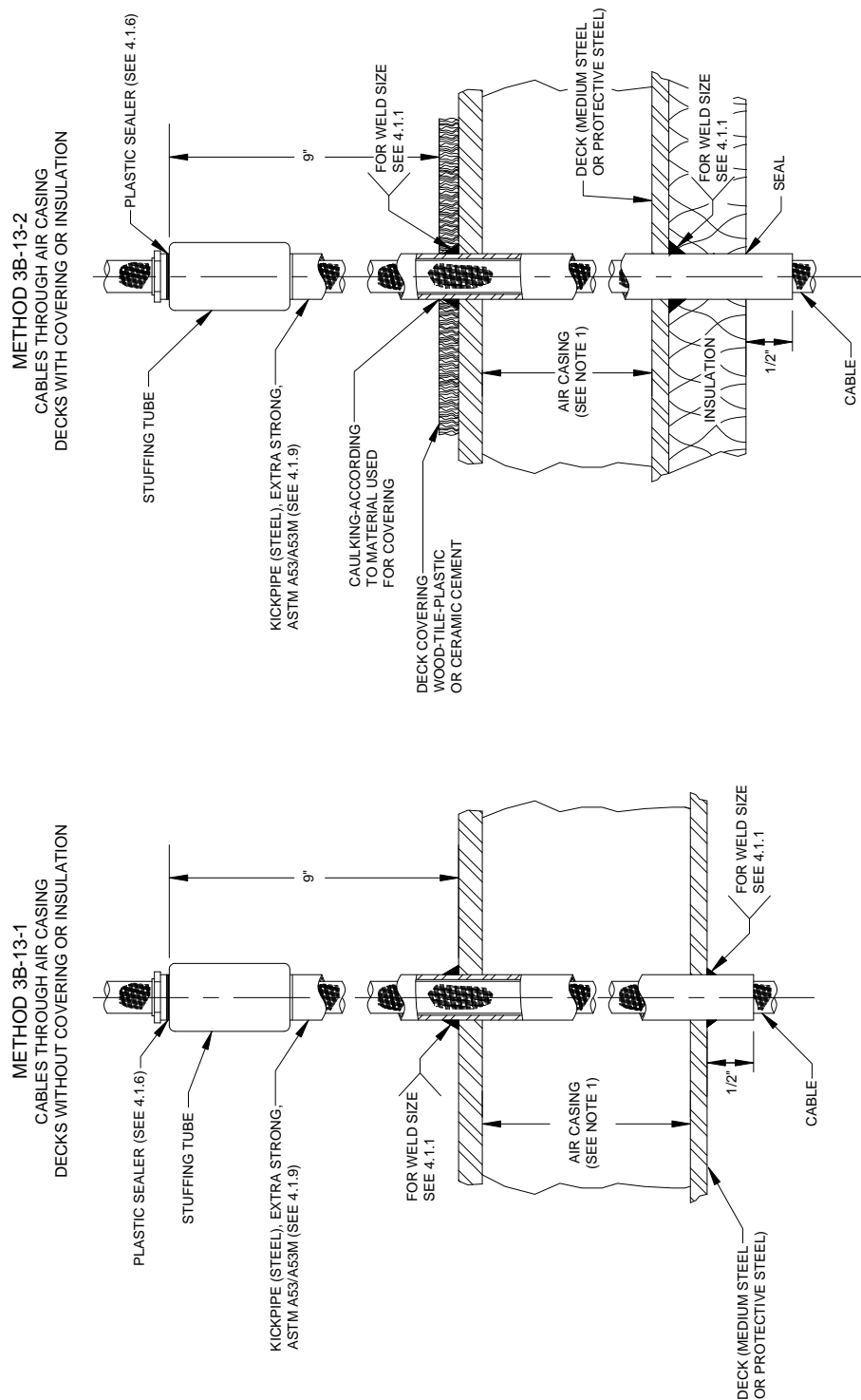


NOTE:

1. For suitable cable support, see MIL-STD-2003-4.

FIGURE 3B12. MIL-S-24235 stuffing tubes through portable sections of false decks (surface ships).

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NOTE:

1. For kickpipe installations through protective decks bounding air casings. The kickpipe shall extend through the air casing, and both decks in one continuous piece.

FIGURE 3B13. MIL-S-24235 stuffing tubes through air spaces (surface ships).

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METHOD 3B-14-1

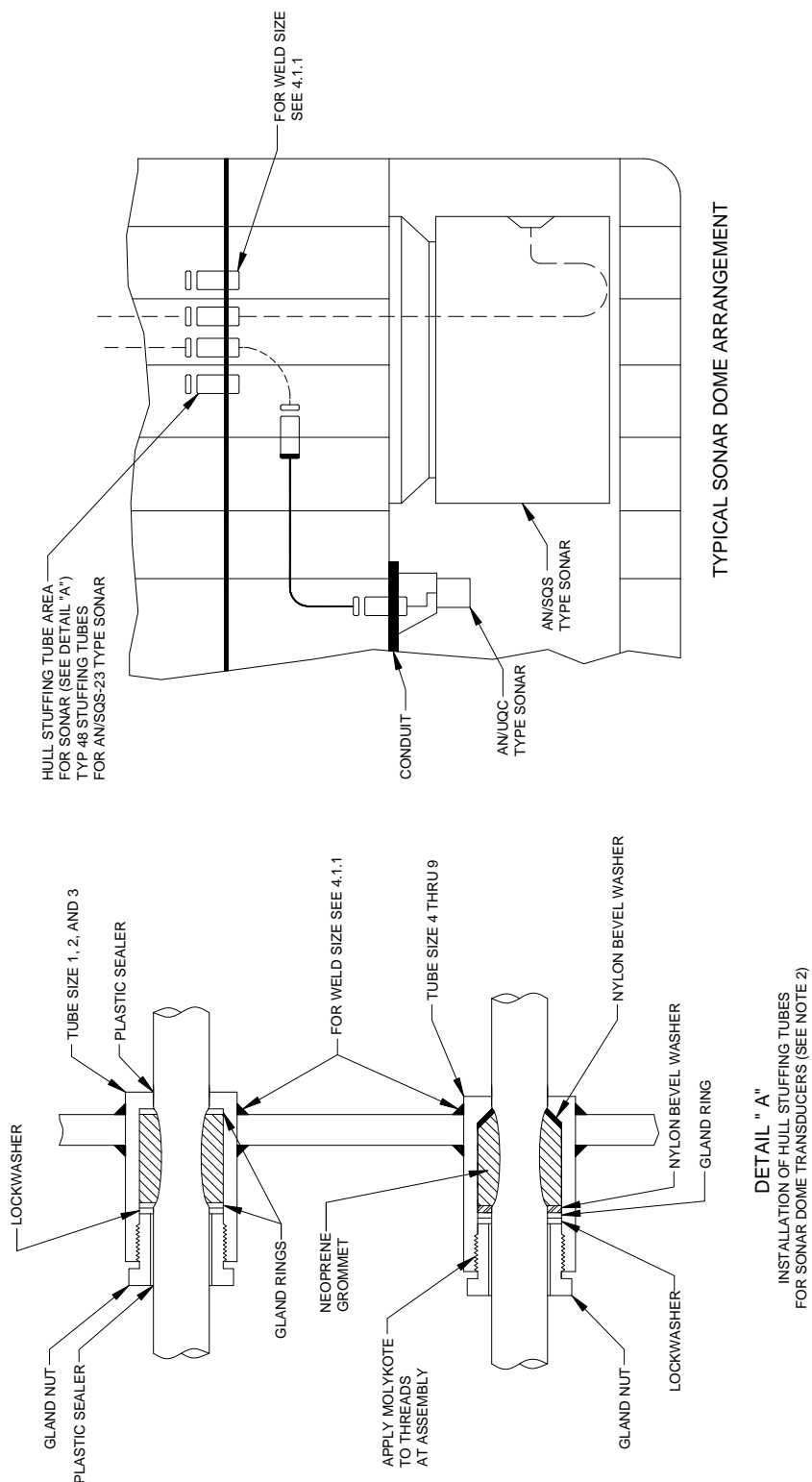


FIGURE 3B14. Stuffing tubes for sonar dome area (surface ships).

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NOTES:

1. The stuffing tube shown is equivalent to one-half of a standard submarine type double-ended stuffing tube in accordance with MIL-S-24235/1 ( $\frac{1}{2}$  of the "m" dimension). See applicable notes on figure 3A10.
2. The arrangement of hull stuffing tube area for sonar dome transducers shall be as specified on detailed construction drawings. Installation of stuffing tubes shall be in accordance with this figure.
3. Holes for stuffing tubes shall be drilled or otherwise mechanically cut.
4. Stuffing tube spacing shall be in accordance with figures 3B1 and 3B2.
5. Plastic sealer use should be in accordance with 4.1.6.
6. Where the use of "MolyKote" is specified, it is recommended that Dow Corning MolyKote G407, or equivalent, be used.

FIGURE 3B14. Stuffing tubes for sonar dome area (surface ships) - Continued.

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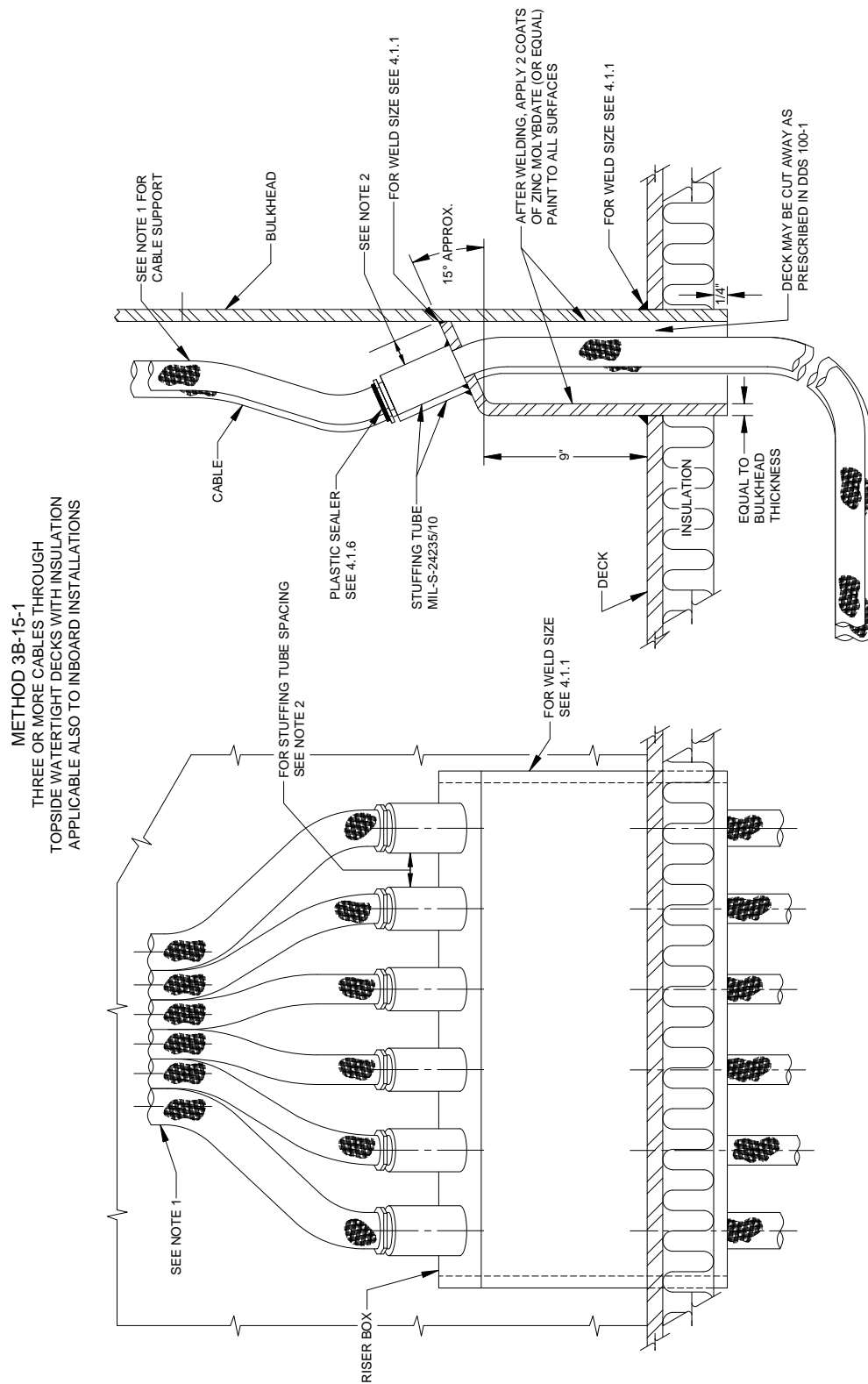


FIGURE 3B15. Topside stuffing tubes with riser box (surface ships).

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NOTES:

1. For suitable cable support, see MIL-STD-2003-4.
2. Tubes shall be spaced 1" minimum from bulkhead and from each other in accordance with figures 3B2 and 3B3.

FIGURE 3B15. Topside stuffing tubes with riser box (surface ships) - Continued.



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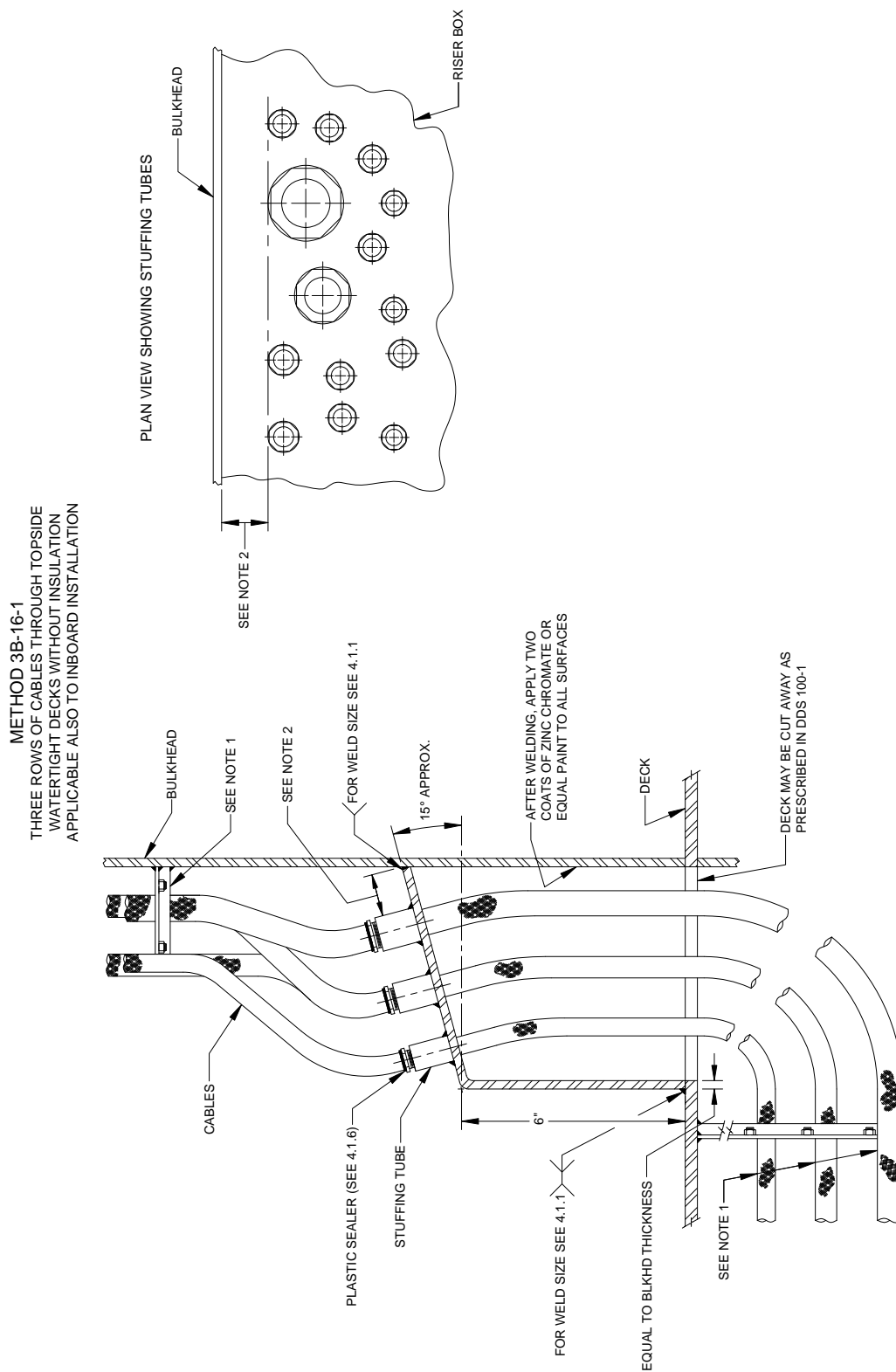


FIGURE 3B16. MIL-S-24235 topside stuffing tubes with riser box for medium steel decks (surface ships).

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NOTES:

1. For suitable cable support, see MIL-STD-2003-4.
2. Tubes shall be spaced 1" minimum from bulkhead and from each other in accordance with stuffing tube spacing figures 3B2 and 3B3.

FIGURE 3B16. MIL-S-24235 topside stuffing tubes with riser box for medium steel decks (surface ships) - Continued.

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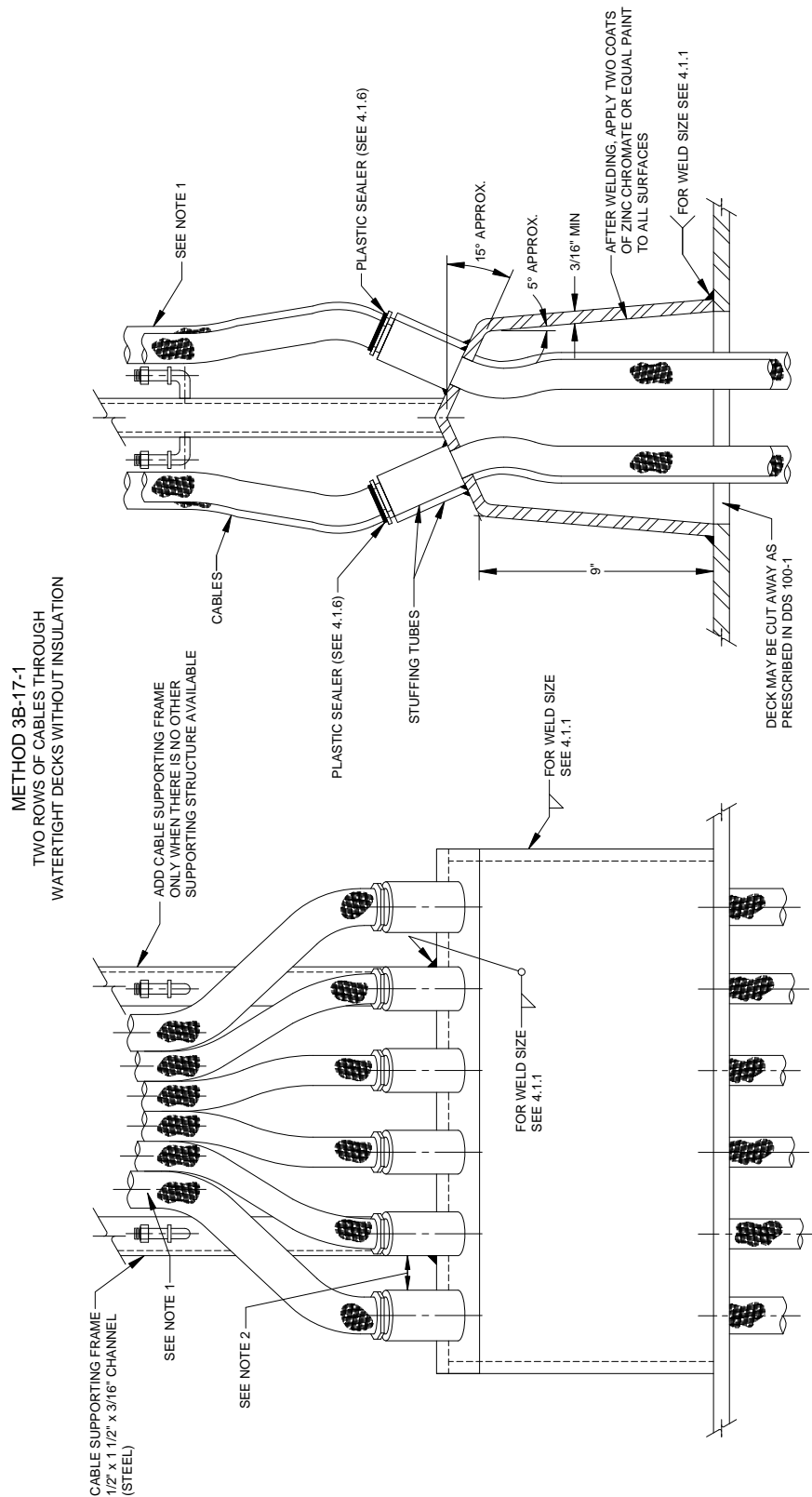


FIGURE 3B17. MIL-S-24235 topside stuffing tubes with riser box on medium steel decks not adjacent to a bulkhead (surface ships).

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NOTES:

1. For suitable cable support, see MIL-STD-2003-4.
2. Stuffing tubes shall be spaced from each other and framework as prescribed on figures 3B2 and 3B3.

FIGURE 3B17. MIL-S-24235 topside stuffing tubes with riser box on medium steel decks not adjacent to a bulkhead (surface ships) - Continued.

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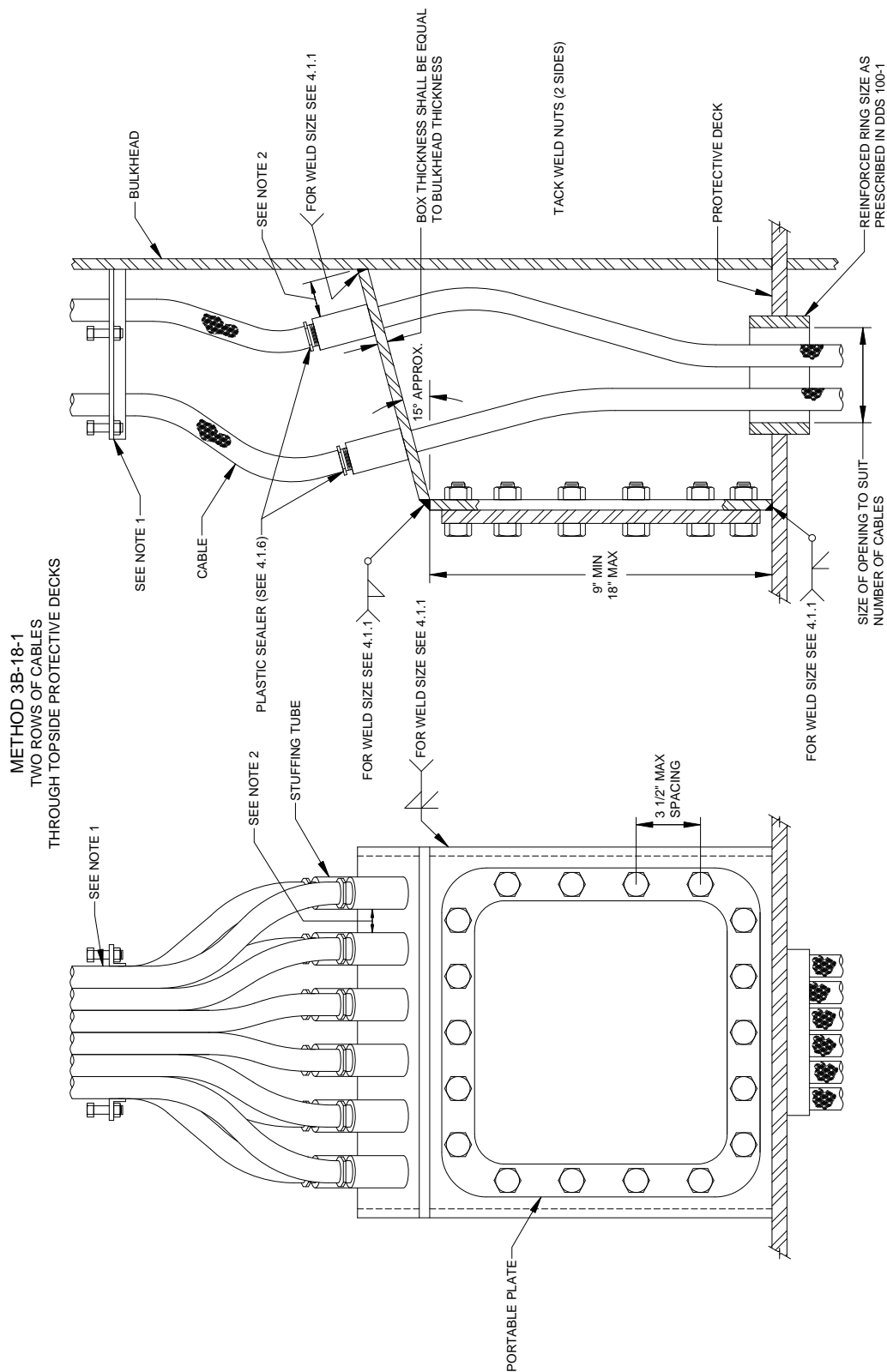


FIGURE 3B18. MIL-S-24235 topside stuffing tubes with riser box (surface ships).

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NOTES:

1. For suitable cable support, see MIL-STD-2003-4.
2. Tubes shall be spaced 1" minimum from bulkhead and from each other in accordance with stuffing tube spacing on figures 3B2 and 3B3.

FIGURE 3B18. MIL-S-24235 topside stuffing tubes with riser box (surface ships) - Continued.

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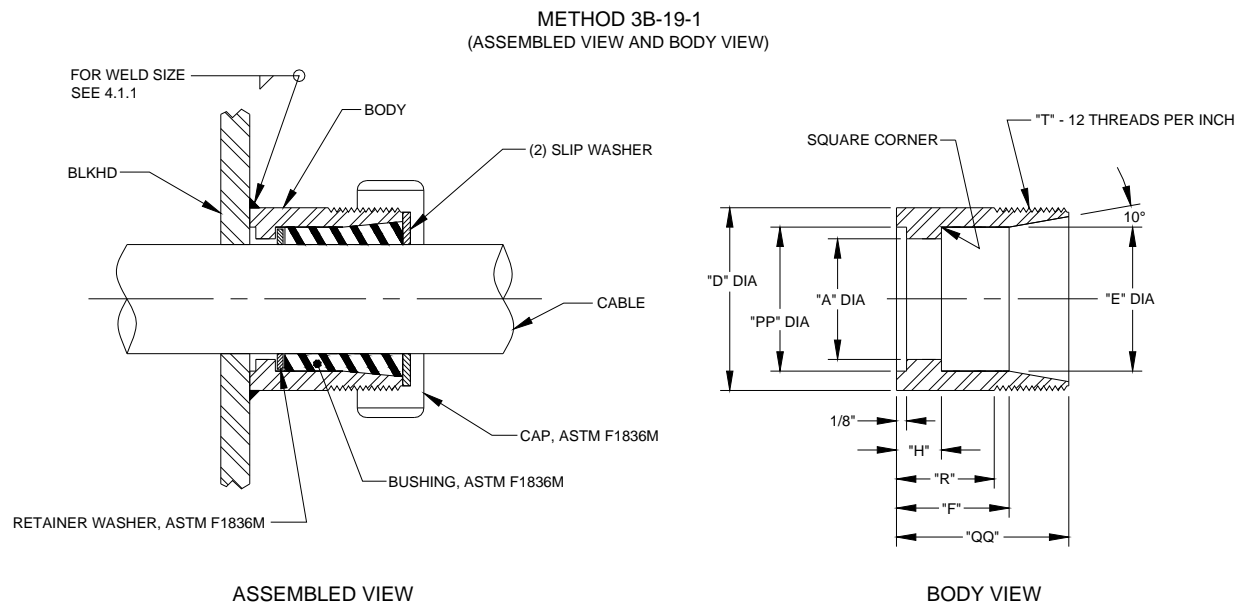


TABLE 3B19-I. Stuffing tube body dimensions.

Tube size	Tube body										Clearance hole in bulkhead	Std. pipe size for riser
	A	D	E	F	H	R	T		PP	QQ		
1	0.3500	0.8750	0.5600	1.1870	0.7500	0.8430	0.8750		0.7100	1.437	0.750	0.375
2	0.5640	1.0000	0.6250	1.1870	0.7500	0.8440	1.0000		0.8750	1.500	0.875	0.500
3	0.6870	1.1250	0.7650	1.1870	0.7500	0.8440	1.1250		0.8750	1.500	1.000	0.500
4	0.8250	1.2500	0.9060	1.1870	0.7500	0.8440	1.2500		1.0630	1.500	1.125	0.750
5	1.1870	2.0000	1.3430	1.5000	0.7500	0.8750	2.0000		1.6880	1.875	1.625	1.125
6	1.5050	2.5000	1.7500	1.5620	0.7500	0.8750	2.5000		1.9380	2.125	1.938	1.500
7	1.6890	2.7500	1.9370	1.6250	0.7500	0.8750	2.7500		2.4380	2.250	2.125	2.000
8	2.0890	3.2500	2.3150	1.7500	0.7500	1.0000	3.1250		2.9380	2.500	2.562	2.500
9	2.8420	4.0000	3.2500	1.8430	0.7500	1.1880	4.0000		3.5630	2.750	3.312	3.000

NOTES:

1. Method 3B-19-1 is for welding to kick-pipe (riser) and bulkheads.
2. These stuffing tubes are authorized for use only on weather decks in deck house bulkheads and below decks above the tightness level in surface ships.

FIGURE 3B19. Stuffing tube for steel and aluminum bulkheads (surface ships).

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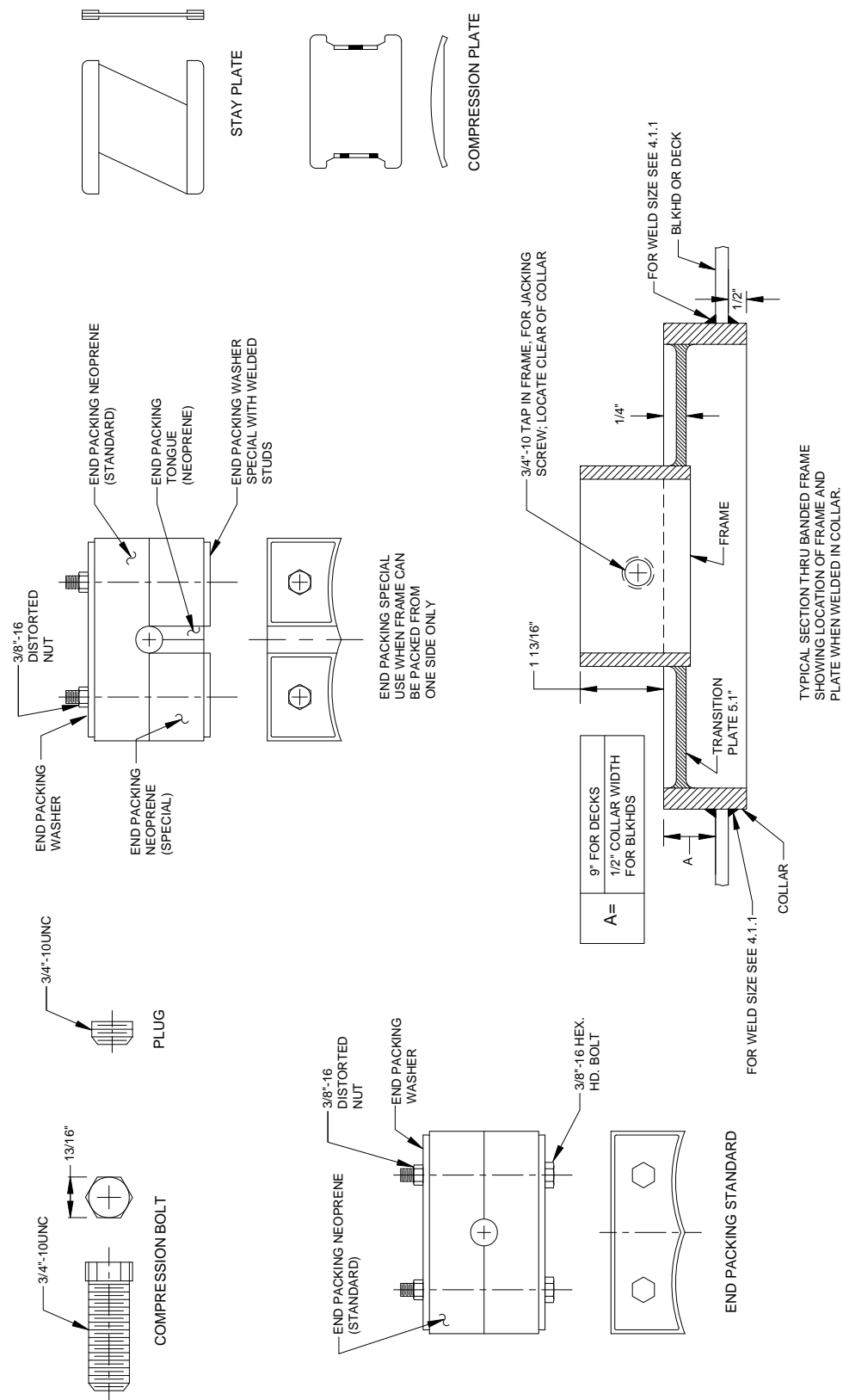


FIGURE 3B20. Multiple cable penetrator nomenclature.



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**Multiple cable penetrators:**

A system of passing cables through water and non-watertight bulkheads and decks designed to suit particular bulkhead and deck weights.

**Nomenclature:**

Throughout this standard of electric plant installation drawings, the following shall prevail.

(A) Frames, unbanded

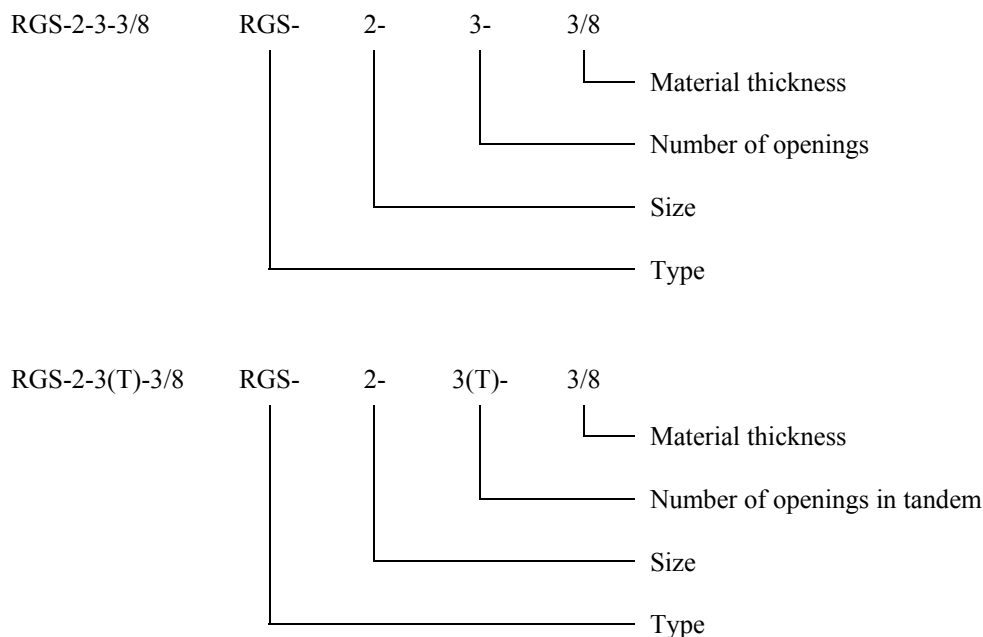
- (a1) Consists of three basic sizes 2, 4, and 6. All are 5.506 wide. Size 2 is 4.726 high; size 4 is 7.029 high; and size 6 is 9.333 high.
- (a2) Material shall be either steel or aluminum,  $\frac{1}{4}$  or  $\frac{3}{8}$  thick (depending on weight of bulkhead or deck) in steel or  $\frac{1}{2}$  thick in aluminum. All are  $2\frac{3}{8}$  wide.
- (a3) There are four different type frames  
RGS – Steel, four corners welded (completely closed)  
RGSO – Steel, two corners welded (open bottom)  
RGA – Aluminum, four corners welded (completely closed)  
RGAO – Aluminum, two corners welded (open bottom)
- (a4) To recap sub-paragraphs (a1) through (a3), an unbanded frame is identified as follows: an RGS-2 x  $\frac{3}{8}$  is a  $\frac{3}{8}$ -thick size 2 steel frame with four corners welded (completely closed).

(B) Frames, banded

- (b1) Consists of three basic sizes sub-paragraph (a1), each of which is enclosed by a reinforcing band of proper size material to suit particular bulkhead weight. In addition to the band filler, plates are employed to seal empty spaces between frame and band.
- (b2) RGS and RGA banded frames are complete units ready to be installed in bulkhead. RGSO and RGAO banded frames have lower half of band and frame temporarily tack welded. At installation, this tack weld is broken, frame is wrapped around cables, and all welding is completed.

(C) Physical arrangement and identification

- (c1) Various arrangements of frames are available in all sizes and types. Examples and dimensions are shown on figures 3B24, 3B25, and 3B26.
- (c2) Identification of various arrangements are made by the following examples:



Single or double wall, banded or unbanded must be specified.

FIGURE 3B20. Multiple cable penetrator nomenclature - Continued.

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**Nomenclature (continued):**

- (D) Compression bolt
  - (d1) Stainless steel,  $\frac{3}{4}$ -10 thread when tightened seats the compression plate farther down into the transit frame
- (E) Plug
  - (e1) Stainless steel,  $\frac{3}{4}$ -10 thread used to plug tapped hole in frame opposite compression bolt
- (F) Stay plate
  - (f1) Either steel or aluminum normally placed between every other row of insert blocks keeping them positioned in the transit frame.
- (G) Compression plate
  - (g1) Either cast iron or cast aluminum seats and compresses the insert blocks so that the end packing can be inserted in the transit frame.
- (H) End packing - standard
  - (h1) Compresses the insert blocks used when frame can be packed from either side
  - (h2) Assembly, which consists of two neoprene elastomer blocks and two end packing washers held together by two  $\frac{3}{8}$ -16 bolts and hex nuts. Washers, nuts, and bolts are steel cadmium plated. For non-magnetic applications, stainless steel is used.
- (J) End packing - special
  - (j1) Compresses the insert blocks used when frame can only be packed from one side
  - (j2) Assembly, which consists of four neoprene elastomer pieces, one end packing washer, two end packing washers special, and two  $\frac{3}{8}$ -16 hex nuts, all are steel cadmium plated. For non-magnetic applications, stainless steel is used.
- (K) Insert blocks
  - (k1) Twin half blocks are specially formulated of a neoprene elastomer with a centered semi-circular groove. When matched around a cable these blocks form a single block with a tight fit. Basic sizes are shown on figure 3B21.
- (L) Spares
  - (l1) Solid blocks are specially formulated of a neoprene elastomer and are used as fillers or spare provisions for addition of future cables. Sizes are shown on figure 3B21.
- (M) Fill-ins
  - (m1) Same material as insert blocks and spares used to pack thicknesses of 5 or 10 millimeters caused by the presence of different size blocks in the same row. Also employed to increase the pressure in the penetrator frame when exceptionally soft cables are used. These fill-ins are available in two sizes 24 x 5/0 or 12 x 10/0 (see figure 2B21). Serrations have been provided to permit slicing of the fill-ins to the required length.

Example: 6 x 10/0, 8 x 5/0, etc.



- (N) Tallow
  - (n1) Insert block lubricant used when packing penetrator frame allows the blocks to slide easily over each other when packing and compressing them around cables.
- (P) Sealer
  - (p1) Liquid silicone rubber applied to cable side of each gauge block upon compression. This provides a seal between the armor of the cable and its impervious inner sheath.
- (Q) Distorted nut
  - (q1) All nuts are to be in accordance with NASM 25027.
- (R) All dimensions are in inches unless otherwise stated.

FIGURE 3B20. Multiple cable penetrator nomenclature - Continued.

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NOTES:

1. Multiple cable penetrators shall not be used in bulkheads or decks which are exposed to the weather.
2. For alternate multiple cable penetrator design, see figures 3B21 through 3B61.

FIGURE 3B20. Multiple cable penetrator nomenclature - Continued.

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TABLE 3B21-I. Cable information and assignment  
for MCP insert blocks.

