

INCH-POUND

MIL-DTL-24231E(SH)

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SUPERSEDING

MIL-C-24231D(SH)

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DETAIL SPECIFICATION

CONNECTORS, PLUGS, RECEPTACLES, ADAPTERS, HULL
INSERTS, AND HULL INSERT PLUGS, PRESSURE-PROOF,
GENERAL SPECIFICATION FOR

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

1. SCOPE

1.1 Scope. This specification covers pressure-proof single and multiple cable connectors, plugs, receptacles, adapters, hull inserts, and hull insert plugs.

1.2 Classification. Pressure-proof fittings (connectors, plugs, receptacles, adapters, hull inserts, and hull insert plugs) are of the following types as specified (see 6.2).

1.2.1 Types.

Type I – Molded plugs (straight and 90-degree).

Type II – Adapters for molded plugs.

Type III – Single cable connectors.

Type IV – Multiple cable connectors.

Type V – Multi-pin receptacles (receptacles for multiple cable connectors).

Type VI – Plugs for hull inserts.

Type VII – Hull inserts.

1.3 Part or identifying number (PIN). PINs to be used for pressure-proof single and multiple cable connectors, plugs, receptacles, adapters, hull inserts, and hull insert plugs acquired to this specification are created as follows:

<u>M</u>	<u>24231</u>	<u>/XX</u>	:	<u>XXX</u>
Prefix	Specification Number	Specification Sheet Number		Dash Number

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

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2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

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

FEDERAL SPECIFICATIONS

- L-P-390 - Plastic Molding and Extrusion Material, Polyethylene and Copolymers (Low, Medium, and High Density)
- QQ-N-281 - Nickel-Copper Alloy Bar, Rod, Plate, Sheet, Strip, Wire, Forgings, and Structural and Special Shaped Sections
- QQ-N-286 - Nickel-Copper-Aluminum Alloy, Wrought (UNS N05500)

FEDERAL STANDARDS

- FED-STD-H28/2 - Screw-Thread Standards for Federal Services, Section 2, Unified Inch Screw Threads – UN and UNR Thread Forms

DEPARTMENT OF DEFENSE SPECIFICATIONS

- MIL-S-901 - Shock Tests, H.I. (High-Impact) Shipboard Machinery, Equipment, and Systems, Requirements for
- MIL-DTL-915 - Cable, Electrical, for Shipboard Use, General Specification for
- MIL-DTL-915/8 - Cable, Power Electrical, 600 Volts, for Outboard Use Only (Not for Inboard Use), Types DSS, TSS, FSS, and 7SS
- MIL-DTL-15024 - Plates, Tags, and Bands for Identification of Equipment, General Specification for
- MIL-P-15024/5 - Plates, Identification
- MIL-DTL-16878/1 - Wire, Electrical, Polyvinyl Chloride (PVC) Insulated, 105 Degree C, 600 Volts (Not for Navy Shipboard Use)
- MIL-E-21562 - Electrodes and Rods – Welding, Bare, Nickel Alloy
- MIL-E-22200/3 - Electrodes, Welding, Covered: Nickel Base Alloy; and Cobalt Base Alloy
- MIL-DTL-24643/33 - Cable, Electrical, -20 °C to +90 °C, Type LS2SWU
- MIL-DTL-24643/38 - Cable, Electrical, -20 °C to +90 °C, 600 Volts, Type LSECM
- MIL-P-25732 - Packing, Preformed, Petroleum Hydraulic Fluid Resistant, Limited Service at 275 Deg. F (135 Deg. C)

(See supplement 2 for list of associated specification sheets.)

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DEPARTMENT OF DEFENSE STANDARDS

- MIL-STD-129 - Military Marking for Shipment and Storage
- MIL-STD-167-1 - Mechanical Vibrations of Shipboard Equipment (Type I – Environmental and Type II – Internally Excited)
- MIL-STD-202 - Electronic and Electrical Component Parts

DEPARTMENT OF DEFENSE HANDBOOKS

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

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

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

NAVAL SEA SYSTEMS COMMAND (NAVSEA) PUBLICATIONS

- S9074-AQ-GIB-010/248 - Requirements for Welding and Brazing Procedure and Performance Qualification
- S9074-AR-GIB-010/278 - Requirements for Fabrication Welding and Inspection, and Casting Inspection and Repair for Machinery, Piping, and Pressure Vessels
- S9320-AM-PRO-020 - Underwater Cable Assembly and Encapsulated Components, Fabrication, Repair, and Installation Manual; Vol. II, Molding and Inspection Procedures for Fabricating Connector Plugs for Submarine Outboard Cables
- T9074-AS-GIB-010/271 - Requirements for Nondestructive Testing Methods

(Copies of these documents are available online at <https://n11.ahf.nmci.navy.mil/>. These publications can be located by searching the Navy Publications Index for the TMIN without the suffix.)

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 B46.1 - Surface Texture (Surface Roughness, Waviness, and Lay)

(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.)

ASTM INTERNATIONAL

- ASTM D2240 - Standard Test Method for Rubber Property Durometer Hardness
- ASTM E10 - Standard Test Method for Brinell Hardness of Metallic Materials
- ASTM E18 - Standard Test Methods for Rockwell Hardness of Metallic Materials

(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.)

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SAE INTERNATIONAL

SAE-AMS2817	- Packaging and Identification, Preformed Packings
SAE-AMS3216	- Fluorocarbon (FKM) Rubber, High-Temperature-Fluid Resistant, Low Compression, Set 70-80
SAE-AMS3218	- Fluorocarbon (FKM) Rubber, High-Temperature-Fluid Resistant, Low Compression, Set 85 to 95
SAE-AMS7259	- Rings, Sealing, Fluorocarbon (Fkm) Rubber High-Temperature-Fluid Resistant Low Compression Set 85 to 95
SAE-AMS7276	- Rubber: Fluorocarbon (FKM) High-Temperature-Fluid Resistant Low Compression Set for Seals in Fuel Systems and Specific Engine Oil Systems
SAE-AMS-P-83461	- Packing, Preformed, Petroleum Hydraulic Fluid Resistant, Improved Performance At 275Mdf (135Mdc)
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.)

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

3. REQUIREMENTS

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

3.2 First article. When specified (see 6.2), a sample shall be subjected to first article inspection in accordance with 4.2.

3.3 Materials. Materials shall be as specified (see 3.1). Sufficient material identifications and controls shall be exercised by the contractor to assure that the final product conforms to this specification.

3.3.1 Material control. Chemical analysis and physical properties of material per heat from the mill shall be traceable from the bar stock to the final product. Material identity shall be maintained throughout the manufacturing process. When specified (see 6.2), material control objective quality evidence shall be prepared.

3.3.2 Hull insert plugs, connector bodies, nuts, and washers. Unless otherwise specified (see 3.1), hull insert plugs, connector bodies, nuts, and washers shall be manufactured from mill annealed Ni-Cu-Al alloy in accordance with QQ-N-286. The Ni-Cu-Al alloy shall be age hardened either before machining or after machining and welding to obtain 130,000 pounds force per square inch (lbf/in²) minimum tensile strength, 85,000 lbf/in² minimum yield strength at 0.2 percent offset, and 20 percent minimum elongation.

3.3.2.1 Receptacle bodies. Unless otherwise specified (see 3.1), receptacle bodies shall be manufactured from Ni-Cu alloy in accordance with Class A, Form 1, hot finished of QQ-N-281 with a minimum yield strength of 40,000 lbf/in² at 0.2 percent offset, or Ni-Cu alloy in accordance with Class A, Form 1, cold drawn of QQ-N-281 with a minimum yield strength of 50,000 lbf/in² at 0.2 percent offset. The chemical and physical analysis furnished by the mill will satisfy certification requirements when supplemented by the required traceability markings identifying the finished receptacle bodies to the bar stock on which the chemical and physical analysis was conducted. When specified (see 6.2), material control objective quality evidence shall be prepared.

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3.3.3 Retainer plates and retainer plate assemblies. Retainer plates and retainer plate assemblies shall be made from Ni-Cu alloy in accordance with Class A, Form 1, hot finished of QQ-N-281 with a minimum yield strength of 40,000 lbf/in² at 0.2 percent offset or Ni-Cu alloy in accordance with Class A, Form 1, cold drawn of QQ-N-281 with a minimum yield strength of 50,000 lbf/in² at 0.2 percent offset.

3.3.4 Pin and socket contacts.

3.3.4.1 Pin contacts. Unless otherwise specified (see 3.1), pin contacts shall be Bendix Aviation Corporation, size 16M, short, part no. 10-101515-15P, gold plated; L.L. Rowe Company, part no. 40096; Connector Technology, part no. PC001086; or equal. Any other pin contact submitted as equal is subject to NAVSEA approval.

3.3.4.2 Socket contacts. Unless otherwise specified (see 3.1), socket contacts shall be Bendix Aviation Corporation, size 16M, short, part no. 10-101515-15S, gold plated; L.L. Rowe Company, part no. 40097; Connector Technology, part no. SCA1315-1; or equal. Any other socket contact submitted as equal is subject to NAVSEA approval.