Cable type	Cable diameter in inches	Cable diameter in mm	Insert block part number size mm	Insert block part number size mm
SSGA-3	0.305	7.75	15/7	20/7
SSGA-4	0.323	8.20	15/8	20/8
SSGA-9	0.371	9.42	15/9	20/9
SSGA-14	0.414	10.51	20/10	
SSGA-23	0.453	11.50	20/11	
SSGA-30	0.484	12.30	20/12	30/12
SSGA-40	0.515	13.08	20/13	30/13
SSGA-150	0.844	21.44	30/21	
SSGA-500	1.290	32.77	40/30	
SSGA-1300	1.880	47.75	60/48	
DCOP-3	0.425	10.80	20/10	
DCOP-4	0.460	11.68	20/12	30/12
DCOP-6	0.510	12.95	20/13	30/13
DCOP-9	0.570	14.48	20/14	30/14
DCOP-14	0.705	17.91	30/18	
DCOP-23	0.860	21.84	30/22	
DCOP-30	0.960	24.38	30/24	40/24
DCOP-83	1.450	36.83	60/36	
DCOP-250	2.100	53.34	60/52	
DCOP-400	2.500	63.50	90/60	
DSPA-14	0.680	17.27	30/17	
DSPA-23	0.781	19.84	30/19	
DSPA-30	0.852	21.64	30/21	
DSPA-40	0.898	22.81	30/22	40/22
DSPA-50	0.961	24.41	30/24	40/24
DSPA-60	1.031	26.19	40/26	
DSPA-125	1.374	34.90	40/34	60/34
DSPA-150	1.479	37.57	60/36	
DSPA-250	1.759	34.68	60/44	

TABLE 3B21-I. Cable information and assignment  
for MCP insert blocks - Continued.

Cable type	Cable diameter in inches	Cable diameter in mm	Insert block part number size mm	Insert block part number size mm
(TTHFWA)				
TT-1-1/2	0.380	9.65	15/9	20/9
TT-3	0.500	12.70	20/12	30/12
TT-5	0.590	14.99	20/14	30/14
TT-10	0.690	17.53	30/17	
TT-15	0.800	20.32	30/20	
TT-20	0.880	22.35	30/22	40/22
TT-30	1.030	26.16	40/26	
TT-40	1.130	28.70	40/28	
TT-50	1.265	32.13	40/32	60/32
TT-60	1.350	34.29	40/34	60/34
TTRSA-2	0.740	18.80	30/18	
TTRSA-4	0.800	20.32	30/20	
TTRSA-6	0.940	23.88	30/23	
TTRSA-8	1.050	26.67	40/26	
TTRSA-10	1.140	28.96	40/28	
TTRSA-12	1.160	29.46	40/28	
TTRSA-16	1.250	31.75	40/30	
2SA 2SWA-3	0.570	14.48	20/14	30/14
-7	0.710	18.03	30/18	
-10	0.880	22.35	30/22	40/22
-14	0.980	24.89	30/24	40/24
-19	1.090	27.69	40/26	
-24	1.260	32.00	40/30	
-30	1.330	34.80	40/34	60/34
-37	1.430	36.32	60/36	
-44	1.600	40.64	60/40	
-61	1.790	45.47	60/44	

TABLE 3B21-I. Cable information and assignment  
for MCP insert blocks - Continued.

[illegible]TABLE 3B21-I. Cable information and assignment  
for MCP insert blocks - Continued.

Cable type	Cable diameter in inches	Cable diameter in mm	Insert block part number size mm	Insert block part number size mm
MA-14	0.450	11.43	20/11	
TCOP-42	1.250	31.75	40/30	
MDGA-19(6)	1.285	32.63	40/32	60/32
MDGA-19(14)	1.520	38.61	60/38	
MDGA-19(23)	1.820	46.23	60/46	
MDGA-19(40)	2.100	53.34	60/52	
SPCLXDUCER 7819478P1	1.200	30.48	40/30	
SMU-5	0.500	12.70	20/12	30/12

FIGURE 3B21. Cable information and assignment for MCP insert blocks.

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TABLE 3B21-I. Cable information and assignment  
for MCP insert blocks - Continued.[illegible]

TABLE 3B21-I. Cable information and assignment  
for MCP insert blocks - Continued.

[illegible]

TABLE 3B21-I. Cable information and assignment  
for MCP insert blocks - Continued.

Cable type	Cable diameter in inches	Cable diameter in mm	Insert block part number size mm	Insert block part number size mm
MHFF-2	0.460	11.68	20/11	
MHFF-4	0.520	13.21	20/13	30/13
MHFF-7	0.627	15.93	30/15	
MHFF-10	0.795	20.20	30/20	
MHFF-14	0.844	21.44	30/21	
MHFF-19	0.995	25.28	30/24	40/24
MHFF-24	1.120	28.45	40/28	
MHFF-30	1.194	30.33	40/30	
MHFF-37	1.290	32.77	40/32	60/32
MHFF-44	1.420	36.07	60/36	

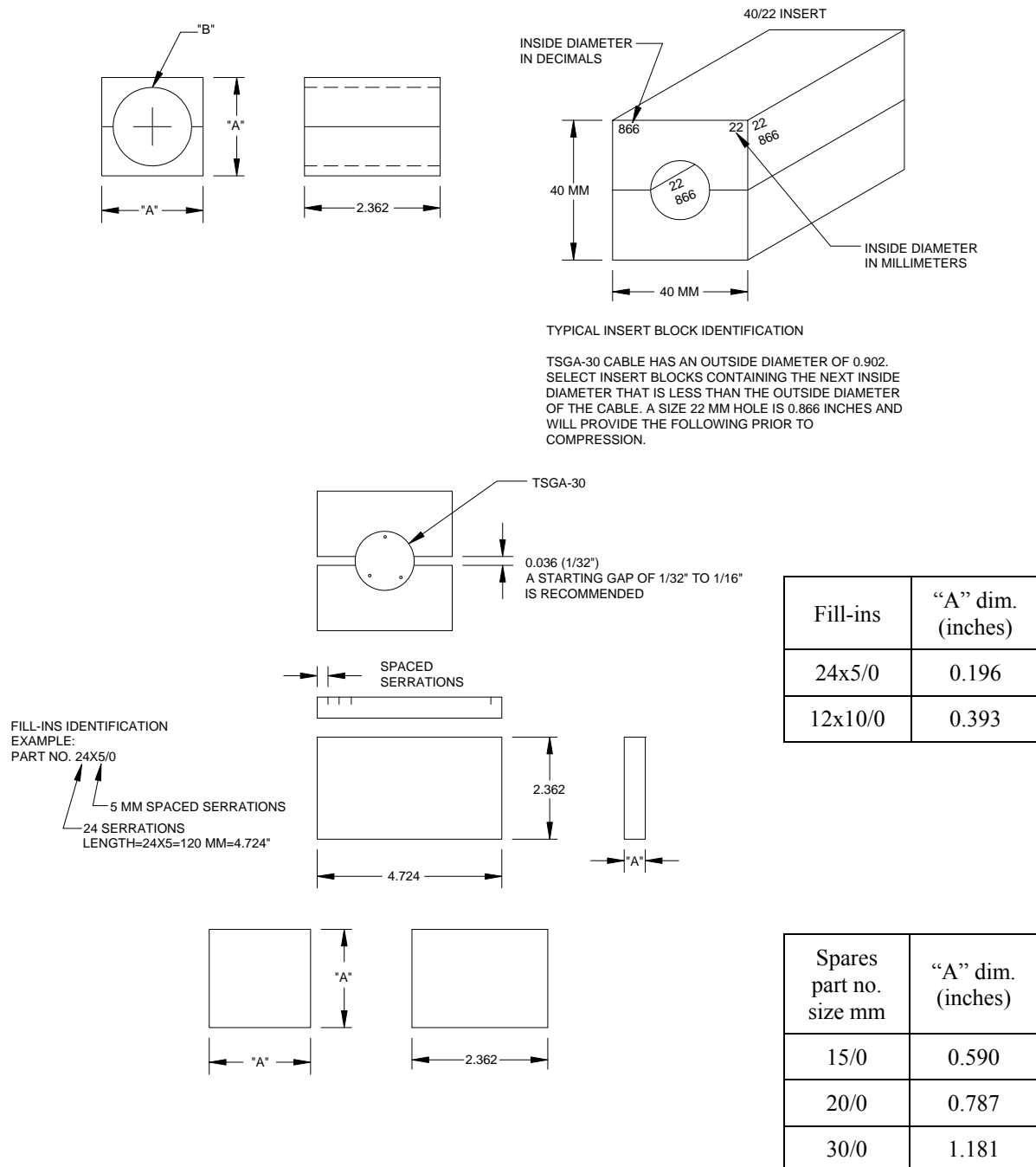
TABLE 3B21-II. Insert blocks.

Insert block part no size mm	"A" dim in.	"B" dim in.	Insert block part no size mm	"A" dim in.	"B" dim in.
15/4	0.590	0.157	40/24	1.575	.945
15/5	0.590	0.197	40/26	1.575	1.024
15/6	0.590	0.236	40/28	1.575	1.102
15/7	0.590	0.276	40/30	1.575	1.181
15/8	0.590	0.315	40/32	1.575	1.260
15/9	0.590	0.354	40/34	1.575	1.339
20/4	0.787	0.157	60/32	2.362	1.260
20/5	0.787	0.197	60/34	2.362	1.339
20/6	0.787	0.236	60/36	2.362	1.417
20/7	0.787	0.276	60/38	2.362	1.496
20/8	0.787	0.315	60/40	2.362	1.575
20/9	0.787	0.354	60/42	2.362	1.654
20/10	0.787	0.394	60/44	2.362	1.732
20/11	0.787	0.433	60/46	2.362	1.811
20/12	0.787	0.472	60/48	2.362	1.890
20/13	0.787	0.512	60/50	2.362	1.969
20/14	0.787	0.551	60/52	2.362	2.047
			60/54	2.362	2.128
30/12	1.181	0.472			
30/13	1.181	0.512	90/50	3.543	1.969
30/14	1.181	0.551	90/55	3.543	2.165
30/15	1.181	0.591	90/60	3.543	2.362
30/16	1.181	0.630	90/65	3.543	2.559
30/17	1.181	0.669	90/70	3.543	2.756
30/18	1.181	0.709			
30/19	1.181	0.748	120/75	4.724	2.953
30/20	1.181	0.787	120/80	4.724	3.150
30/21	1.181	0.827	120/85	4.724	3.346
30/22	1.181	0.866	120/90	4.724	3.543
30/23	1.181	0.906	120/95	4.724	3.740
30/24	1.181	0.945			
40/22	1.575	0.866			

TABLE 3B21-II. Insert  
blocks - Continued.

FIGURE 3B21. Cable information and assignment for MCP insert blocks - Continued.

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NOTES:

- See figures 3B36 and 3B37 for current cable assignment.
- Approved multi-diameter insert blocks may be used where available.

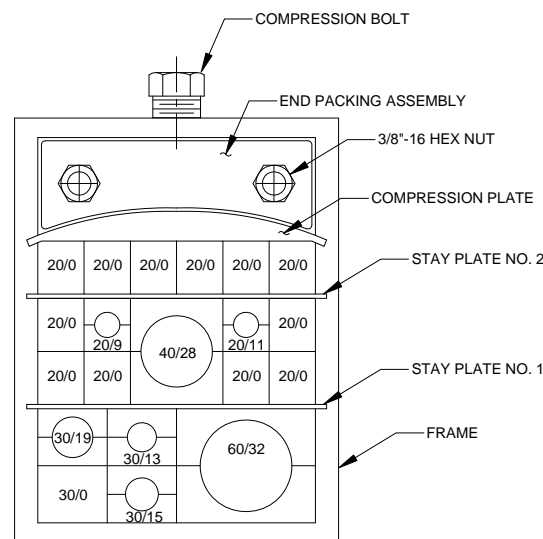
FIGURE 3B21. Cable information and assignment for MCP insert blocks - Continued.

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**Installation notes:**

RGS and RGA multiple cable penetrators

1. Multiple cable penetrator is a modular system that utilizes standard units and dimensions to allow maximum flexibility and compatibility with various numbers and sizes of cables. Final sealed units will provide watertight, airtight, and fireproof bulkhead or deck penetrations.
2. Pull all cable through cable penetrator, bearing in mind cables shall always approach in a horizontal plane perpendicular to the penetrator. This can be accomplished if the nearest cable hanger is 16" minimum from bulkhead. Cables running up a bulkhead and through a cable penetrator must have its full bending radius outside of the penetrator. While in the process of pulling cables, it is imperative that a reasonable amount of slack should be left to facilitate movement of cable within the cable penetrator to ease packing operation. Also, it is necessary that each cable be identified on the compression bolt side of multiple cable penetrator by lead number and cable size. All cables through a new multiple cable penetrator shall be pulled prior to installing insert blocks.
3. After pulling all cables through a particular multiple cable penetrator, it can be packed. First apply a light coat of cable lubricant (tallow) to all outside surfaces of the insert blocks, the inside portion of the frame, and the curved surface of the compression plate. When packing armored cable, apply Nelson Fire stop Caulk, or equal, sealer on the surface of each block that contacts the cable (a  $\frac{1}{8}$ " bead every  $\frac{1}{2}$ " around the circumference). Each frame must be laid out (blocked) showing solid blocks (used as spares) and cable assignments prior to packing. A typical example of a packed RGS-4 frame with instructions for packing is shown below.



- a. Select insert blocks and spares from sheet and prepare as above (lubricant and sealer where required).
- b. Starting with heaviest cable, place the lower half of the 60/32 insert block under the cable in the frame. Next repeat the procedure with the 30/15 then add one 30/0 spare. Add the upper half of the 60/32 and the 30/15. Place lower half of 30/13 and 30/19 under cable then add upper halves. Across the top of these add stay plate no. 1.
- c. On top of the stay plate, place four 20/0 spares and the lower half of the 40/28 under its cable. In the next higher row, place two 20/0 spares and the lower half of 20/9 and 20/11 under their respective cables. Then add upper halves of 40/28, 20/11, and 20/9. On top of these, add stay plate no. 2.
- d. Add compression plate to the frame.
- e. Lift compression plate clear of stay plate no. 2. Add final row of six 20/0 spares. Lower compression plate to this level.

FIGURE 3B22. Multiple cable penetrator installation notes (type RGS and RGA).

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**Installation notes (continued):**

- f. Tighten compression bolt down on compression plate to compress entire contents of frame and provide just enough clearance to insert end packing assembly. Apply a generous amount of lubricant to this cavity to assist insertion of end packing.
  - g. Disassemble end packing assembly and install in frame around the compression bolt. Reassemble and tighten  $\frac{3}{8}$ -16 hex nuts evenly until end packing insert material expands in the cavity and there is a slight roll of the material around the end packing metal washers. Back off compression bolt approximately  $\frac{1}{8}$  of a turn. Packing is now complete.
4. When a multiple cable penetrator frame is installed in a structure in such a manner that the compression bolt is located on the bottom, packing procedure is the same except:
  - a. The compression plate is installed first.
  - b. The frame is packed from the bottom up with the smallest cables being packed first.
5. To add a new cable to a packed frame, loosen the  $\frac{3}{8}$ -16 hex nuts and remove the end packing metal washers. Tighten the compression bolt until end packing insert material is loose. Remove insert material from frame, loosen compression bolt, and lift compression plate clear of top six 20/0 spares. Remove these inserts. Remove compression plate and full access to the insert blocks and cable is available.
6. Template all work from ship.
7. All welding and inspection to be in accordance with NAVSEA S9074-AR-GIB-010/278.
8. All painting to be done in accordance with MIL-E-917.
9. The structural reinforcement shown on this plan does not apply to flight deck bents, flight deck support structures, or other similar type structures on other ships. Such cases must be individually resolved with structural design.
10. Material of F.B. reinforcement is to be similar to material of bulkhead, deck, or riser box penetrated.
11. This plan was developed from DDS 100-1. Reinforcement of openings in structure of surface ships other than in protective plating, to permit installation of multiple cable penetrator frame (Tecrona Products of Nelson Electric) in watertight decks and bulkheads of surface ships.
12. Fillet weld reinforcement for T2V.1 weld joint shall be  $\frac{1}{8}$ " for plating up to 15.3# and  $\frac{1}{4}$ " for plating above 17.85#.
13. The bulkheads and decks which are considered to be longitudinal strength members are defined in DDS-100-1 as components in "strength envelope (i.e., in outside plating, uppermost strength deck, inner bottom, and their associated longitudinal framing), and for other strength decks within the midship three-fifths length." If there is difficulty in definition, consult with structural design.
14. Care should be taken, while installing multiple cable penetrators, to ensure that all of its coaming protrudes through bulkhead sufficiently to weld in place. After welding, examine for cracks and sharp edges that may damage cable when being pulled through penetrator. If grinding is required, ensure grinding areas do not weaken the penetrator.
15. It is mandatory to maintain a minimum of  $\frac{7}{8}$ " from bulkhead to bolt hole center for wrench clearance. Also leave 4" clearance to allow for installation of compression bolt (from bolt hole side of C.T.D. to any structure).
16. Riser box to be attached to bulkhead of 7.65#PLT. or heavier. If bulkhead is less than 7.65#PLT. adjacent to riser box installation, install a back plate of 10.2#PLT between the back of the riser box and the bulkhead.
17. After installation is complete, entire penetrator may be painted to suit surrounding structure in accordance with the general specifications for building ships for the U.S. Navy.

FIGURE 3B22. Multiple cable penetrator installation notes (type RGS and RGA) - Continued.



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**Installation notes (continued):**

RGSO and RGAO multiple cable penetrators

18. Temporarily insulate cable for protection against welding and burning.
19. Remove old non-watertight structure.
20. Prepare hole in bulkhead to receive multiple cable penetrator frame (designated "RGSO"). External banding is used only when required.
21. Bottom of "RGSO" unit is tack welded to other three sides – remove this piece.
22. Segregate and confine required cables within each three-sided frame.
23. Wrap welders blanket around cable. Replace bottom piece and continuously weld corners. Grind smooth same as top corners.
24. Slide unit into prepared hole in bulkhead. Position so that center line of tapped hole is  $\frac{7}{8}$ " out from face of bulkhead to permit clearance for the compression screw.
25. Weld frame to bulkhead with continuous weld all around frame on both sides of bulkhead.
26. Proceed as outlined in note 3.

NOTE:

1. The tables and dimensions shown on these sheets are for typical steel installations. Other unique situations shall be handled as a case-by-case basis through the structures department.

FIGURE 3B22. Multiple cable penetrator installation notes (type RGS and RGA) – Continued.



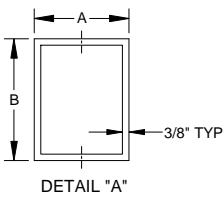
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NOTE:

1. Multiple cable penetrator for frames are available in various sizes and arrangements. Shown is a two-frame penetrator.

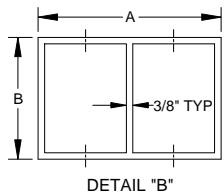
FIGURE 3B23. Multiple cable penetrator installation in steel or aluminum bulkheads using two-frame penetrator (types RGS and RGA) - Continued.

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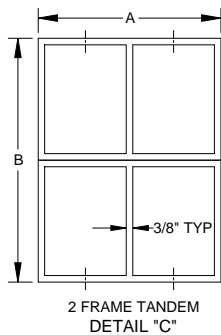
**3/8 thk single frame**

Type	A	B
RGS-2	5.5	4.726
RGS-4	5.5	7.029
RGS-6	5.5	9.333



**3/8 thk 1 thru 6 multi-frame**

Type	Dim	1 Frame	2 Frame	3 Frame	4 Frame	5 Frame	6 Frame
RGS-2	A	5.506	10.637	15.768	20.899	26.030	31.161
RGS-4	A	5.506	10.637	15.768	20.899	26.030	31.161
RGS-6	A	5.506	10.637	15.768	20.899	26.030	31.161
RGS-2	B	4.726	4.726	4.726	4.726	4.726	4.726
RGS-4	B	7.029	7.029	7.029	7.029	7.029	7.029
RGS-6	B	9.333	9.333	9.333	9.333	9.333	9.333

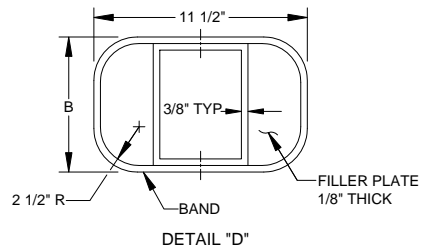


**3/8 thk 1 thru 6 tandem multi-frame**

Type	Dim	T Fr.	2T Fr.	3T Fr.	4T Fr.	5T Fr.	6T Fr.
RGS-2	A	5.506	10.637	15.768	20.899	26.030	31.161
RGS-4	A	5.506	10.637	15.768	20.899	26.030	31.161
RGS-6	A	5.506	10.637	15.768	20.899	26.030	31.161
RGS-2	B	9.452	9.452	9.452	9.452	9.452	9.452
RGS-4	B	14.058	14.058	14.058	14.058	14.058	14.058
RGS-6	B	18.666	18.666	18.666	18.666	18.666	18.666

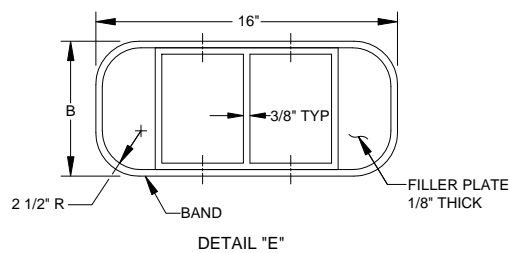
FIGURE 3B24. Multiple cable penetrator details (types RGS and RGA).

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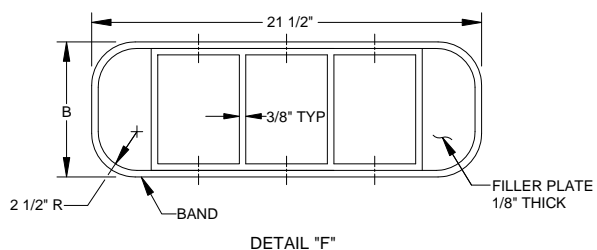
**3/8 single frame banded**

Dimension "B"			
BHD plate	10.2#	17.85	25.5
	12.75	20.4	28.0
	15.3	23.0	30.6
RGS-2	5 <sup>9</sup> / <sub>16</sub>	5 <sup>13</sup> / <sub>16</sub>	6 <sup>5</sup> / <sub>16</sub>
RGS-4	7 <sup>7</sup> / <sub>8</sub>	8 <sup>1</sup> / <sub>8</sub>	8 <sup>5</sup> / <sub>8</sub>
RGS-6	10 <sup>3</sup> / <sub>16</sub>	10 <sup>7</sup> / <sub>16</sub>	10 <sup>15</sup> / <sub>16</sub>
BAND	3/8 x 4"	1/2 x 4"	3/4 x 4"



**3/8 thk 2 frame banded**

Dimension "B"			
BHD plate	10.2#	17.85#	23.0#
	12.75	20.4	25.5
	15.3	20.4	28.0
RGS-2	5 <sup>9</sup> / <sub>16</sub>	5 <sup>13</sup> / <sub>16</sub>	6 <sup>5</sup> / <sub>16</sub>
RGS-4	7 <sup>7</sup> / <sub>8</sub>	8 <sup>1</sup> / <sub>8</sub>	8 <sup>5</sup> / <sub>8</sub>
RGS-6	10 <sup>3</sup> / <sub>16</sub>	10 <sup>7</sup> / <sub>16</sub>	10 <sup>15</sup> / <sub>16</sub>
BAND	3/8x4"	1/2x4"	3/4x4"

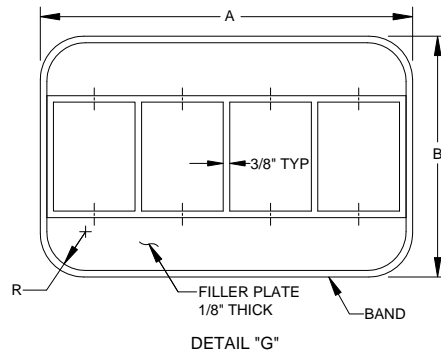


**3/8 thk multi-frame banded**

Dimension "B"			
BHD plate lbs	10.2	15.3	23.0
	12.75	17.85	25.5
		20.4	28.0
RGS-2	5 <sup>9</sup> / <sub>16</sub>	5 <sup>13</sup> / <sub>16</sub>	6 <sup>5</sup> / <sub>16</sub>
RGS-4	7 <sup>7</sup> / <sub>8</sub>	8 <sup>1</sup> / <sub>8</sub>	8 <sup>5</sup> / <sub>8</sub>
RGS-6	10 <sup>3</sup> / <sub>16</sub>	10 <sup>7</sup> / <sub>16</sub>	10 <sup>15</sup> / <sub>16</sub>
BAND	3/8 x 4"	1/2 x 4"	3/4 x 4"

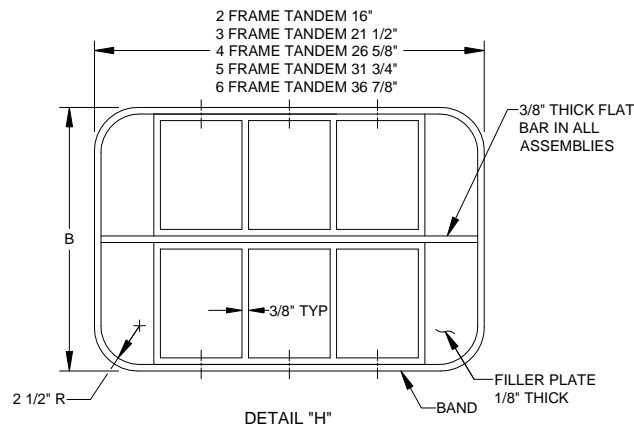
FIGURE 3B24. Multiple cable penetrator details (types RGS and RGA) - Continued.

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**3/8 thk 4 frame banded**

BHD plate lbs			"B" dim			"A"	"R"	Band
			RGS-2	RGS-4	RGS-6			
10.2	12.75	15.3	11 <sup>1</sup> / <sub>16</sub>	13 <sup>3</sup> / <sub>8</sub>	15 <sup>11</sup> / <sub>16</sub>	21 <sup>3</sup> / <sub>4</sub>	3 <sup>3</sup> / <sub>8</sub>	3/8 x 4"
17.85	20.4	23.0	11 <sup>9</sup> / <sub>16</sub>	13 <sup>7</sup> / <sub>8</sub>	16 <sup>3</sup> / <sub>16</sub>	22 <sup>1</sup> / <sub>4</sub>	3 <sup>3</sup> / <sub>8</sub>	5/8 x 4"
25.5	28.0	30.6	11 <sup>13</sup> / <sub>16</sub>	14 <sup>1</sup> / <sub>8</sub>	16 <sup>7</sup> / <sub>16</sub>	22 <sup>1</sup> / <sub>2</sub>	3 <sup>1</sup> / <sub>2</sub>	3/4 x 4"



**3/8 thk 2 thru 6 tandem multi-frame banded**

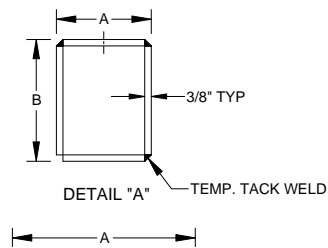
Dimension "B"						
BHD plate	7.65#	10.2#	12.75# 15.3	17.85# 20.4	25.5#	30.6# 35.7
RGS-2	10 <sup>5</sup> / <sub>8</sub>	10 <sup>7</sup> / <sub>8</sub>	11 <sup>1</sup> / <sub>8</sub>	11 <sup>3</sup> / <sub>8</sub>	11 <sup>5</sup> / <sub>8</sub>	11 <sup>5</sup> / <sub>8</sub>
RGS-4	15 <sup>3</sup> / <sub>16</sub>	15 <sup>7</sup> / <sub>16</sub>	15 <sup>11</sup> / <sub>16</sub>	15 <sup>15</sup> / <sub>16</sub>	16 <sup>3</sup> / <sub>16</sub>	16 <sup>3</sup> / <sub>16</sub>
RGS-6	19 <sup>13</sup> / <sub>16</sub>	20 <sup>1</sup> / <sub>16</sub>	20 <sup>5</sup> / <sub>16</sub>	20 <sup>9</sup> / <sub>16</sub>	20 <sup>13</sup> / <sub>16</sub>	20 <sup>13</sup> / <sub>16</sub>
BAND	3/8 x 4	1/2 x 4	5/8 x 4	3/4 x 5	7/8 x 6	7/8 x 6 <sup>1</sup> / <sub>2</sub>

NOTE:

1. Material RGS frames and filler plates are mild steel ASTM A36/A36M. Reinforcing bands are either mild steel (ASTM A36/A36M) or high tensile steel MIL-S-22698 in order for material to be similar to bulkhead or deck in which penetration is being made.

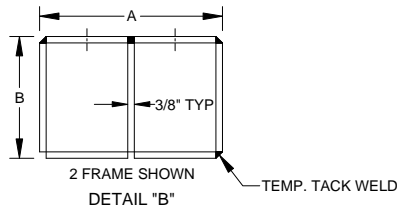
FIGURE 3B24. Multiple cable penetrator details (types RGS and RGA) - Continued.

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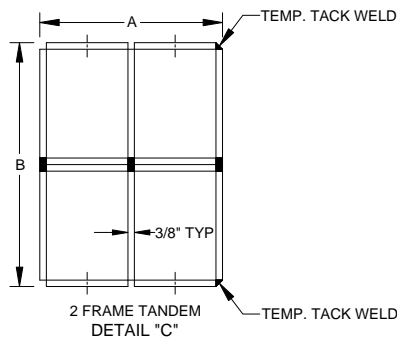
**3/8 thk single frame**

Type	A	B
RGSO-2	5.506	4.726
RGSO-4	5.506	7.029
RGSO-6	5.506	9.333

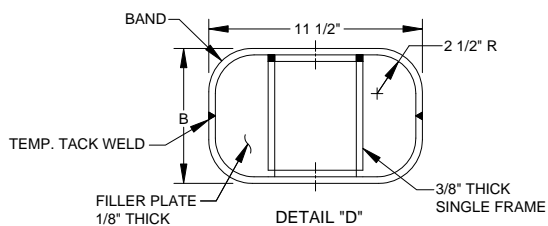


**3/8 thk 2 thru 6 multi-frame**

Type	Dim	2 Frame	3 Frame	4 Frame	5 Frame	6 Frame
RGSO-2	A	10.637	15.768	20.899	26.030	31.161
RGSO-4	A	10.637	15.768	20.899	26.030	31.161
RGSO-6	A	10.637	15.768	20.899	26.030	31.161
RGSO-2	B	4.726	4.726	4.726	4.726	4.726
RGSO-4	B	7.029	7.029	7.029	7.029	7.029
RGSO-6	B	9.333	9.333	9.333	9.333	9.333



Type	Dim	T frame	2T frame	3T frame	4T frame	5T frame	6T frame
RGSO-2	A	5.506	10.637	15.768	20.899	26.030	31.161
RGSO-4	A	5.506	10.637	15.768	20.899	26.030	31.161
RGSO-6	A	5.506	10.637	15.768	20.899	26.030	31.161
RGSO-2	B	9.452	9.452	9.452	9.452	9.452	9.452
RGSO-4	B	14.058	14.058	14.058	14.058	14.058	14.058
RGSO-6	B	18.666	18.666	18.666	18.666	18.666	18.666



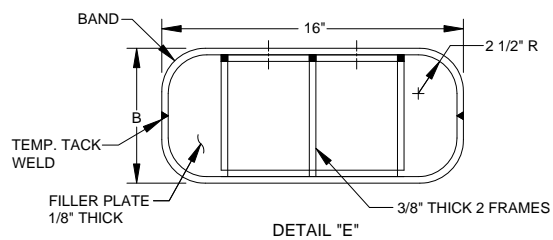
**3/8 thk single frame banded**

Dimension "B"			
BHD plate lbs	10.2 12.75 15.3	17.85 20.4	23.0 25.5 28.0 30.6
RGSO-2	5 <sup>9</sup> / <sub>16</sub>	5 <sup>13</sup> / <sub>16</sub>	6 <sup>5</sup> / <sub>16</sub>
RGSO-4	7 <sup>7</sup> / <sub>8</sub>	8 <sup>1</sup> / <sub>8</sub>	8 <sup>5</sup> / <sub>8</sub>
RGSO-6	10 <sup>3</sup> / <sub>16</sub>	10 <sup>7</sup> / <sub>16</sub>	10 <sup>15</sup> / <sub>16</sub>
BAND	<sup>3</sup> / <sub>8</sub> x 4"	<sup>1</sup> / <sub>2</sub> x 4"	<sup>3</sup> / <sub>4</sub> x 4"

Catalog no. for RGSO-6 banded with <sup>3</sup>/<sub>8</sub> x 4 flat bar would be RGSO-6 4375.

FIGURE 3B25. Multiple cable penetrator details (types RGS and RGA).

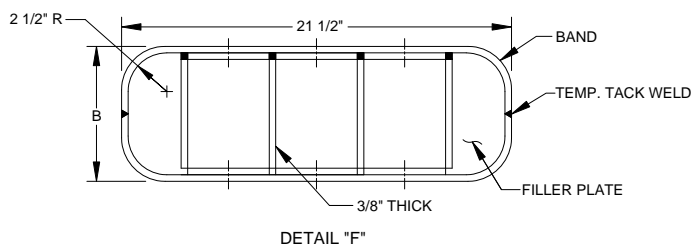
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**3/8 thk 2 frame banded**

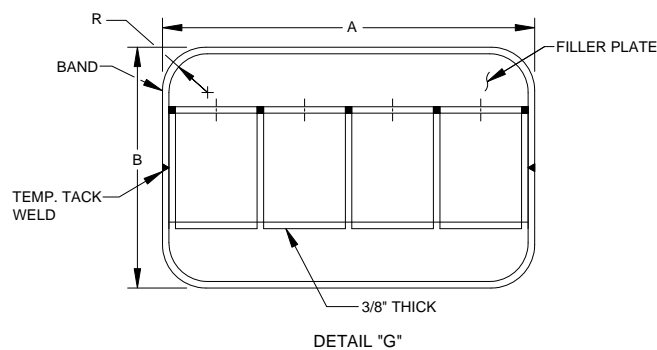
Dimension "B"			
BHD plate lbs	10.2# 12.75 15.3	17.85 20.4	23.0 25.5 28.0 30.6
RGSO-2	5 <sup>9</sup> / <sub>16</sub>	5 <sup>13</sup> / <sub>16</sub>	6 <sup>5</sup> / <sub>16</sub>
RGSO-4	7 <sup>7</sup> / <sub>8</sub>	8 <sup>1</sup> / <sub>8</sub>	8 <sup>5</sup> / <sub>8</sub>
RGSO-6	10 <sup>3</sup> / <sub>16</sub>	10 <sup>7</sup> / <sub>16</sub>	10 <sup>15</sup> / <sub>16</sub>
BAND	3/8 x 4"	1/2 x 4"	3/4 x 4"

Catalog no. for RGSO-6x2 banded with 3/8 x 4 flat bar would be RGSO-6x2 4375.



**3/8 thk multi-frame banded**

Dimension "B"			
BHD plt lbs	10.2 12.75	15.3 17.85 20.4	23.0 25.5 28.0 30.6
RGSO-2	5 <sup>9</sup> / <sub>16</sub>	5 <sup>13</sup> / <sub>16</sub>	6 <sup>5</sup> / <sub>16</sub>
RGSO-4	7 <sup>7</sup> / <sub>8</sub>	8 <sup>1</sup> / <sub>8</sub>	8 <sup>5</sup> / <sub>8</sub>
RGSO-6	10 <sup>3</sup> / <sub>16</sub>	10 <sup>7</sup> / <sub>16</sub>	10 <sup>15</sup> / <sub>16</sub>
BAND	3/8 x 4"	1/2 x 4"	3/4 x 4"



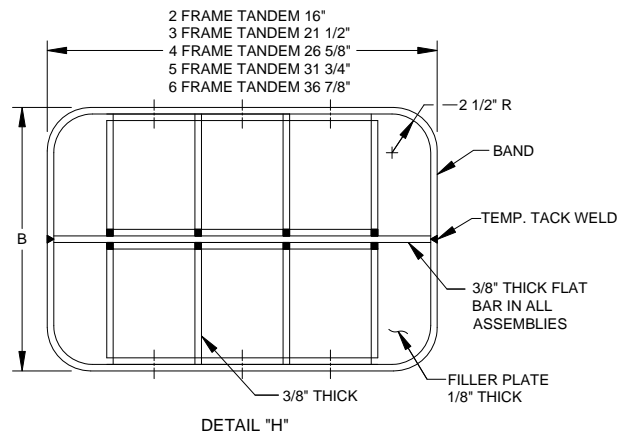
**3/8 thk 4 frame banded**

BHD plate lbs			Dimension "B"			"A"	"R"	Band
			RGSO-2	RGSO-4	RGSO-6			
10.2	12.75	15.3	11 <sup>1</sup> / <sub>16</sub>	13 <sup>3</sup> / <sub>8</sub>	15 <sup>11</sup> / <sub>16</sub>	21 <sup>3</sup> / <sub>4</sub>	3 <sup>1</sup> / <sub>8</sub>	3/8 x 4"
17.85	20.4	23.0	11 <sup>9</sup> / <sub>16</sub>	13 <sup>7</sup> / <sub>8</sub>	16 <sup>3</sup> / <sub>16</sub>	22 <sup>1</sup> / <sub>4</sub>	3 <sup>3</sup> / <sub>8</sub>	5/8 x 4"
25.5	28.0	30.6	11 <sup>15</sup> / <sub>16</sub>	14 <sup>1</sup> / <sub>8</sub>	16 <sup>7</sup> / <sub>16</sub>	22 <sup>1</sup> / <sub>2</sub>	3 <sup>1</sup> / <sub>2</sub>	3/4 x 4"

FIGURE 3B25. Multiple cable penetrator details (types RGS and RGA) - Continued.



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**3/8 thk tandem (T) frames banded**

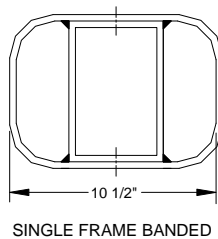
Dimension "B"						
BHD plt lbs	7.65#	10.2#	12.75# 15.3	17.85# 20.4	25.5#	30.6# 35.7
RGSO-2	10 <sup>5/8</sup>	10 <sup>7/8</sup>	11 <sup>1/8</sup>	11 <sup>3/8</sup>	11 <sup>5/8</sup>	11 <sup>5/8</sup>
RGSO-4	15 <sup>3/16</sup>	15 <sup>7/16</sup>	15 <sup>11/16</sup>	15 <sup>15/16</sup>	16 <sup>3/16</sup>	16 <sup>3/16</sup>
RGSO-6	19 <sup>13/16</sup>	20 <sup>1/16</sup>	20 <sup>5/16</sup>	20 <sup>9/16</sup>	20 <sup>13/16</sup>	20 <sup>13/16</sup>
BAND	3/8 x 4	1/2 x 4	5/8 x 4	3/4 x 5	7/8 x 6	7/8 x 6 1/2

NOTE:

- RGSO frames and filler plates are mild steel ASTM A36/A36M. Reinforcing bands are either mild steel (ASTM A36/A36M) or high tensile steel MIL-S-22698 in order for material to be similar to bulkhead or deck in which penetration is being made.

FIGURE 3B25. Multiple cable penetrator details (types RGS and RGA) - Continued.

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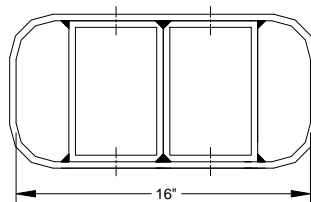


**Type I**

Size of band			
Wt of structure penetrated	Long'l strength member		BHDs & decks other than long'l strength members
	BHDs	Decks	
7.65 lbs	5" x $\frac{5}{16}$ "	12" x $\frac{5}{16}$ "	5" x $\frac{5}{16}$ "
10.2 lbs	5" x $\frac{5}{16}$ "	12" x $\frac{5}{16}$ "	5" x $\frac{5}{16}$ "
12.75 lbs	5" x $\frac{5}{16}$ "	12" x $\frac{5}{16}$ "	5" x $\frac{5}{16}$ "
15.3 lbs	5" x $\frac{5}{16}$ "	12" x $\frac{5}{16}$ "	5" x $\frac{5}{16}$ "
17.85 lbs	5" x $\frac{3}{8}$ "	12" x $\frac{3}{8}$ "	5" x $\frac{5}{16}$ "
20.4 lbs	5" x $\frac{3}{8}$ "	12" x $\frac{3}{8}$ "	5" x $\frac{5}{16}$ "
25.5 lbs	5" x $\frac{3}{8}$ "	12" x $\frac{3}{8}$ "	5" x $\frac{3}{8}$ "
30.6 lbs	5" x $\frac{1}{2}$ "	12" x $\frac{1}{2}$ "	5" x $\frac{1}{2}$ "
35.7 lbs	5" x $\frac{1}{2}$ "	12" x $\frac{1}{2}$ "	5" x $\frac{1}{2}$ "

FIGURE 3B26. Multiple cable penetrator details (types RGS and RGA).

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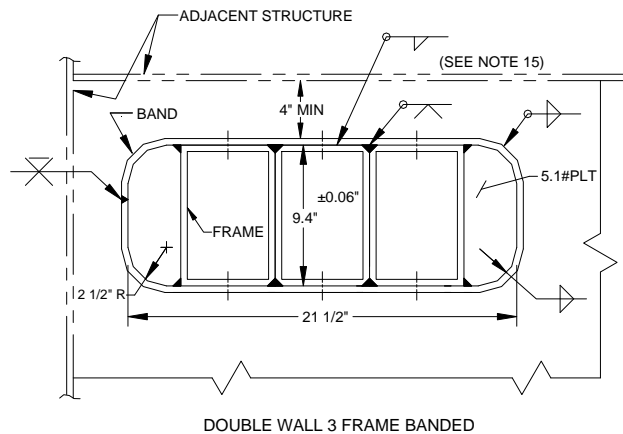
DOUBLE WALL 2 FRAME BANDED

**Type II**

Wt of structure penetrated	Size of band		
	Long'l strength member		BHDs & decks other than long'l strength members
	BHDs	Decks	
7.65 lbs	5" x $\frac{5}{16}$	12" x $\frac{5}{16}$	5" x $\frac{5}{16}$
10.2 lbs	5" x $\frac{5}{16}$	12" x $\frac{5}{16}$	5" x $\frac{5}{16}$
12.75 lbs	5" x $\frac{5}{16}$	12" x $\frac{5}{16}$	5" x $\frac{5}{16}$
15.3 lbs	5" x $\frac{3}{8}$	12" x $\frac{3}{8}$	5" x $\frac{5}{16}$
17.85 lbs	5" x $\frac{1}{2}$	12" x $\frac{1}{2}$	5" x $\frac{5}{16}$
20.4 lbs	5" x $\frac{1}{2}$	12" x $\frac{1}{2}$	5" x $\frac{5}{16}$
25.5 lbs	5" x $\frac{5}{8}$	12" x $\frac{5}{8}$	5" x $\frac{3}{8}$
30.6 lbs	5" x $\frac{3}{4}$	12" x $\frac{3}{4}$	5" x $\frac{1}{2}$
35.7 lbs	5" x $\frac{7}{8}$	12" x $\frac{7}{8}$	5" x $\frac{1}{2}$

FIGURE 3B26. Multiple cable penetrator details (types RGS and RGA) - Continued.

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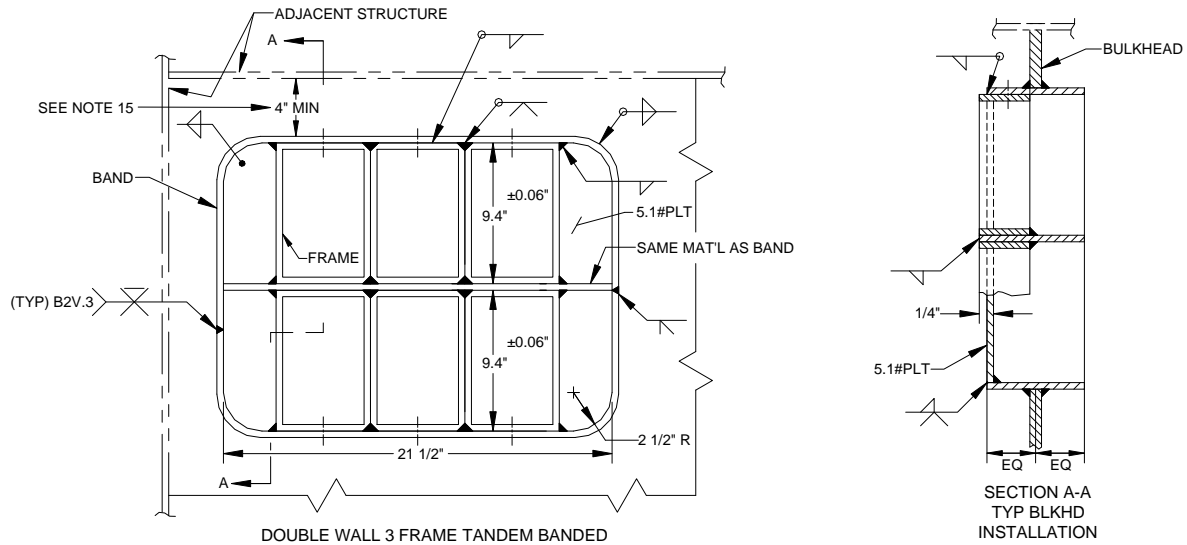


**Type III**

Size of band			
Wt of structure penetrated	Long'l strength member		BHDs & decks other than long'l strength members
	BHDs	Decks	
7.65 lbs	6" x $\frac{3}{8}$	12" x $\frac{3}{8}$	5" x $\frac{5}{16}$
10.2 lbs	6" x $\frac{3}{8}$	12" x $\frac{3}{8}$	5" x $\frac{5}{16}$
12.75 lbs	6" x $\frac{3}{8}$	12" x $\frac{3}{8}$	5" x $\frac{5}{16}$
15.3 lbs	6" x $\frac{7}{16}$	12" x $\frac{7}{16}$	5" x $\frac{5}{16}$
17.85 lbs	6" x $\frac{1}{2}$	12" x $\frac{1}{2}$	5" x $\frac{3}{8}$
20.4 lbs	6" x $\frac{5}{8}$	12" x $\frac{5}{8}$	5" x $\frac{3}{8}$
25.5 lbs	6" x $\frac{3}{4}$	12" x $\frac{3}{4}$	5" x $\frac{1}{2}$
30.6 lbs	7" x $\frac{3}{4}$	12" x $\frac{3}{4}$	5" x $\frac{1}{2}$
35.7 lbs	7" x $\frac{7}{8}$	12" x $\frac{7}{8}$	5" x $\frac{3}{4}$

FIGURE 3B26. Multiple cable penetrator details (types RGS and RGA) - Continued.

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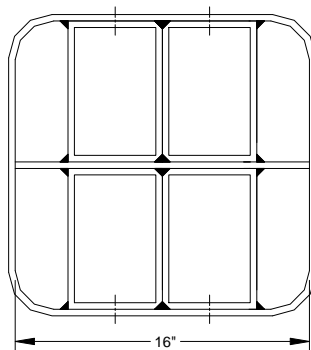


**Type IV**

Size of band			
Wt of structure penetrated	Long'l strength member		BHD's & decks other than long'l strength members
	BHDs	Decks	
7.65 lbs	5" x $\frac{5}{16}$ "	12" x $\frac{5}{16}$ "	5" x $\frac{5}{16}$ "
10.2 lbs	5" x $\frac{3}{8}$ "	12" x $\frac{3}{8}$ "	5" x $\frac{5}{16}$ "
12.75 lbs	5" x $\frac{3}{8}$ "	12" x $\frac{3}{8}$ "	5" x $\frac{5}{16}$ "
15.3 lbs	5" x $\frac{3}{8}$ "	12" x $\frac{3}{8}$ "	5" x $\frac{5}{16}$ "
17.85 lbs	5" x $\frac{1}{2}$ "	12" x $\frac{1}{2}$ "	5" x $\frac{3}{8}$ "
20.4 lbs	5" x $\frac{1}{2}$ "	12" x $\frac{1}{2}$ "	5" x $\frac{3}{8}$ "
25.5 lbs	5" x $\frac{5}{8}$ "	12" x $\frac{5}{8}$ "	5" x $\frac{1}{2}$ "
30.6 lbs	5" x $\frac{3}{4}$ "	12" x $\frac{3}{4}$ "	5" x $\frac{5}{8}$ "
35.7 lbs	6" x $\frac{3}{4}$ "	12" x $\frac{3}{4}$ "	5" x $\frac{3}{4}$ "

FIGURE 3B26. Multiple cable penetrator details (types RGS and RGA) - Continued.

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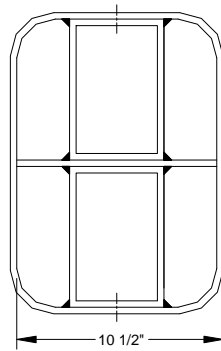
DOUBLE WALL 2 FRAME TANDEM BANDED

**Type V**

Size of band			
Wt of structure penetrated	Long'l strength member		BHDs & decks other than long'l strength members
	BHDs	Decks	
7.65 lbs	5" x $\frac{5}{16}$	12" x $\frac{5}{16}$	5" x $\frac{5}{16}$
10.2 lbs	5" x $\frac{3}{8}$	12" x $\frac{3}{8}$	5" x $\frac{5}{16}$
12.75 lbs	5" x $\frac{3}{8}$	12" x $\frac{3}{8}$	5" x $\frac{5}{16}$
15.3 lbs	5" x $\frac{3}{8}$	12" x $\frac{3}{8}$	5" x $\frac{5}{16}$
17.85 lbs	5" x $\frac{1}{2}$	12" x $\frac{1}{2}$	5" x $\frac{3}{8}$
20.4 lbs	5" x $\frac{1}{2}$	12" x $\frac{1}{2}$	5" x $\frac{3}{8}$
25.5 lbs	5" x $\frac{5}{8}$	12" x $\frac{5}{8}$	5" x $\frac{1}{2}$
30.6 lbs	5" x $\frac{3}{4}$	12" x $\frac{3}{4}$	5" x $\frac{5}{8}$
35.7 lbs	6" x $\frac{3}{4}$	12" x $\frac{3}{4}$	5" x $\frac{3}{4}$

FIGURE 3B26. Multiple cable penetrator details (types RGS and RGA) - Continued.

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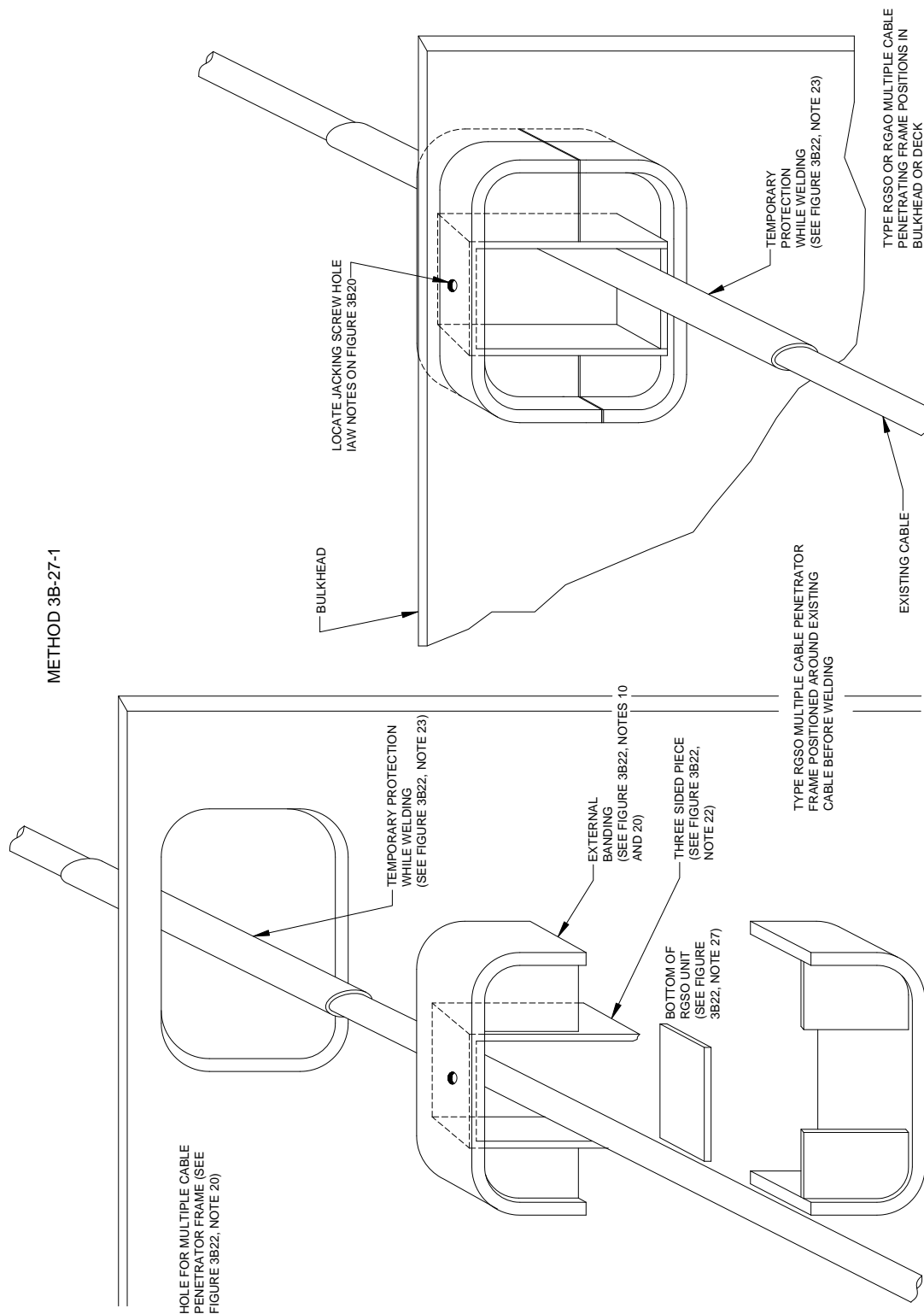
SINGLE FRAME TANDEM BANDED

**Type VI**

Size of band			
Wt of structure penetrated	Long'l strength member		BHDs & decks other than long'l strength members
	BHDs	Decks	
7.65 lbs	5" x $\frac{5}{16}$ "	12" x $\frac{5}{16}$ "	5" x $\frac{5}{16}$ "
10.2 lbs	5" x $\frac{3}{8}$ "	12" x $\frac{3}{8}$ "	5" x $\frac{5}{16}$ "
12.75 lbs	5" x $\frac{3}{8}$ "	12" x $\frac{3}{8}$ "	5" x $\frac{5}{16}$ "
15.3 lbs	5" x $\frac{3}{8}$ "	12" x $\frac{3}{8}$ "	5" x $\frac{5}{16}$ "
17.85 lbs	5" x $\frac{1}{2}$ "	12" x $\frac{1}{2}$ "	5" x $\frac{3}{8}$ "
20.4 lbs	5" x $\frac{1}{2}$ "	12" x $\frac{1}{2}$ "	5" x $\frac{3}{8}$ "
25.5 lbs	5" x $\frac{5}{8}$ "	12" x $\frac{5}{8}$ "	5" x $\frac{3}{8}$ "
30.6 lbs	5" x $\frac{3}{4}$ "	12" x $\frac{3}{4}$ "	5" x $\frac{1}{2}$ "
35.7 lbs	5" x $\frac{3}{4}$ "	12" x $\frac{3}{4}$ "	5" x $\frac{3}{4}$ "

FIGURE 3B26. Multiple cable penetrator details (types RGS and RGA) - Continued.

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NOTE:

1. See figure 3B22, notes 18 though 26 for additional data.

FIGURE 3B27. Multiple cable penetrator installation details (types RGS and RGA).



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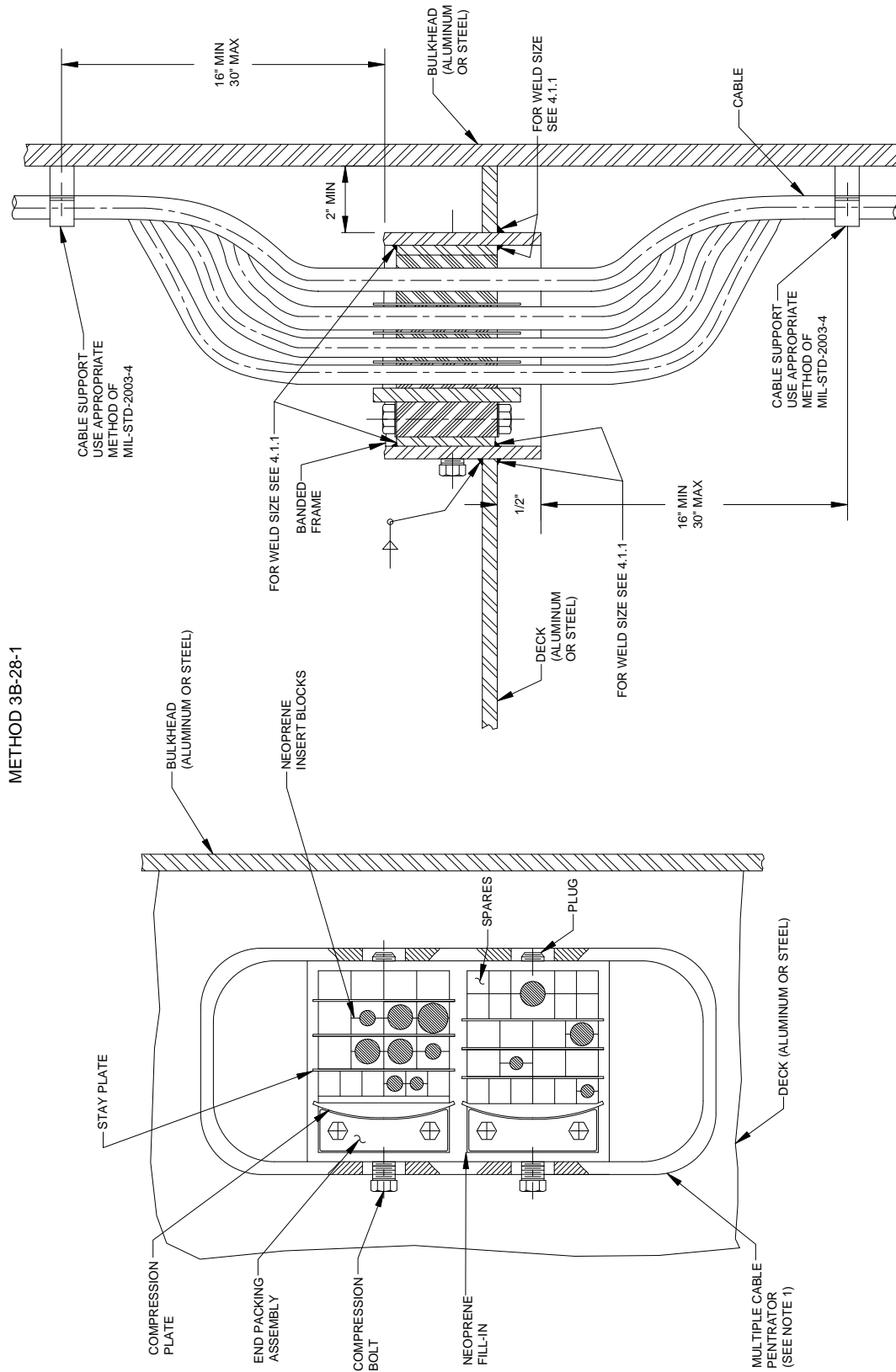


FIGURE 3B28. Multiple cable penetrator frame in decks (types RGS and RGA).

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NOTE:

1. Multiple cable penetrator frames are available in various sizes and arrangements. Shown is a two-frame penetrator.

FIGURE 3B28. Multiple cable penetrator frame in decks (types RGS and RGA) - Continued.

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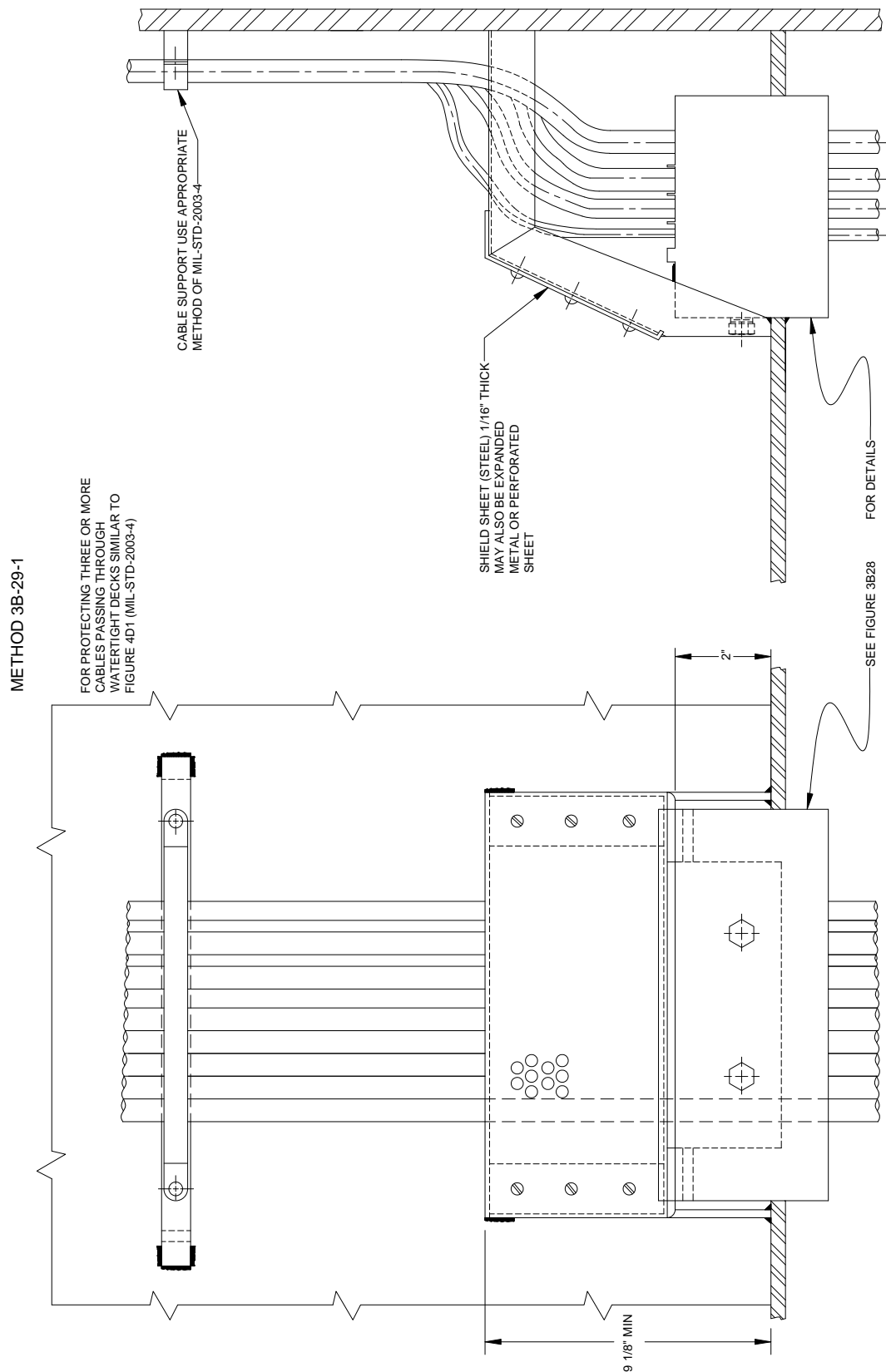


FIGURE 3B29. Multiple cable penetrator (type RGS and RGA) shield.

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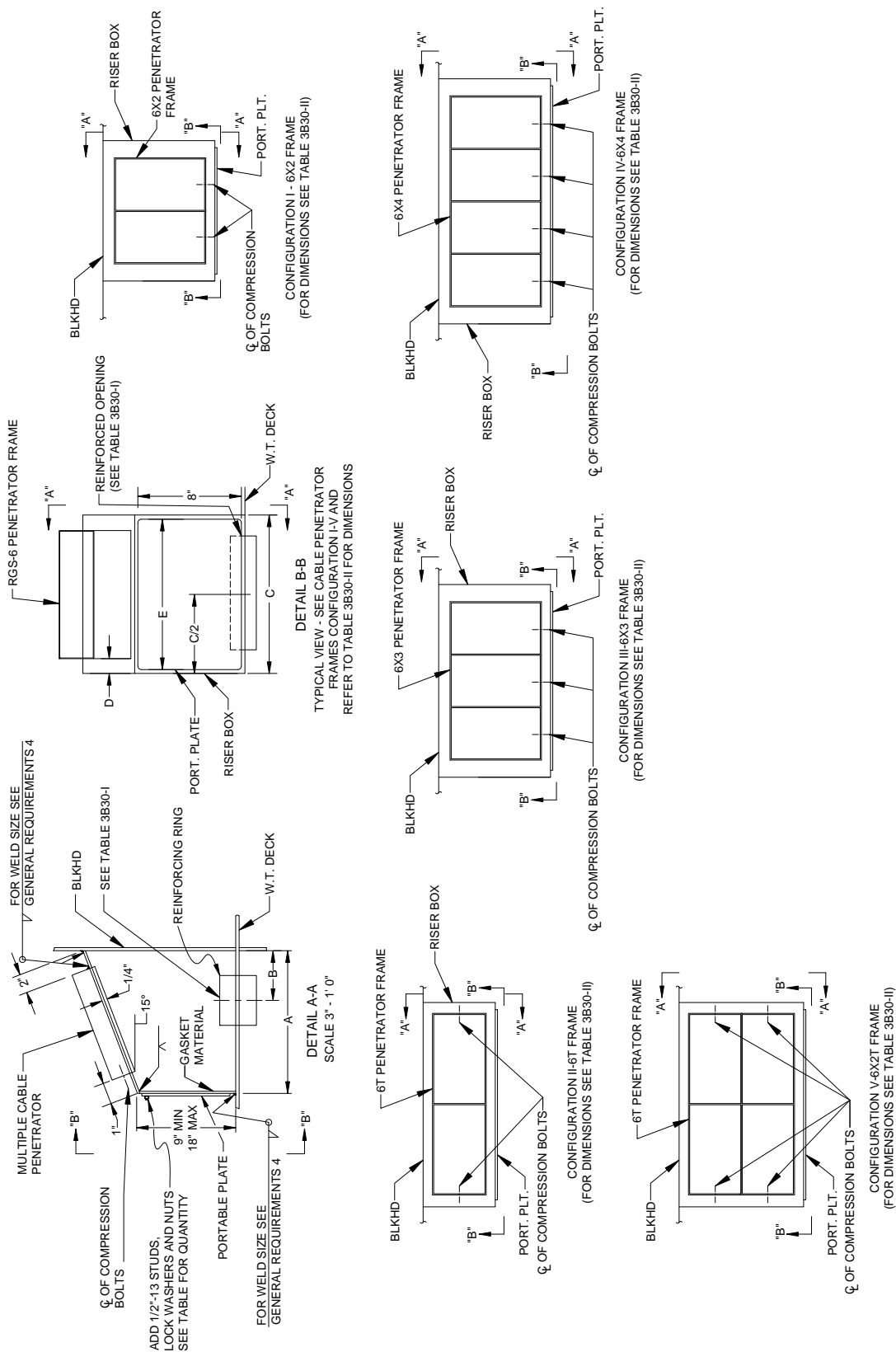


FIGURE 3B30. Multiple cable penetrator riser box.

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TABLE 3B30-I. Reinforced frame opening dimensions<sup>1/</sup>.

No. frames	Size of op'g
6 x 2	10" x 4"
6 x 3	15" x 4"
6 x 4	20" x 4" or 16" x 5"

NOTE:

<sup>1/</sup> Min. of 20 sq. in. opening for each frame.

TABLE 3B30-II. Frame dimensions.

Dimensions						
Configuration number	A	B	C	D	E	Bolts req'd.
I	12½"	5"	14"	1¾"	13"	14
II	8"	4½"	21"	1⅛"	20"	16
III	12½"	5"	19"	1⅝"	18"	16
IV	12½"	5"	24"	1½"	23"	18
V	13½"	7"	21"	1⅛"	20"	16

FIGURE 3B30. Multiple cable penetrator riser box - Continued.

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METHOD 3B-31-1

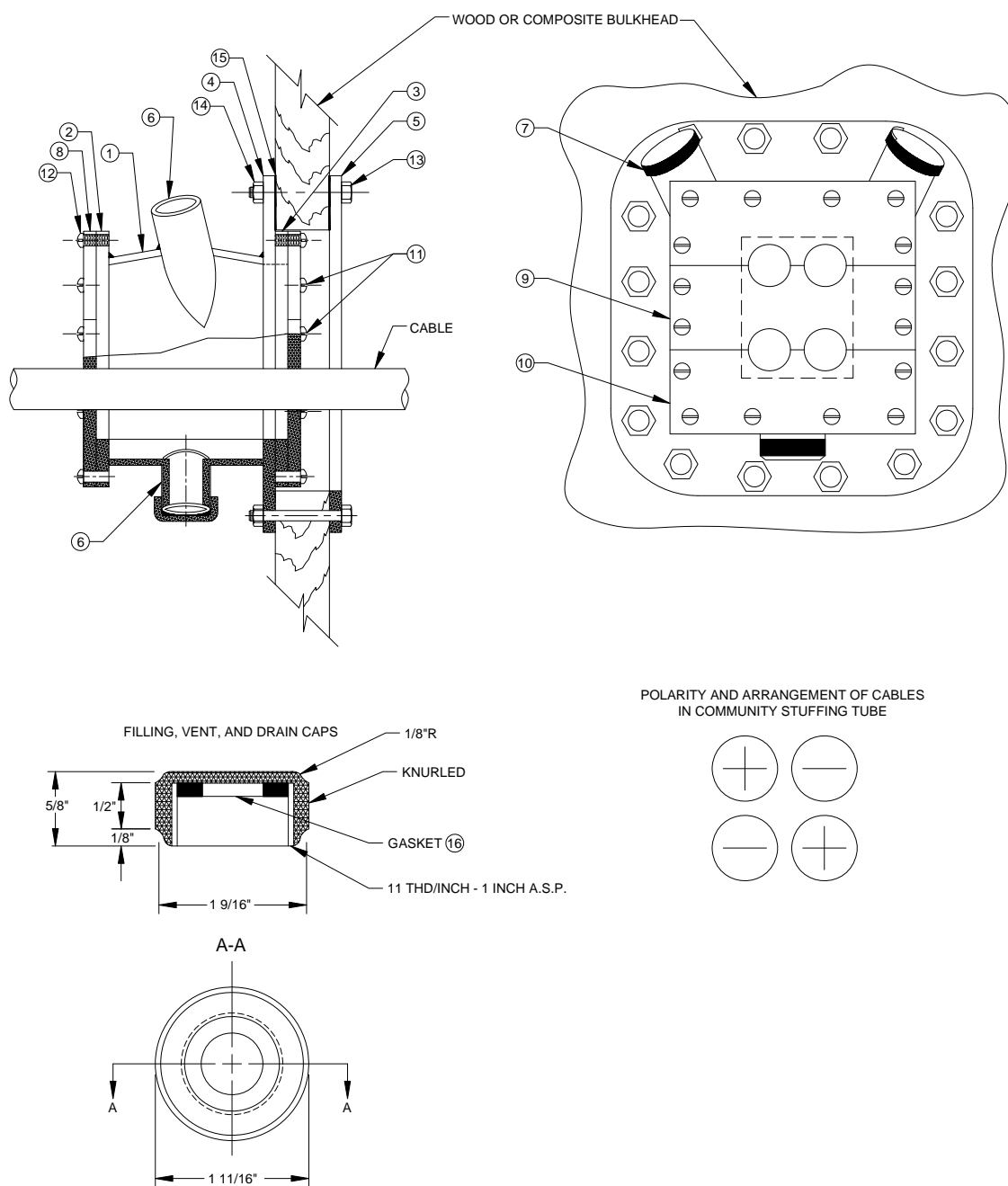


FIGURE 3B31. Community stuffing tube for minesweepers.

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TABLE 3B31-I. List of materials.

18	As req'd.	Plastic sealer		MIL-I-3064
17	As req'd.	Filling compound	Rubber	
16	3	Gasket - Cap 0.090 thk.	Rubber	MIL-PRF-15624
15	2	Gasket - Flange 0.090 thk	Rubber	MIL-PRF-15624
14	16	$\frac{3}{8}$ " nut	CRES 316	
13	16	$\frac{3}{8}$ " bolt, length as reqd.	CRES 316	
12	32	$\frac{1}{4}$ " FIL-H screw, $\frac{1}{4}$ " long	CRES 316	MS35361
11	32	$\frac{1}{4}$ " FIL-H screw, $\frac{5}{8}$ " long	CRES 316	
10	2	Slat, 2 $\frac{1}{4}$ "	Alum	ASTM B209
9	2	Slat, 1 $\frac{3}{4}$ "	Alum	ASTM B209
8	2	Slat, 2"	Alum	ASTM B209
7	3	Cap - fill, drain & vent	Alum	ASTM B209
6	3	Pipe - 1", length to suit	Alum	ASTM B209
5	1	Backing plate, $\frac{1}{4}$ " pl.	Alum	ASTM B209
4	1	Flange, $\frac{1}{4}$ " pl.	Alum	ASTM B209
3	1	Back face plate, $\frac{3}{8}$ " pl.	Alum	ASTM B209
2	1	Front face plate, $\frac{5}{16}$ " pl.	Alum	ASTM B209
1	1	Gland body, $\frac{3}{16}$ " plate	Alum	ASTM B209
<b>PC. no.</b>	<b>Qty.</b>	<b>Name</b>	<b>Material</b>	<b>Matl. spec. or std. dwg. no.</b>

**Installation notes:**

1. The gland is to be positioned on the bulkhead so that there is reasonable access to the filling, drain, and vent tubes, and so that the top of the gland is horizontal (maximum permissible tilt is 5 degrees).
2. An opening 7 $\frac{3}{8}$ " high by 7 $\frac{1}{8}$ " wide should be prepared in the bulkhead for receiving the gland.
3. Fit rubber gaskets and bolt gland to bulkhead.
4. Wipe the gland interior completely to remove traces of grease or oil.
5. Pull cables through gland, removing, where possible, all dirt and grease from cables.
6. The portions of the cables passing through the gland, especially at the slat assembly positions, must be wiped clean with rags and cyclohexanone to remove all traces of grease or oil from the cables.
7. Coat the cable holes, butting edges, and butting side of the bottom slats with sealer, PC 18. Fit the slats into position and screw to gland body (1 slat each side).
8. Position the bottom row of cables on the slats.
9. Proceed in a similar manner, to position the cables until all slats are in position.
10. After cables are in position, they should not be disturbed.

FIGURE 3B31. Community stuffing tube for minesweepers - Continued.

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APPENDIX B**Installation notes (continued):**

11. Final gland cleaning operation – Remove the caps from the filling, drain, and vent tubes. Fit a hose to the drain tube to feed into a clean bucket and provide a clamp on the hose near the gland. Fill the gland with liquid degreasing agent. Caution – use adequate ventilation, avoid prolonged or repeated breathing of vapor, and avoid prolonged or repeated contact with skin. Do not take internally. After about 5 minutes, release the clamp to drain the gland, and blow compressed air through the gland from the top for about 5 minutes to ensure complete elimination of any fluid that might remain in the gland. Any leaks noted during the cleaning operation should be repaired.
12. The liquid filling compound, PC 17, consists of two separate liquids which are mixed together immediately prior to use. The success of the resultant compound depends on thorough mixing, and this should be a stirring action. The compound should be stirred for 5 minutes. Complete mixing instructions are printed on the filling compound container.
13. Pour the filling compound into the gland until the tubes are filled.
14. Both sides of the gland must be inspected during the filling operation for leakage. It may be possible to repair slight leaks by external application of sealer. If leakage persists, the filling operation must stop. Immediately drain the filling compound. After leak has been stopped, the filling operation may be restarted.
15. Fit filling and vent tube caps.

FIGURE 3B31. Community stuffing tube for minesweepers - Continued.



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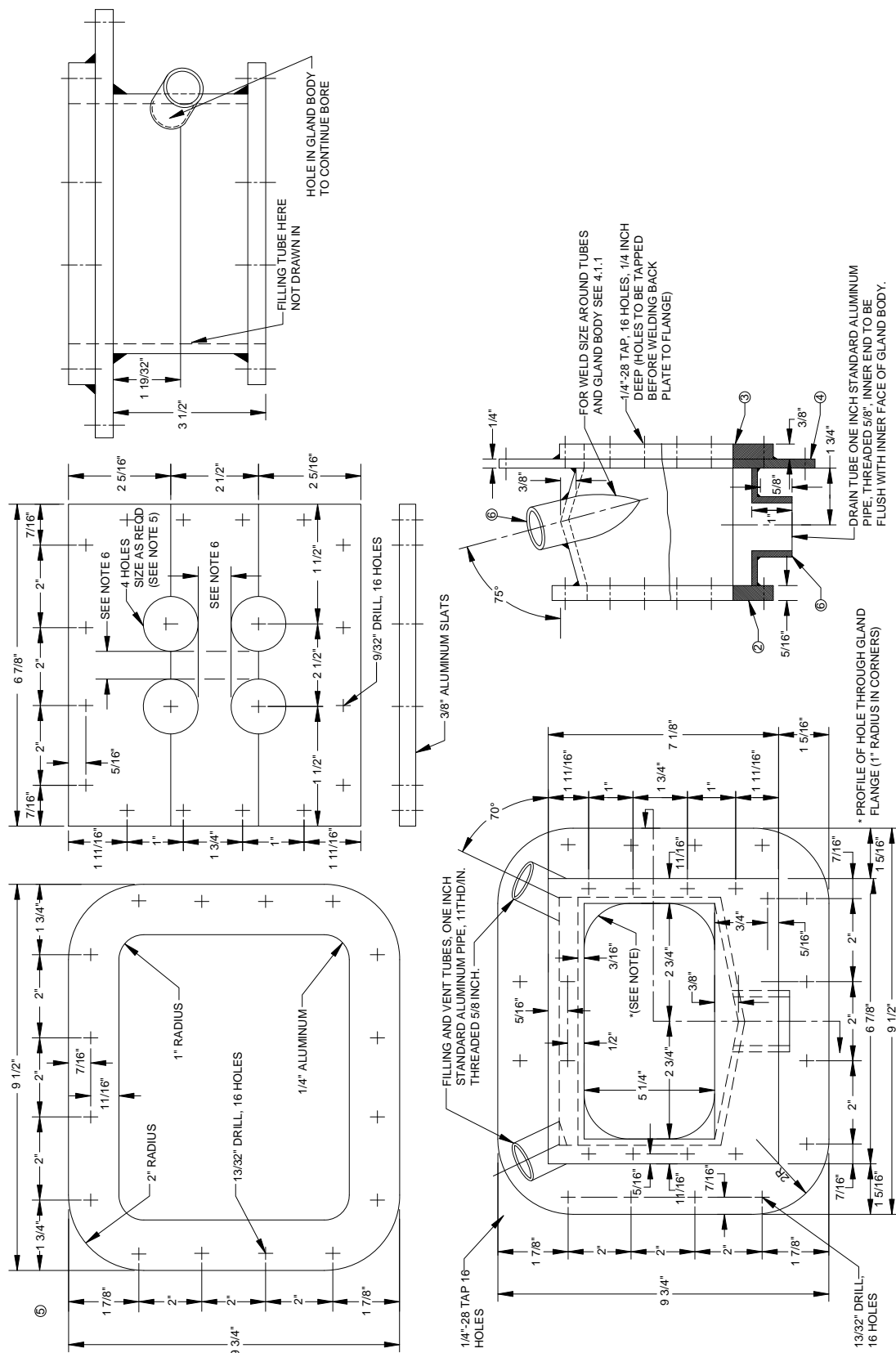


FIGURE 3B32. Community stuffing tubes for minesweepers (details).

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NOTES:

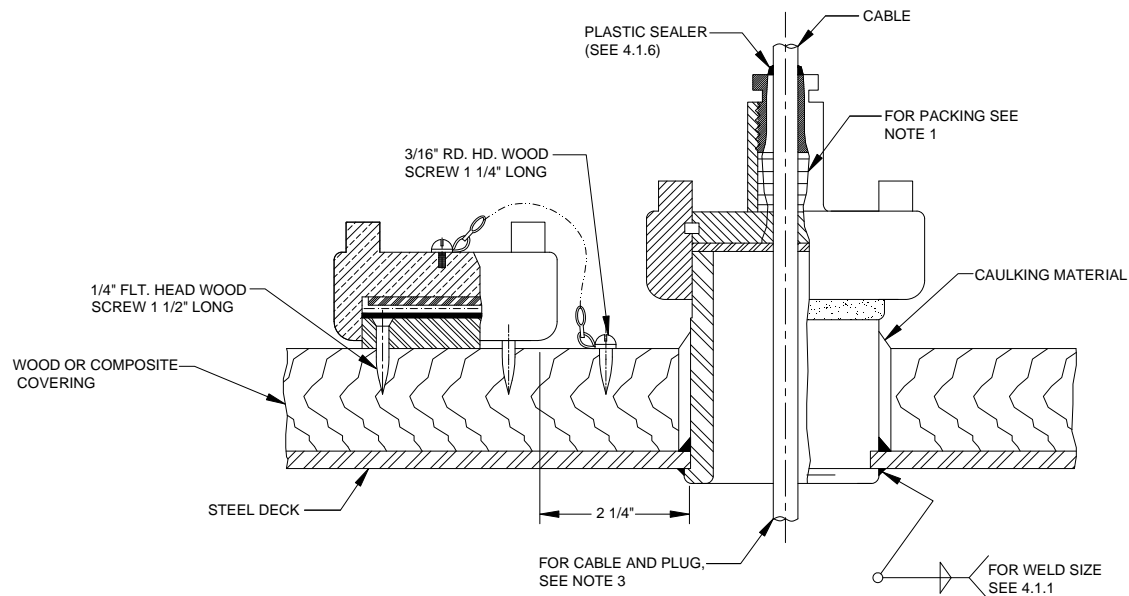
1. For material, see list of material on figure 3B31.
2. See figure 3B31 for fill, drain, and vent cap detail.
3. Drill front and back slats at the same time.
4. Painting shall be in accordance with approved methods.
5. The diameter of the holes should be same size ( $+\frac{1}{16}$ , -0) outside diameter of minesweep cable used.
6. The separation of these holes should provide a minimum spacing of 0.625 between cables and also provide a minimum spacing of 0.5 between cable and inner faces of gland body.