3.3.5 Molded inserts. Material for molded inserts shall be as specified (see 3.1) or equal. Any material submitted as equal is subject to NAVSEA approval.

3.3.6 O-ring packings. O-ring gaskets shall be in accordance with SAE-AMS7276, SAE-AMS7259, SAE-AMS3216, or SAE-AMS3218. Refer to MIL-P-25732 for guidance. Size shall be as specified (see 3.1). O-rings shall be lubricated with a light film of silicone compound in accordance with SAE-AS8660 at the time of assembly.

3.3.7 Caps and sealing plugs. Pressure-proof protective caps and sealing plugs shall be of the material specified (see 3.1). Where caps or sealing plugs are not specified, refer to L-P-390 for guidance in installing Type I plastic end caps to prevent damage to threads or entrance of water or dust.

3.3.8 Prohibited materials. Asbestos, cadmium, and mercury (see 3.3.8.1) shall not be used in construction of pressure-proof fittings covered by this specification.

3.3.8.1 Mercury. Mercury in any form shall not be used in manufacturing and test processes (including test equipment such as mercury thermometers) applying to the basic hull fitting, but may be used in manufacturing and test processes for materials and parts provided it is used in such a way that contamination of the materials and parts themselves cannot result.

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

3.4 Construction. The construction and physical dimensions shall be as specified herein and in 3.1.

3.4.1 Pin and socket contact assemblies. Contact arrangements and spacing shall be as specified (see 3.1). Solder cups shall be aligned to facilitate soldering.

3.4.1.1 Soldering. Soldering should follow the guidance provided in Guideline 5 of MIL-HDBK-454.

3.4.1.2 Socket contacts. Before, during, and after molding, contact surfaces of socket contacts shall be free of dirt, grease, or any other contaminants at all times. Removal of contamination after molding shall not be allowed as cleaning may damage or remove gold plating.

3.4.1.3 Sleeving. Sleeving shall be installed over each socket contact with the end of the sleeve $\frac{1}{32}$ inch from the face of the plug. Polyurethane shall not enter into the socket contact.

3.4.2 Wires and cables. Unless otherwise specified (see 6.2), wires and cables shall be as specified (see 3.1).

3.4.2.1 Conductor color code. Unless otherwise specified (see 6.2), the individual conductor color code number in cables shall be connected to the matching number of socket contacts.

3.4.2.2 Cable identification. The cable type shall be permanently marked on the molded plug or the cable within 6 inches of each plug. The cable manufacturer's repetitive cable identification markings are acceptable.

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3.4.2.3 Wire identification (inserts and receptacles). Ends of wires extending from inserts and receptacles shall be marked with the pin number to which they are attached.

3.4.2.4 Wire identification (plugs). Wires of cables molded to plugs shall be marked at ends according to the sockets to which they are attached.

3.4.2.5 Shields. Where shielded cables are molded in inserts, each shield shall be insulated from other shields in the cable, except where shields are connected to a common pin.

3.4.3 Molded plugs and inserts. Molded plugs and inserts shall be free of flash, blow holes, or other imperfections. Small gas bubbles that form on the face and top surface shall not be cause for rejection provided the molded parts are in accordance with the requirements specified (see 3.1). The flash shall be removed and the width of the flash edges shall be not greater than $\frac{1}{32}$ inch. Flash edges shall then be buffed smooth.

3.4.3.1 Plugs. The termination of the mold at the cable may be a featheredge or may be terminated short of a featheredge at the option of the contractor, provided the mold meets the requirements specified herein. Metal areas of plug sleeves in contact with polyurethane or epoxy compounds shall be sandblasted and cleaned in accordance with S9320-AM-PRO-020 to obtain the best possible bond. The molding compound shall be bonded to metal parts and cured in accordance with S9320-AM-PRO-020. Surfaces in contact with O-rings shall be protected from sandblasting.

3.4.3.2 Inserts. Inserts shall be of a one-piece construction. Split inserts shall not be allowed. Pre-pot inserts subsequently molded into a complete one-piece insert assembly are acceptable. Pre-pots can be used in high density count connectors thus permitting contact insertion and soldering of wires prior to final molding of the complete insert.

3.4.4 Caps. Cable connectors, receptacles, and adapter fittings shall be provided with caps in place to prevent damage to threads and entrance of water or dust into the receptacle. Caps shall remain in place until final assembly with plugs.

3.4.4.1 Pressure-proof caps. When specified (see 6.2), pressure-proof caps (see 3.1) consisting of a cover and O-ring shall be furnished with single cable and multi-pin receptacles, and molded plug adapters. The number of caps furnished shall be as specified (see 3.1). When pressure-proof caps are not specified, plastic caps shall be furnished (see 3.3.7).

3.4.4.2 Sealing plugs. When specified (see 6.2), sealing plugs consisting of a cover and O-ring shall be furnished with molded plugs.

3.4.4.3 Protective caps. Protective caps shall be furnished with molded plugs when sealing plugs are not specified (see 3.4.4.2). Where protective caps are not specified on the applicable specification sheet, plastic caps shall be furnished (see 3.3.7).

3.4.5 Welding. Welding shall be in accordance with S9074-AR-GIB-010/278.

3.4.5.1 Welders. Welders shall be qualified in accordance with S9074-AQ-GIB-010/248.

3.4.5.2 Electrodes. In welding nickel-copper (Ni-Cu) alloy to Ni-Cu-Al alloy, the following electrodes shall be used:

- a. 8N12 or 9N10 covered electrode in accordance with MIL-E-22200/3 (manual metal arc).
- b. MIL-EN60 or MIL-RN60 electrode in accordance with MIL-E-21562 (tungsten inert gas).
- c. See Requirement 16 of MIL-DTL-24231/11.

3.4.5.3 Weld repair. There shall be no weld repair on any portion of a hull fitting body, nut, washer, or plug for hull inserts.

3.4.6 Stress relieving. Metals used in fabrication and assembly shall be treated or heat-treated to prevent deterioration or failure due to stresses or other conditions resulting from working, forming, welding, brazing, and so forth during the fabrication process. Final condition shall be in accordance with the applicable specification sheet.

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3.4.7 Threads. Unless otherwise specified (see 3.1), threads shall be right-hand, Class 2, in accordance with United and American National screw threads as specified in FED-STD-H28/2.

3.4.7.1 Undercuts. Unless otherwise dimensioned (see 3.1), all undercuts shall be not more than 0.005 inch greater than the minimum minor diameter or maximum major diameter of the thread.

3.4.8 O-rings. Assembled O-rings shall be examined and installed in accordance with S9320-AM-PRO-020.

3.4.9 Sharp edges. Drilled and tapped holes shall have all burrs removed. Sharp edges shall be slightly rounded.

3.4.10 Finish. Surface finishes shall be in accordance with ASME B46.1, except that O-ring sealing surfaces shall be free of all defects, scratches, voids, blow holes, dents, and flaws.

3.4.11 Loose parts. Loose parts required for installation or operation shall be enclosed in a cloth or plastic bag and packaged with the assembly (see 6.6).

3.4.12 Voltage and current ratings (for application purposes only). In general, all of the electrical pressure-proof fittings specified herein and in 3.1 shall have the following voltage and current ratings:

Voltage (maximum)	Current (maximum)	Power (maximum)
600 volts alternating current (VAC) root mean square (rms)	For Type B-16 wire; 6 amperes (see MIL-DTL-16878/1)	2000 watts (W)
1000 volts direct current (VDC)	See applicable cable requirements of the specification sheets	

3.5 Performance.

3.5.1 Insulation resistance. When tested (see 4.5.1), the insulation resistance of the electrical pressure-proof fittings shall be as follows:

- a. Electrical connectors, receptacles, and adapters:
 - (1) Conductor to conductor: 5000 megohms or greater.
 - (2) Conductor to ground: 5000 megohms or greater.
 - (3) Conductor to shield: 5000 megohms or greater.
 - (4) Shield to ground: 1000 megohms or greater.
- b. Molded plug assemblies:
 - (1) Conductor to conductor: 200 megohms or greater.
 - (2) Conductor to ground: 200 megohms or greater.
 - (3) Conductor to shield: 100 megohms or greater.
 - (4) Shield to ground: 100 megohms or greater.

3.5.2 Dielectric withstanding voltage. When tested (see 4.5.2), electric pressure-proof fittings shall withstand dielectric voltage and there shall be no evidence of disruptive discharge, arcing, flashover, corona, or breakdown.

3.5.3 Continuity check. When electrical pressure-proof fittings are tested as specified in 4.5.3, there shall be no evidence of open circuits.

3.5.4 Hydrostatic pressure. There shall be no evidence of leakage when pressure-proof fittings are subjected to the hydrostatic pressure test (see 4.5.4).

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3.5.5 Hardness.