FIGURE 3B32. Community stuffing tubes for minesweepers (details) - Continued.

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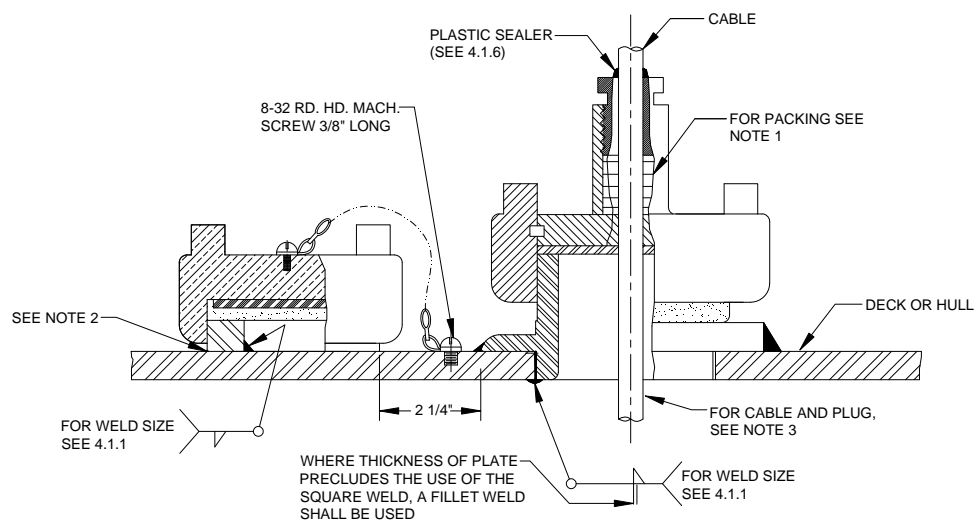
METHOD 3B-33-1

FOR PASSING CABLES THROUGH WEATHER  
DECK WITH WOOD OR COMPOSITE COVERING



METHOD 3B-33-2

FOR PASSING CABLES THROUGH WEATHER  
DECK AND HULL MIL-S-24235



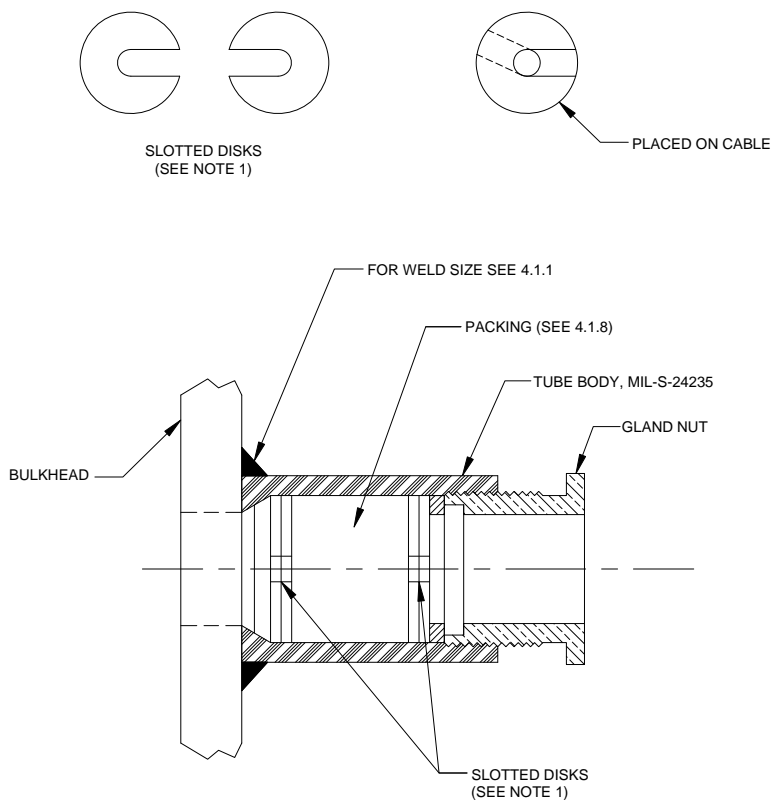
NOTES:

1. Glands of outlets shall be packed with prefabricated packing Type 2, size "B" in accordance with MIL-DTL-16685.
2. After welding dummy plug (MIL-S-24235) in place, an approved coal tar pitch emulsion shall be used to seal the cracks and fill the inside flush.
3. Outlets are designed to accommodate a single cable and Type CCC-2 plug in accordance with MIL-DTL-2726/68.
4. Plastic sealer is required on kick pipes and stuffing tubes when exposed to the elements (penetrates the skin of the ship).

FIGURE 3B33. Deck outlets for portable cables (surface ships).

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METHOD 3B-34-1  
(SEE NOTE 2)



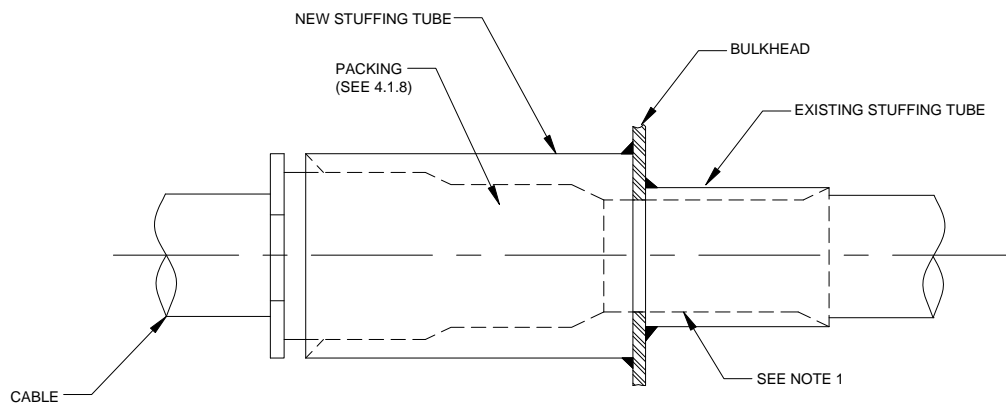
NOTE:

1. Cut a slot in a disk or washer on one side of the cable hole only. Two slotted disks or slotted washers are then slipped around the cable both in the gland bottom and under the gland nut to hold the packing securely in place.

FIGURE 3B34. MIL-S-24235 stuffing tubes for smaller size cables using slotted packing disks.

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METHOD 3B-35-1



TYPICAL INSTALLATION

TABLE 3B35-I. New stuffing tubes – MIL-S-24235/10.

Existing stuffing tubes MIL-S-24235/10	Size	A	B	C	D	E	F	G	J	K	L	M	N	P	R	S	T	V	W	X	Y	Z	AA	BB
	A		X	X	X	X	X																	
	B			X	X	X	X	X																
	C				X	X	X	X	X															
	D					X	X	X	X	X														
	E						X	X	X	X														
	F							X	X	X	X													
	G								X	X	X	X												
	J									X	X	X	X	X										
	K										X	X	X	X	X									
	L											X	X	X	X									
	M												X	X	X	X								
	N													X	X	X	X							
	P														X	X	X	X						
	R															X	X	X	X					
	S																X	X	X	X	X			
	T																	X	X	X	X	X	X	
	V																		X	X	X	X	X	
	W																			X	X	X	X	
	X																				X	X	X	X
	Y																					X	X	X
	Z																						X	X
	AA																							X
	BB																							X

X indicates an acceptable combination.

NOTES:

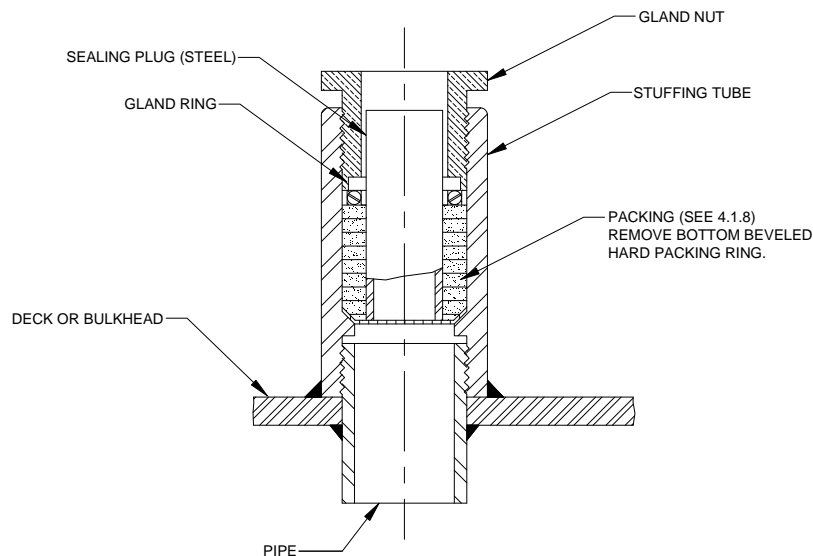
1. Table 3B35-I indicates new tube size limitations for adaptation to undersized non-reusable stuffing tubes.
2. Ream smooth and round off inside edge of existing tube to prevent cable chafing.

FIGURE 3B35. Changing stuffing tube sizes to accommodate larger cable.

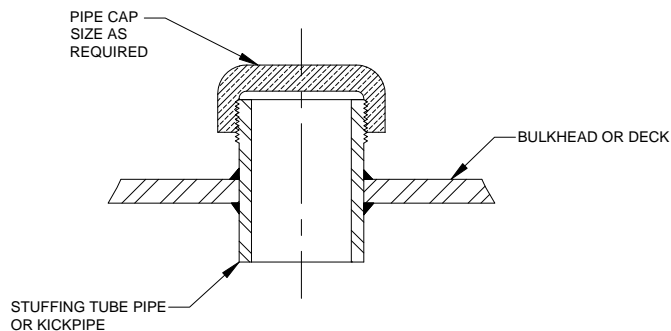
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METHOD 3B-36-1  
SEALING UNUSED STUFFING TUBES  
IN DECKS AND BULKHEADS

SEALING PLUG MIL-S-24235/19  
APPLICABLE TO ALL DECK AND BULKHEAD TYPES



METHOD 3B-36-2  
SEALING UNUSED KICKPIPS AND  
STUFFING TUBES WITH REMOVABLE  
STUFFING TUBE BODY



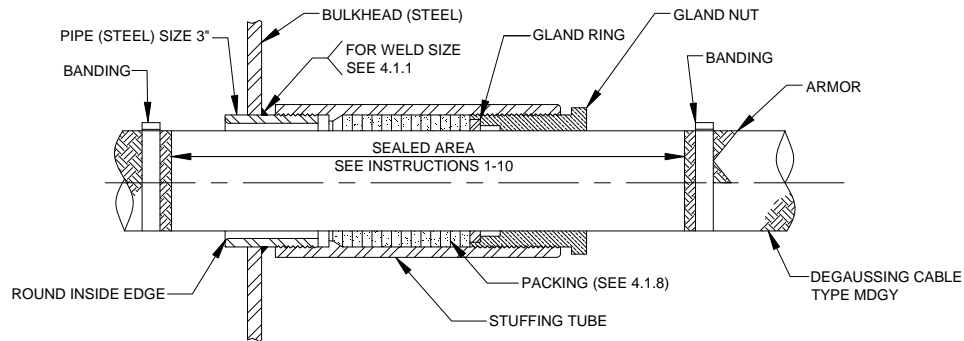
NOTE:

1. Application of the methods shown (3B-36-1 and 3B-36-2) are intended for existing installed stuffing tubes whose cables have been removed and not necessarily replaced.

FIGURE 3B36. Sealing unused stuffing tubes in medium steel bulkhead and decks.

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METHOD 3B-37-1



**Instructions:**

1. Cut away the outer armor in the way of the stuffing tube and secure as shown. Remove the duct tape down to the impervious sheathing.
2. Smooth the impervious sheathing such that any imprint of the armor is removed. This will prevent channels that could allow passage of water through the tube. Clean the impervious sheathing to allow bonding of the sealant.
3. Wrap the cable area to be sealed with layers of porous plastic spacer tape until the diameter of the area to be sealed is nearly equal to the outer diameter of the MDGY cable.
4. Attach the injection fitting near the center of the area to be sealed.
5. Cover the area to be sealed with a layer of no. 22 Scotch (or equal) electric tape to form the outer mold for the resin and to secure the injection fitting in place.
6. Cover the electrical tape with a cloth tape tightly wrapped to restrain the mold when it is under pressure.
7. Inject "Scotchcast" resin no. 4 (Minnesota Mining & Mfg. Co. or equal) into the sealing area by means of a pressure gun attached to the injection fitting.
8. Prick pin holes through the electrical tape near the extremities of the seal. The sealing area is filled and void-free when drops of resin form at the pin holes.
9. After the resin has cured, remove the cloth tape and cut off the injection fitting.
10. Position the molded area of the MDGY cable within the stuffing tube and tighten gland nut.

FIGURE 3B37. Sealing degaussing cable in bulkhead stuffing tubes.





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METHOD 3B-38-1  
STUFFING TUBES BEVEL REDUCING ADAPTER ASSEMBLIES  
(MIL-S-24235/18)

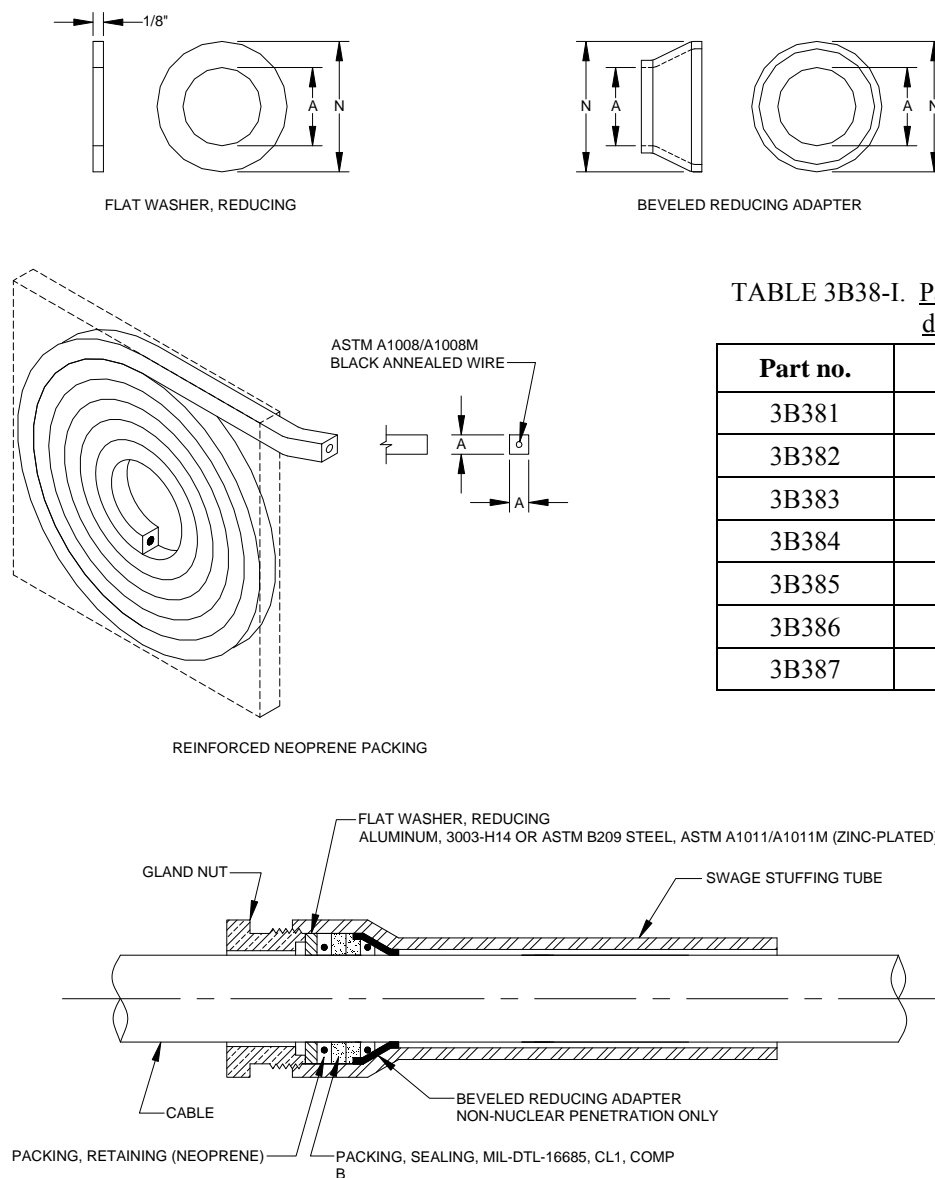


FIGURE 3B38. MIL-S-24235/18 stuffing tube bevel reducing adapter assemblies.

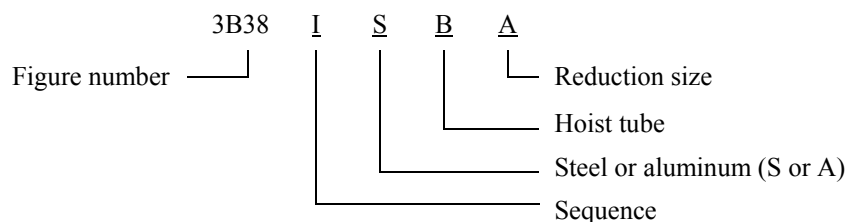
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TABLE 3B38-II. Stuffing tube adapter sets.

Adapter set (steel)	Adapter set (aluminum)	Existing tube	"N" dim. O.D.	Effective reduction size	"A" dim. I.D.
3B381SBA	3B381ABA	B	0.875	A	0.406
3B382SDA	3B382ADA	D	1.032	A	0.406
3B383SDB	3B383ADB	D	1.032	B	0.515
3B384SDC	3B384ADC	D	1.032	C	0.640
3B385SGB	3B385AGB	G	1.360	B	0.516
3B386SGC	3B386AGC	G	1.360	C	0.640
3B387SGD	3B387AGD	G	1.360	D	0.750
3B388SGE	3B388AGE	G	1.360	E	0.812
3B389SGF	3B389AGF	G	1.360	F	0.843
3B3810SLG	3B3810ALG	L	1.703	G	0.953
3B3811SLJ	3B3811ALJ	L	1.703	J	1.062
3B3812SLK	3B3812ALK	L	1.703	K	1.172
3B3813SNL	3B3813ANL	N	1.875	L	1.265
3B3814SNM	3B3814ANM	N	1.875	M	1.406
3B3815SSN	3B3815ASN	S	2.562	N	1.515
3B3816SSP	3B3816ASP	S	2.562	P	1.625
3B3817SSR	3B3817ASR	S	2.562	R	1.750
3B3818SWS	3B3818AWS	W	3.000	S	1.875
3B3819SWT	3B3819AWT	W	3.000	T	2.062
3B3820SWV	3B3820AWV	W	3.000	V	2.187
3B3821SAAX	3B3821AAAX	AA	3.625	X	2.500
3B3822SAAY	3B3822AAAX	AA	3.625	Y	2.609
3B3823SAAZ	3B3823AAAZ	AA	3.625	Z	2.781

NOTES:

- Adapter set consists of one flat washer and one bevel reducing adapter.
- Definition of adapter sets numbering system follows:



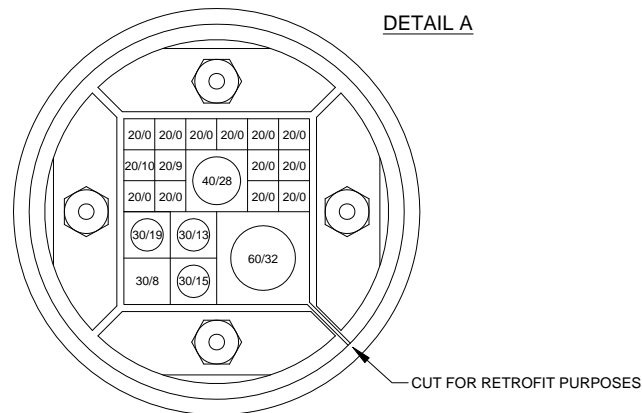
- Neoprene shall be in accordance with MIL-PRF-15624, Class I, Grade 50.

FIGURE 3B38. MIL-S-24235/18 stuffing tube bevel reducing adapter assemblies - Continued.

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**Installation notes:**

1. Round multi-cable penetrator (RMCP) is a modular system that utilizes standard units and dimensions to allow maximum flexibility and compatibility with various numbers and sizes of cables. Final sealed units are designed to provide watertight, airtight, and fireproof bulkhead or deck penetrations.
2. Freely lubricate outside of the RMCP with cable lubricant (tallow) before inserting into pipe sleeve, but do not push RMCP completely into the sleeve at this time.  
Pull all cables through the RMCP, bearing in mind, cables shall always approach in a horizontal plane to the penetrator. This can be accomplished if the nearest cable hanger is 16" min. from the bulkhead. Cable running up the bulkhead and through an RMCP must have its full bending radius outside of the penetrator. While in the process of pulling cables, it is imperative that a reasonable amount of slack should be left to facilitate movement of cables within the RMCP to ease packing operation. Also, it is necessary that each cable be identified on the compression nut side of multiple cable penetrator by lead number and cable size. All cables through a new round multiple cable penetrator shall be pulled prior to installing insert blocks.
3. After pulling all cables through a particular round multi-cable penetrator, it can be packed. First, apply a light coat of cable lubricant (tallow) to all outside surfaces of the insert blocks and inside of the RMCP. Apply General Electric's RTV-106 sealer, or equal, on the surface of each block that contacts the cable (a  $\frac{1}{8}$ " bead every  $\frac{1}{2}$ " around the circumference). Each RMCP must be laid out (blocked) showing solid blocks (used as spares) and cable assignments prior to packing. A typical example of a packed RMCP unit with location assignments for packing is shown below.



- a. Select insert blocks and spares (see note 2) and prepare as illustrated above. (Lubricant and sealer where required.)
- b. Starting with largest cable, place the lower half of the 60/32 insert block under the cable in the unit. Next, repeat the procedure with the 30/15, then add one 30/0 spare. Add the upper half of the 60/32 and the 30/15. Place lower half of the 30/13 and 30/19 under cable, then add upper halves.

**CAUTION:** For easiest packing, do not insert the blocks fully into the square hole until all cable holding and spare blocks are in their assigned locations.

- c. On top of the previously installed blocks, place four 20/0 spares and the lower half of the 40/28 under its cable. In the next higher row, place two 20/0 spares and the lower half of the 20/9 and 20/11 under their respective cables. Then add upper halves of 40/28, 20/9, and 20/11 on top.
- d. Add final row of six 20/0 spares.

FIGURE 3B39. Round multi-cable penetrators installation notes.

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**Installation notes (continued):**

- e. All blocks and their RMCP can now be fully inserted simultaneously, i.e., the blocks pushed completely into the square hole of the plug and RMCP completely into the sleeve.
- f. When the RMCP unit is completely filled and inserted, then the nuts are alternately tightened until the RMCP is secure in the hole. The installation is then complete.
- 4. To add a new cable to a packed RMCP unit, loosen the four hex nuts and remove the desired spare insert modules. Pull the new cable and add matching cable holding blocks in accordance with previous instructions.
- 5. Template all work from ship.
- 6. All welding and inspection to be in accordance with NAVSEA S9074-AR-GIB-010/278.
- 7. All painting to be done in accordance with MIL-E-917.
- 8. This plan was developed for the reinforcement of openings in structure of surface ships other than in protective plating to permit installation of round multi-cable penetrator in watertight decks and bulkheads of surface ships.
- 9. Fillet weld reinforcement for T2V. 1 weld joint shall be  $\frac{1}{8}$  for plating up to 15.3# and  $\frac{1}{4}$  for plating above 17.85#.
- 10. The bulkheads and decks which are considered to be longitudinal strength members are defined as components in "strength envelope (i.e., in outside plating, uppermost strength deck, inner bottom, and their associated longitudinal framing) and for other strength decks within the midship three-fifths length". If there is difficulty in definition, consult with structural design.
- 11. After installation is complete, pipe sleeve of penetrator may be painted to suit surrounding structure in accordance with general specifications for building ships for the U.S. Navy.

**Round multi-cable penetrators for existing cables:**

- 12. Temporarily insulate cable for protection against welding and burning.
- 13. Remove old non-watertight structure.
- 14. Prepare hole in bulkhead to receive round multi-cable penetrator (designated "RMCPO"). One corner of RMCP is cut (see detail A) to allow it to be opened and placed around the existing cables. Pipe sleeve must also be placed around the cable.
- 15. Segregate and confine required cables for protection and installation.
- 16. Slide unit into prepared sleeve in bulkhead, then proceed as outlined in note 3.

**NOTES:**

- 1. The round multi-cable penetrator shall not be installed in bulkheads and decks which are exposed to the weather.
- 2. Insert block cable assignments are shown on figure 3B21.
- 3. Approved multi-diameter insert blocks may be used where available.

FIGURE 3B39. Round multi-cable penetrators installation notes - Continued.

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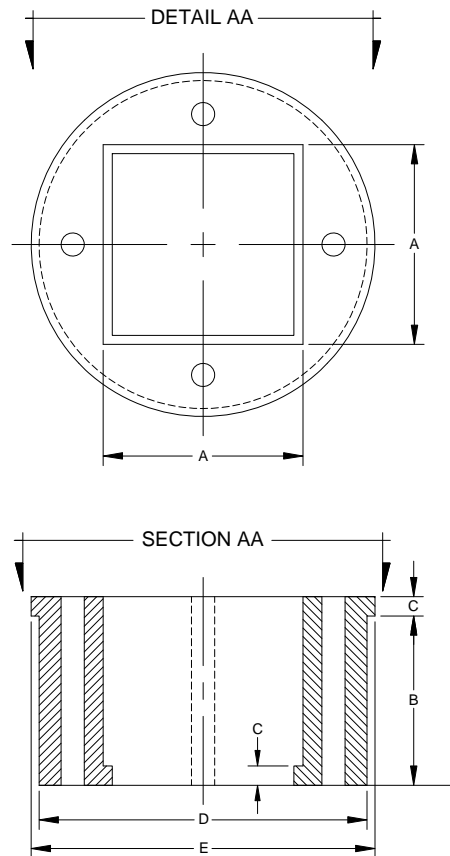


TABLE 3B40-I. Dimensions.

	A		B	C	D	E
	IN	MM				
RMCP2	1.181	30	2.559	0.197	2.000	2.232
RMCP25	1.220	30	2.559	0.197	2.302	2.634
RMCP3	1.614	40	2.559	0.197	3.000	3.340
RMCP4	2.362	60	2.559	0.197	4.000	4.282
RMCP5	3.188	80	2.559	0.197	5.000	5.339
RMCP6	3.543	90	2.559	0.197	6.000	6.375
RMCP8	4.763	120	2.559	0.197	8.000	8.312

For factory cut corner for retrofit applications add "0" to the nomenclature, i.e., "RMCP0"

Material: Special neoprene elastomer

FIGURE 3B40. Round multiple cable penetrators (dimensions).

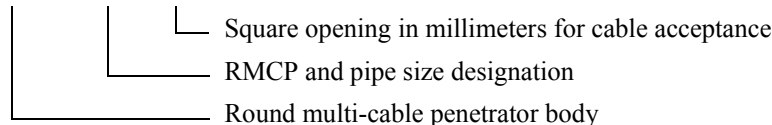
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**Nomenclature:**

Round multiple cable penetrators (RMCP): a system of passing cables through water and non-watertight bulkheads and decks designed to suit particular bulkhead and deck weights.

- a. Physical arrangement and identification

RMCP    2    -30



- b. RMCP consists of seven basic sizes: 2, 2.5, 3, 4, 5, 6, and 8 for insertion into steel pipe (table 3B41-I) or aluminum pipe (detail 2).
- c. Compression hardware for sealing is comprised of the following:
- (1) Back compression plate (detail 1) with press fitted compression bolt (table 3B41-III) to make furnished assembly (table 3B41-II).
  - (2) Front compression plate similar to back compression plate, only it is furnished without compression bolt.
  - (3) Hex nut (table 3B41-IV) to be used with front compression plate and stud.
- d. Insert blocks:  
Twin half blocks are specially formulated of a neoprene elastomer with a centered semi-circular groove. When matched around a cable, these blocks form a single block with a tight fit. See note 2.
- e. Spares:  
Solid blocks are specially formulated of a neoprene elastomer and are used as fillers or spare provisions for addition of future cables. Sizes shown on figure 3B21.
- f. Fill-ins:  
Same material as insert blocks and spares are used to fill thicknesses of 5 or 10 millimeters created by the presence of different size blocks in the same row. Also employed to increase the pressure in the penetrator unit when exceptionally soft cables are used. These fill-ins are available in two sizes: 24x5/0 or 12x10/0. See figure 3B21. Serrations have been provided to permit slicing of the fill-ins to the required length. Example: 6x10/0, 8x5/0, etc.
- g. Tallow:  
Insert block lubricant used when packing penetrator unit allows the blocks to slide easily over each other when packing and compressing them around cables.
- h. Sealer:  
Liquid silicone rubber applied to cable side of each gauge block. Upon compression, this provides a seal between the armor of the cable and its impervious inner sheath.
- i. Assembly steps:
- (1) Place RMCP into appropriate pipe sleeve and leave slightly extended.
  - (2) Pass cable through RMCP.
  - (3) Place modules around cable and inside RMCP.
  - (4) Press complete assembly into pipe until flange is flush with end of pipe.
  - (5) Then tighten hardware for compression and expansion of multi-plug to achieve air and water seal.
- j. All dimensions are in inches unless otherwise stated.

FIGURE 3B41. Round multi-cable penetrators.

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TABLE 3B41-I. Round carbon steel tube.

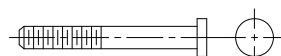
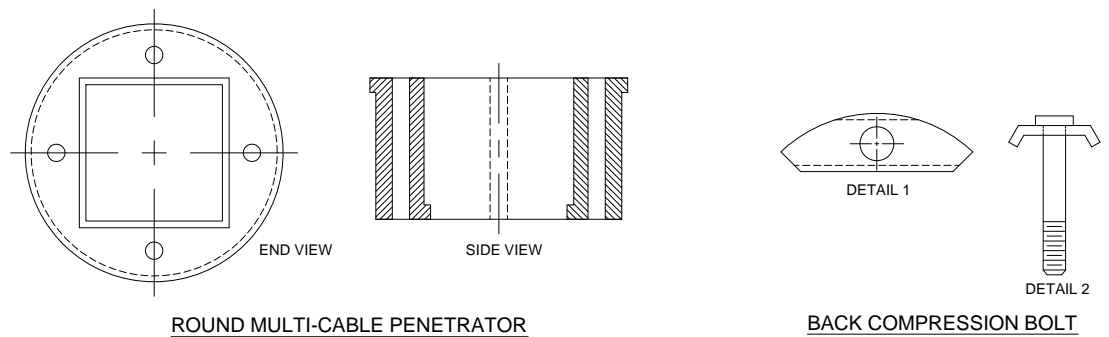
Ident. no.	O.D.	Wall	Theoretical I.D.	Type	Wt. per ft.	Length for blkhd	Length for deck
RMCP2	2 $\frac{3}{8}$	0.154	2.067	SCH 40 PIPE	3.653	4	12
RMCP2.5	2 $\frac{7}{8}$	0.203	2.469	SCH 40 PIPE	5.793	4	12
RMCP3	3 $\frac{1}{2}$	0.216	3.068	SCH 40 PIPE	7.576	4	12
RMCP4	4 $\frac{1}{2}$	0.237	4.026	SCH 40 PIPE	10.790	4	12
RMCP5	5 $\frac{9}{16}$	0.258	5.047	SCH 40 PIPE	14.620	4	12
RMCP6	6 $\frac{5}{8}$	0.280	6.065	SCH 40 PIPE	18.970	4	12
RMCP8	8 $\frac{5}{8}$	0.322	7.981	SCH 40 PIPE	28.550	4	12

TABLE 3B41-II. Round aluminum (alloy 6061-T6).

Ident. no.	O.D.	Wall	Theoretical I.D.	Type	Wt. per ft.	Length for blkhd	Length for deck
RMCP2	2 $\frac{3}{8}$	0.154	2.067	SCH 40 PIPE	1.264	4	12
RMCP2.5	2 $\frac{7}{8}$	0.203	2.469	SCH 40 PIPE	2.004	4	12
RMCP3	3 $\frac{1}{2}$	0.216	3.068	SCH 40 PIPE	2.621	4	12
RMCP4	4 $\frac{1}{2}$	0.237	4.026	SCH 40 PIPE	3.733	4	12
RMCP5	5 $\frac{9}{16}$	0.258	5.047	SCH 40 PIPE	5.057	4	12
RMCP6	6 $\frac{5}{8}$	0.280	6.065	SCH 40 PIPE	6.564	4	12
RMCP8	8 $\frac{5}{8}$	0.322	7.981	SCH 40 PIPE	9.878	4	12

FIGURE 3B41. Round multi-cable penetrators - Continued.

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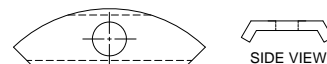


**COMPRESSION BOLT**

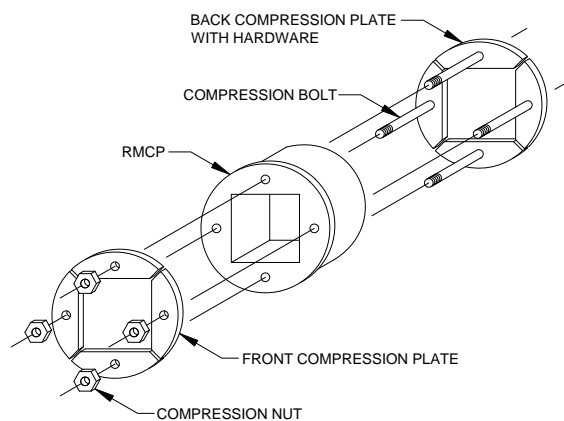
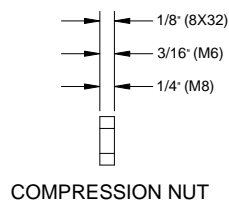
TABLE 3B41-III

1. #8-32 FLAT HEAD STRUX CLINCH BOLT (APPLICABLE ON SIZE 2, 2.5, AND 3 RMCP)
2. M-6 RD. HEAD STRUX CLINCH BOLT (APPLICABLE ON SIZE 4 AND 5 RMCP)
3. M-8 RD. HEAD STRUX CLINCH BOLT (APPLICABLE ON SIZES 6 AND 8 RMCP)

TABLE 3B41-IV HEX NUT UTILIZED FOR UNIT COMPRESSION	
5/16"	8X32 HEX NUT APPLICABLE WITH RMCP 2, 2.5, AND 3
3/8"	M6 HEX NUT APPLICABLE WITH RMCP4 AND RMCP5
1/2"	M8 HEX NUT APPLICABLE WITH RMCP6 AND RMCP8



**FRONT COMPRESSION PLATE**



**ROUND MULTI-CABLE PENETRATOR ASSEMBLY**

**NOTES:**

1. Bolts and back compression plates are factory assembled into one unit.
2. Insert block cable assignments are shown on figure 3B21.

FIGURE 3B41. Round multi-cable penetrators - Continued.



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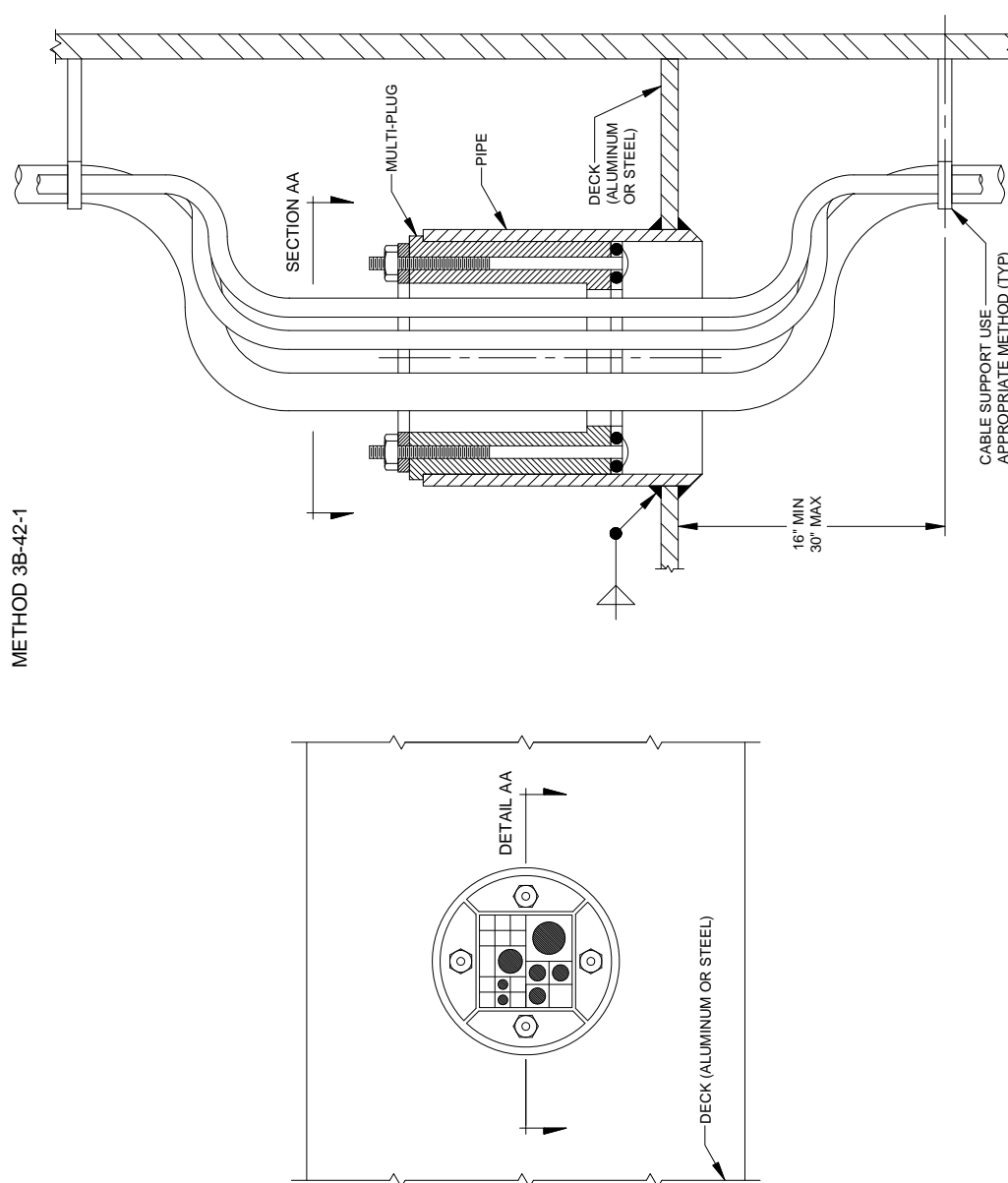


FIGURE 3B42. Multiple cable penetrators installation in steel or aluminum decks adjacent to bulkheads.

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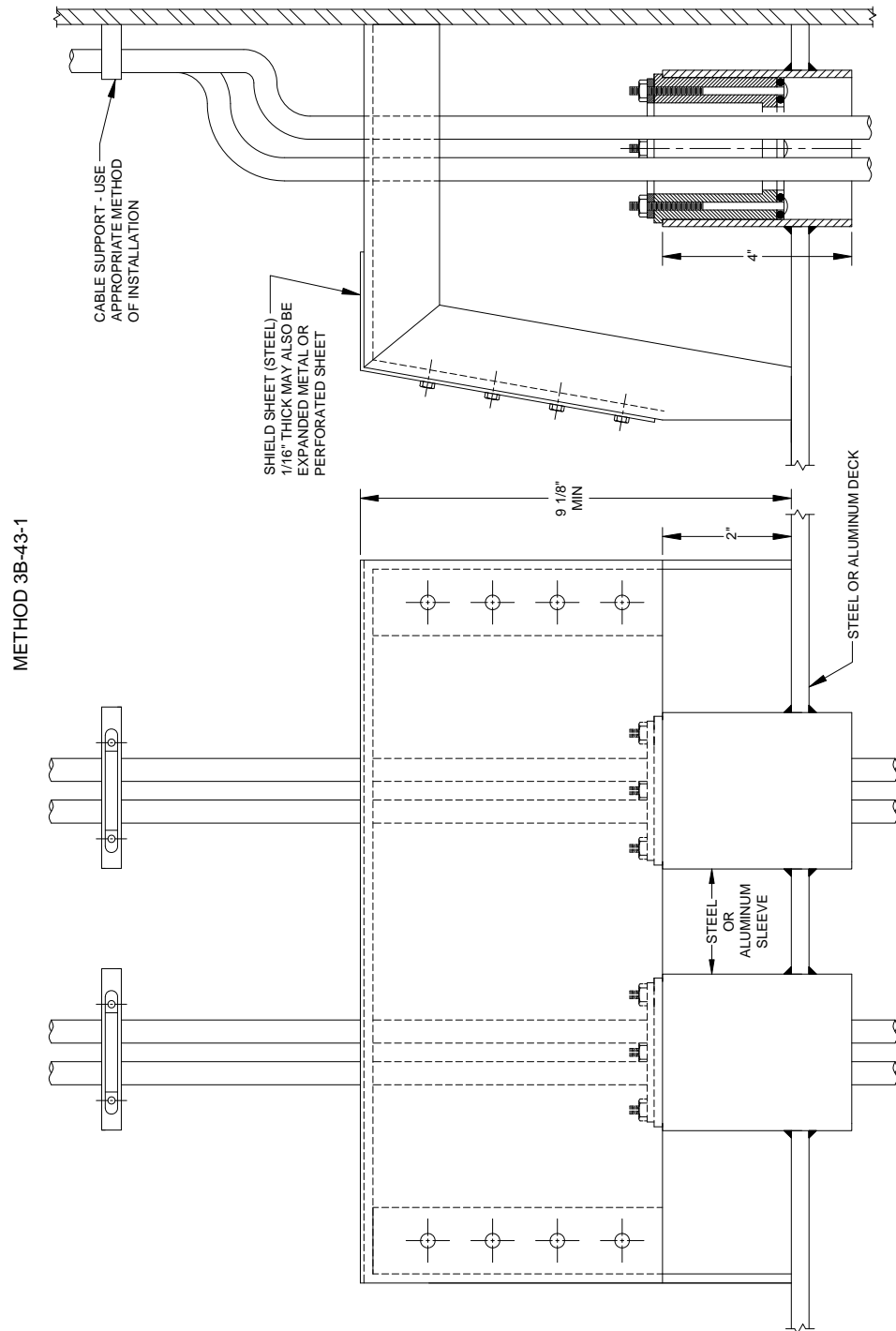


FIGURE 3B43. Round multiple cable penetrator shield.

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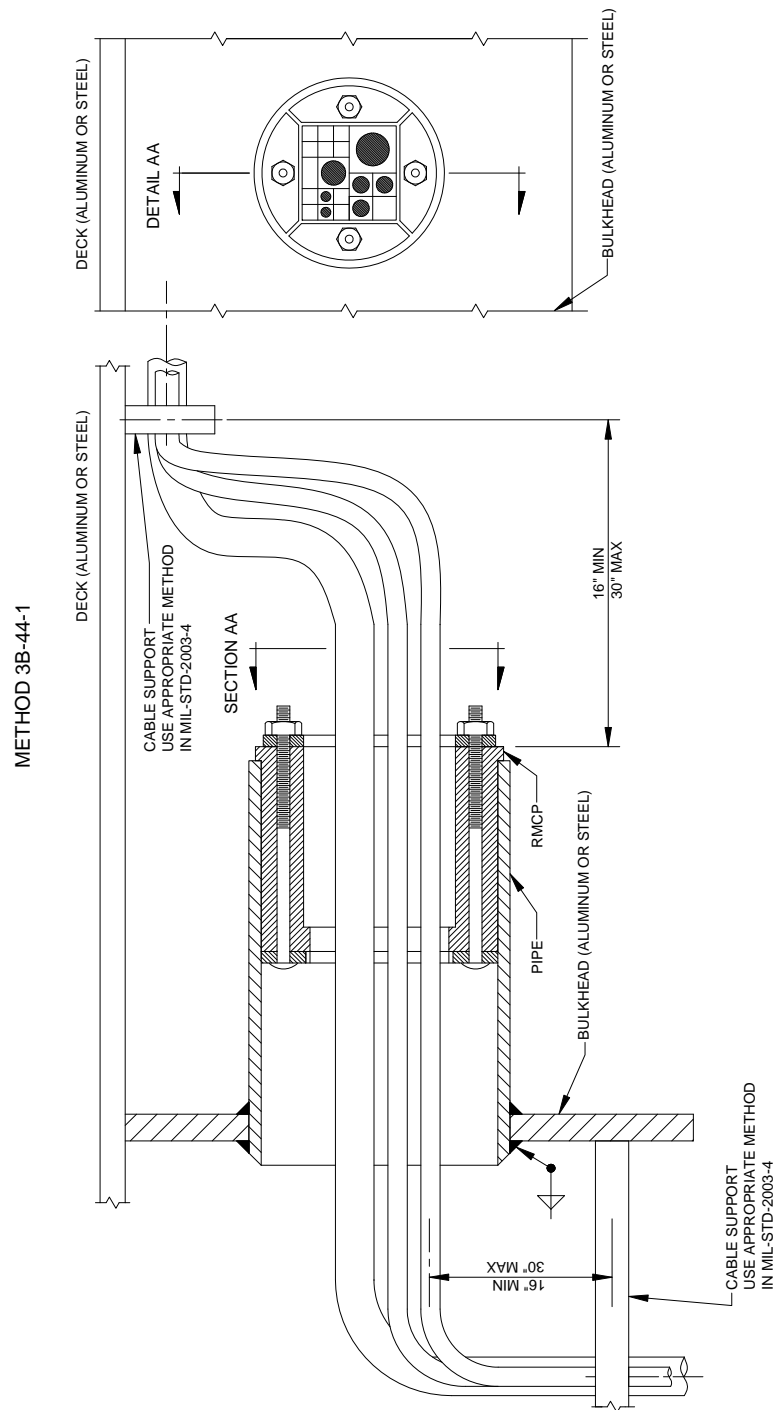


FIGURE 3B44. Round multiple cable penetrator installation in steel or aluminum bulkhead.

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METHOD 3B-45-1

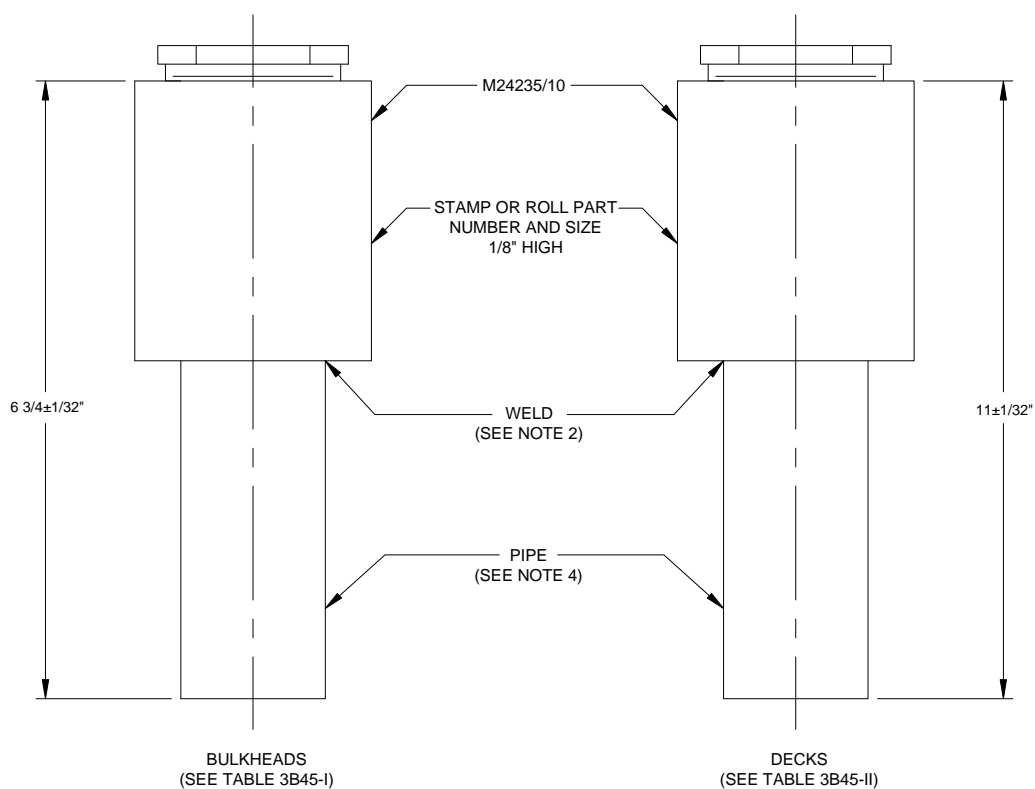


FIGURE 3B45. MIL-S-24235/10 stuffing tubes for steel decks and bulkheads with pipe protection (surface ships).

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TABLE 3B45-I. Bulkheads.

Part no.	Tube size	Stuffing tube	IPS pipe size	Pipe length <sup>1/</sup>
3B45B1	A	M24235/10-01	½ SCH 80-( <sup>27</sup> / <sub>32</sub> )	5
3B45B2	B	M24235/10-02	½ SCH 80-( <sup>27</sup> / <sub>32</sub> )	5
3B45B3	C	M24235/10-03	¾ SCH 40-( <sup>1</sup> / <sub>16</sub> )	5
3B45B4	D	M24235/10-04	¾ SCH 40-( <sup>1</sup> / <sub>16</sub> )	5
3B45B5	E	M24235/10-05	1 SCH 40-( <sup>21</sup> / <sub>64</sub> )	5
3B45B6	F	M24235/10-06	1 SCH 40-( <sup>21</sup> / <sub>64</sub> )	5
3B45B7	G	M24235/10-07	1 SCH 40-( <sup>21</sup> / <sub>64</sub> )	5 <sup>15</sup> / <sub>16</sub>
3B45B8	J	M24235/10-08	1¼ SCH 40-( <sup>21</sup> / <sub>32</sub> )	5 <sup>15</sup> / <sub>16</sub>
3B45B9	K	M24235/10-09	1¼ SCH 40-( <sup>21</sup> / <sub>32</sub> )	3 <sup>5</sup> / <sub>8</sub>
3B45B10	L	M24235/10-10	1¼ SCH 40-( <sup>21</sup> / <sub>32</sub> )	3 <sup>5</sup> / <sub>8</sub>
3B45B11	M	M24235/10-11	1½ SCH 40-( <sup>29</sup> / <sub>32</sub> )	3 <sup>5</sup> / <sub>8</sub>
3B45B12	N	M24235/10-12	1½ SCH 40-( <sup>29</sup> / <sub>32</sub> )	3 <sup>5</sup> / <sub>8</sub>
3B45B13	P	M24235/10-13	2 SCH 40-( <sup>5</sup> / <sub>16</sub> )	3 <sup>5</sup> / <sub>8</sub>
3B45B14	R	M24235/10-14	2 SCH 40-( <sup>5</sup> / <sub>16</sub> )	3 <sup>5</sup> / <sub>8</sub>
3B45B15	S	M24235/10-15	2 SCH 40-( <sup>5</sup> / <sub>16</sub> )	1 <sup>5</sup> / <sub>8</sub>
3B45B16	T	M24235/10-16	2½ SCH 40-( <sup>27</sup> / <sub>8</sub> )	1 <sup>5</sup> / <sub>8</sub>
3B45B17	V	M24235/10-17	2½ SCH 40-( <sup>27</sup> / <sub>8</sub> )	1 <sup>5</sup> / <sub>8</sub>
3B45B18	W	M24235/10-18	2½ SCH 40-( <sup>27</sup> / <sub>8</sub> )	1 <sup>5</sup> / <sub>8</sub>
3B45B19	X	M24235/10-19	3 SCH 40-( <sup>3</sup> / <sub>2</sub> )	1 <sup>5</sup> / <sub>8</sub>
3B45B20	Y	M24235/10-20	3 SCH 40-( <sup>3</sup> / <sub>2</sub> )	1 <sup>5</sup> / <sub>8</sub>
3B45B21	Z	M24235/10-21	3 SCH 40-( <sup>3</sup> / <sub>2</sub> )	1 <sup>5</sup> / <sub>8</sub>
3B45B22	AA	M24235/10-22	-	-
3B45B23	BB	M24235/10-23	-	-
NOTE: <sup>1/</sup> Pipe length shall be $\pm \frac{1}{32}$ .				

FIGURE 3B45. MIL-S-24235/10 stuffing tubes for steel decks and bulkheads with pipe protection (surface ships) - Continued.

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TABLE 3B45-II. Decks.

Part no.	Tube size	Stuffing tube	IPS pipe size	Pipe length <sup>1/</sup>
3B45D31	A	M24235/10-01	½ SCH 80-( <sup>27</sup> / <sub>32</sub> )	9¼
3B45D32	B	M24235/10-02	½ SCH 80-( <sup>27</sup> / <sub>32</sub> )	9¼
3B45D33	C	M24235/10-03	¾ SCH 40-(1 <sup>1</sup> / <sub>16</sub> )	9¼
3B45D34	D	M24235/10-04	¾ SCH 40-(1 <sup>1</sup> / <sub>16</sub> )	9¼
3B45D35	E	M24235/10-05	1 SCH 40-(1 <sup>21</sup> / <sub>64</sub> )	9¼
3B45D36	F	M24235/10-06	1 SCH 40-(1 <sup>21</sup> / <sub>64</sub> )	9¼
3B45D37	G	M24235/10-07	1 SCH 40-(1 <sup>21</sup> / <sub>64</sub> )	9 <sup>3</sup> / <sub>16</sub>
3B45D38	J	M24235/10-08	1¼ SCH 40-(1 <sup>21</sup> / <sub>32</sub> )	9 <sup>3</sup> / <sub>16</sub>
3B45D39	K	M24235/10-09	1¼ SCH 40-(1 <sup>21</sup> / <sub>32</sub> )	7 <sup>7</sup> / <sub>8</sub>
3B45D40	L	M24235/10-10	1¼ SCH 40-(1 <sup>21</sup> / <sub>32</sub> )	7 <sup>7</sup> / <sub>8</sub>
3B45D41	M	M24235/10-11	1½ SCH 40-(1 <sup>29</sup> / <sub>32</sub> )	7 <sup>7</sup> / <sub>8</sub>
3B45D42	N	M24235/10-12	1½ SCH 40-(1 <sup>29</sup> / <sub>32</sub> )	7 <sup>7</sup> / <sub>8</sub>
3B45D43	P	M24235/10-13	2 SCH 40-(1 <sup>5</sup> / <sub>16</sub> )	7 <sup>7</sup> / <sub>8</sub>
3B45D44	R	M24235/10-14	2 SCH 40-(1 <sup>5</sup> / <sub>16</sub> )	5 <sup>7</sup> / <sub>8</sub>
3B45D45	S	M24235/10-15	2 SCH 40-(1 <sup>5</sup> / <sub>16</sub> )	5 <sup>7</sup> / <sub>8</sub>
3B45D46	T	M24235/10-16	2½ SCH 40-(2 <sup>7</sup> / <sub>8</sub> )	5 <sup>7</sup> / <sub>8</sub>
3B45D47	V	M24235/10-17	2½ SCH 40-(2 <sup>7</sup> / <sub>8</sub> )	5 <sup>7</sup> / <sub>8</sub>
3B45D48	W	M24235/10-18	2½ SCH 40-(2 <sup>7</sup> / <sub>8</sub> )	5 <sup>7</sup> / <sub>8</sub>
3B45D49	X	M24235/10-19	3 SCH 40-(3½)	5 <sup>7</sup> / <sub>8</sub>
3B45D50	Y	M24235/10-20	3 SCH 40-(3½)	5 <sup>7</sup> / <sub>8</sub>
3B45D51	Z	M24235/10-21	3 SCH 40-(3½)	5 <sup>7</sup> / <sub>8</sub>
3B45D52	AA	M24235/10-22	3 SCH 40-(3½)	4 <sup>1</sup> / <sub>8</sub>
3B45D53	BB	M24235/10-23	3½ SCH 40-(4)	4 <sup>1</sup> / <sub>8</sub>
NOTE: <sup>1/</sup> Pipe length shall be ± <sup>1</sup> / <sub>32</sub> .				

NOTES:

1. This method is equal to and is an acceptable replacement for M24235/17 and /18.
2. Welding shall be in accordance with NAVSEA S9074-AR-GIB-010/278.
3. Break all sharp edges.
4. Pipe shall be in accordance with ASTM A106, Grade A.

FIGURE 3B45. MIL-S-24235/10 stuffing tubes for steel decks and bulkheads with pipe protection (surface ships) - Continued.

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**General:**

1. TW multi-cable penetrators are devices utilizing standard units and dimensions which are compatible with various numbers and sizes of cables that may be used whenever there is a need to seal cables penetrating watertight, airtight, and fireproof bulkheads and decks.
2. Few parts required to seal a wide range of cable diameters.
3. High degree of flexibility with interchangeable sealing block assemblies and a selection of different sizes of frames.
4. Frame:
  - a. One piece cast steel mounting frame to be welded directly into bulkhead or deck.
  - b. Cast keyways in mounting frame. Align and position sealing block assemblies.
  - c. Frames may be installed so that sealing block assemblies can be used inserted in either horizontal or vertical position.
5. Sealing block assembly:
  - a. Specially formulated elastomeric material between case-malleable pressure plates protects cable from mechanical damage, provides high pullout resistance, provides positive cable separation, and expands during fire to seal any voids left by burned cable insulation.
  - b. Interchangeable sealing block assemblies fit all TW multi-cable penetrator mounting frames.
  - c. Cast stops on front pressure plate prevents sealing block assemblies from slipping through frame during installation.
  - d. Sealing block assemblies are offered for all cable outside diameters from 0.250" to 3.500" (6.4 mm to 88.9 mm).
  - e. Depending on opening size range, a standard sealing block assembly will seal from two to eleven cables. It is possible to increase cable density with double-sided sealing block assemblies (see table 3B47-I, figure 3B47) sandwiched between halves of a standard assembly.
  - f. Reducers permit sealing block assemblies to accept cables with a smaller outside diameter than the specified range.
  - g. Plugs are to fill unused openings in sealing block assemblies.
6. Blank sealing block assemblies are used to fill unused spaces in frames, providing for future expansion.
7. Template all work from ship.
8. All welding and inspection to be in accordance with NAVSEA S9074-AR-GIB-010/278.
9. All painting to be in accordance with MIL-E-917.
10. The structural reinforcement shown on this drawing does not apply to flight deck bents, flight deck support structures, or other similar type structures on other ships. Such cases must be individually resolved with structural design.
11. Material or flat bar reinforcement is to be similar to material of bulkhead or deck.
12. This plan was developed to permit installation of multi-cable penetrator frame in watertight bulkheads and decks on surface ships.
13. Fillet weld reinforcement for T-2 weld joint shall be  $\frac{1}{8}$ " for plating up to 15.3# and  $\frac{1}{4}$ " for plating above 17.85#.

**Selection of parts:**

1. The selection of components is based on the quantity and size of cables going through the penetration. Once they are known, the sealing block assemblies and frames can be selected.
2. Group cables by outside diameter and rank from largest to smallest. Keeping in mind that sealing block assemblies are available in  $\frac{1}{4}$ " increments, group cables that fall within the same sealing block assembly outside diameter size range. Starting with the largest cable outside diameter, select the sealing block assemblies required. Specify reducers to accommodate smaller diameter cables and plugs to fill openings not used; all openings must be filled.
3. Total the frame spaces required for the specified sealing block assemblies and select the appropriate frame(s). Keep "spare" requirements in mind when specifying frame. Specify blank sealing block assemblies to fill unused frame space.

FIGURE 3B46. Multi-cable penetrators installation notes (type TW).

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






















**Installation of sealing block assemblies:**

1. Clean all inside surfaces of frame and edges of frame openings, removing all foreign materials.
2. Lubricate all inside surfaces of frames, with a silicone-based lubricant.
3. Move cables from immediate area of frame where first sealing block assembly will be installed. Group cables according to their diameter and with respect to sizes of openings in the sealing block assemblies to be installed. The diameter of openings of sealing block assemblies are in 1/4" increments (6.4 mm) and each is marked with their size range. Cables to be sealed in a given sealing block assembly need not all be of the same size. Reducers may be used with cables having an outside diameter up to 1/4" (6.4 mm) smaller than the range of the opening in the sealing block assembly.
4. Slide the first section of sealing block assembly into frame keyways, beginning at one end or bottom of frame. Be certain that flat side of this assembly is against inside surface of frame.
5. Arrange cables in slots of sealing block assembly section. While holding these cables in place, slide the mating section of sealing block into frame. CAUTION: When individual conductors of a power circuit are carried through a frame, all conductors of that circuit should be installed in the same sealing block assembly to avoid heating of the pressure plate due to electro-magnetic induction. Repeat operations of steps 4 and 5 with appropriate sealing block assemblies until all sealing block assemblies are in place.
6. Install reducers where needed. Fill unused frame spaces with black sealing block assemblies. Fill unused openings in the sealing block assemblies with correct size plugs. For holes one size larger than plug, use plug and reducer in combination. Be sure that plugs and reducers are fully inserted into openings of sealing block assemblies.
7. Assemble keeper bar over cast stops of front pressure plates.
8. Tighten all nuts only a few turns at a time until sealing material "rolls" into spaces between pressure plates of sealing block assemblies and between pressure plates and frame. This step to be performed when ambient temperature is at least 40 °F (4.5 °C).  
Uniform tightening of compression hardware is important. It can be properly done by noting how far threaded studs extend through nuts. In general, when assemblies are all installed, extension of threaded studs will be nearly the same for those assemblies occupying the same number of frame spaces.  
CAUTION: Torque values on nuts should not exceed 12 foot-pounds on 5/16 bolts, nor 45 foot-pounds on 7/16 bolts. These torque levels are not ordinarily required to affect a seal. However, if nuts are torqued to these values and a tighter seal is required, retorque after 24 hours.
9. Check tightness of assembly by placing a bright light source on one side of the assembly and inspecting it from the opposite side to see if any light is visible through the assembly. Any visible light indicates that proper seal has not been formed. Tighten compression hardware further.

FIGURE 3B46. Multi-cable penetrators installation notes (type TW) - Continued.



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OPENING SIZE RANGE	in. mm	0.250-0.500 6.4-12.7		0.500-0.750 12.7-19.1		0.750-1.000 19.1-25.4		1.000-1.250 25.4-31.8		1.250-1.500 31.8-38.1		1.500-1.750 38.1-44.5		1.750-2.000 44.5-50.8		2.000-2.250 50.8-57.2		2.250-2.500 57.2-63.5		2.500-2.750 63.5-69.9		2.750-3.000 69.9-75.20		3.000-3.250 75.20-82.60		3.250-3.500 82.60-88.90		BLANK-NO OPENINGS			
		11	11 ADDED	6	11 ADDED	6	5	4	3	3	3	2	2	2	2	2	2	NONE	NONE												
NO. OPENINGS IN BLOCK																															
SEALING BLOCK ASSEMBLY NUMBER																															
																															TWBS2111
FRAME SPACES REQUIRED		2	1	2	2	2	3	3	3	3	4	4	5	5	5	5	5	5	5	5	5	5	1	3							
PLUG CAT. #		TWP1		TWP3		TWP5		TWP6		TWP7		TWP8		TWP9		TWP10		TWP11		TWP12		TWP13		TWP14		TWP15		TWP16		TWP17	
REDUCER CAT. #		--	TWR2	TWR3	TWR4	TWR5	TWR55	TWR6	TWR66	TWR7	TWR77	TWR8	TWR88	TWR9	TWR99	TWR100	TWR101	TWR102	TWR103	TWR104	TWR105	TWR106	TWR107	TWR108	TWR109	TWR110	TWR111	TWR112	TWR113	TWR114	



**PLUGS**  
PLUGS WILL CLOSE ANY UNUSED  
OPENINGS IN SEALING BLOCK  
ASSEMBLIES. SEE TABLE ABOVE  
FOR PLUG NUMBERS WHICH MATCH  
SPECIFIC SEALING BLOCK ASSEMBLIES.



**REDUCERS**  
REDUCERS WILL REDUCE  
OPENINGS BY 0.250" (6.4 MM)  
IN SEALING BLOCK ASSEMBLIES.  
SEE TABLE ABOVE FOR REDUCER  
NUMBERS WHICH MATCH SPECIFIC  
SEALING BLOCK ASSEMBLIES.

Example for specifying information:

Cables specified: 8 power cables – sizes ranging from 1.875" to 2.180" outside diameter (O.D.)

31 control cables – sizes ranging from 0.490" to 0.945" O.D.

Spare capacity required: 25%

Step 1. Group cables by O.D. and rank from largest to smallest.

Cable qty.	Cable O.D.
2	2.180
2	2.140
2	1.875
1	0.945
4	0.890
5	0.700
7	0.637
6	0.550
8	0.490
<b>Total</b>	<b>37</b>

FIGURE 3B47. Multi-cable penetrators ordering/selection criteria (type TW).

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Step 2. Group cables that fall within the same sealing assembly O.D. range.

Cable qty.	Sealing block O.D. range
4	2.000-2.250
2 (with reducers)	2.000-2.250
5	0.750-1.000
18	0.500-0.750
8 (with reducers)	0.500-0.750
<u>Total</u>	<u>37</u>

Step 3. Starting with the largest cable O.D., select the quantity of sealing block assemblies required. Specify TWR reducers to accommodate smaller diameter cables where possible and TWP plugs to fill openings not used. (See example diagram.)

Sealing block assy cat. #	O.D. range	Number of openings	Cables to be sealed	Openings not used	Frame spaces req'd.
TWBS40366	2.000-2.250	3	3		4
TWBS40366	2.000-2.250	3	3		4
TWBS2063	0.750-1.000	6	5	1	2
TWBS2062	0.500-0.750	6	6		2
TWBS2112	0.500-0.750	11	11		2
TWBS2112	0.500-0.750	<u>11</u>	<u>9</u>	<u>2</u>	<u>2</u>
Totals		40	37	3	16

NOTE: In this example, two TWBS2112 sealing block assemblies are sandwiched between two halves of a TWBS2062. This dramatically increases cable density in minimum frame space. One TWP3 plug is required for unused opening in TWBS2063 and two TWP1 plugs are required for unused openings in the TWBS2122. Ten TWR2 and two TWR66 reducers are required for sealing cables of smaller diameter and for use in conjunction with TWP1 in 0.750 holes.

Step 4. Total the frame spaces required for sealing block assemblies and select appropriate size mounting frame(s). Factor in spare capacity required for future expansion.

Total frame spaces required	16
Specification requires 25%	
Spare capacity	<u>4</u>
TOTAL	20 spaces

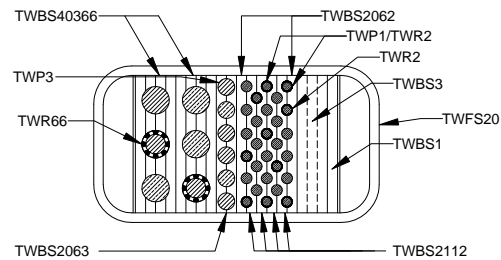
Selection: One TWFS20 mounting frame with total capacity of 20 spaces, one TWBS3, and one TWBS1 blank sealing block assembly to fill unused frame space. (Choice of frame could vary based on future expansion needs and/or specific cable arrangement.)

Step 5. Bill of materials for specification should read:

(1) TWFS 20	(1) TWBS2062	(2) TWP1	(10) TWR2	For sealing smaller dia. cables
(2) TWBS40368	(2) TWBS2112	(1) TWBS3		
(1) TWBS2063	(1) TWP3	(1) TWBS1	(2) TWR66	

FIGURE 3B47. Multi-cable penetrators ordering/selection criteria (type TW) - Continued.

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NOTES:

1. TWBS1111 and TWBS2112 sealing block assemblies are used to increase the density of the cable fill. Use these double-sided assemblies when the quantity of cables exceeds the number of openings in the TWBS2111 or TWBS2062 standard sealing block assemblies.
2. One or more of the double-sided assemblies can be sandwiched between halves of the standard assemblies. Make sure the TWBS1111 is matched with TWBS21111 and TWBS2112 with TWBS2062.

FIGURE 3B47. Multi-cable penetrators ordering/selection criteria (type TW) - Continued.

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METHOD 3B-48-1

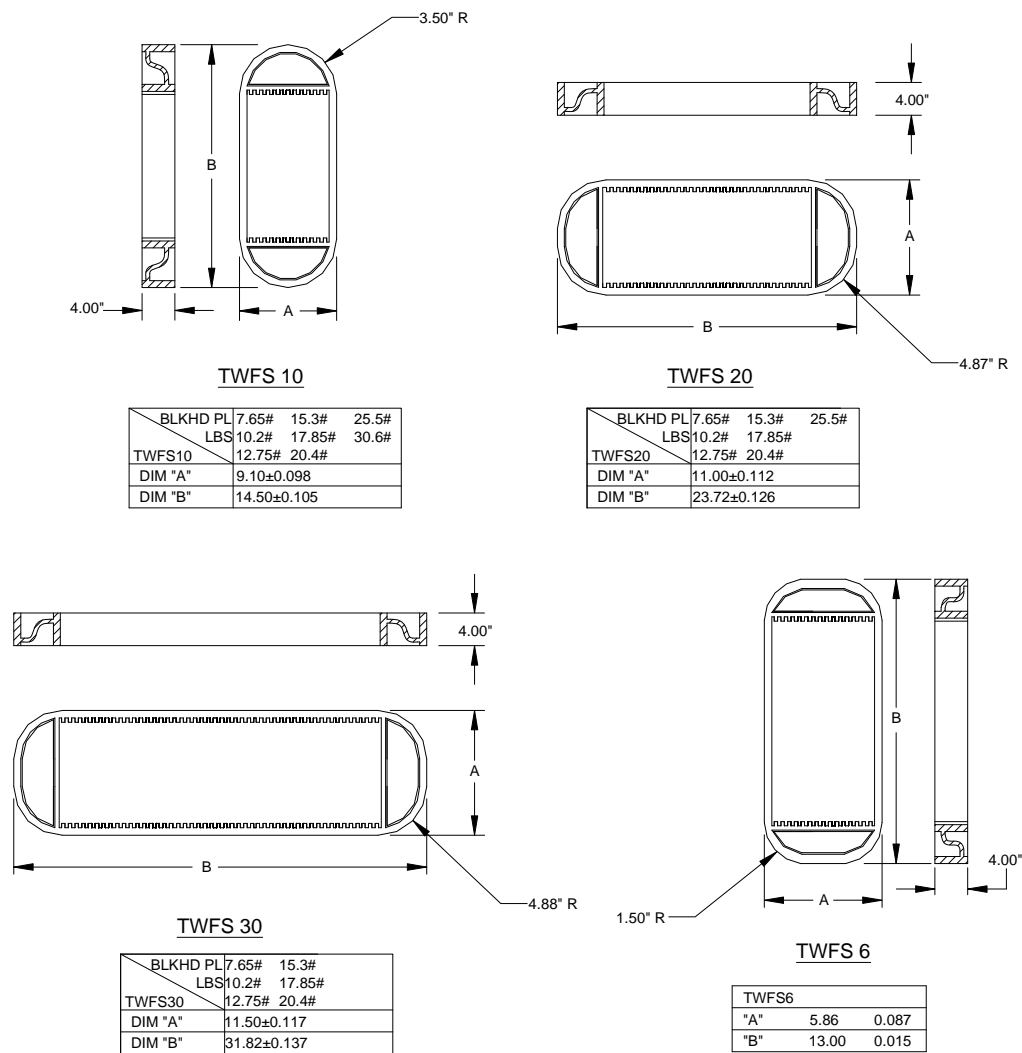


FIGURE 3B48. Multi-cable penetrator (type TW) frame details.

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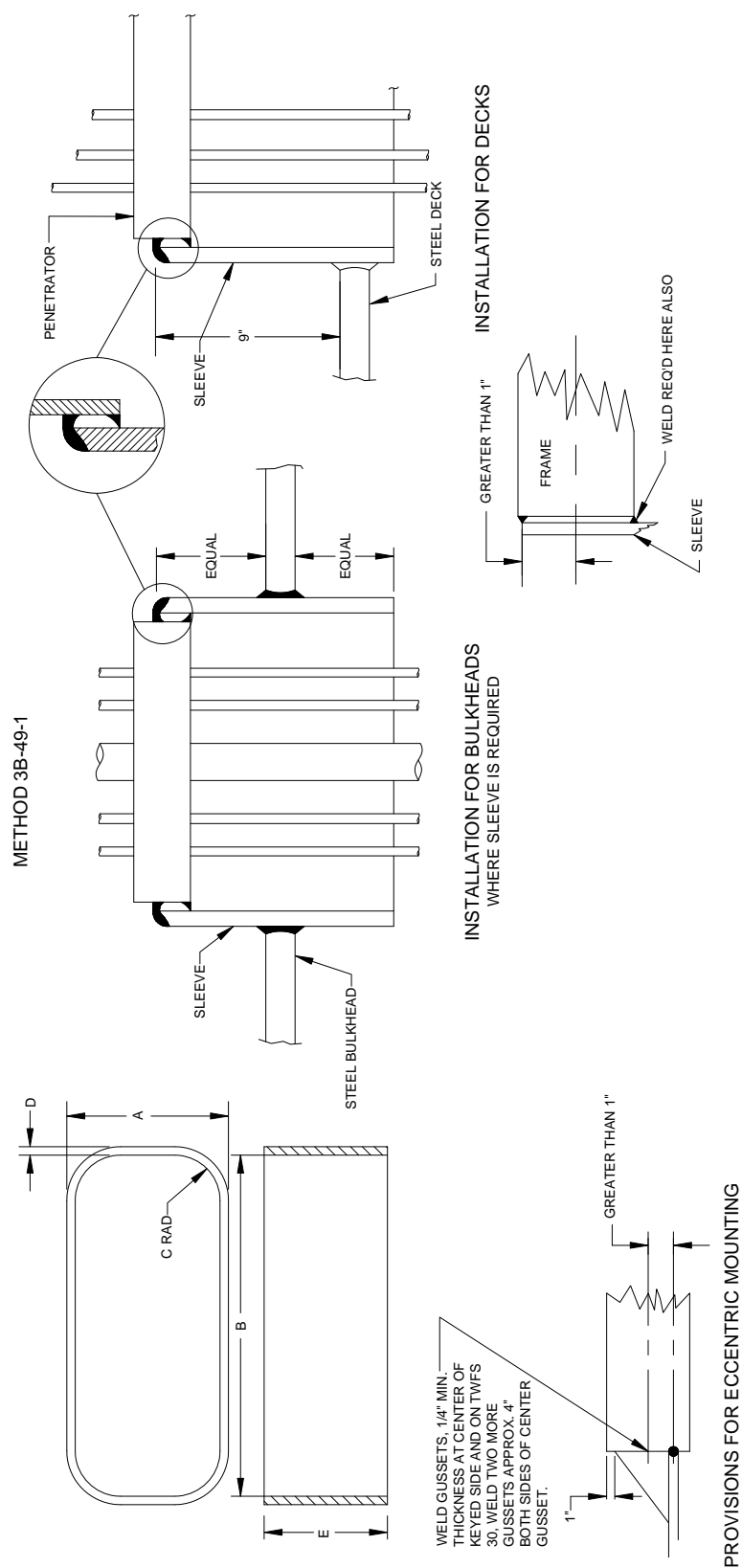


FIGURE 3B49. Multi-cable penetrator (type TW) sleeve installation.

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TABLE 3B49-I. Penetrator sleeve dimensions A, B, &amp; C.

Sleeve			
Penetrator \ Dimen.	"A"	"B"	"C"
TWFS 6	6.11	12.25	1.62
TWFS 10	9.36	14.75	3.63
TWFS 20	11.25	23.98	5.00
TWFS 30	11.75	32.08	5.00

TABLE 3B49-II. Penetrator sleeve dimensions D &amp; E for bulkhead installations.

Dk pl lbs \ Penetrator	Dimen. "D"					Dimen. "E"				
	7.65# 10.2# 12.75# 15.3# 17.85# 20.4#	25.5#	30.6#	35.7#	40.8#	7.65# 10.2# 12.75# 15.3# 17.85# 20.4#	25.5#	30.6#	35.7#	40.8#
TWFS 6	N/R	N/R	N/R	N/R	0.625	N/R	N/R	N/R	N/R	3.75
TWFS 10	N/R	N/R	N/R	0.625	0.625	N/R	N/R	N/R	3.75	4.50
TWFS 20	N/R	N/R	0.625	0.625	0.75	N/R	N/R	4.25	5.00	4.75
TWFS 30	N/R	0.625	0.625	0.75	0.75	N/R	4.00	4.75	5.00	5.50

TABLE 3B49-III. Penetrator sleeve dimensions D &amp; E for deck installations.

Dk pl lbs \ Penetrator	Dimen. "D" / Dimen. "E"									
	7.65#	10.20#	12.75#	15.3#	17.85#	20.4#	25.5#	30.6#	35.7#	40.8#
TWFS 6	¼ / 10.0	¼ / 10.25	⅙ / 10.25	⅕ / 10.5	⅜ / 10.5	⅜ / 10.75	⅞ / 11.0	½ / 11.25	½ / 11.5	⅝ / 11.5
TWFS 10	¼ / 10.0	⅕ / 10.5	⅕ / 10.5	⅜ / 10.5	⅜ / 11.0	⅜ / 11.0	½ / 11.5	½ / 11.5	⅝ / 12.0	⅝ / 12.0
TWFS 20	⅕ / 10.5	⅕ / 10.5	⅜ / 10.75	⅜ / 10.75	⅞ / 11.0	½ / 11.0	½ / 11.5	⅝ / 11.5	⅝ / 12.0	¾ / 12.0
TWFS 30	⅕ / 10.25	⅜ / 10.75	⅜ / 10.75	⅞ / 11.0	½ / 11.25	½ / 11.25	⅝ / 11.75	⅝ / 11.75	¾ / 12.25	¾ / 12.25

FIGURE 3B49. Multi-cable penetrator (type TW) sleeve installation - Continued.

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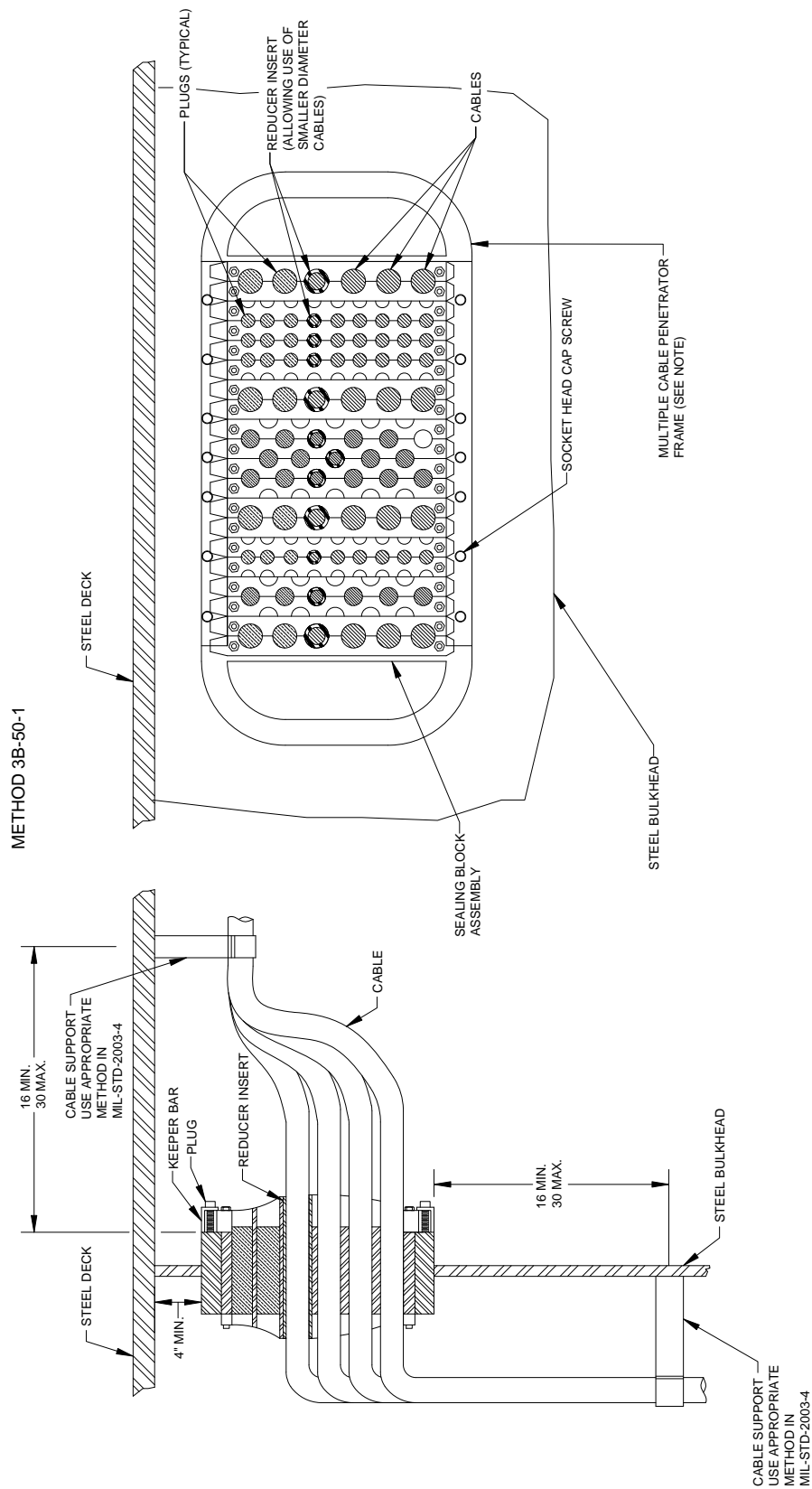


FIGURE 3B50. Multi-cable penetrators (type TW) typical installation in steel bulkhead.