3.5.5.1 Hardness. Ni-Cu-Al alloy parts shall have a minimum hardness of 250 Brinell or 24 Rockwell “C” (see 4.5.5.1).

3.5.5.2 Rubber packing. Rubber packing shall have a durometer hardness as specified in 3.1 when tested as specified in 4.5.5.2.

3.5.6 Bonding (type I). Type I fittings shall withstand the bonding test, as applicable, (see [figure 1](#) and [figure 2](#)) when tested as specified in 4.5.6.

3.5.7 Underwater explosion (types III and IV). Unless otherwise specified (see 6.2), the underwater explosion requirement and test procedures for Types III and IV fittings shall be as specified in 4.5.7.

3.5.8 Operation (types I through V). Types I through V fittings shall operate as specified herein when tested as specified in 4.5.8.

3.5.9 Dye penetrant (types II through VI). Types II through VI fittings shall withstand the dye penetrant test (see 4.5.9) as applicable, without cracks. Welds shall withstand the applicable dye penetrant tests.

3.5.10 Shock. The pressure-proof fittings shall withstand shock in accordance with Grade A, Class I, Type A for lightweight equipment of MIL-S-901 when tested (see 4.5.10).

3.5.11 Vibration. The pressure-proof fittings shall withstand vibration in accordance with Type I of MIL-STD-167-1 when tested (see 4.5.11).

3.6 Marking. Manufacturer’s marking shall be that of the prime manufacturer responsible for the final acceptance of equipment.

3.6.1 Designation and information plates. Designation and information plates shall be in accordance with Type B or C corrosion-resisting steel (CRES), or Type H [aluminum (Al) alloy] of MIL-DTL-15024, $\frac{1}{16}$ inch thick. Plates shall be constructed for severe service in accordance with MIL-P-15024/5.

3.6.2 Receptacle, single and multiple cable connector bodies, and hull insert plug. Manufacturer’s marking consisting of the military part number, manufacturer’s serial number, and heat code shall appear on the outboard (unthreaded) end of each hull insert plug, on the outer diameter of each multiple cable connector body, single cable connector body, and receptacle body. The marking shall be permanent and legible, and shall be applied so as not to induce detrimental stresses or cause malfunction of the part. Electro-chemical etching and vibra tool etching are considered satisfactory. Lettering shall be $\frac{1}{8}$ -inch minimum.

3.6.3 Body nut and washer. Manufacturer’s marking consisting of the military part number, manufacturer’s serial number, and heat code shall appear on the exterior section of each Ni-Cu-Al alloy nut and washer. The markings shall be permanent and legible, and shall be applied so as not to induce detrimental stresses or cause malfunction of the part. Lettering shall be $\frac{1}{8}$ -inch minimum.

3.6.4 Molded plug. Manufacturer’s markings shall appear on the exterior molded section of each Type I molded plug assembly (straight or 90-degree). The marking shall consist of the military part number and the manufacturer’s symbol. Markings shall be a part of the mold, embossed, $\frac{1}{8}$ -inch minimum lettering, legible, and located so as not to affect the function of the mold.

3.6.5 Pin and socket contacts. Pin and socket contact numbers shall be molded into the polyurethane and epoxy resin compounds. The orientation of the numbers shall be as shown on the applicable specification sheet. Lettering shall be $\frac{1}{16}$ -inch minimum.

3.7 Workmanship. Penetrators, plug assemblies, and accessories shall meet all design dimensions and interchangeability requirements of this specification. Loose contacts, poor molding fabrication, loose materials, defective bonding, damaged or improperly assembled contacts, peeling or stripping of plating or finish, galling of mated parts, nicks or burrs on metal parts, and post-molding warpage will be considered adequate basis for rejection of items as being of inferior quality for the purpose intended.

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4. VERIFICATION

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

- a. First article inspection (see 4.2).
- b. Conformance inspection (see 4.3).

4.2 First article inspection. First article inspection shall be performed on sample units which have been produced with equipment and procedures normally used in production. When specified (see 6.2), a first article inspection report shall be prepared (see 6.3).

4.2.1 Sample size. One complete pressure-proof fitting assembly or one single item (see 4.5.12) of each military part number shall be subjected to first article inspection. Where applicable, the sample shall be furnished with an approximately 1-foot length of cable or wire, wired and molded as required by 3.1.

4.2.2 Inspection routine. Samples shall be subjected to the first article inspection specified in [table I](#), in the order shown.

4.3 Conformance inspection.

4.3.1 Inspection of product for delivery. Inspection of product for delivery shall consist of groups A, B, and C conformance inspections specified in [table I](#). When specified (see 6.2), a conformance inspection report shall be prepared.

4.3.1.1 Inspection lot. An inspection lot shall consist of complete pressure-proof fittings or single items (see 4.5.12) of the same military part number, produced under essentially the same conditions, and offered for inspection at one time.

4.3.1.1.1 Disposition of sample units. Sample units that have been subjected to group C inspection shall not be delivered on the contract.

TABLE I. First article, conformance, and single item inspection.

Inspection	Requirement	Test method	First article							Conformance							Single item						
			Type							Type							Type						
			I	II	III	IV	V	VI	VII	I	II	III	IV	V	VI	VII	I	II	III	IV	V	VI	VII
GROUP A																							
General examination	3.1, 3.3, 3.4, 3.6, and 3.7	4.4.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Operation	3.5.8	4.5.8	X	X	X	X	X	-	-	X	X	X	X	X	-	-	-	-	-	-	-	-	-
GROUP B																							
Insulation resistance	3.5.1	4.5.1	X	X	X	X	X	-	-	X	X	X	X	X	-	-	X	X	X	X	X	-	-
Continuity check	3.5.3	4.5.3	X	X	X	X	X	-	-	X	X	X	X	X	-	-	X	X	X	X	X	-	-
O-ring	3.4.8	4.4.1	X	X	X	X	X	X	-	X	X	X	X	X	X	-	X	X	X	X	X	X	-
Hardness																							
Brinell or Rockwell	3.5.5.1	4.5.5.1	-	X	X	X	-	X	-	-	X	X	X	-	X	-	-	X	X	X	-	X	-
Durometer	3.5.5.2	4.5.5.2	-	-	X	X	-	-	-	-	-	X	X	-	-	-	-	X	X	-	-	-	
Dye penetrant	3.5.9	4.5.9	-	X	X	X	X	X	X	-	X	X	X	X	X	-	-	X	X	X	X	X	-
Bonding (non-destructive)	3.5.6	4.5.6.1	X	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	
Vibration	3.5.11	4.5.11	X	X	X	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Shock	3.5.10	4.5.10	X	X	X	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Underwater explosion shock ^{4/}	3.5.7	4.5.7	-	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Hydrostatic pressure (24 hours) ^{1/3/}	3.5.4	4.5.4.1	X	X	X	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Hydrostatic pressure (2 hours) ^{2/3/}	3.5.4	4.5.4.2	-	-	-	-	-	-	-	X ^{3/}	X	X	X	X	-	-	-	X	X	X	X	-	
Dielectric withstanding voltage	3.5.2	4.5.2	X	X	X	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
GROUP C																							
Bonding (destructive)	3.5.6	4.5.6.2	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

See footnotes at top of next page.

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TABLE I. First article, conformance, and single item inspection – Continued.

NOTES:

- ^{1/} The insulation resistance test (see 4.5.1) shall be performed before, during, and after the hydrostatic test. The continuity test shall be performed before and after the hydrostatic pressure test.
- ^{2/} The insulation resistance test and continuity test shall be performed before the 0 to 100 lbf/in² test and after the 0 to 2000 lbf/in² test.
- ^{3/} Molded plugs mated to matching receptacles shall also be tested during the hydrostatic pressure test.
- ^{4/} Underwater explosion testing can be waived from first article upon both satisfactory underwater explosion performance of the parent design and satisfactory compliance with all other first article requirements.

4.4 Examinations.

4.4.1 Visual and mechanical examination. Pressure-proof fittings and single items (see 4.5.12) shall be examined to verify that materials, design, construction, physical dimensions, marking, and workmanship are in accordance with the requirements specified herein and in the specification sheets (see 3.1, 3.3, 3.4, 3.6, and 3.7).

4.5 Tests.

4.5.1 Insulation resistance. Insulation resistance tests shall be in accordance with Method 302, Test Condition B of MIL-STD-202. The points of measurement shall be as follows:

- a. Single cable and multiple cable connectors, receptacles, and adapters:
 - (1) Conductor to conductor.
 - (2) Conductor to ground.
 - (3) Conductor to shield.
 - (4) Shield to ground.
- b. Molded plugs:
 - (1) Conductor to conductor.
 - (2) Conductor to ground.
 - (3) Conductor to shield.
 - (4) Shield to ground.

When pins are exposed to water, no insulation resistance tests shall be conducted during the hydrostatic pressure tests. Insulation resistance readings shall be in accordance with 3.5.1.