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NOTE:

1. Multiple cable penetration penetrator frames are available in various sizes and arrangements; shown is a twenty space penetrator.

FIGURE 3B50. Multi-cable penetrators (type TW) typical installation in steel bulkhead - Continued.



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METHOD 3B-51-1

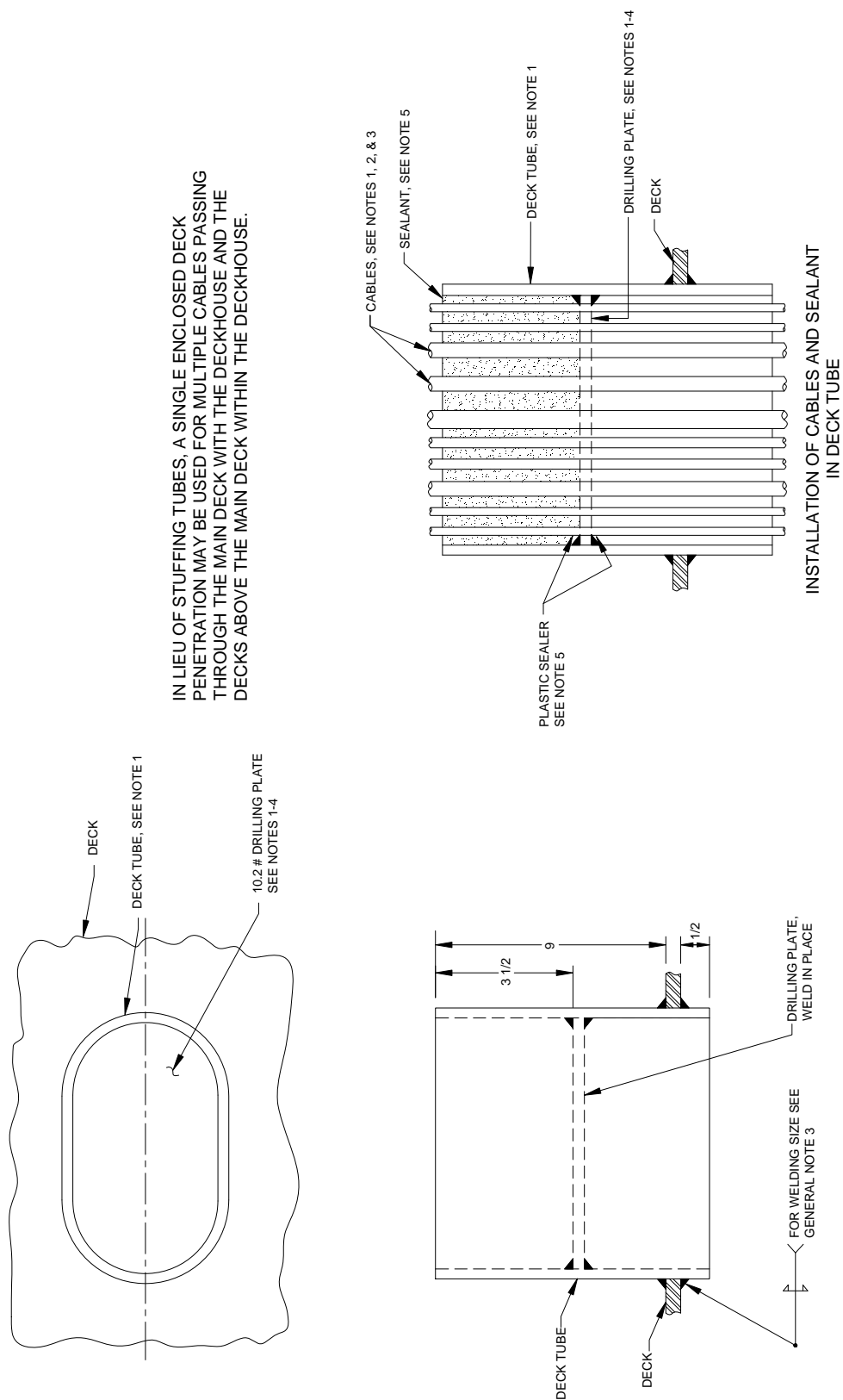


FIGURE 3B51. Community cable tube – watertight decks (poured seal).

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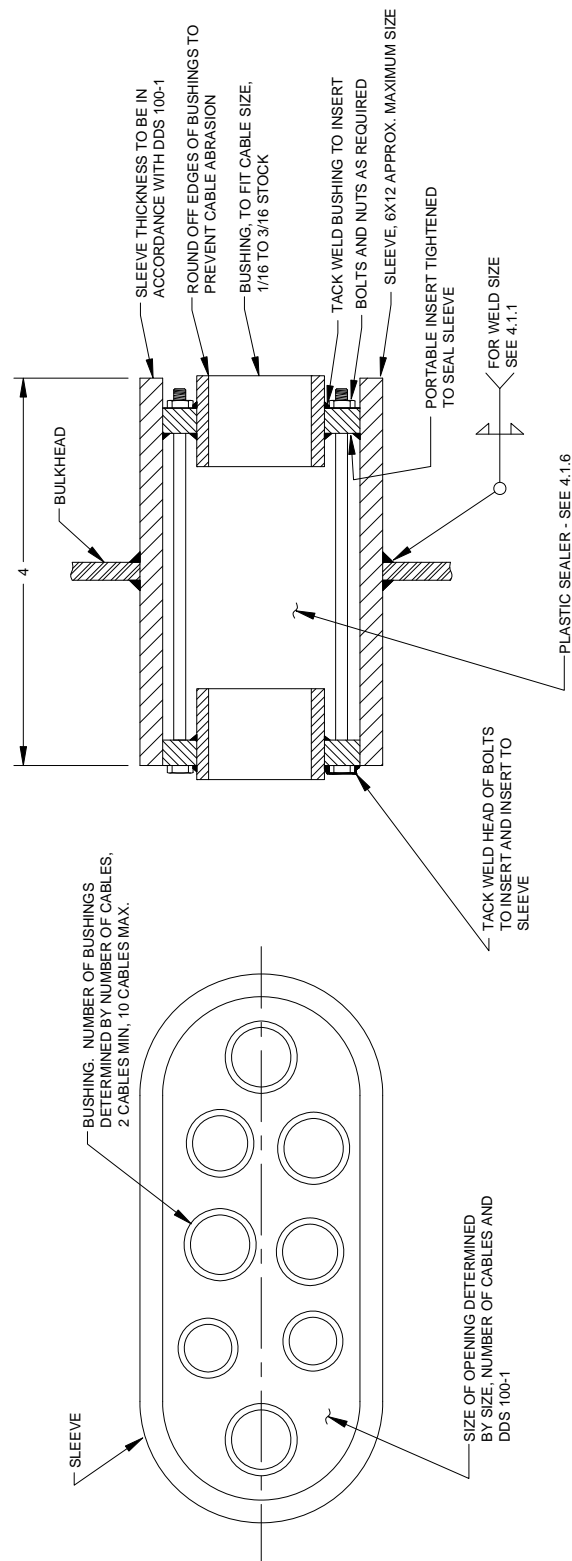
NOTES:

1. Deck tube wall thickness, maximum size, and maximum quantity of cables through drilling plate shall be in accordance with DDS 100-1.
2. Cable size and quantity, up to the maximum allowed, shall be determined by the shipyard.
3. Cable clearance holes shall be sized in accordance with standard shipyard practice. Holes to be rounded to prevent abrasion of cable.
4. Minimum clearance between holes in drilling plate and side of tube shall be  $\frac{3}{8}$ ".
5. Sealant shall be products Research & Chemical Corporation Sealant Number 498 or equal, with a minimum finished pour depth of 3". Prior to pouring sealant, gaps around the cables shall be packed with plastic sealer, MIL-I-3064, Type HF, to retain sealer when in the liquid state and serve as a permanent fire stop.
6. This method was canceled by ACN R240316Z dated July 1996. It has been retained in this revision since the shipyard may choose to use it in certain circumstances.

FIGURE 3B51. Community cable tube – watertight decks (poured seal) - Continued.

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METHOD 3B-52-1



NOTE: This method was canceled by ACN R240316Z dated July 1996. It has been retained in this revision since the shipyard may choose to use it in certain circumstances.

FIGURE 3B52. Community cable tube – watertight bulkheads (trowled seal).

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GROUP 3C – PENETRATIONS – STUFFING TUBES, GENERAL

C.1 SCOPE

C.1.1 Scope. This appendix describes the installation standard methods for stuffing tubes in general applications.

C.2. APPLICABLE DOCUMENTS

C.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.

C.2.2 Government documents.

C.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-S-24235	-	Stuffing Tubes, Metal, and Packing Assemblies for Electric Cables, General Specification for
MIL-S-24235/3	-	Stuffing Tubes, Metal, and Packing Assemblies for Electric Cables, Bulkhead, for Ballast Tanks
MIL-S-24235/9	-	Stuffing Tubes, Metal, and Packing Assemblies for Electric Cables, Brass and Steel, for Decks and Bulkheads with Pipe Protection
MIL-I-24391	-	Insulation Tape, Electrical, Plastic Pressure-Sensitive
MIL-I-24768/1	-	Insulation, Plastic, Laminated, Thermosetting, Glass-Cloth, Melamine-Resin (GME)

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-2003-4	-	Electric Plant Installation Standard Methods for Surface Ships and Submarines (Cableways)
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(Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch/> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

C.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 D710	-	Standard Specification for Vulcanized Fiber Sheets, Rods, and Tubes Used for Electrical Insulation
ASTM D4066	-	Standard Classification System for Nylon Injection and Extrusion Materials (PA)
ASTM D5948	-	Standard Specification for Molding Compounds, Thermosetting
ASTM F1836M	-	Standard Specification for Stuffing Tubes, Nylon, and Packing Assemblies (Metric)

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(Copies of these documents are available from ASTM International, 100 Barr Harbor Dr., P.O. Box C700, West Conshohocken, PA 19428-2959 or online at [www.astm.org](http://www.astm.org).)

SAE INTERNATIONAL

- |                 |  |
|-----------------|--|
| SAE-AMS-P-5516  | - Packing, Preformed, Petroleum Hydraulic Fluid Resistant, 160Mdf                                  |
| SAE-AMS-P-83461 | - Packing, Preformed, Petroleum Hydraulic Fluid Resistant, Improved Performance at 275Mdf (135Mdc) |

(Copies of these documents are available from SAE World Headquarters, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or online at [www.sae.org](http://www.sae.org).)

C.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.

### C.3 REQUIRED EQUIPMENT AND MATERIALS

C.3.1 Required equipment and materials. The required equipment and materials for the proper installation of stuffing tubes in general applications are as shown in the Appendix C methods.

### C.4 NOTES AND PROCEDURES

C.4.1 Dimensions. For figures and tables in this section, all dimensions are in inches unless otherwise noted.

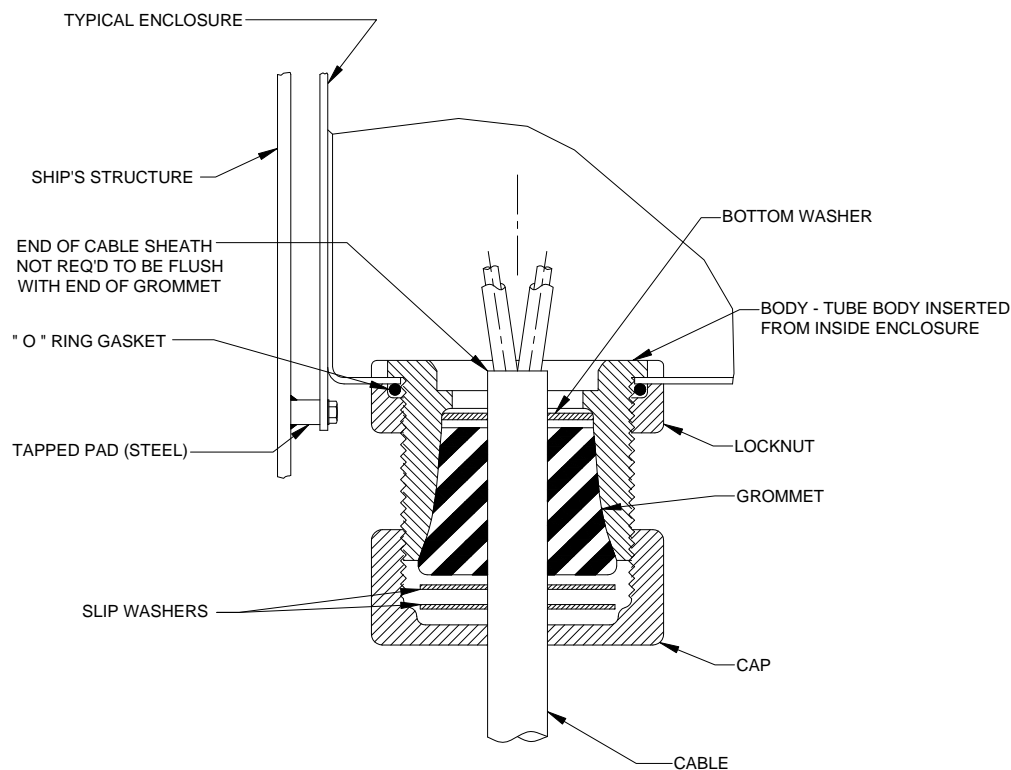
C.4.2 Figures. Table 3CI provides information for the figures in this group.

TABLE 3CI. Figures for general purpose stuffing tubes.

Figure number	Stuffing tube installation	Page
3C1	ASTM F1836M nylon stuffing tube typical installation	155
3C2	ASTM F1836M nylon stuffing tube assembly	157
3C3	ASTM F1836M nylon stuffing tube data	159
3C4	MIL-S-24235 stuffing tubes through refrigerated spaces (surface ships)	161
3C5	Stuffing tubes through refrigerated spaces	162
3C6	MIL-S-24235 stuffing tubes through refrigerated spaces (surface ships)	164
3C7	MIL-S-24235 stuffing tubes through refrigerated spaces (surface ships)	165
3C8	MIL-S-24235/3 community stuffing tubes for bulkheads (submarines or surface ships)	166
3C9	Stuffing tube inserts	167

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METHOD 3C-1-1  
APPLIES ALSO TO ANGLE TUBES



**Installation notes:**

1. Inspect the hole in the enclosure for conformance with the clearance hole required as shown on figure 3C3, and remove any burrs or irregularities.
2. For steel enclosures where roughness is greater than a 125 micro-inch finish (not required on aluminum enclosures), remove paint, and roughen surface with emery paper ½" wide around the hole on the exterior of the enclosure. Apply one coat of approved shipboard primer and allow to dry. Dust primer-coated surface with talc (soapstone). If primer is thoroughly dry at time of tube installation, omit talc.
3. With straight tube type, insert the stuffing tube body in the hole from inside the enclosure. If necessary, remove the interior fitting from the enclosure.
4. With angle and "Y" tubes, insert the stuffing tube body in the hole from the outside of the enclosure. Excess length protruding into the enclosure may be removed.
5. Screw locknut onto body and tighten against "O" ring gasket sufficiently to obtain plastic-to-metal contact of the stuffing tube and enclosure. In cases where this plastic-to-metal contact cannot be obtained, tighten the locknut until the threads start to skip. This will be considered a satisfactory indication of tightness (see installation note 13).
6. Remove sufficient armor (when present) from the cable for connections within the enclosure plus the body length and trim to suit (see figure 3C2). Avoid cutting cable sheath. Secure armor (when present) on cable a minimum of 1" from plastic tube face with pressure sensitive vinyl tape, MIL-I-24391, or by a shrink fit plastic sleeve. Place cap and the two slip washers over end of cable.
7. Prepare conductors for making electrical connection.
8. Place bottom washer over the end of cable against the end of the grommet.
9. Insert end of cable through stuffing tube and into the enclosure so as to seat the grommet into tube body.

FIGURE 3C1. ASTM F1836M nylon stuffing tube typical installation.

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APPENDIX C**Installation notes (continued):**

10. Screw on cap and tighten sufficiently to compress the grommet to form a tight seal between the cable and tube.
11. Hold tube body when tightening locknut to prevent turning. Also hold tube body when tightening cap to prevent breaking the watertight seal.
12. Sealing plugs in accordance with ASTM F1836M shall be used to seal nylon stuffing tubes from which the cables have been removed. When installing the plugs, the cable grommet shall be discarded, but the nylon washers shall be retained and left in the stuffing tube. Tube bonding agent is not required on plug.
13. "O" rings shall be furnished by the installing activity in accordance with SAE-AMS-P-83461 or SAE-AMS-P-5516, Class 2 oil-resistant type.
14. When necessary to pass airtight test, apply Silastic 731731 RTV silicone rubber, or equal, to the grommet.

**NOTES:**

1. In general, the sizes of the stuffing tubes do not change when end sealing of cable is required as shown on figure 1A15 or 1A18. In those instances where the addition of the required synthetic resin tubing increases the diameter of the bunched individual leads larger than the throat diameter of the assigned tube, the next larger tube size is specified.
2. In those cases where the bunched conductor leads cannot be accommodated in a standard grommet, use the sealing plug assigned to the tube. Freeze the plug to -40 °F and drill a hole to the dimension given, thus making a new grommet.

FIGURE 3C1. ASTM F1836M nylon stuffing tube typical installation - Continued.

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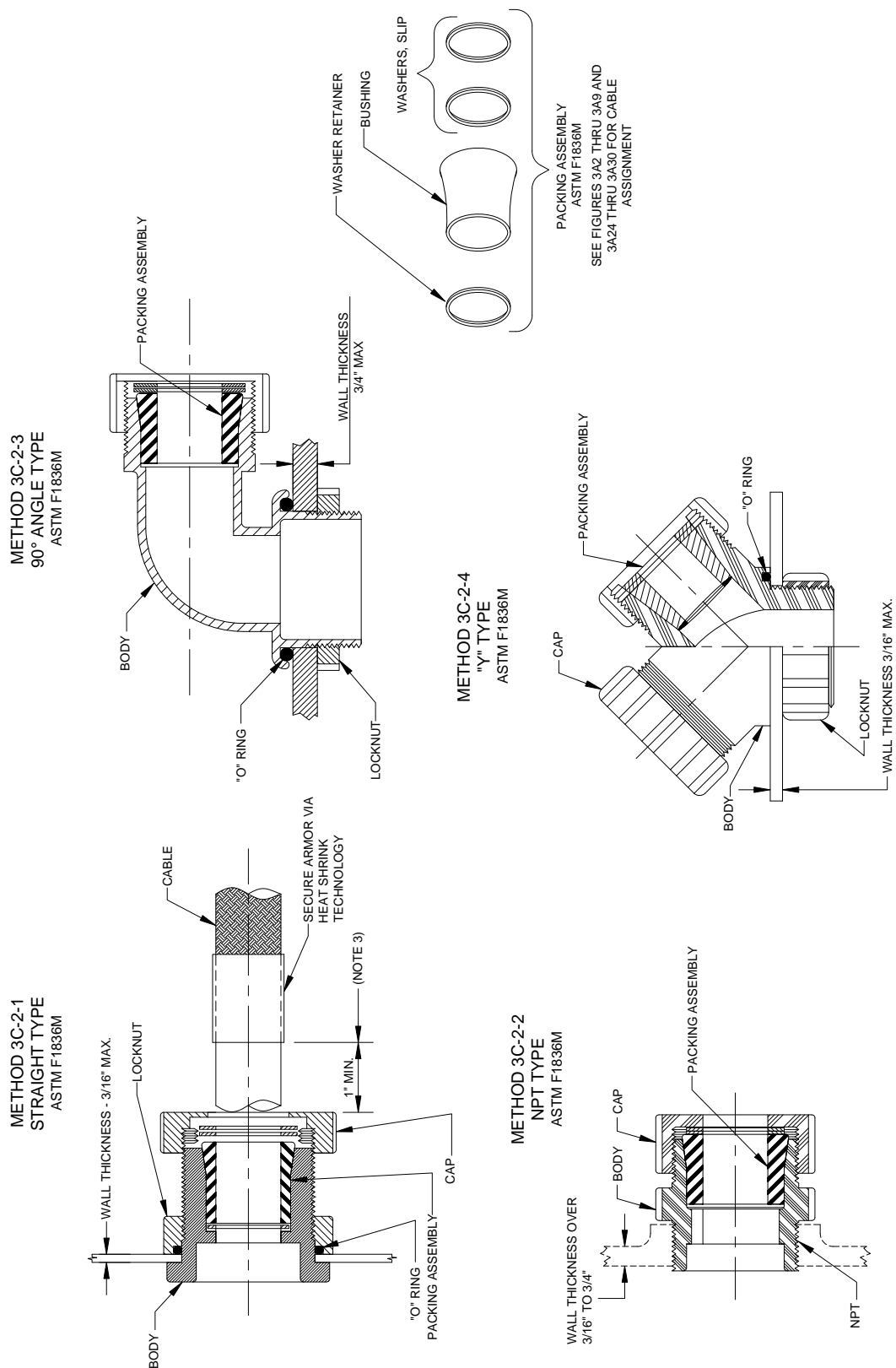


FIGURE 3C2. ASTM F1836M nylon stuffing tube assembly.



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NOTES:

1. Packing assemblies and "O" rings are not furnished with stuffing tubes. They must be ordered separately by installing activity to suit installations.
2. "O" rings are not required for non-watertight installations.
3. Secure armor (when present) on cable a minimum of 1" from plastic tube face with shrink fit plastic sleeve, metal squeeze rings similar to Burndy-Hyring may be used.
4. See figure 3C1 for general installation notes.

FIGURE 3C2. ASTM F1836M nylon stuffing tube assembly - Continued.

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**Stuffing tube sizes**

TABLE 3C3-I. Straight tube sizes 1 through 9, ASTM F1836M.

<b>Straight tube</b>					
<b>Tube size</b>	<b>ASTM F1836M part number</b>	<b>National stock number (NSN)</b>	<b>O ring</b>		<b>Clearance hole</b>
			<b>ARP number</b>	<b>National stock number (NSN)</b>	
1	1-001	5975-00-296-4092	568-212	5330-00-187-3638	0.885
2	1-002	5975-00-296-4093	568-214	5330-00-196-5382	1.010
3	1-003	5975-00-877-6957	568-216	5330-00-198-6177	1.135
4*	1-004	5975-00-296-4095	568-218	5330-00-196-5385	1.260
4T	1-005	5975-00-989-5046	568-220	5330-00-198-6186	1.385
5	1-006	5975-00-296-4096	568-226	5330-00-256-0190	2.010
6	1-007	5975-00-296-4097	568-230	5330-00-054-6866	2.510
7	1-008	5975-00-296-4098	568-232	5330-00-194-3720	2.760
8	1-009	5975-00-296-4099	568-236	5330-00-231-4107	3.260
9	1-010	5975-00-296-4100	568-242	5330-00-194-3737	4.010

TABLE 3C3-II. Angle tube sizes 1 through 6, ASTM F1836M.

<b>Angle tube</b>					
<b>Tube size</b>	<b>ASTM F1836M part number</b>	<b>National stock number (NSN)</b>	<b>O ring</b>		<b>Clearance hole</b>
			<b>ARP number</b>	<b>National stock number (NSN)</b>	
1	2-001	5975-00-503-4694	568-212	5330-00-187-3638	0.885
2	2-002	5975-00-503-4693	568-212	5330-00-187-3638	0.885
3	2-003	5975-00-877-6956	568-216	5330-00-198-6177	1.135
4	2-004	5975-00-503-4692	568-218	5330-00-171-9916	1.260
4T	2-005	5975-00-989-5045	568-218	5330-00-196-5385	1.260
5	2-006	5975-00-503-4695	568-226	5330-00-256-0190	2.010
6	2-007	5975-00-503-4697	568-230	5330-00-054-6866	2.510

FIGURE 3C3. ASTM F1836M nylon stuffing tube data.

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TABLE 3C3-III. NPT tube sizes 1 through 9, ASTM F1836M.

<b>NPT tube</b>			
<b>Tube size</b>	<b>ASTM F1836M part number</b>	<b>National stock number (NSN)</b>	<b>NPT tap</b>
1	3-001	5975-00-808-4063	1/2
2	3-002	5975-00-808-4064	3/4
3	3-003	5975-00-877-6955	1
4T	3-004	5975-00-752-2945	1
5	3-005	5975-00-808-9272	1-1/2
6	3-006	5975-00-808-4066	2
7	3-007	5975-00-808-4067	2-1/2
8	3-008	5975-00-808-4068	3
9	3-009	5975-00-808-4069	3-1/2

TABLE 3C3-IV. “Y” type tube sizes 1 through 4, ASTM F1836M.

<b>“Y” tube</b>					
<b>Tube size</b>	<b>ASTM F1836M part number</b>	<b>National stock number (NSN)</b>	<b>O ring</b>		<b>Clearance hole</b>
			<b>ARP number</b>	<b>National stock number (NSN)</b>	
1	4-01	5975-00-782-6139	568-212	5330-00-187-3638	0.885
2	4-02	5975-00-782-6140	568-214	5330-00-196-5382	1.010
3	4-03	5975-00-782-6141	568-216	5330-00-198-6177	1.135
4T	4-04	5975-00-782-6142	568-220	5330-00-198-6186	1.385

NOTE:

1. Size 4 straight and angle tube is for replacement only in existing installations where size 4T is not interchangeable.

FIGURE 3C3. ASTM F1836M nylon stuffing tube data - Continued.

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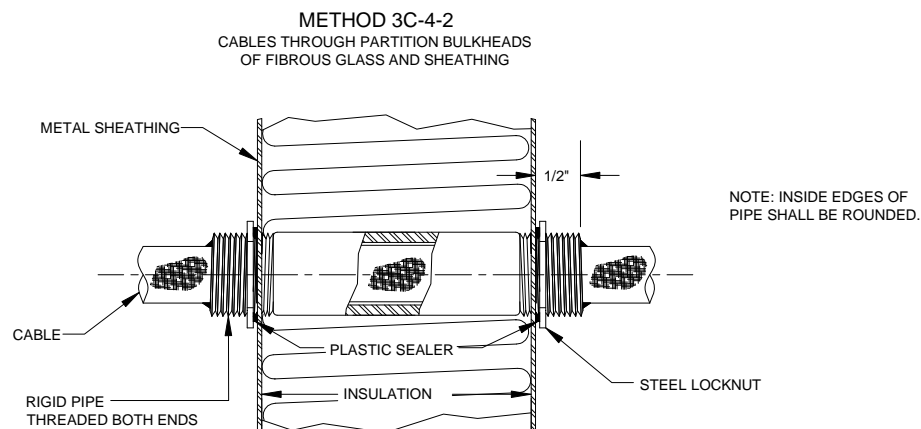
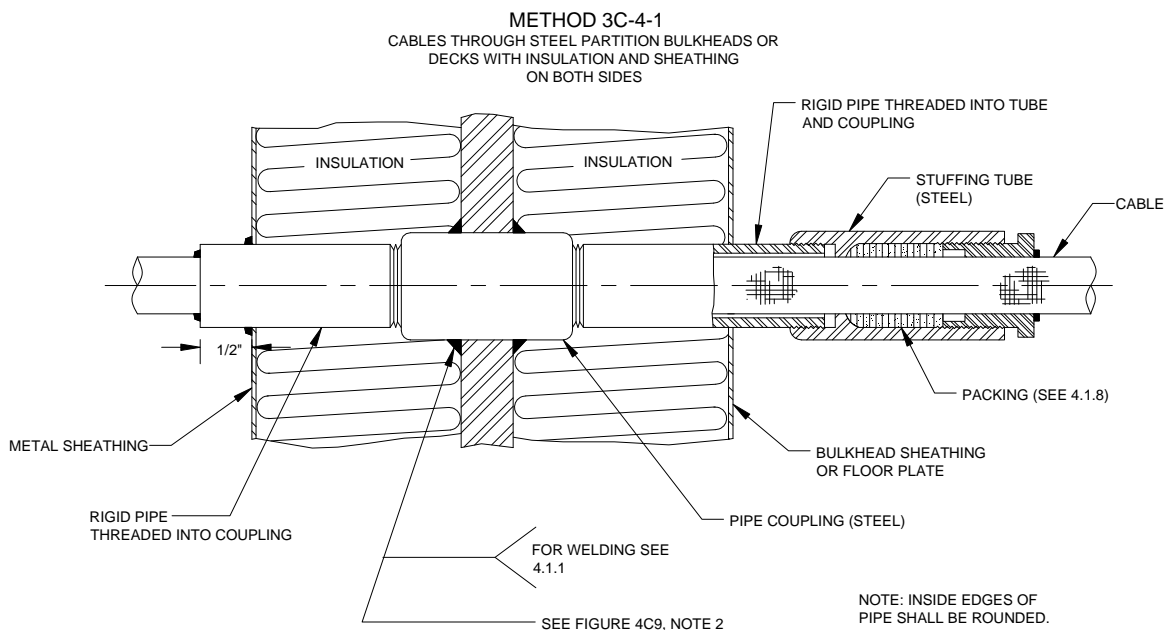


FIGURE 3C4. MIL-S-24235 stuffing tubes through refrigerated spaces (surface ships).

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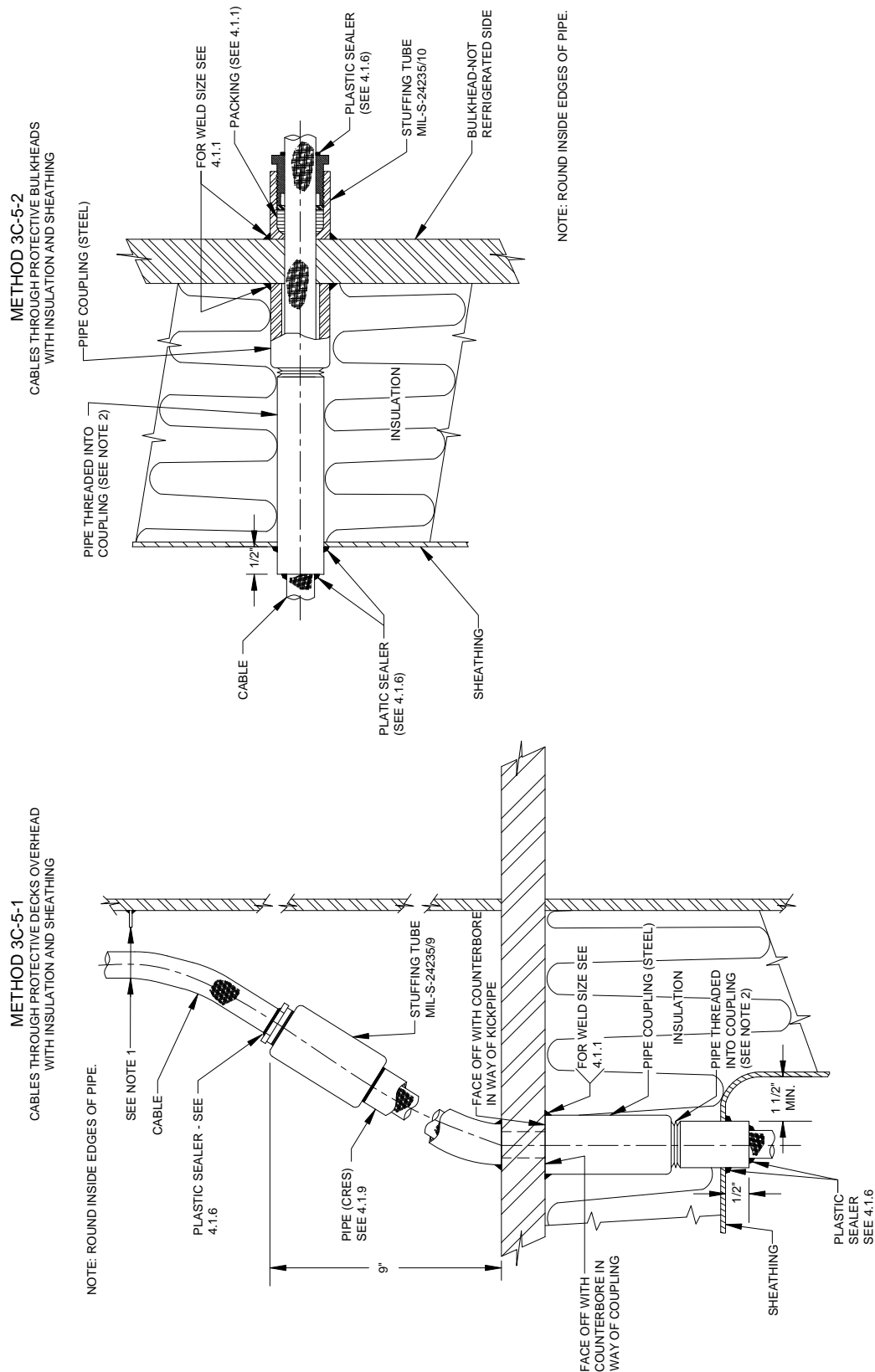


FIGURE 3C5. Stuffing tubes through refrigerated spaces.

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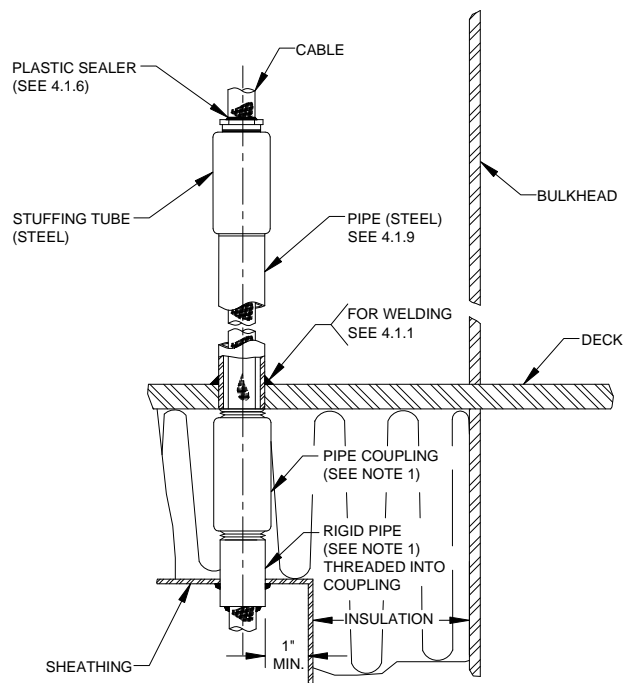
NOTES:

1. For suitable cable support, see MIL-STD-2003-4.
2. Plastic pipe and fitting shall be nylon.

FIGURE 3C5. Stuffing tubes through refrigerated spaces - Continued.

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APPENDIX C

METHOD 3C-6-1  
CABLES THROUGH OVERHEAD STEEL DECKS  
WITH INSULATION AND SHEATHING



NOTE: ROUND INSIDE EDGES OF PIPE.

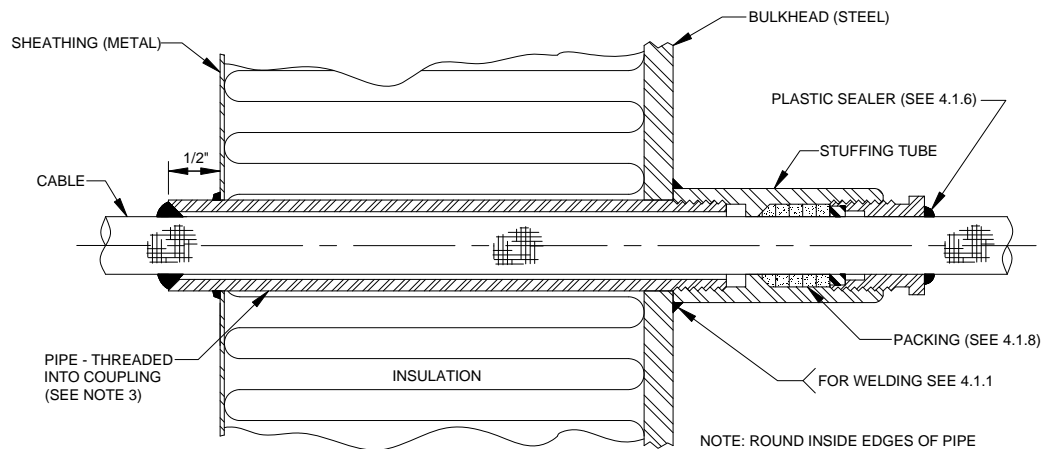
NOTE:

1. Plastic pipe and fittings shall be nylon.

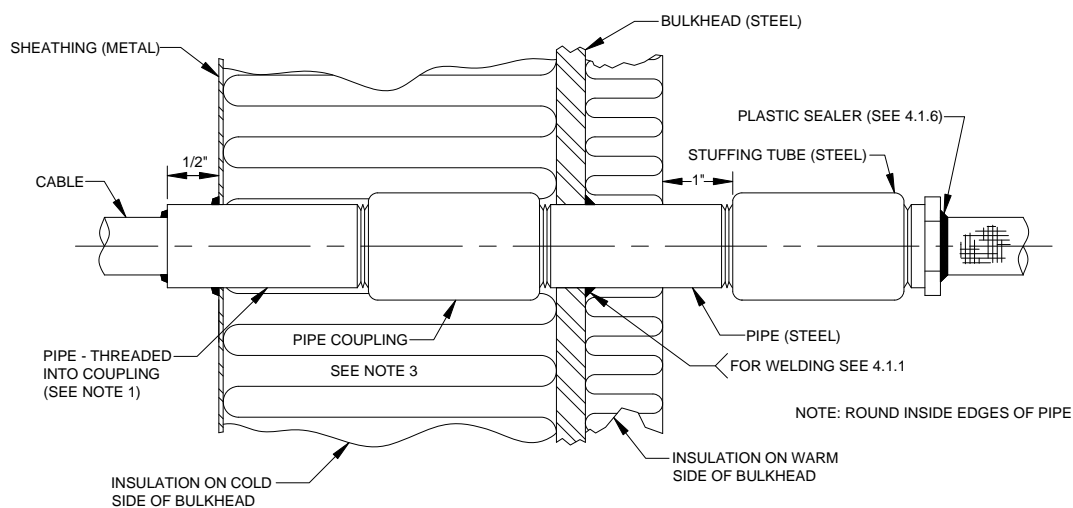
FIGURE 3C6. MIL-S-24235 stuffing tubes through refrigerated spaces (surface ships).