4.5.2 Dielectric withstanding voltage. Electric pressure-proof fittings shall be tested in accordance with Method 301 of MIL-STD-202 to determine conformance to 3.5.2. The following shall apply:

- a. Magnitude of test voltage: 1600 volts root mean square (V_{rms}) or the value specified on the applicable cable or wire specification sheet (see 3.1), whichever is lower.
- b. Nature of potential: alternating current (AC).
- c. Points of application of test voltage: between any two adjacent contacts and between the metal portion of the connector and contact.

4.5.3 Continuity check. Using an ohmmeter, a continuity check shall be performed on the fitting types and at the intervals specified in [table I](#) to determine conformance to 3.5.3.

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4.5.4 Hydrostatic pressure.

4.5.4.1 First article test. The pressure-proof fittings shall be tested in the configuration specified for the applicable type (see 4.5.4.1.1 through 4.5.4.1.4). Cables or wires shall be protected to prevent water from entering open ends. The fittings shall be subjected to the following pressure cycles:

- a. Gauge pressure 0 to 100 pounds per square inch (lb/in²) for 5 minutes, cycle three times.
- b. Gauge pressure 0 to 2000 lb/in², one cycle; 24-hour duration.

4.5.4.1.1 Type I. The molded plug and cable shall be assembled with an applicable receptacle.

4.5.4.1.2 Type II. Unless otherwise specified (see 4.5.4.2), the completed adapter shall be tested in the unmated condition (pins exposed to pressure side) and mated condition (mated with matching plug).

4.5.4.1.3 Type III and IV. Unless otherwise specified (see 4.5.4.2), the assembled (single or multiple) cable connector shall be tested in the unmated (pins exposed to pressure side) and mated condition (mated with matching plug).

4.5.4.1.4 Type V. The receptacle body shall be welded or secured in a test plate or pressure-proof enclosure for testing purposes. Receptacles shall be tested to the same configuration as specified in 4.5.4.1.3.

4.5.4.2 Conformance test. Pressure-proof fittings shall be tested as specified in 4.5.4.1, except that the fittings shall be tested in the unmated condition and the gauge pressure 0 to 2000 lb/in² test shall be maintained for 2 hours in lieu of 24 hours.

4.5.5 Hardness.

4.5.5.1 Brinell or rockwell. The Brinell or Rockwell hardness of each Ni-Cu-Al alloy connector and body cover, body, body washer, body nut, and plug for hull insert shall be tested in accordance with ASTM E10 or ASTM E18, as applicable. Unless otherwise specified (see 3.1), hardness shall be checked at three locations, avoiding critical surfaces. Tests shall be considered as an indication of final material condition and shall be in accordance with 3.5.5.1.

4.5.5.2 Durometer. Rubber packing shall be subjected to the Type A test specified in ASTM D2240 to determine compliance with 3.5.5.2.

4.5.6 Bonding.

4.5.6.1 Nondestructive. The nondestructive bonding test (see [figure 1](#)) shall be conducted on sample plugs. Evidence of poor bonding shall be cause for rejection (see 3.5.6).

4.5.6.2 Destructive. The destructive bonding test shall be conducted on one plug assembly in a fully cured condition as determined by correct durometer and shall be tested as follows: With a sharp knife, make two cuts ($\frac{5}{8}$ inch apart and 3 inches long) as shown on [figure 2](#). Cut to metal surface and cable surface. Place a screwdriver or spatula (minimum width of $\frac{1}{4}$ inch) approximately midway between the polyurethane surface and the metal sleeve surface in one of the cuts as shown on [figure 2](#). Pry back the polyurethane material in this manner until the polyurethane breaks or the bond releases. Repeat this probing process along the 3-inch cut. If necessary, use pliers to pull polyurethane compound during test. Cut pieces removed for adhesion test shall show no uncured compound as determined by the hydrometer tests of both inside and outside surfaces. Any evidence of poor bonding between polyurethane and exposed metal or cable shall be cause for rejection (see 3.5.6).

4.5.7 Underwater explosion. Single and multiple cable connectors shall be tested for underwater explosion (see 3.5.7). Failure to pass this test shall be cause for rejection.

4.5.8 Operation. Each molded plug assembly shall be mated with a matching receptacle and each receptacle or connector assembly shall be mated with matching plugs to ascertain proper fit. With each completed assembly mated with its matching assembly, an electrical continuity test shall be conducted while the cable is flexed where it enters the fitting to determine conformance to 3.5.8. The continuity test may be omitted where the cable for one of the matching assemblies is received with a component (such as a hydrophone) molded to one end.

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4.5.9 Dye penetrant. Single cable connector bodies, multiple cable connector bodies, and covers, nuts, washers, and plugs for hull inserts shall be examined for cracks by the liquid penetrant method, Type II, of T9074-AS-GIB-010/271. If any cracks are found, this shall be cause for rejection. Welds shall be dye penetrant tested. Surfaces shall be clean and free from oxide films prior to testing.

4.5.10 Shock. The shock test shall be conducted in accordance with Grade A, Class I, Type A lightweight equipment of MIL-S-901 on completely assembled pressure-proof fittings to determine conformance to 3.5.10. Any signs of electrical or mechanical damage shall be cause for rejection.

4.5.11 Vibration. The vibration test shall be performed on completely assembled pressure-proof fittings in accordance with Type I of MIL-STD-167-1 to determine conformance to 3.5.11. Any signs of electrical or mechanical damage shall be cause for rejection.

4.5.12 Inspection of single items. The tests specified in 4.5.12.1 through 4.5.12.4 shall apply to individual parts of pressure-proof fittings acquired separately (that is, in lieu of a completely assembled fitting). These tests apply to first article and conformance inspections.

4.5.12.1 Molded insert assemblies. The following tests shall apply to all molded insert assemblies purchased separately:

- a. Visual and dimensional examination (see 4.4.1).
- b. Insulation resistance and electrical continuity check (see 4.5.1 and 4.5.3).
- c. Hydrostatic pressure test (see 4.5.4) shall be performed while insert assembly is mounted in an applicable receptacle and in an unmated condition.

4.5.12.2 Hull insert plug, single cable connector body, multiple cable connector body, and multi-pin receptacle body and adapter body for molded plugs. The tests specified for single items (see [table I](#)) shall be performed where applicable.

4.5.12.3 Packing. The durometer hardness of each packing shall be in accordance with 3.5.5.2 when subjected to the test specified in 4.5.5.2.

4.5.12.4 Caps. Each cap shall be checked for correct dimensions and O-ring surface finish.

5. PACKAGING

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

6. NOTES

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

6.1 Intended use. The pressure-proof fittings covered in this specification are primarily intended for use on Naval submarines to provide watertight integrity. They are to be used as hull and bulkhead fittings for electrical penetrations thereof.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification and the applicable specification sheet.
- b. The complete military part number.
- c. Type of pressure-proof fittings required (see 1.2).
- d. When first article is required (see 3.2).

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- e. When material control objective quality evidence is required (see 3.3.1 and 3.3.2.1).
- f. Wires and cables required if other than specified (see 3.4.2).
- g. Conductor color code required if other than specified (see 3.4.2.1).
- h. When pressure-proof caps are required (see 3.4.4.1).
- i. When sealing plugs are required (see 3.4.4.2).
- j. Underwater explosion requirement and test procedures required for Types III and IV fittings (see 3.5.7).
- k. When a first article inspection report is required (see 4.2).
- l. When a conformance inspection report is required (see 4.3.1).
- m. Packaging requirements (see 5.1).
- n. Levels of packaging and packing required (see 6.6).
- o. Special marking required (see 6.7).
- p. Inspection of industrial packaging required (see 6.8).
- q. Wiring table to be used, where applicable (see Appendix A).

6.3 First article. When a first article inspection is required, the item should be a first production item. The first article should consist of one unit. The contracting officer should include specific instructions in acquisition documents regarding arrangements for examinations, approval of first article test results and disposition of first articles. Invitations for bids should provide that the Government reserves the right to waive the requirements for samples for first article inspection to those bidders offering a product which has been previously acquired or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending contract.

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

6.5 Material control objective quality evidence.

6.5.1 Objective evidence. When specified in the contract or order, material control quality evidence should be prepared (see 6.3). Each Ni-Cu-Al alloy single cable connector body, multiple cable connector body, multi-pin receptacle body, hull insert plug, washer, nut, and HY80/HTS hull insert should be accompanied by material control objective evidence that the material is in accordance with all the requirements of the applicable specification. The following information should be a part of the objective evidence:

- a. Military part number (for example, M24231/7-001).
- b. Contract number.
- c. Contractor's identity.
- d. Material certification and heat treatments with a statement to the effect that objective evidence is on file in support of material identification and heat treatment, traceable from the part number (see 3.3.1 and 3.3.2.1).
- e. Brinell or Rockwell hardness (three readings) with acceptable range of readings (except for multi-pin receptacles).
- f. Direct reading of O-ring surface diameter with specified standard.
- g. That "32" surface finishes are as shown on the applicable specification sheet and are free of imperfections.
- h. Dye penetrant (MT where required) results of welded joints and parts, as applicable.
- i. Signature or symbol of contractor's inspector.
- j. Signature or symbol of Defense Contract Management Agency (DCMA) representative.