MIL-STD-2003-3A(SH)  
APPENDIX C

METHOD 3C-7-1  
CABLES THROUGH BOUNDARY BULKHEADS OR OVERHEAD  
DECKS WITH INSULATION AND SHEATHING ON  
THE COLD SIDE



METHOD 3C-7-2  
CABLES THROUGH BOUNDARY BULKHEADS OR OVERHEAD  
DECKS WITH INSULATION AND SHEATHING ON THE  
COLD SIDE AND INSULATION WITHOUT SHEATHING  
ON THE WARM SIDE



NOTES:

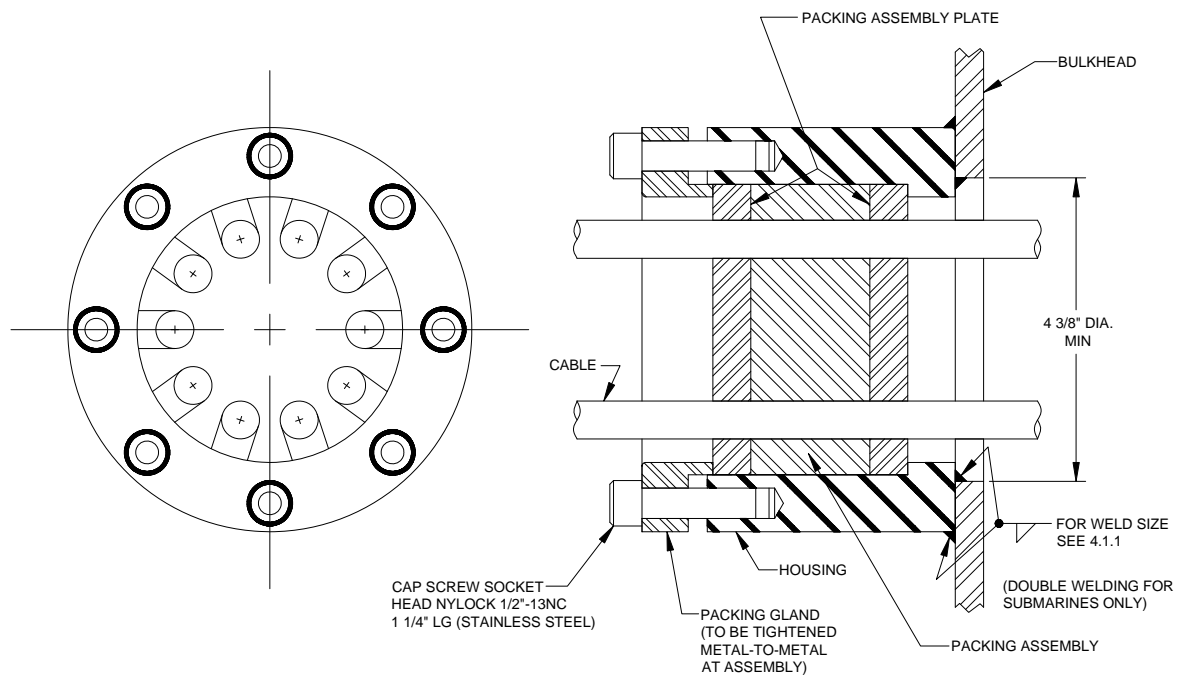
1. Cable entrance to refrigerated spaces preferably through bulkheads or overhead decks.
2. Stuffing tubes are located preferably on the warm side of boundary bulkheads or overhead decks.
3. Plastic pipe and fittings shall be nylon.

FIGURE 3C7. MIL-S-24235 stuffing tubes through refrigerated spaces (surface ships).



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APPENDIX C

METHOD 3C-8-1



NOTES:

1. The design shown hereon is for use for passing cables through ballast tank bulkheads for submarines and is a typical installation only. Bulkhead fittings for submarines shall withstand maximum pressure of 45 psi and conform to MIL-S-24235.
2. This method is also applicable to surface ships by varying size to suit the number and size of cables to be accommodated, and the specified material may be changed to suit the shipbuilder, except that grommet shall remain Neoprene of 40-45 durometer and gland ring shall be brass. Other changes may be made to lighten the construction such as decrease of housing thickness and flange thickness, providing gland ring is threaded into housing using the same construction used for single cable stuffing tubes. Design for surface ships shall withstand minimum pressure of 15 psi.
3. For wood construction, housing shall be designed with a suitable flange for securing to wood bulkhead.
4. Radial staggering of cables to attain maximum acceptance of cables in minimum space is satisfactory. However, requirements of GSS regarding bulkhead strength and tightness must be maintained.
5. This sheet showing Method 3C-8-1 is considered a working plan. The submission or preparation of plans showing details of accomplishing the method or the permissive notes on this sheet is not required.
6. Position stuffing tube so that packing gland is on the most accessible side of ballast tank bulkhead.

FIGURE 3C8. MIL-S-24235/3 community stuffing tubes for bulkheads (submarines or surface ships).

MIL-STD-2003-3A(SH)  
APPENDIX C

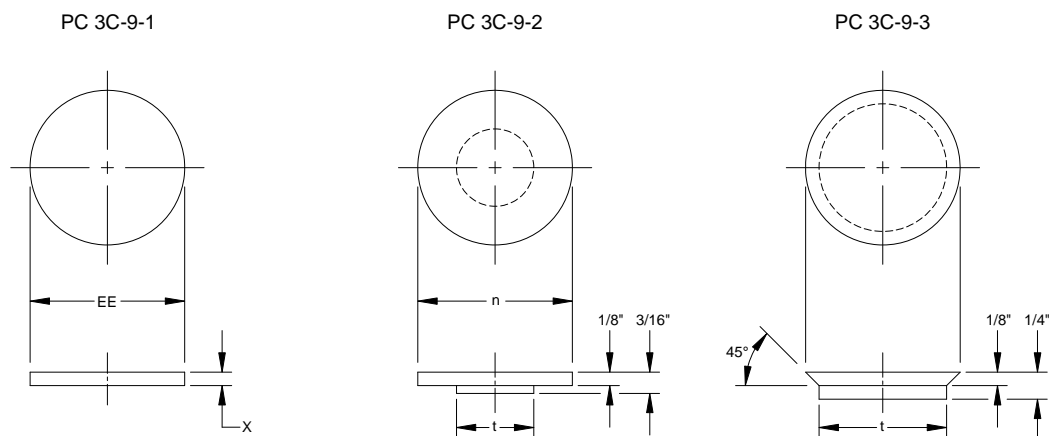


TABLE 3C9-I. Inserts PC 3C-9-1.

Size	Dimensions	
	EE	X
1	0.550	$\frac{3}{32}$
2	0.615	
3	0.755	
4	0.896	
5	1.383	$\frac{1}{8}$
6	1.740	
7	1.927	
8	2.302	
9	3.240	

FIGURE 3C9. Stuffing tube inserts.

MIL-STD-2003-3A(SH)  
APPENDIX C

TABLE 3C9-II. Inserts PCs 3C-9-2 and 3C-9-3.

Size	Dimensions	
	n	t
A	$\frac{3}{4}$	$\frac{3}{8}$
B	$\frac{7}{8}$	$\frac{15}{32}$
C	1	$\frac{19}{32}$
D	$1\frac{1}{8}$	$\frac{23}{32}$
E	$1\frac{1}{8}$	$\frac{25}{32}$
F	$1\frac{3}{16}$	$\frac{13}{16}$
G	$1\frac{3}{8}$	$\frac{29}{32}$
J	$1\frac{1}{2}$	$1\frac{1}{32}$
K	$1\frac{5}{8}$	$1\frac{1}{8}$
L	$1\frac{11}{16}$	$1\frac{7}{32}$
M	$1\frac{7}{8}$	$1\frac{3}{8}$
N	$1\frac{15}{16}$	$1\frac{15}{32}$
P	$2\frac{1}{16}$	$1\frac{19}{32}$
R	$2\frac{3}{16}$	$1\frac{23}{32}$
S	$2\frac{9}{16}$	$1\frac{27}{32}$
T	$2\frac{3}{4}$	$2\frac{1}{32}$
V	$2\frac{7}{8}$	$2\frac{5}{32}$
W	3	$2\frac{9}{32}$
X	$3\frac{1}{8}$	$2\frac{15}{32}$
Y	$3\frac{1}{4}$	$2\frac{9}{16}$
Z	$3\frac{7}{16}$	$2\frac{3}{4}$
AA	$3\frac{5}{8}$	$2\frac{27}{32}$

NOTES:

- For method of sealing cable ends, see 4.1.6.
- For cable assignment, see figure 3C3.
- Insert, PC 3C-9-1 used with nylon stuffing tubes, ASTM F1836M.
- Insert, PCs 3C-9-2 and 3C-9-3 used with steel stuffing tubes, MIL-S-24235, drawn and machined respectively.
- Insert PCs 3C-9-1, 3C-9-2, and 3C-9-3 may be made of the following materials:
  - Polyamide (nylon) plastic, ASTM D4066.
  - Laminated plastic, MIL-I-24768/1. The laminations shall be parallel to the faces of the insert.
  - Molded phenolic, Type MAJ-60, ASTM D5948.
  - Fiber, ASTM D710, Grade "CH", Form "B" or "S". The fiber shall be given a coat of insulating varnish, NEMA RE2.

FIGURE 3C9. Stuffing tube inserts - Continued.

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APPENDIX D

GROUP 3D – PENETRATIONS – KICKPIPES

D.1 SCOPE

D.1.1 Scope. This appendix describes the installation standard methods for kickpipes.

D.2. APPLICABLE DOCUMENTS

D.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.

D.2.2 Government documents.

D.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-S-24235	-	Stuffing Tubes, Metal, and Packing Assemblies for Electric Cables, General Specification for
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-24235/18	-	Stuffing Tubes, Metal, and Packing Assemblies for Electric Cables, Swage Type, Reduced Diameter, Steel and Aluminum, for Deck and Bulkheads with Pipe Protection

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-2003-4	-	Electric Plant Installation Standard Methods for Surface Ships and Submarines (Cableways)
----------------	---	---

(Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch/> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

D.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 F1836M	-	Standard Specification for Stuffing Tubes, Nylon, and Packing Assemblies (Metric)
-------------	---	---

(Copies of these documents are available from ASTM International, 100 Barr Harbor Dr., P.O. Box C700, West Conshohocken, PA 19428-2959 or online at [www.astm.org](http://www.astm.org).)

SAE INTERNATIONAL

SAE-AMS-WW-T-700/6	-	Tube, Aluminum Alloy, Drawn, Seamless, 6061
--------------------	---	---

(Copies of these documents are available from SAE World Headquarters, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or online at [www.sae.org](http://www.sae.org).)

D.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.

MIL-STD-2003-3A(SH)  
APPENDIX D

### D.3 REQUIRED EQUIPMENT AND MATERIALS

D.3.1 Required equipment and materials. The required equipment and materials for the proper installation of kickpipes are as shown in the Appendix D methods.

### D.4 NOTES AND PROCEDURES

D.4.1 Dimensions. For figures and tables in this section, all dimensions are in inches unless otherwise noted.

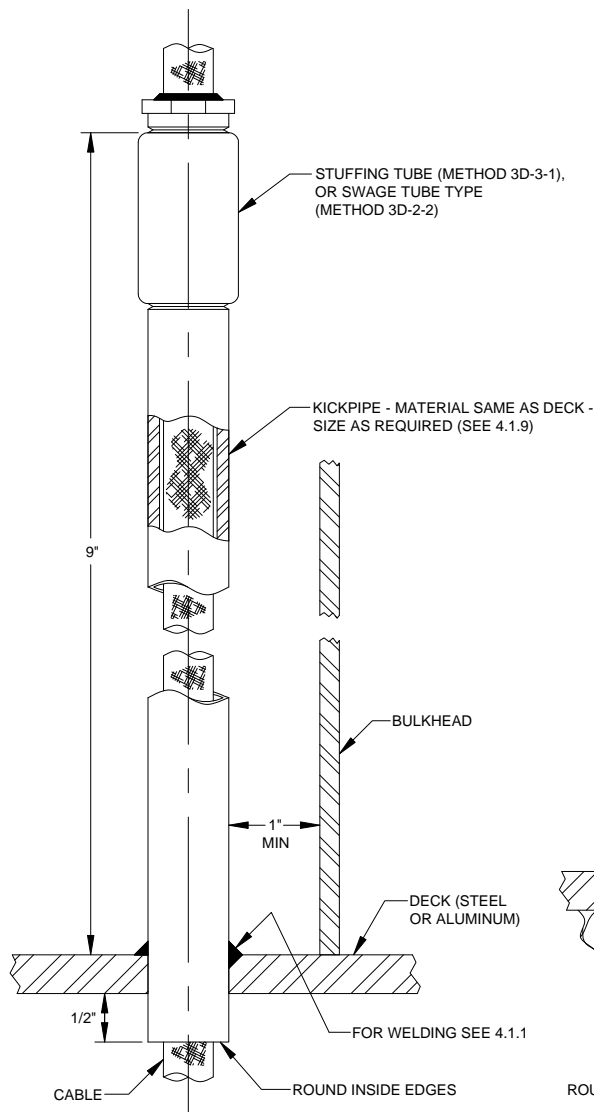
D.4.2 Figures. Table 2DI provides information for the figures in this group.

TABLE 3DI. Figures for kickpipes.

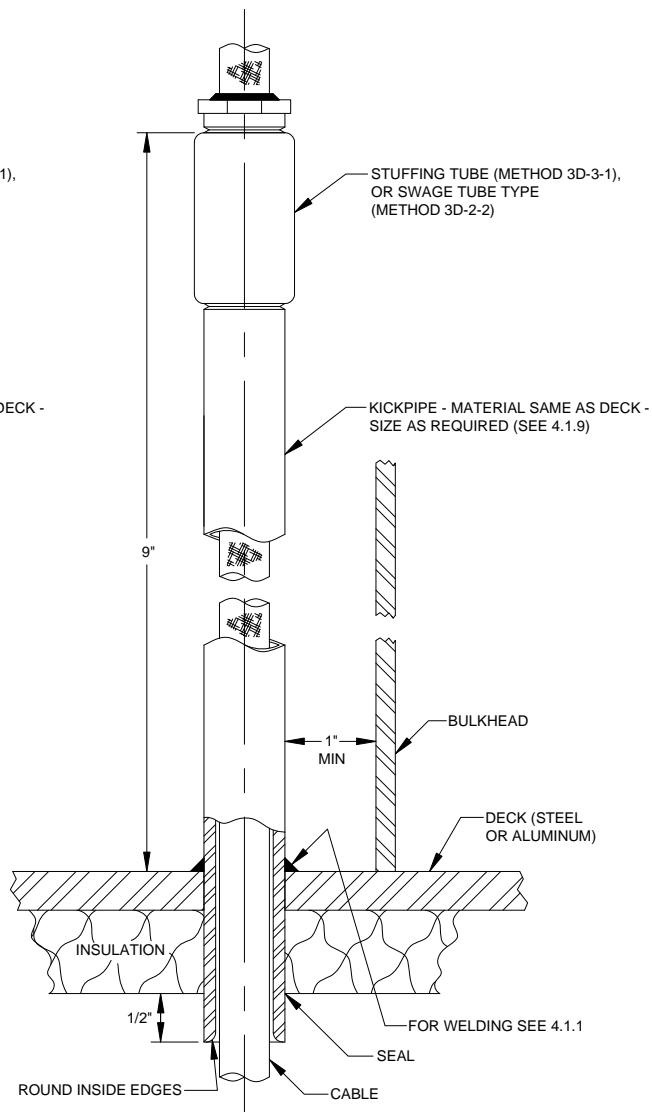
<b>Figure number</b>	<b>Installation of kickpipes</b>	<b>Page</b>
3D1	Kickpipes through steel or aluminum decks (surface ships)	171
3D2	Kickpipes through steel or aluminum decks (surface ships)	172
3D3	Kickpipes through steel or aluminum decks (surface ships)	173
3D4	Kickpipes through non-watertight decks (surface ships)	174
3D5	Kickpipes through ballistic plating (surface ships)	175
3D6	Kickpipes through ballistic plating (surface ships)	176
3D7	Kickpipes through wooden decks	177
3D8	Kickpipes with unions (surface ships)	179

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METHOD 3D-1-1  
KICKPIPES  
THROUGH WATERTIGHT DECK WITHOUT INSULATION



METHOD 3D-1-2  
KICKPIPES  
THROUGH WATERTIGHT DECK WITH INSULATION

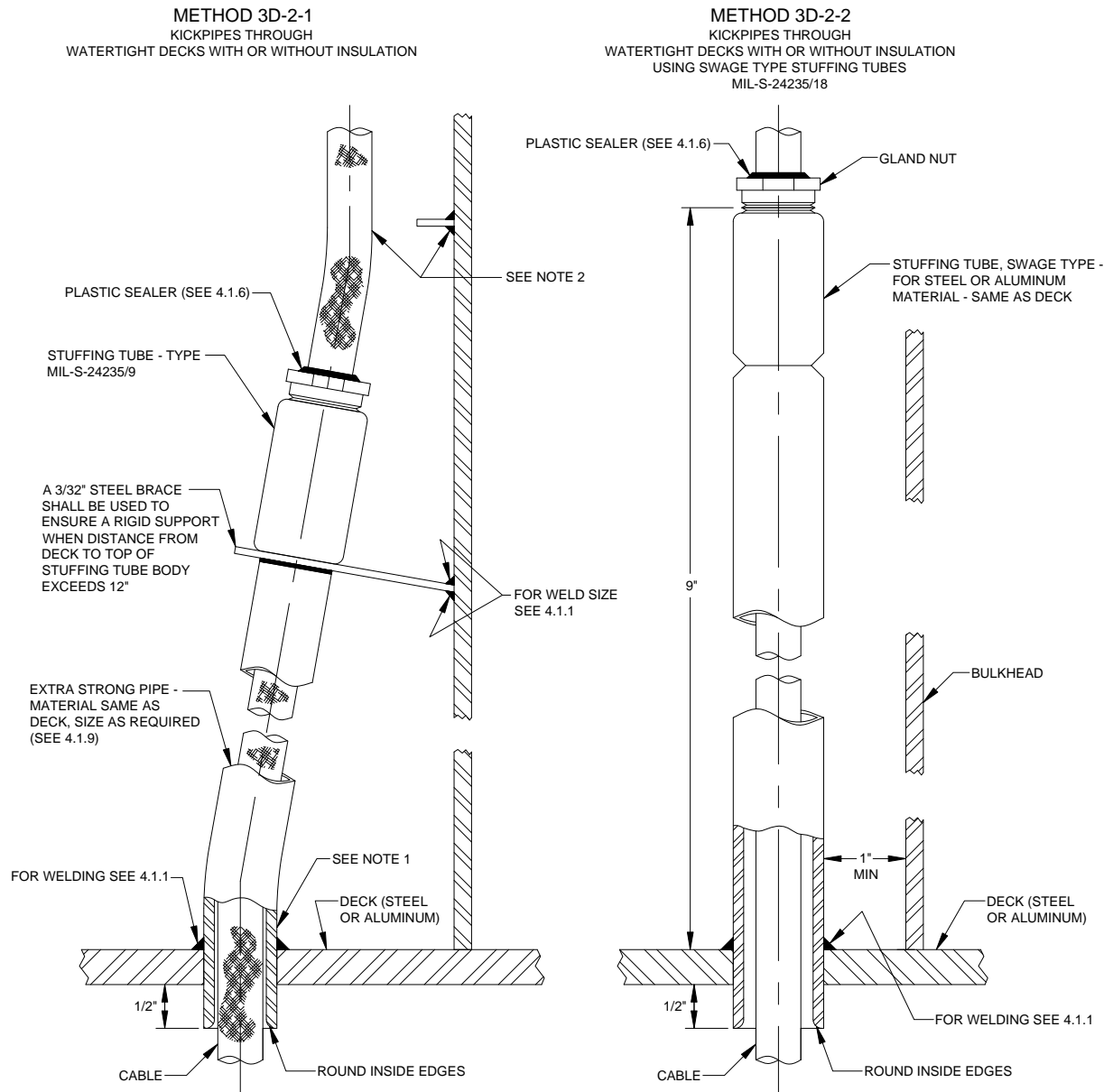


NOTES:

1. Use bent kickpipe to conserve space, if needed.
2. For suitable cable support, see MIL-STD-2003-4.
3. Pipes used in conjunction with stuffing tubes shall be welded on one side of the bulkhead or deck penetrated except for the following types of bulkheads or decks where welds on both sides are required:
  - a. Ballistic bulkheads
  - b. Shell plating
  - c. Torpedo defense system bulkheads
  - d. Penetrations exposed to weather or wet spaces

FIGURE 3D1. Kickpipes through steel or aluminum decks (surface ships).

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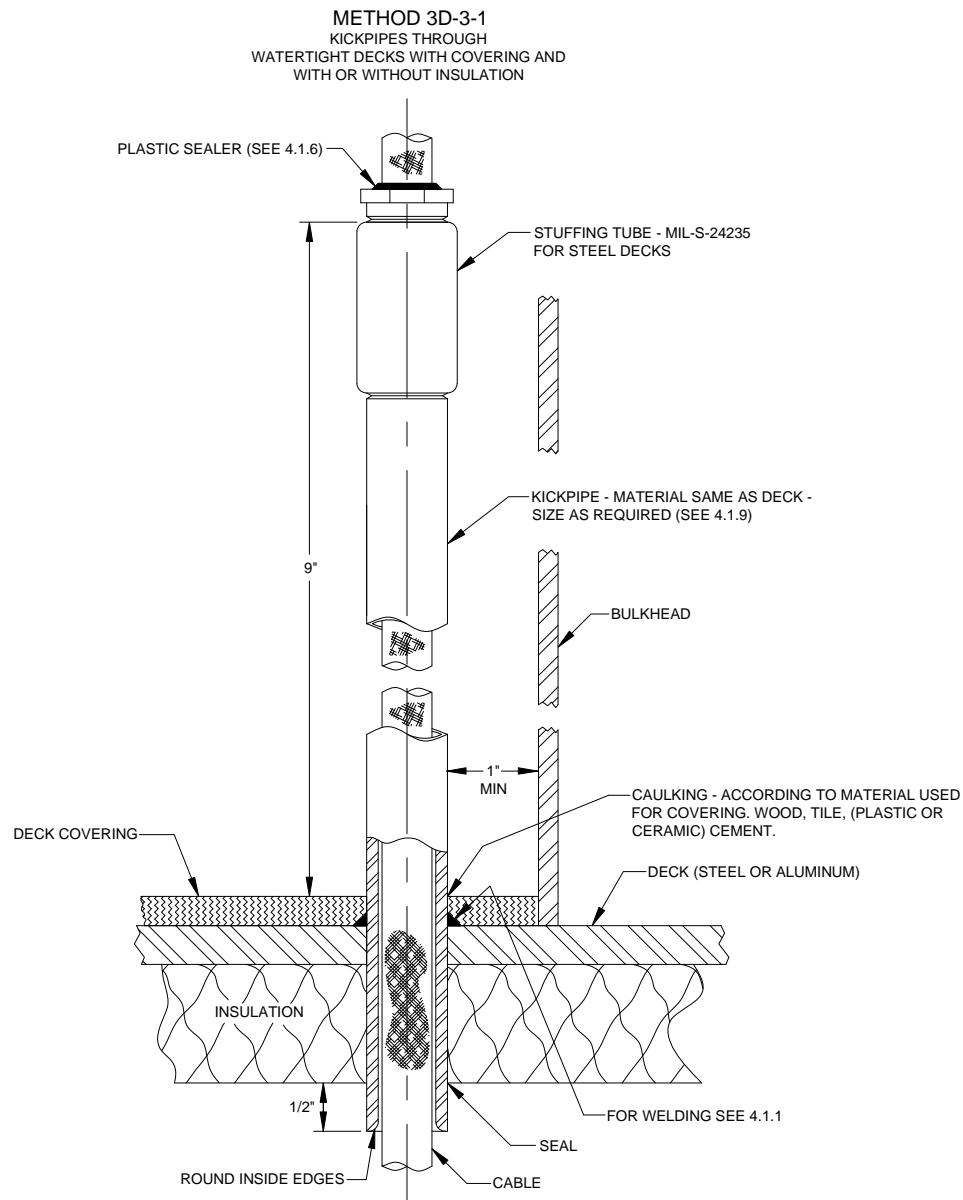


NOTES:

1. Use bent kickpipe to conserve space, if needed.
2. For suitable cable support, see MIL-STD-2003-4.
3. Pipes used in conjunction with stuffing tubes shall be welded on one side of the bulkhead or deck penetrated except for the following types of bulkheads or decks where welds on both sides are required:
  - a. Ballistic bulkheads
  - b. Shell plating
  - c. Torpedo defense system bulkheads
  - d. Penetrations exposed to weather or wet spaces
4. Plastic sealer is only required on kick pipes and stuffing tubes when exposed to the elements (penetrates the skin of the ship).

FIGURE 3D2. Kickpipes through steel or aluminum decks (surface ships).

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NOTE:

1. Pipes used in conjunction with stuffing tubes shall be welded on one side of the bulkhead or deck penetrated except for the following types of bulkheads or decks where welds on both sides are required:
  - a. Ballistic bulkheads
  - b. Shell plating
  - c. Torpedo defense system bulkheads
  - d. Penetrations exposed to weather or wet spaces

FIGURE 3D3. Kickpipes through steel or aluminum decks (surface ships).



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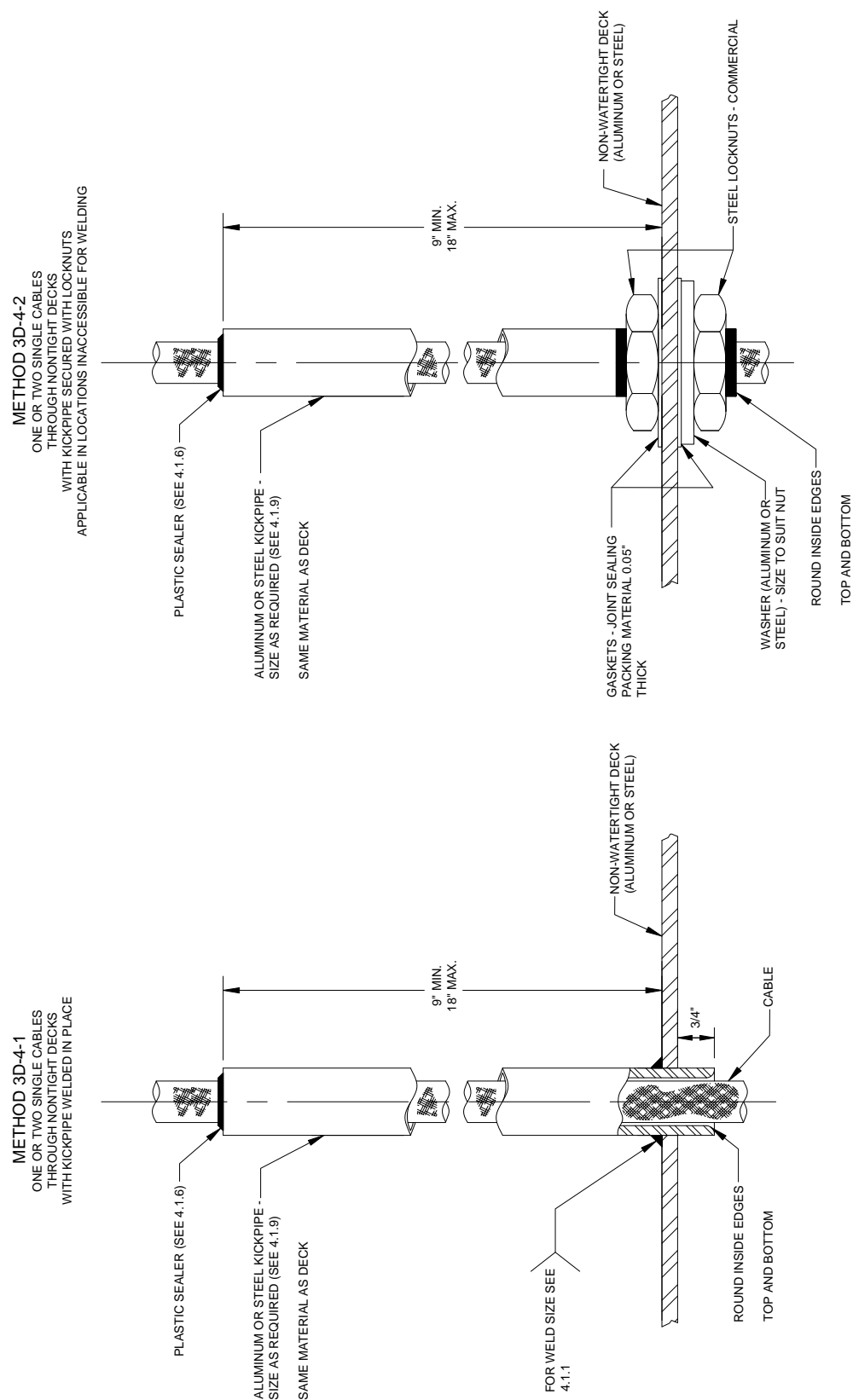


FIGURE 3D4. Kickpipes through non-watertight decks (surface ships).

MIL-STD-2003-3A(SH)  
APPENDIX D

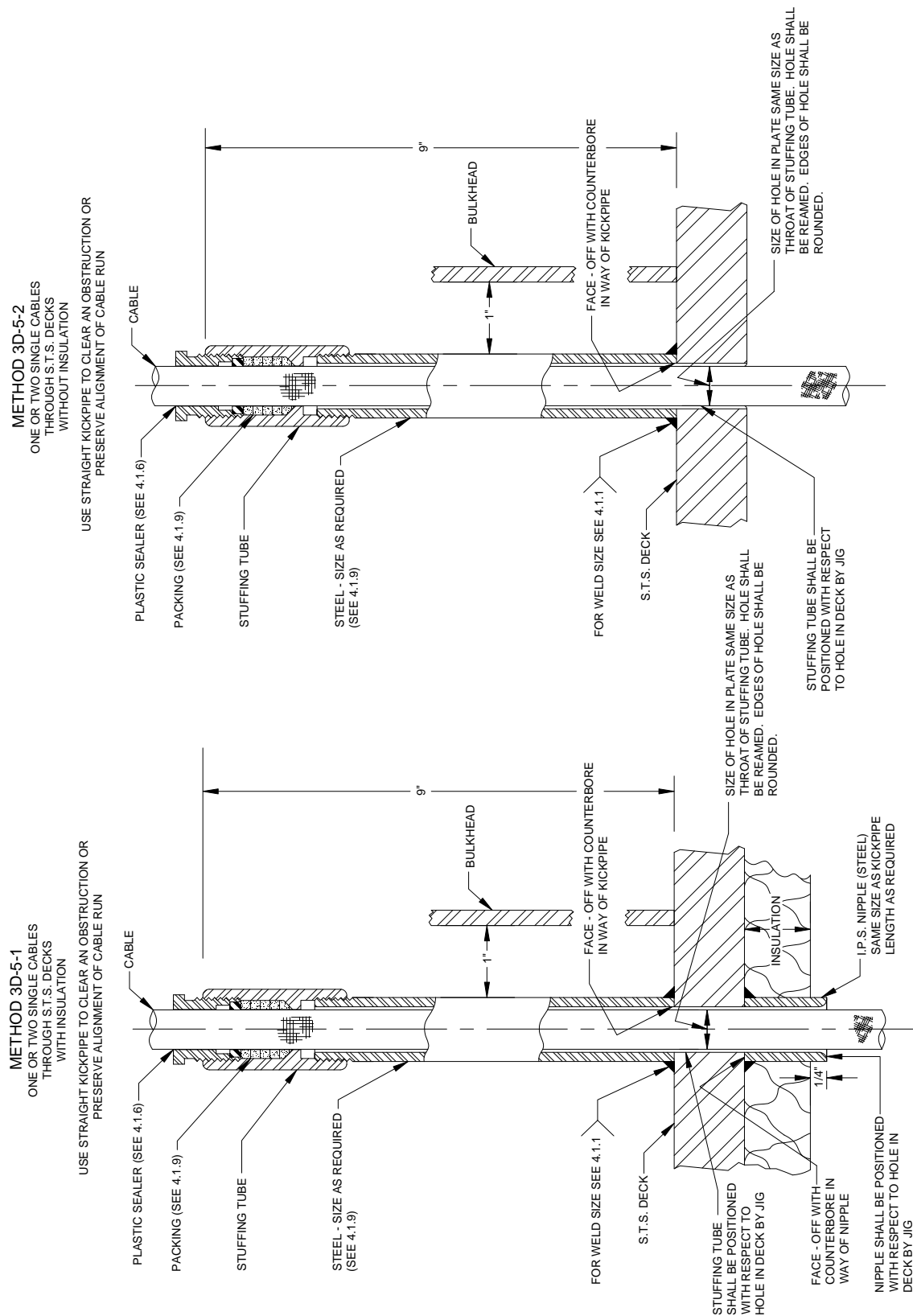
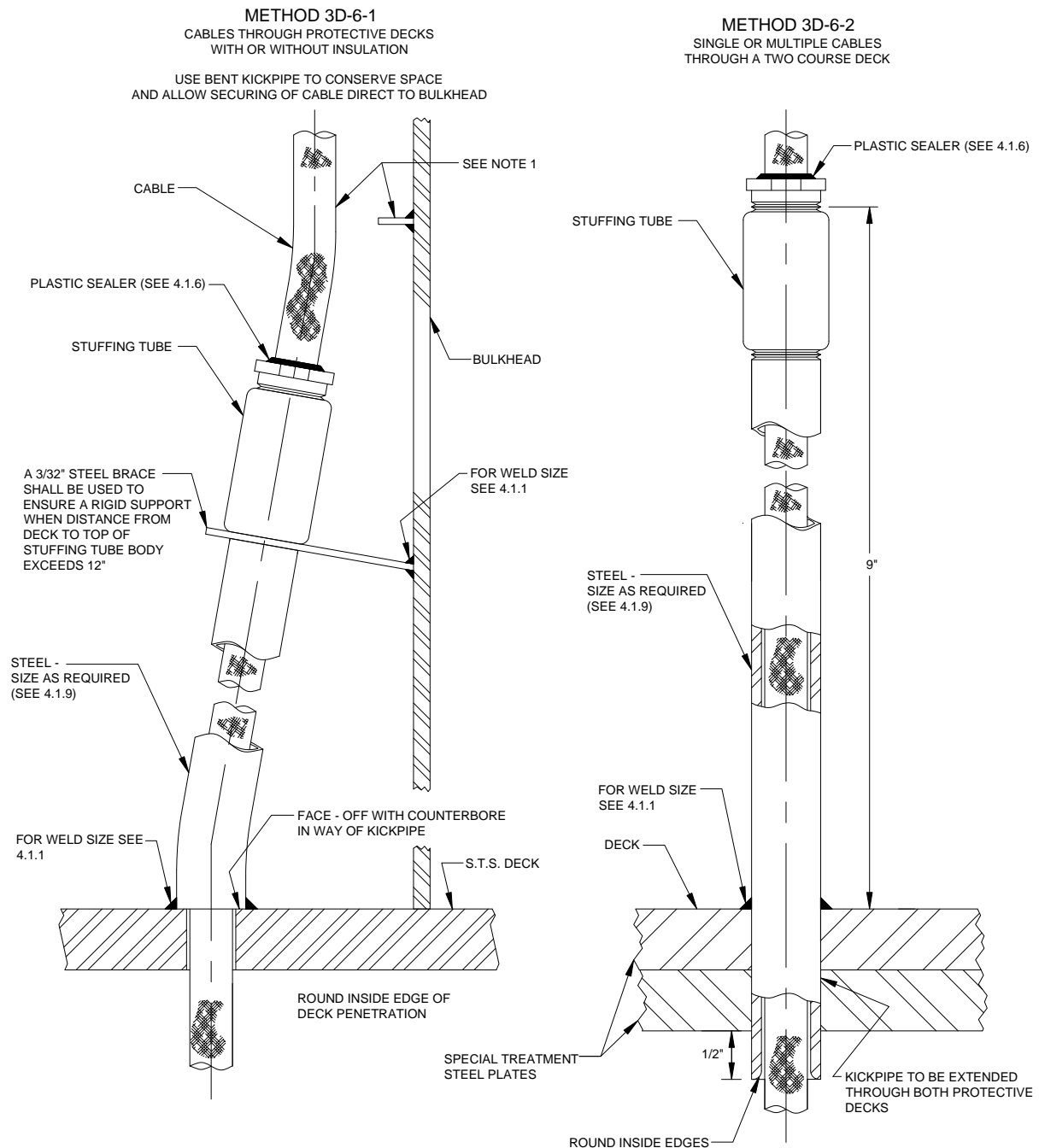


FIGURE 3D5. Kickpipes through ballistic plating (surface ships).

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APPENDIX D



NOTE:

1. For suitable cable support, see MIL-STD-2003-4.

FIGURE 3D6. Kickpipes through ballistic plating (surface ships).

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APPENDIX D

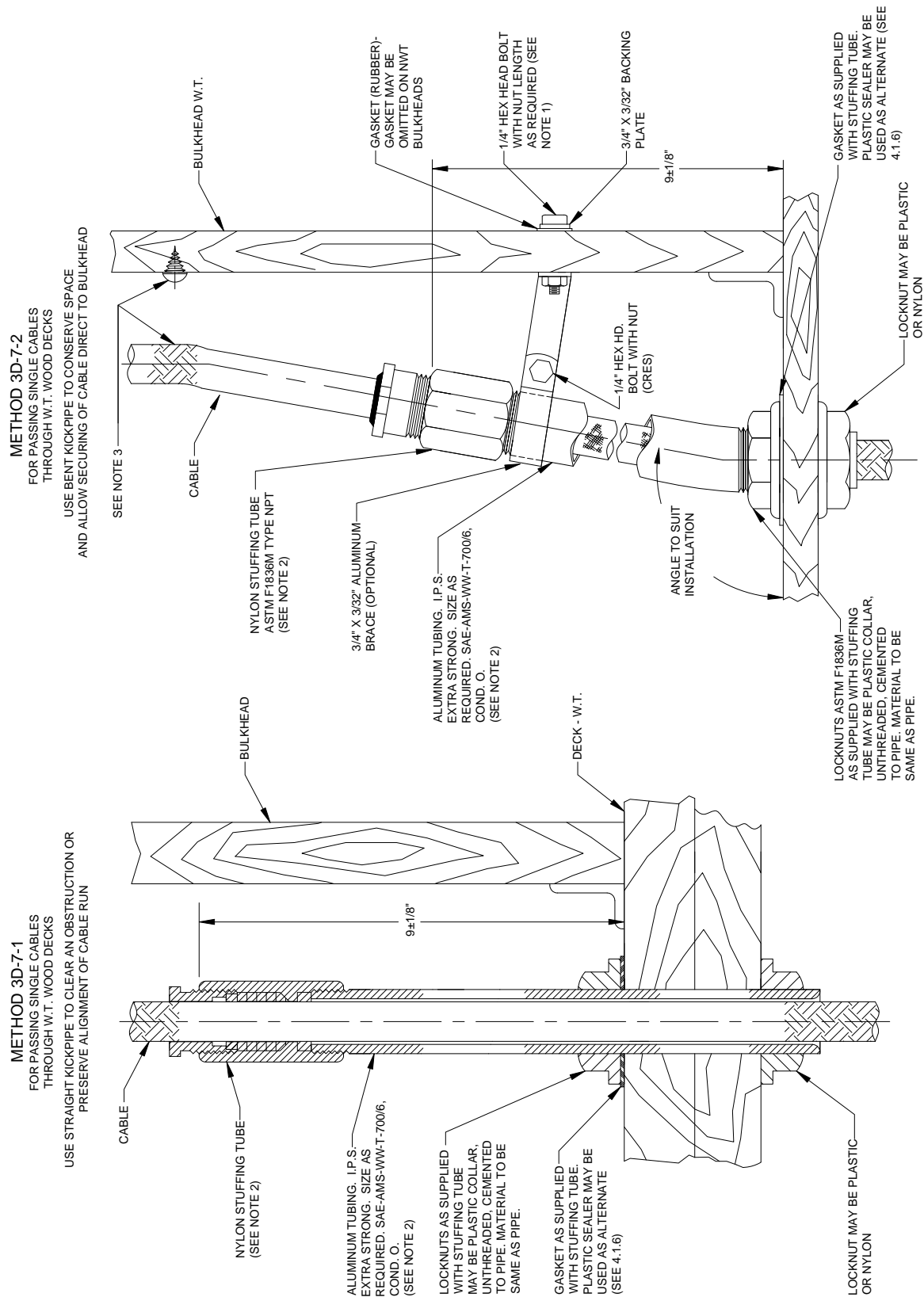


FIGURE 3D7. Kickpipes through wooden decks.

MIL-STD-2003-3A(SH)  
APPENDIX D

NOTES:

1. Lag or wood screws (CRES) not less than 1" long may be used in lieu of bolts on bulkheads over 1" thick.
2. Plastic pipe fittings and stuffing tube may be used in lieu of aluminum shown. Stuffing tube should be nylon, ASTM F1836M, NPT Type, sized to fit.
3. For suitable cable support, see MIL-STD-2003-4.

FIGURE 3D7. Kickpipes through wooden decks - Continued.