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6.5.1.1 Delivery. The contractor should pack one copy of the objective quality evidence with the item (see 6.6) and retain a duplicate copy on file. The cognizant inspection service is authorized to withhold shipment until the required objective quality evidence is in accordance with this specification. Failure to provide acceptable objective quality evidence should be cause for rejection of the material.

6.6 Packaging, packing, and marking. Pressure-proof fittings or single items should be packaged level A or C, packed level A, B, or C as specified (see 6.2), and marked in accordance with MIL-E-17555 except that descriptive details and plans and testing of a first article pack are not required. In addition, the following apply:

- a. O-rings furnished separately with the hull fitting should be individually packaged and marked in accordance with SAE-AMS2817. Each packaged O-ring should be placed within the applicable package.
- b. Unassembled (loose) parts should be packaged in a cloth or plastic bag and should be placed within the applicable package (see 3.4.11).
- c. Prior to unit packaging, each fitting should be fitted with a metal or plastic cap on both ends of each assembly as applicable, to protect contacts and insulators from entry of foreign matter and to protect the metal surfaces from mechanical and physical damage.

6.7 Marking. In addition to any special marking required (see 6.2), unit, intermediate, and exterior shipping containers should be marked for shipment in accordance with MIL-STD-129 and should include bar code markings on unit packs.

6.8 Inspection of packaging. Except when industrial packaging is specified, the sampling and inspection of the preservation and interior package marking should be in accordance with groups A and B conformance inspection requirements of MIL-STD-2073-1. The sampling and inspection of the packing and marking for shipment and storage should be in accordance with the quality assurance provisions of the applicable specification shown in section 6 and the marking requirements of MIL-STD-129. The inspection of industrial packaging should be as specified (see 6.2).

6.9 Subject term (key word) listing.

Construction

Contacts

Fittings

Inserts

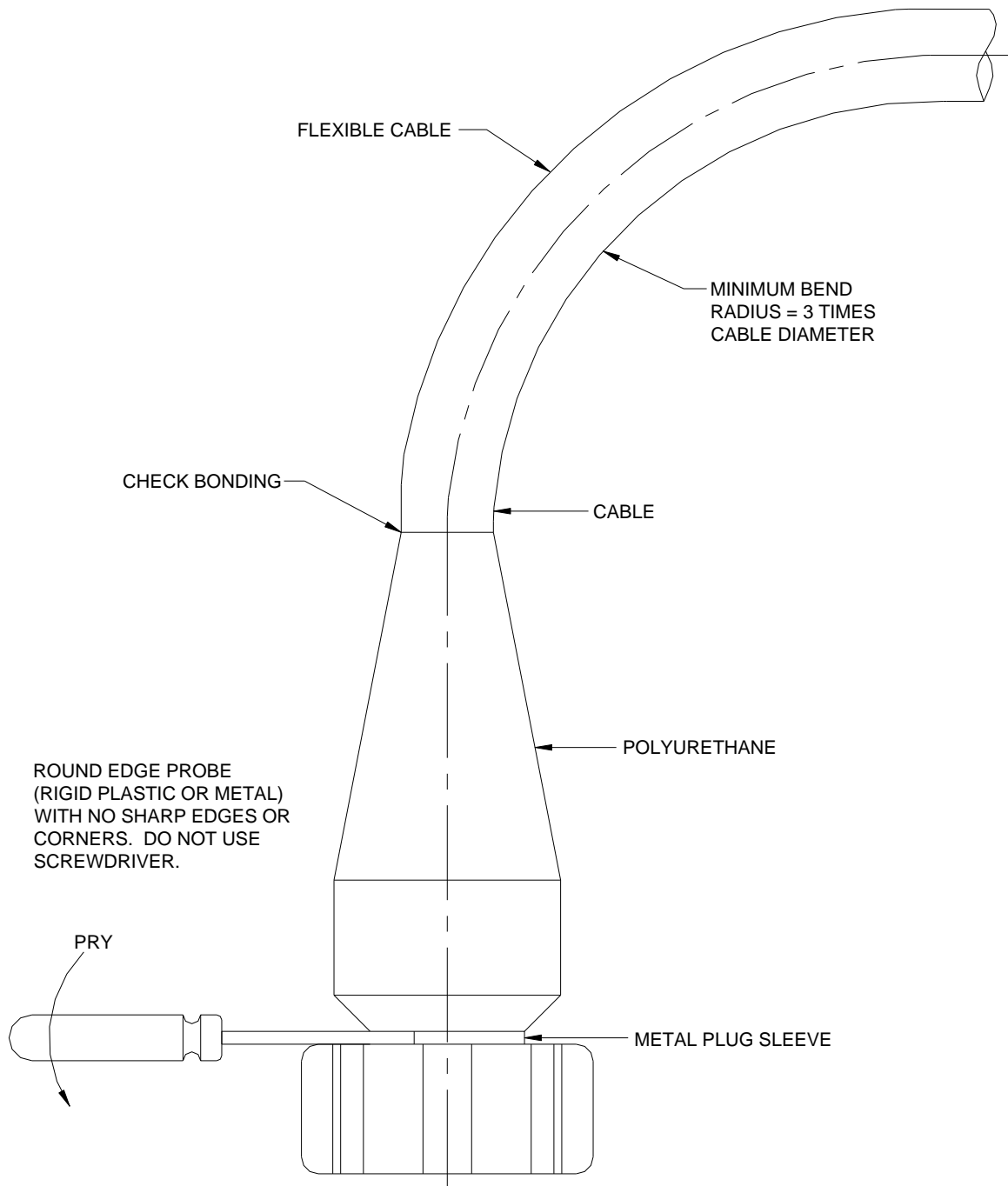
Packing

Performance

Plugs

6.10 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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IF POLYURETHANE MATERIAL PEELS BACK TO REVEAL BARE METAL, THE PLUG ASSEMBLY SHALL BE REJECTED. REPEAT TEST AT FOUR DIFFERENT POINTS ALONG CIRCUMFERENCE.

FIGURE 1. Bonding test (nondestructive).

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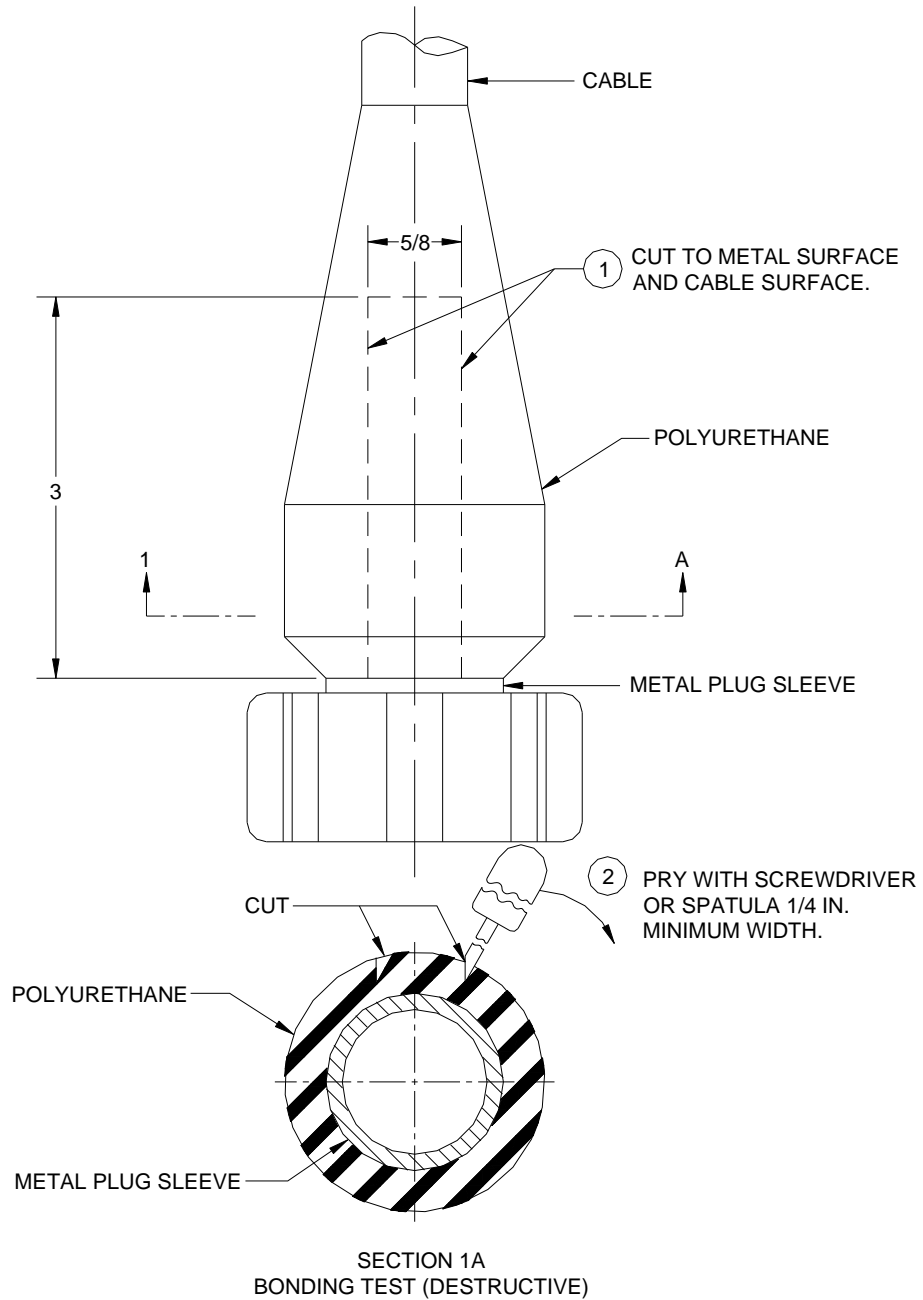


FIGURE 2. Bonding test (destructive).

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APPENDIX A

APPENDIX A

USAGE DATA

A.1 SCOPE

A.1.1 Scope. This appendix describes the uses of the various plugs, receptacles, adapters, single and multiple cable connectors, and hull insert plugs, and shows the mating connections in tabular form. This appendix also lists the standard electrical drawings which are superseded by this specification. This Appendix is not a mandatory part of the specification. The information contained herein is intended for guidance only.

A.2 APPLICABLE DOCUMENTS

A.2.1 General. The documents listed in this section are specified in sections 3 or 4 of this appendix. 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 or 4 of this appendix, 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.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-DTL-915	- Cable, Electrical, for Shipboard Use, General Specification for
MIL-DTL-915/58	- Cable, Electrical, 600 Volts, Type MWF.
MIL-DTL-23020	- Cable, Coaxial (for Submarine Use)
MIL-C-23020/4	- Cable, Coaxial (Submarine Use) Type RG-264C/U
MIL-DTL-24643/33	- Cable, Electrical, -20 °C to +90 °C, Type LS2SWU
MIL-DTL-24643/38	- Cable, Electrical, -20 °C to +90 °C, 600 Volts, Type LSECM

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

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) PUBLICATIONS

S9320-AM-PRO-020	- Underwater Cable Assembly and Encapsulated Components, Fabrication, Repair, and Installation Manual; Vol. II, Molding and Inspection Procedures for Fabricating Connector Plugs for Submarine Outboard Cables
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(Copies of this document are available online at <https://n11.ahf.nmci.navy.mil/>. This publication can be located by searching the Navy Publications Index for the TMIN without the suffix.)

A.2.3 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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APPENDIX A

A.3 USAGE

A.3.1 Mating connectors. [Table A-I](#) lists the plugs, adapters, and receptacles by assembly (part) numbers and shows their respective mating connectors, also by assembly (part) number.

TABLE A-I. Cross index of mating plugs, receptacles, adapters, and single and multiple cable connectors.

Military part no. M24231/	No. of contacts	Description	Cables	Use with M24231/	Wiring table	Supersedes	
						Drawing	Symbol
1-001	3	Molded plug	THOF-3 ^{1/}	5-001; 12-001; 15-001	IV	1197004	713
1-001	3	Molded plug	TSS-4; DSS-3 ^{1/}	6-001; 12-002; 15-001	IV	1197004	713
1-002	4	Molded plug	FSS-2 ^{1/}	5-002; 12-003; 15-002	V	1197004	713.6
2-001	3	Molded plug; 90-degree	THOF-3 ^{1/}	5-001; 12-001; 15-001	IV	1197004	713.5
2-001	3	Molded plug; 90-degree	TSS-4; DSS-3 ^{1/}	6-001; 12-002; 15-001	IV	1197004	713.5
2-002	4	Molded plug; 90-degree	FSS-2 ^{1/}	5-002; 12-003; 15-002	V	1197004	713.8
3-001	7	Molded plug	TSS-4 ^{1/}	8-001; 13-002; 16-001	VI	1197004	713.1
3-001	7	Molded plug	FSS-2 ^{1/}	8-002; 13-002; 16-001	VI	1197004	713.1
3-001	7	Molded plug	FSS-4 ^{1/}	8-003; 13-002; 16-001	VI	1197004	713.1
3-001	7	Molded plug	MSS-6 ^{2/} ; 7SS-2 ^{1/}	9-001; 13-002; 16-001	VI	1197004	713.1
3-001	7	Molded plug	MHOF-7 ^{2/}	7-001; 13-001; 16-001	VI	1197004	713.1
3-002	9	Molded plug	RG264A/U ^{3/}	9-003; 17-001	VII	--	--
3-003	9	Molded plug	RG264C/U ^{4/}	9-002; 17-001	VII	1197004	713.7
4-001	14	Molded plug	MWF-14 ^{5/} ; MHOF-14 ^{1/}	10-001; 14-001	^{6/}	1197004	713.2
4-002	24	Molded plug	MWF-24; MWF-19 ^{5/} ; MHOF-24; TSP-11 ^{1/}	10-002; 14-002	^{6/}	1197004	713.3
4-003	30	Molded plug	MWF-30 ^{5/} ; MHOF-30 ^{1/}	10-003; 14-003	^{6/}	1197004	713.4
4-004	40	Molded plug	As specified	10-004; 14-004	--	1197004	713.4
4-005	40	Molded plug	2SWU-19 ^{7/}	10-005	XV	--	713.10
5-001	3	Single cable connector	-----	25-001 ^{8/}	--	1197003	517
5-002	4	Single cable connector	-----	25-001 ^{8/}	--	1197003	517.11
6-001	3	Single cable connector	DDS-3 ^{1/}	25-001 ^{8/}	IV	1197003	517.4
7-001	7	Single cable connector	-----	25-001 ^{8/}	--	1197003	517.1
8-001	7	Single cable connector	TSS-4 ^{1/}	25-001 ^{8/}	VI	1197003	517.8
8-002	7	Single cable connector	FSS-2 ^{1/}	25-001 ^{8/}	VI	1197003	517.7
8-003	7	Single cable connector	FSS-4 ^{1/}	25-001 ^{8/}	VI	1197003	517.9
9-001	7	Single cable connector	MSS-6 ^{2/} ; 7SS-2 ^{1/}	25-001 ^{8/}	VI	1197003	517.5
9-002	9	Single cable connector	RG264A/U ^{3/}	25-001 ^{8/}	VII	1197003	517.12
9-003	9	Single cable connector	RG264C/U ^{4/}	25-001 ^{8/}	VII	---	---
10-001	14	Single cable connector	-----	25-002 ^{8/}	--	1197003	517.2
10-002	24	Single cable connector	-----	25-002 ^{8/}	--	1197003	517.3
10-003	30	Single cable connector	-----	25-002 ^{8/}	--	1197003	517.6
10-004	40	Single cable connector	-----	25-002 ^{8/}	--	---	517.14
10-005	40	Single cable connector	-----	25-002 ^{8/}	--	---	---

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APPENDIX A

TABLE A-I. Cross index of mating plugs, receptacles, adapters, and single and multiple cable connectors – Continued.

Military part no. M24231/	No. of contacts	Description	Cables	Use with M24231/	Wiring table	Supersedes	
						Drawing	Symbol
11-001	--	Multiple cable connector	-----	25-002 ^{8/}	--	1197011	516
11-002	--	Multiple cable connector	-----	25-002 ^{8/}	--	1197011	516.1
11-003	--	Multiple cable connector	-----	25-002 ^{8/}	--	1197011	516.2
12-001	3	Multi-pin receptacle	-----	11-001; 11-002; 11-003	--	1197012	737
12-002	3	Multi-pin receptacle	2 cond. shld.		--	1197012	737.4
12-003	4	Multi-pin receptacle	-----	11-001; 11-002; 11-003 11-001	--	1197012	737.7
13-001	7	Multi-pin receptacle	-----	11-001	--	1197012	737.1
13-002	7	Multi-pin receptacle	-----	11-001	--	1197012	737.6
14-001	14	Multi-pin receptacle	-----	11-001	--	1197012	737.2
14-002	24	Multi-pin receptacle	-----	11-001	--	1197012	737.3
14-003	30	Multi-pin receptacle	-----	11-001	--	1197012	737.5
14-004	40	Multi-pin receptacle	-----	11-001	--	---	---
15-001	3	Adapter for molded plug	-----	1-001; 2-001	--	1197208	1115
15-002	4	Adapter for molded plug	-----	1-002; 2-002	--	1197208	---
16-001	7	Adapter for molded plug	-----	3-001	--	1197209	1116
17-001	9	Adapter for molded plug	-----	3-002	--	1197209	1116.1
18-001	65	Molded plug	TSP-31 ^{1/}	19-001; 20-001	VII	1197049	1139
19-001	65	Single cable connector	-----	25-003 ^{8/}	--	1197048	1138
20-001	65	Multi-pin receptacle	-----	-----	--	1197048	1138.1
21-001	80	Molded plug	ECM ^{9/}	22-001	VIII	1197100	1118
22-001	80	Receptacle, 2.125 base	-----	-----	--	1197100	1117
22-002	80	Receptacle, 3.875 base	-----	-----	--	1197100	1117.1
23-001	3	Molded plug	THOF-9 ^{1/}	24-001 ^{8/}	III	1197004	713.9
24-001	3	Single cable connector	THOF-9 ^{1/}	25-001 ^{8/}	III	1197003	517.13
25-001	--	Hull insert	-----	-----	--	1197003	PC. 5
25-002	--	Hull insert	-----	-----	--	1197003	PC. 6
25-003	--	Hull insert	-----	-----	--	1197048	PC. 2
26-001	14	Single cable connector	2 cond. shield. (3)	25-002 ^{8/}	IX, X,	---	1270
26-002	14	Single cable connector	2 cond. shield. (4)	25-002 ^{8/}	XI	---	1270.1
26-003	24	Single cable connector	2 cond. shield. (7)	25-002 ^{8/}	IX, X, XI IX, X, XI	---	1270.2