MIL-STD-2003-3A(SH)  
APPENDIX D

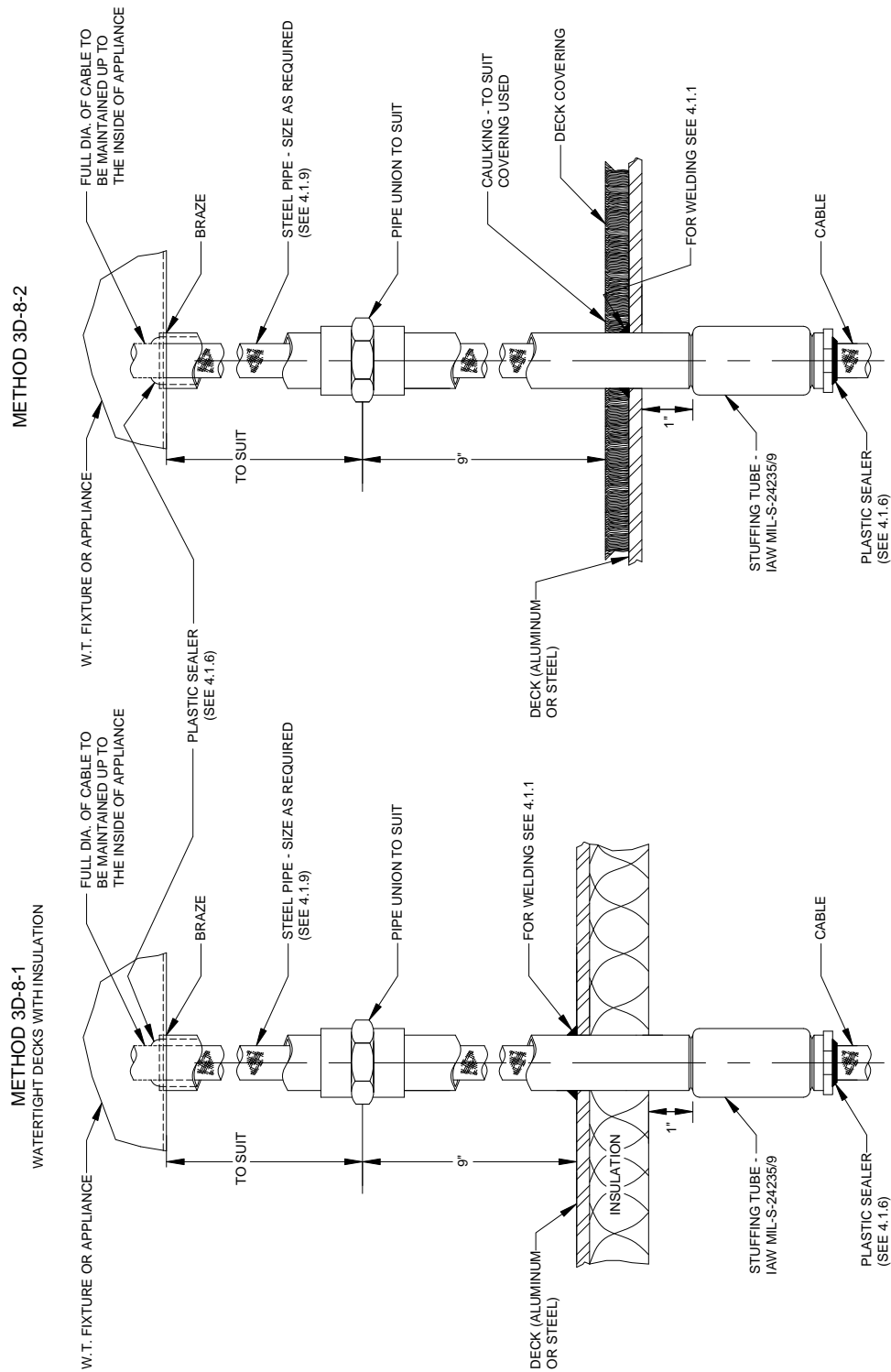


FIGURE 3D8. Kickpipes with unions (surface ships).

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APPENDIX E

GROUP 3E - PENETRATIONS – PRESSURE HULLS, SUBMARINES

E.1 SCOPE

E.1.1 Scope. This appendix describes the installation standard methods for penetration through pressure hulls of submarines.

E.2. APPLICABLE DOCUMENTS

E.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.

E.2.2 Government documents.

E.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 SPECIFICATIONS

QQ-N-281	-	Nickel-Copper Alloy Bar, Rod, Plate, Sheet, Strip, Wire, Forgings, and Structural and Special Shaped Sections
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COMMERCIAL ITEM DESCRIPTIONS

A-A-59588	-	Rubber, Silicone
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DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-DTL-915	-	Cable, Electrical, for Shipboard Use, General Specification for
MIL-C-24231	-	Connectors, Plugs, Receptacles, Adapters, Hull Inserts, and Hull Insert Plugs, Pressure-Proof, General Specification for
MIL-C-24231/1	-	Connector, Plug, Type I, Molded, Three-, Four-, and Five-Conductor
MIL-C-24231/3	-	Connector, Plug, Type I, Molded, Seven- and Nine-Conductor (Straight and 90 Degrees)
MIL-C-24231/4	-	Connectors, Plug, Type I, Molded, 14-, 24-, 30-, or 40-Conductor (Straight and 90 Degrees)
MIL-C-24231/18	-	Connector, Plug, Type I, Molded, 65-Conductor
MIL-S-24235/16	-	Stuffing Tubes, Metal, and Packing Assemblies for Electric Cables, Cable Shearing Valve, Hull, Pressureproof, Symbols 512, 512.1, 513, and 513.1

(Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch/> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

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APPENDIX E

E.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) DRAWINGS

- |                    |   |
|--------------------|---|
| 815-1197212        | - Electrode, 4000 SBM, Sym. 3012              |
| 815-1197218        | - Fitting, Hull, for AN/BQQ-1, Sym. 538       |
| 9000-S6202-1197101 | - Tube, Stuffing, PP for SS & TSP Type Cables |

(Copies of these documents are available from Commander, Portsmouth Naval Shipyard, ATTN: Code 280.1, Kittery, ME 03904.)

NAVAL SEA SYSTEMS COMMAND (NAVSEA) PUBLICATIONS

- |                       |  |
|-----------------------|--|
| T9074-AD-GIB-010/1688 | - Fabrication, Welding and Inspection of Submarine Structure; Requirements |
|-----------------------|--|

(Copies of these documents are available from the Naval Logistics Library, 5450 Carlisle Pike, Mechanicsburg, PA 17055 or online at <http://nll.ahf.nmci.navy.mil>.)

A.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.

SAE INTERNATIONAL

- |                      |   |
|----------------------|---|
| SAE-AMS-DTL-23053/5  | - Insulation Sleeving, Electrical, Heat Shrinkable, Polyolefin, Flexible Crosslinked    |
| SAE-AMS-DTL-23053/18 | - Insulation Sleeving, Electrical, Heat Shrinkable, Modified Fluoropolymer, Crosslinked |
| SAE-AMS-G-4343       | - Grease, Pneumatic System  |
| SAE-AS8660           | - Silicone Compound NATO Code Number S-736  |

(Copies of these documents are available from SAE World Headquarters, 400 Commonwealth Drive, Warrendale, PA 15096-0001 or online at [www.sae.org](http://www.sae.org).)

E.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.

### E.3 REQUIRED EQUIPMENT AND MATERIALS

E.3.1 Required equipment and materials. The required equipment and materials for the proper installation of penetrations through pressure hulls of submarines are as shown in the Appendix E methods.

### E.4 NOTES AND PROCEDURES

E.4.1 Dimensions. For figures and tables in this section, all dimensions are in inches unless otherwise noted.

E.4.2 Figures. Table 3EI provides information for the figures in this group.

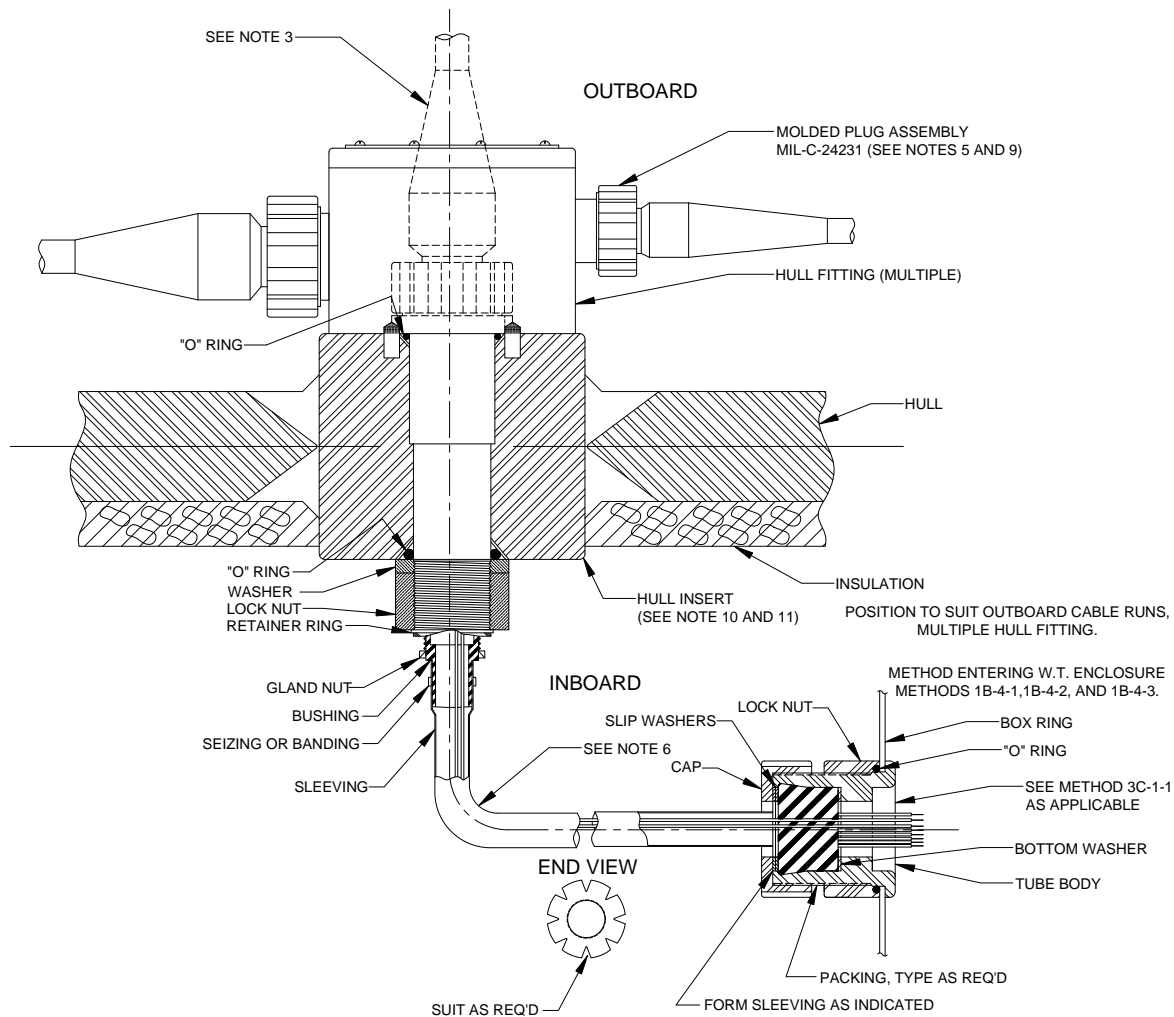


MIL-STD-2003-3A(SH)  
APPENDIX ETABLE 3EI. Figures for penetrations of submarine pressure hulls.

<b>Figure number</b>	<b>Submarine pressure hull penetrations</b>	<b>Page</b>
3E1	Cable connections through pressure hulls of submarines	183
3E2	Sealing plugs for hull inserts on submarines	184
3E3	Passing cable through pressure hull of submarines using cable shearing valve	185
3E4	Hull fitting installation for sonar sphere	188
3E5	Passing SS type cable through pressure hull of submarines	190
3E6	Mounting pressure-proof electrodes on submarines	192
3E7	Temporary sealing and securing pressure-proof molded plug assemblies	193

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APPENDIX E

METHOD 3E-1-1



NOTES:

1. Single and multiple cable connectors shall be installed and inspected in accordance with the applicable Submarine Maintenance Standard.
2. "O" ring surfaces on hull inserts shall be suitably protected from damage or weld splatter at all times prior to installation of hull fitting.
3. Dotted line indicates outline for single cable hull fitting.
4. Coat "O" rings and "O" ring surfaces with grease conforming to SAE-AS8660.
5. Remove receptacle caps prior to installation of molded plug assemblies (see note 9).
6. Secure inboard cable in place with cable supports as required.
7. Methods shown herein have been tested and approved for deep diving submarines.
8. Methods for temporary sealing hull inserts and pressure-proof plug assemblies are shown on figure 3E2.
9. When molded plug assemblies are temporarily disconnected, reinstall pressure-proof caps (see note 5 above).
10. Hull insert to be furnished by shipbuilder of a steel compatible with applicable hull. For further detailed requirements, see MIL-C-24231.
11. Position hull insert to outboard cable runs (multiple hull fittings). Hull insert is to be installed with dowel pins at zero degrees forward (or parallel to the ship's centerline) unless otherwise directed by ship's drawings.

FIGURE 3E1. Cable connections through pressure hulls of submarines.

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APPENDIX E

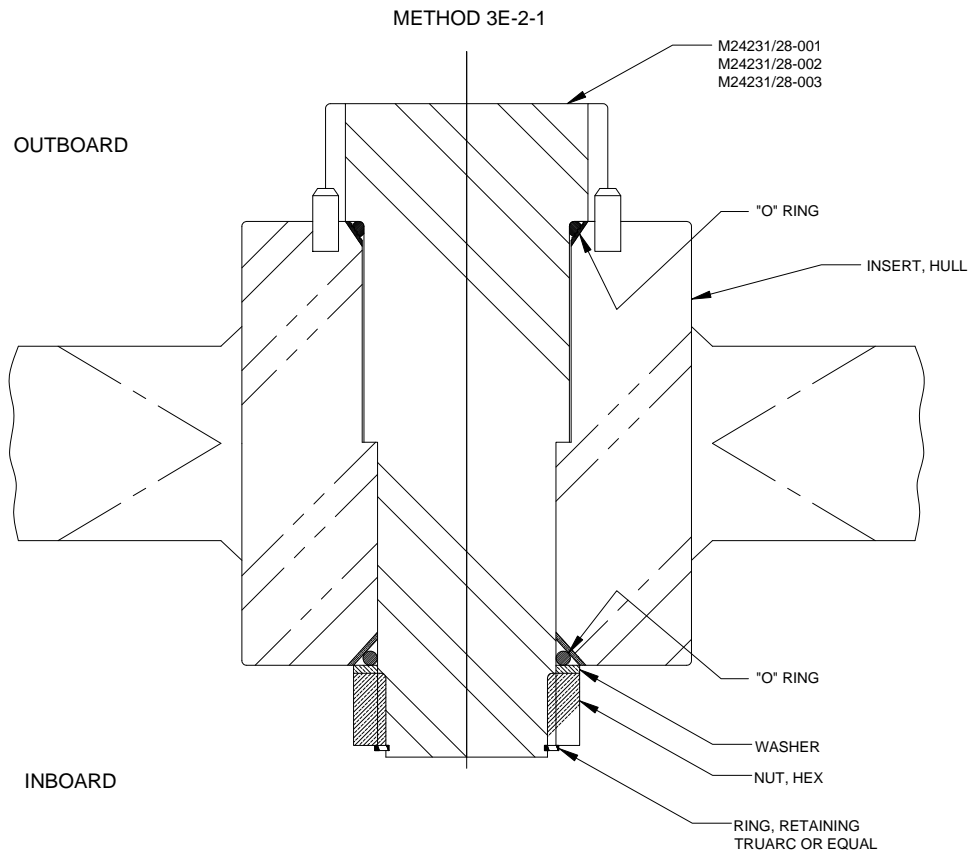


TABLE 3E2-I. Quantities for one sealing plug assembly.

Insert plug assy.	Number required - one						
	Insert plug	Retaining ring	Nut	Washer	"O" ring * - outboard	"O" ring * - inboard	For hull insert
M24321/28-001	M24231/28-010	M24231/5-076	M24231/5-074	M24231/5-075	ARP568-329	ARP568-327	M24231/25-001
M24231/28-002	M24231/28-020	M24231/10-045	M24231/10-042	M24231/10-043	ARP568-334	ARP568-332	M24231/25-002
M24231/28-003	M24231/28-030	M24231/19-014	M24231/19-024	M24231/19-025	ARP568-342	ARP568-339	M24231/25-003
* NOTE: Silicone rubber A-A-59588, Class III.							

NOTES:

1. Install hull insert sealing plug in accordance with applicable Submarine Maintenance Standard.
2. Hull inserts shall be furnished with sealing plugs in place to protect "O" ring surfaces from damage. Sealing plugs shall remain in place during welding and shall not be removed until insertion of single or multiple cable hull fitting.
3. Each sealing plug shall be checked with "go" and "no go" gages to ensure interchangeability with hull inserts.
4. For installation of hull fittings and hull inserts, see figure 3E1.
5. Silicone "O" rings are used only when welding in insert buna type "O" rings are required for service installation.

FIGURE 3E2. Sealing plugs for hull inserts on submarines.

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APPENDIX E

METHOD 3E-3-1

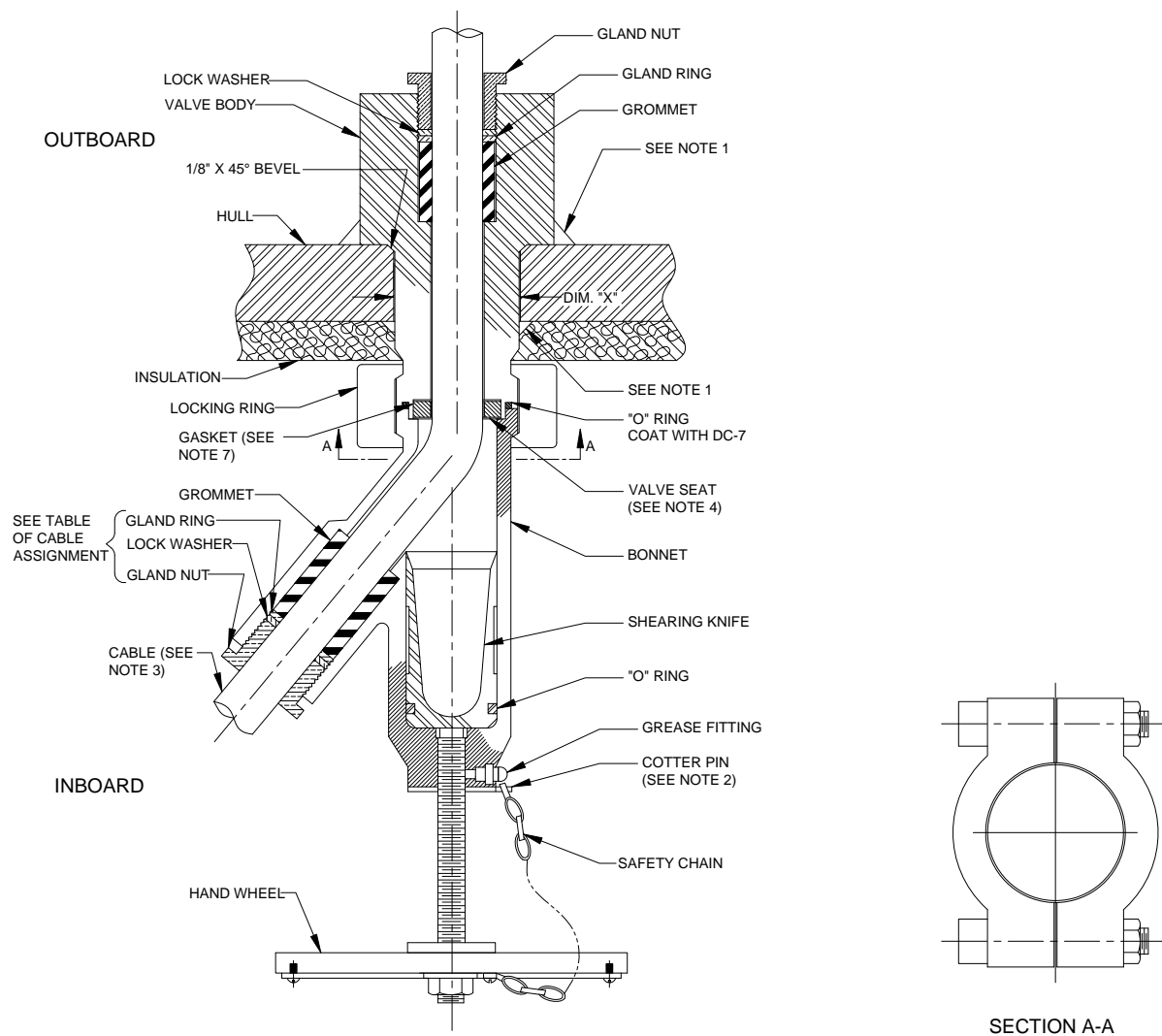


FIGURE 3E3. Passing cable through pressure hull of submarines using cable shearing valve.

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TABLE 3E3-I. Cable assignment.

Symbol no.	Cable O.D.	Grommet PC no.	Gland ring PC no.	Dim "X"
512	0.475	46	59	2.062
	0.510	47	60	
	0.520			
	0.545	48	61	
512.1	0.627	49	62	
	0.632			
	0.720	50	63	
	0.750	51	64	
513	0.795	52	65	2.562
	0.805			
	0.830	53	66	
	0.844			
	0.870	54	67	
513.1	0.995	55	68	
	1.020	56	69	
	1.115	57	70	
	1.120			
	1.150	58	71	
	1.156			

FIGURE 3E3. Passing cable through pressure hull of submarines using cable shearing valve - Continued.

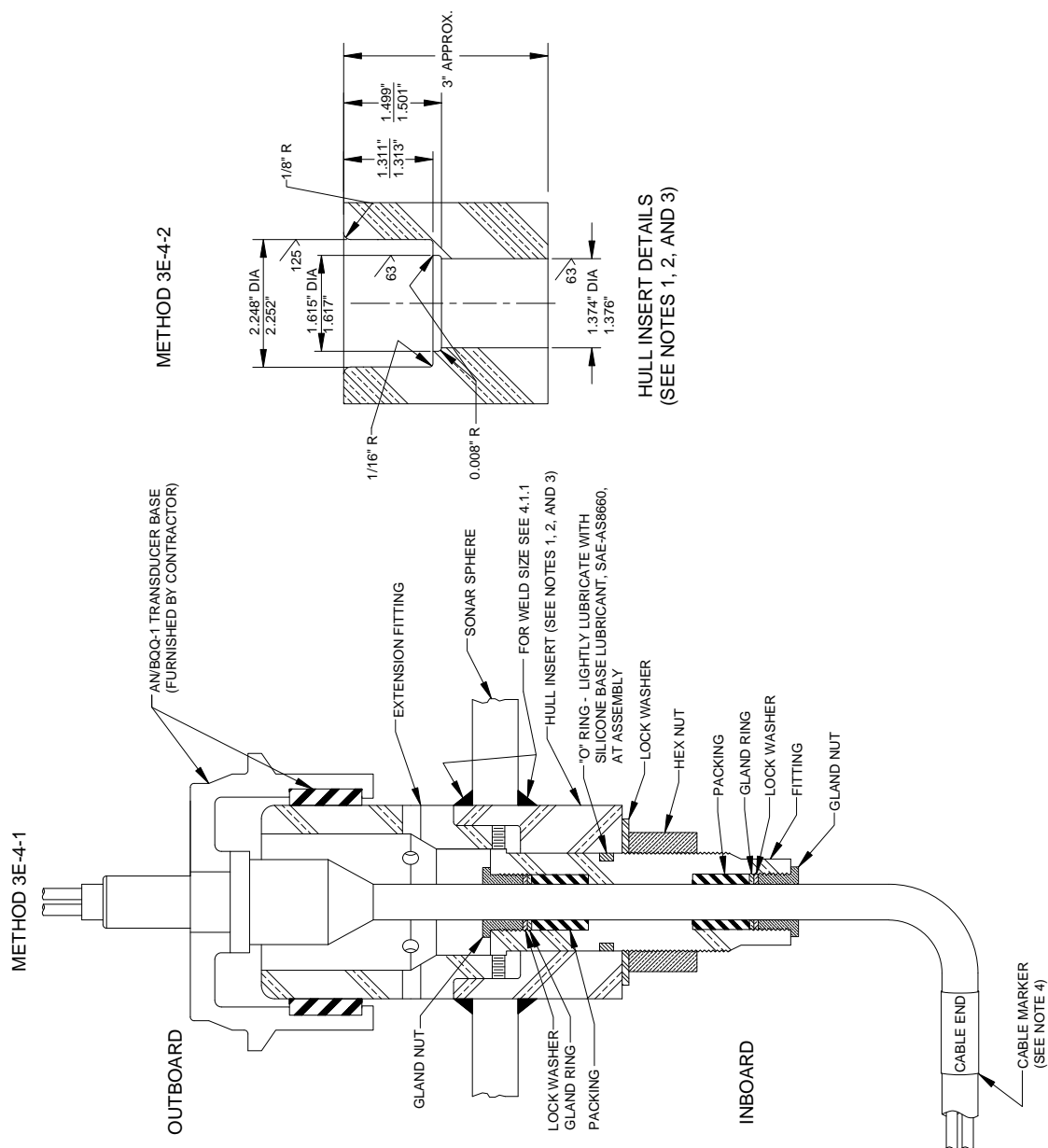
MIL-STD-2003-3A(SH)  
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NOTES:

1. Welding shall comply with T9074-AD-GIB-010/1688.
2. Before assembly, drill hole for cotter pin with valve in full open position. Pin must be easily removed. Bend only enough to prevent falling out.
3. The cable shearing valves are designed for cables in accordance with MIL-DTL-915.
4. If valve seat becomes damaged, it can be reversed and reinstalled with a new valve seat gasket. Removal of valve seat is accomplished by use of a  $\frac{7}{8}$ -12 stud for symbol no. 512 or a  $1\frac{3}{8}$ -12 stud for symbol no. 513.
5. Terminate inboard cable in a junction box, which will be located in the vicinity of the shear valve.
6. For specifications, see MIL-S-24235/16.
7. Cement gasket to valve seat and body.

FIGURE 3E3. Passing cable through pressure hull of submarines using cable shearing valve - Continued.

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NOTES:

1. Install hull fitting in accordance with applicable Submarine Maintenance Standard and the applicable drawing for the ship class.
2. Hull insert shall be machined to finished dimensions as shown under Method 3E-4-2 after all welding has been completed on sonar sphere.

FIGURE 3E4. Hull fitting installation for sonar sphere.

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## NOTES (continued):

3. Hull insert material shall be Ni-CU Monel, QQ-N-281, Class A, hot rolled. Dimensions shown are applicable after welding in sonar sphere and after machining to accept PCs 1, 3, and 9 of Drawing 815-1197218. Outer diameter shall be such as to provide adequate compensation. Hull inserts are to be furnished by the shipbuilder.
4. Cable marker shall consist of heat shrinkable tubing-white in accordance with SAE-AMS-DTL-23053/5, Class 1, with cable designation stamped as required and then covered by a clear heat shrinkable tubing in accordance with SAE-AMS-DTL-23053/18. This method may be used as an alternate to the standard method of marking sonar cables.
5. See the ship SDI for configuration.

FIGURE 3E4. Hull fitting installation for sonar sphere - Continued.



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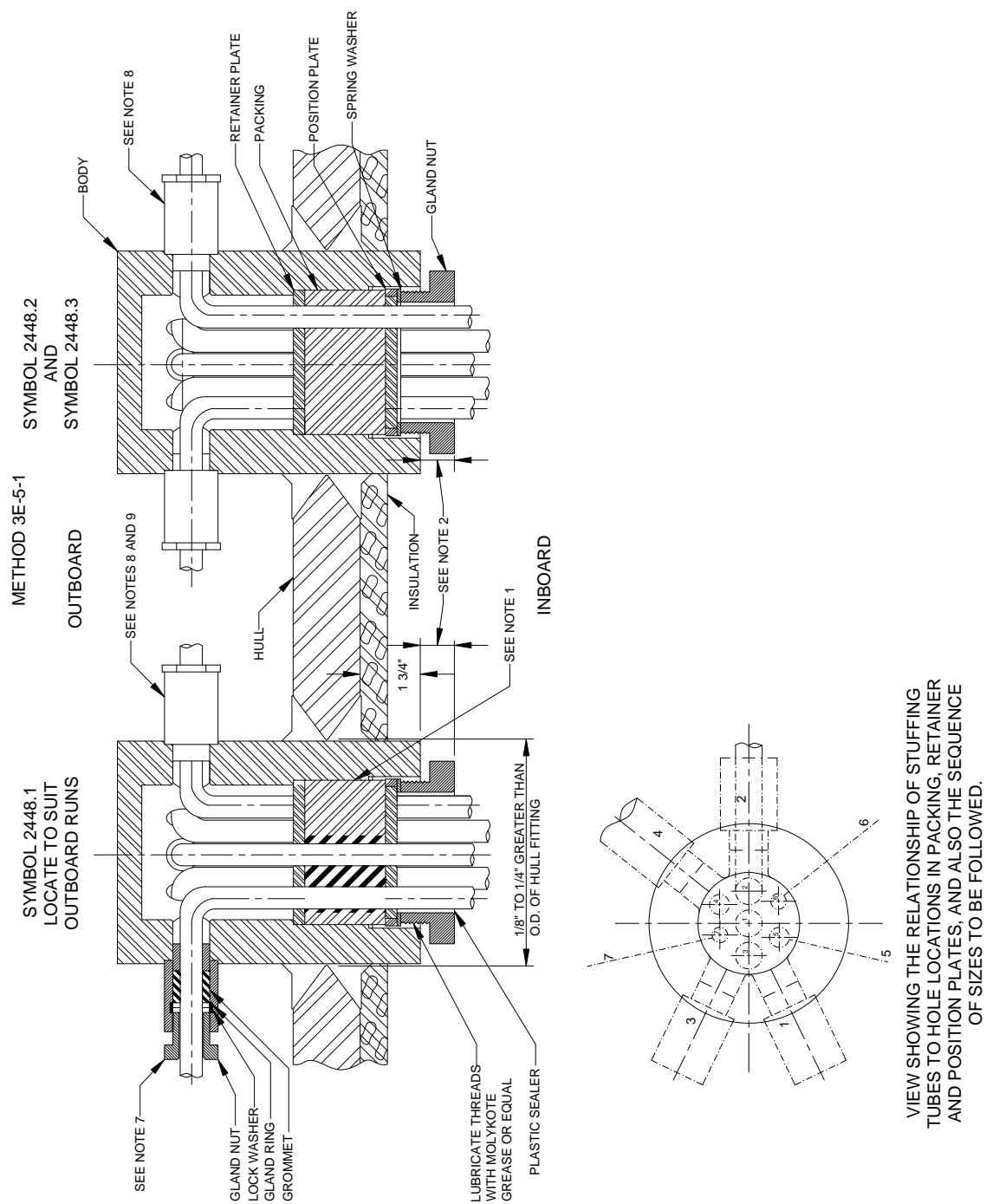


FIGURE 3E5. Passing SS type cable through pressure hull of submarines.

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TABLE 3E5-I. Application.

Symbol	Total number of cables	For cable types
2448.1	2 to 7	0.365 to 0.620 dia. in any combination
2448.2	8	DSS-2 0.365 to 0.390 dia. cable only
2448.3	8	0.425 to 0.500 dia. only in any combination

TABLE 3E5-II. Cable and packing assignments from drawing 9000-S6202-1197101.

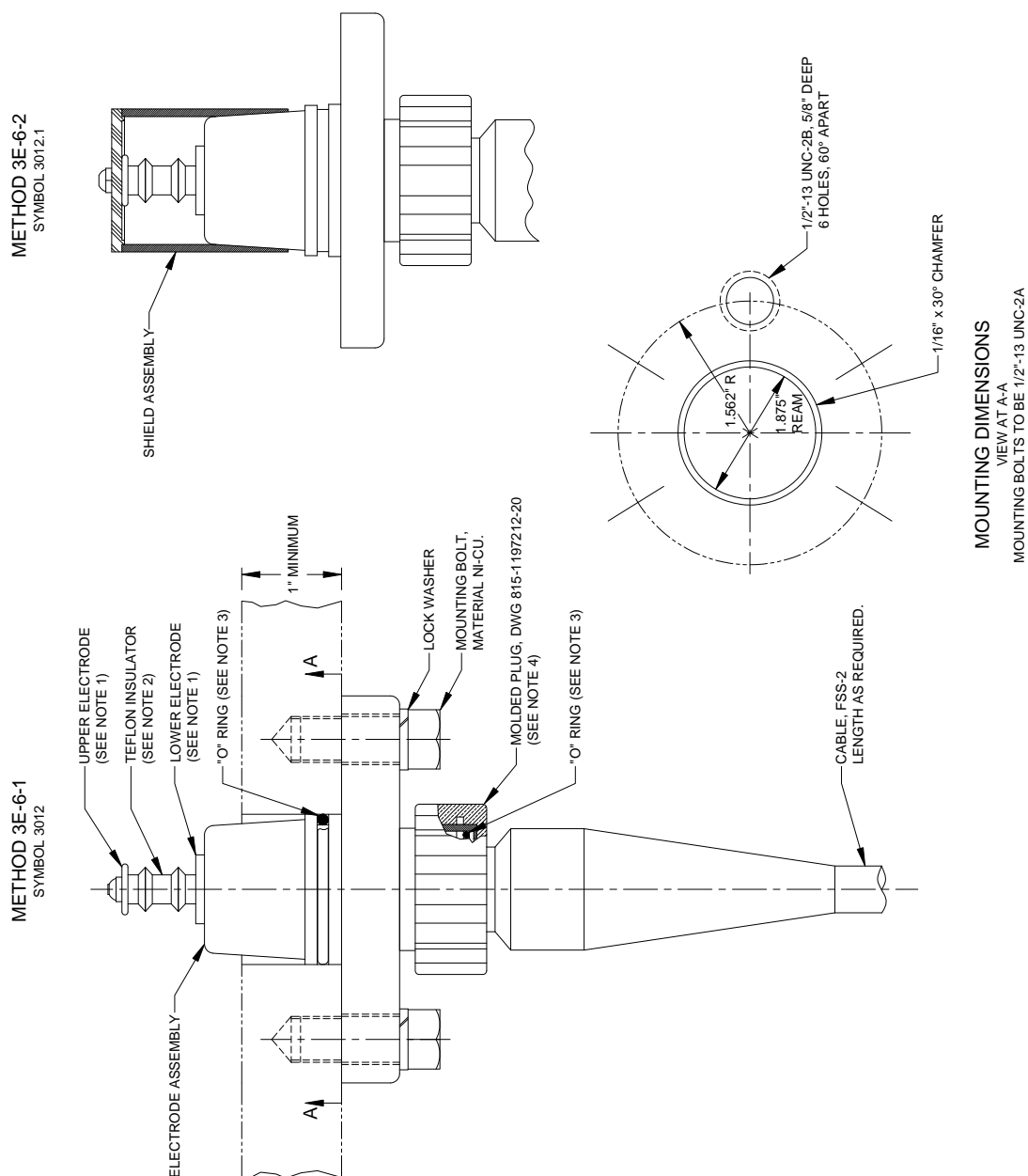
Cable type	Cable O.D.	Grommet		Color coding for grommets	Stuffing tube symbol no.
		Sym. no.	PC no.		
DSS-2	0.365 to 0.390	2447.1	2	3 blue dots	
DSS-3 DSS-4 TSS-4 FSS-2	0.480 to 0.500	2447.3	6	2 yellow dots	2446.1
FSS-4	0.600 to 0.625	2447.4	12	4 green dots	2446.2

## NOTES:

1. Prior to welding, fitting shall be disassembled by removing interior rubber packing. Plugs shall remain in outboard tubes until cables are installed.
2. Turn gland nut down so that this dimension is between  $\frac{19}{32}$  and  $\frac{23}{32}$  at assembly with cables depending on type and number.
3. Check color coding on packing grommets and measure O.D. of cables to ensure that the grommets are in accordance with sizes listed in table 3E5-II.
4. Thread cables in place, maintaining proper alignment, through positioning plate, packing, retainer plate, grommet, and associated stuffing tube.
5. Secure cables in outboard stuffing tubes with gland ring, lockwasher, and gland nut in sequence indicated. Gland nuts shall be tightened down metal-to-metal.
6. Tighten inboard gland nut in place as indicated.
7. Turn gland nut down metal-to-metal at assembly.
8. Sealing plugs furnished with hull fitting shall remain in place until cables are installed.
9. For reference on pressure-proof hull fitting and stuffing tube assembly, see MIL-C-24231 and tube drawing 9000-S6202-1197101.

FIGURE 3E5. Passing SS type cable through pressure hull of submarines - Continued.

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NOTES:

1. Upper and lower electrode surfaces shall be free from contaminants to ensure circuit when immersed in water.
2. Surfaces of Teflon insulator shall be protected during installation to prevent damage and/or contamination by dirt, grease, etc.
3. Coat "O" rings and "O" ring surfaces with grease conforming to SAE-AMS-G-4343 (DC7).
4. Remove receptacle cap furnished with electrode assembly prior to installation of molded plug assembly.
5. This electrode is designed to withstand 2000 psi hydrostatic pressure against either the electrode or the receptacle side.
6. This drawing was developed from BUSHIPS drawing 815-1197212.

FIGURE 3E6. Mounting pressure-proof electrodes on submarines.

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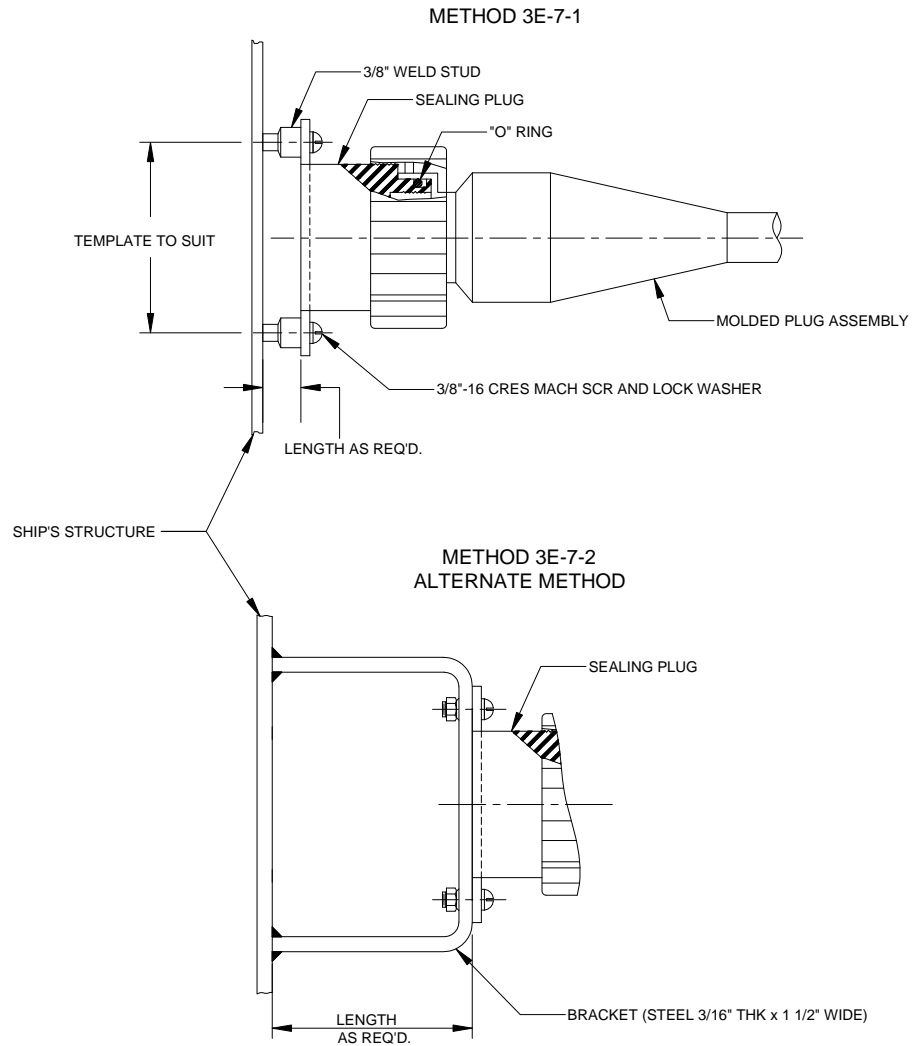


TABLE 3E7-I. Sealing plug assembly.

Molded plug specification	Symbol number	Sealing plug assembly
MIL-C-24231	713	MIL-C-24231/1-020
	713.5	
	713.1	MIL-C-24231/3-020
	713.2	MIL-C-24231/4-020
	713.3	
	713.4	
	1139	MIL-C-24231/18-020
	1118	

FIGURE 3E7. Temporary sealing and securing pressure-proof molded plug assemblies.

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NOTES:

1. Typical methods shown hereon are for information and guidance to installing activities for sealing and/or securing of pressure-proof pin type molded connectors that have been temporarily disconnected from their associated receptacle.
2. Temporary sealing of pin connector hull fittings or receptacles are shown on figures 3E1 and 3E2.
3. Cables shall be properly secured or protected to prevent damage from chaffing, weld splatter, and/or other hazards.

FIGURE 3E7. Temporary sealing and securing pressure-proof molded plug assemblies - Continued.

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Preparing activity:

Navy – SH

(Project SESS-2008-004)

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 <http://assist.daps.dla.mil>.