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APPENDIX A

TABLE A-I. Cross index of mating plugs, receptacles, adapters, and single and multiple cable connectors – Continued.

Military part no. M24231/	No. of contacts	Description	Cables	Use with M24231/	Wiring table	Supersedes	
						Drawing	Symbol
27-001	14	Multi-pin receptacle	2 cond. shield. (3)	11-001	IX, X,	---	1271
27-002	14	Multi-pin receptacle	2 cond. shield. (4)	11-001	XI	---	1271.1
27-003	24	Multi-pin receptacle	2 cond. shield. (7)	11-001	IX, X, XI IX, X, XI	---	1271.2

NOTES:

^{1/} In accordance with MIL-DTL-915.

^{2/} Formerly shown in MIL-DTL-915; replaced by 7SS.

^{3/} Formerly shown in MIL-DTL-23020.

^{4/} Refer to MIL-C-23020/4 for guidance.

^{5/} In accordance with MIL-DTL-915/58.

^{6/} Connections should be made in accordance with the applicable specification.

^{7/} In accordance with MIL-DTL-24643/33.

^{8/} This identifies hull inserts for mounting the applicable part.

^{9/} In accordance with MIL-DTL-24643/38.

A.3.2 Cable connections. [Table A-II](#) through [table A-XI](#) list the cable connections that should be made to all plugs and receptacles.

TABLE A-II. Connections for two-pin receptacles and plugs.

Pin	Color
1	Black
2	White

TABLE A-III. Connections for three-pin receptacles and plugs.

Pin	Cable/color		
	DSS-3	TSS-4 ^{1/}	THOF-3
1	Black	Black	Black
2	White	White	White
3	Shld	Red	Red

NOTE:

^{1/} Shield not connected.

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TABLE A-IV. Connections for four-pin receptacles and plugs.

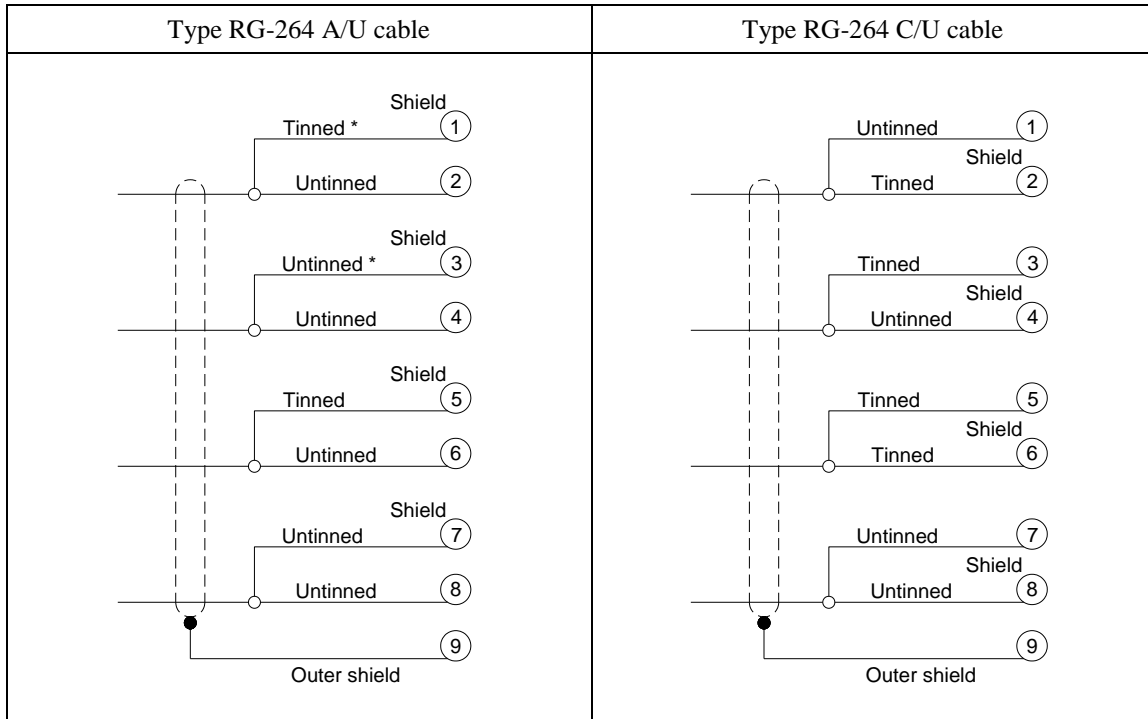
Pin	Cable/color
	FSS-2 ^{1/}
1	Black
2	White
3	Red
4	Green
NOTE: ^{1/} Shield not connected.	

TABLE A-V. Connections for seven-pin receptacles and plugs.

Pin	Cable/color					
	MHOF-7	MSS-6	FSS-2	TSS-4	FSS-4	7SS-2
1	Black	Black	Black	Black	Black	Black
2	White	White	White	White	White	White
3	Red	Blue	Red	Red	Red	Red
4	Green	Red	Green	----	Green	Green
5	Orange	Yellow	----	----	----	Orange
6	Blue	Green	----	----	----	Blue
7	White Black	Both Shlds	Shld	Shld	Shld	Brown Shield not connected

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TABLE A-VI. Connections for type RG-264A/U and RG-264C/U cable.



NOTE: Copper shields should be electronically isolated from each other and from ground. Use care in soldering so as not to damage the insulation.

* With blue marker.

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TABLE A-VII. Connections for type TSP-31 cable.

Pair	Color	Socket no.
Black and white	Black	1
	White	2
Black and red	Black	3
	Red	4
Black and green	Black	5
	Green	6
Black and orange	Black	7
	Orange	8
Black and blue	Black	9
	Blue	10
Black and brown	Black	11
	Brown	12
Black and grey	Black	13
	Grey	14
Black and yellow	Black	15
	Yellow	16
Black and purple	Black	17
	Purple	18
Black and tan	Black	19
	Tan	20
Black and pink	Black	21
	Pink	22
White and red	White	23
	Red	24
White and green	White	25
	Green	26
White and orange	White	27
	Orange	28
White and blue	White	29
	Blue	30
White and brown	White	31
	Brown	32
White and grey	White	33
	Grey	34
White and yellow	White	35
	Yellow	36

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TABLE A-VII. Connections for type TSP-31 cable – Continued.

Pair	Color	Socket no.
White and purple	White	37
	Purple	38
White and tan	White	39
	Tan	40
White and pink	White	41
	Pink	42
Red and green	Red	43
	Green	44
Red and orange	Red	45
	Orange	46
Red and blue	Red	47
	Blue	48
Red and brown	Red	49
	Brown	50
Red and grey	Red	51
	Grey	52
Red and yellow	Red	53
	Yellow	54
Red and purple	Red	55
	Purple	56
Red and tan	Red	57
	Tan	58
Red and pink	Red	59
	Pink	60
Green and orange	Green	61
	Orange	62

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TABLE A-VIII. Connections for 80-conductor plug and receptacle (type ECM cable).

Group no.	Color	Socket no.
1	Black	36
	Black	35
	Black	34
	Black	33
	Black	39
	White	37
	White	38
2	Black	40
	Black	41
	Black	42
	Black	43
	Black	44
	White	45
	White	46
3	Black	64
	Black	65
	Black	66
	Black	67
	Black	68
	White	69
	White	70
4	Black	71
	Black	72
	Black	73
	Black	74
	Black	75
	White	76
	White	77
5	Black	57
	Black	58
	Black	59
	Black	60
	Black	61
	White	62
	White	63
6	Black	55
	Black	54
	Black	53
	Black	51
	Black	50
	White	56
	White	52

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TABLE A-VIII. Connections for 80-conductor plug and receptacle (type ECM cable) – Continued.

Group no.	Color	Socket no.
7	Black	10
	Black	11
	Black	12
	Black	13
	Black	14
	White	8
	White	9
8	Black	1
	Black	2
	Black	3
	Black	4
	Black	7
	White	5
	White	6
Shielded pair no.	Color	Socket no.
1	Black	16
	White	17
	Shld.	15
2	Black	19
	White	20
	Shld.	18
3	Black	29
	White	28
	Shld.	27
4	Black	24
	White	25
	Shld.	26
5	Black	30
	White	31
	Shld.	32
6	Black	48
	White	47
	Shld.	49
7	Black	79
	White	78
	Shld.	80
8	Black	21
	White	23
	Shld.	22

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TABLE A-IX. Connections for 1SWF-2 cable.

Pin no.	Color	Plug M24231/	Receptacle M24231/
1	Black	1-001	12-002
2	----	2-001	
3	Shield		

TABLE A-X. Connections for type 2SWF cables (shields connected to common pins).

Cable pair no.	Cable	2SWF-3	2SWF-4	2SWF-7
	Conductor color	14 pin	14 pin	24 pin
1	Black	5	5	23
	White	6	6	24
	Shield	12	12	1
2	Black	14	14	9
	White	13	13	10
	Shield	12	12	1
3	Black	1	1	11
	White	2	2	12
	Shield	12	12	1
4	Black		10	22
	White		11	13
	Shield		12	1
5	Black			3
	White			16
	Shield			1
6	Black			4
	White			5
	Shield			1
7	Black			6
	White			7
	Shield			1
Molded plug:		M24231/ 4-001	M24231/ 4-001	M24231/ 4-002
Single cable connector assembly:		26-001	26-006	26-003
Multi-pin receptacle:		27-001	27-002	27-003

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TABLE A-XI. Connections for type 2SWF cables (all shields isolated).

Cable pair no.	Cable	2SWF-3	2SWF-4	2SWF-7
	Conductor color	14 pin	14 pin	24 pin
1	Black	5	5	21
	White	6	6	23
	Shield	12	12	24
2	Black	14	14	20
	White	13	13	9
	Shield	7	7	10
3	Black	1	1	11
	White	2	2	12
	Shield	9	9	22
4	Black		10	15
	White		11	14
	Shield		3	1
5	Black			2
	White			3
	Shield			16
6	Black			4
	White			17
	Shield			5
7	Black			18
	White			6
	Shield			7
Molded plug:		M24231/ 4-001	M24231/ 4-001	M24231/ 4-002
Single cable connector assembly:		26-001	26-006	26-003
Multi-pin receptacle:		27-001	27-002	27-003

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A.3.3 Cable list. [Table A-XII](#) lists the cables more commonly used and their matching plug connector assembly (part) number, as a cross reference.

TABLE A-XII. Cable list.

Cable type	Number of conductors	Plug assembly (part no.) M24231	Maximum OD of cable (inches)
DSS-3	2 shielded	1-001; 2-001	0.500
ECM	80	21-001	1.370
FSS-2	4 shielded	1-002; 2-002 ^{1/} ; 3-002 ^{2/} ;	0.500
FSS-4	4 shielded	3-001 ^{3/}	0.625
MHOF-7	7	3-001	0.500
MHOF-14	14	4-001	0.635
MHOF-24	24	4-002	0.795
MHOF-30	30	4-003	0.835
MSS-6	6	3-001 ^{3/}	0.625
7SS-2	7	3-001 ^{3/}	0.625
MWF-7	7	3-001	0.500
MWF-10	10	4-001	0.635
MWF-14	14	4-001	0.635
MWF-19	19	4-002	0.745
MWF-24	24	4-002	0.836
MWF-30	30	4-003	0.945
RG264A/U	4 shielded	3-002	0.765
RG264C/U	4 shielded	3-003	0.765
THOF-3	3	1-001; 2-001	0.450
THOF-9	3	23-001	0.600
TSP-11	22	4-002	0.735
TSP-31	62	18-001	0.062
TSS-4	3 shielded	1-001; 2-001; 3-001 ^{3/}	0.500
As specified	40	4-004	
1SWF-2	1 cond. shielded	See table A-IX	0.625
2SWF-3	3 shielded pairs	See table A-X	0.625
2SWF-4	4 shielded pairs	See table A-X	0.625
2SWF-7	7 shielded pairs	See table A-X	0.815
2SWU-19	19 shielded pairs	4-005 ^{2/}	1.380
NOTES:			
^{1/} Shields not connected to pins.			
^{2/} All shields isolated and connected to pins.			
^{3/} All shields connected to common pin.			

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A.3.4 Cross index of symbols, drawings, and military part numbers. [Table A-XIII](#) is a cross reference list of the symbol numbers and drawing numbers and their corresponding new military part numbers.

TABLE A-XIII. Cross index – symbol and drawing to assembly (part) number.

Symbol no.	Assembly (part no.) M24231/:
516	11-004
516.1	11-005
516.2	11-006
517	5-001
517.1	7-001
517.2	10-001
517.3	10-002
517.4	6-001
517.5	9-001
517.6	10-003
517.7	8-002
517.8	8-001
517.9	8-003
517.11	5-002
517.12	9-002
517.13	24-001
--	9-002
--	10-005
713	7-001
713.1	3-001
713.2	4-001
713.3	4-002
713.4	4-003
713.5	2-001
713.6	1-002
713.7	3-002
713.8	2-002
713.9	23-001
--	4-004
713.10	4-005
737	12-001
737.1	13-001
737.2	14-001
737.3	14-002
737.4	12-002
737.5	14-003
737.6	13-002
737.7	12-003
--	14-004

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TABLE A-XIII. Cross index – symbol and drawing to assembly (part) number – Continued.

1115	15-001
--	15-002
1116	16-001
1116.1	17-001
1117	22-001
1117.1	22-002
1118	21-001
1138	19-001
1138.1	20-001
1139	18-001
1270	26-001
1270.1	26-002
1270.2	26-003
1271	27-001
1271.1	27-002
1271.2	27-003
Drawing no.	Assembly (part no.) M24231/:
1197003-5	25-001
1197003-6	25-002
1197048-2	25-003
73980-51042	28-001
73980-51043	28-002
73980-51044	28-003

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A.3.5 Connections for 40-conductor plug for 2SWU-19 cable. [Table A-XIV](#) lists the connections for the 40-conductor plug for 2SWU-19 cable.

TABLE A-XIV. Connections for 40-conductor plug for 2SWU-19 cable.

Socket no.	Color	Shielded pair no.
1	Black	1
2	White	
3	Black	2
4	White	
5	Black	3
6	White	
7	Black	4
8	White	
9	Black	5
10	White	
11	Black	6
12	White	
13	Black	7
14	White	
15	Black	8
16	White	
17	Black	9
18	White	
19	Black	10
20	White	
21	Black	11
22	White	
23	Black	12
24	White	
25	Black	13
26	White	
27	Black	14
28	White	
29	Black	15
30	White	
31	Shield	
31	Shield	16
32	Black	
33	White	
34	Black	17
35	White	

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TABLE A-XIV. Connections for 40-conductor plug for 2SWU-19 cable – Continued.

Socket no.	Color	Shielded pair no.
36	Black	18
37	White	
38	Shield	
38	Shield	19
39	Black	
40	White	

A.3.6 Cable types for molded plugs. [Table A-XV](#) lists the cable types which, for molded plugs installed on the listed systems, require the shield to be cut back with the cable sheathing rather than soldering of the shield to a pin.

TABLE A-XV. Cable types for molded plugs.

System	Cable type (MIL-DTL-915/8)	Hyd/Trans
AN/BQA-8 SERIES	FSS-2	DT-287, DT-288, DT-333 DT-344, DT-506, DT-531 DT-513
AN/BQC-1 SERIES	DSS-3	AT-385, TR-122A, TR-122B
AN/BQR-2 SERIES	DSS-3	DT-168, DT-168A, DT-168B DT-532
AN/BQR-7 SERIES	DSS-3	DT-211, DT-211A, DT-276
AN/UQC-1 SERIES	DSS-3	AT-186A, AT-186B, AT-186C TR-193, TR-193A, TR-193B TR-230
AN/UQN-SERIES	DSS-3/4	AT-200, AT-200A, AT-200B AT-200D, AT-200C, TR-192 AT-200E, TR-192A, AT-200F
AN/UQN-1 & 4 SERIES	DSS-3/4	AT-200G, TR-192B, TR-256
AN/WQC-2/2A	DSS-3	TR-232, TR-233
AN/BQN-13	DSS-3	AN-BQN-13

A.4 TECHNICAL MANUAL

A.4.1 Molding processes. For information concerning installation, maintenance, and repair of item or assemblies described in this specification, see S9320-AM-PRO-020.

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