

MIL-C-24231D(SH)
15 May 1987
SUPERSEDING
MIL-C-24231C(SHIPS)
30 August 1976
(See 6.6)

MILITARY SPECIFICATION

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

This specification is approved for use within the Naval Sea Systems Command, Department of the Navy, 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) shall be of the following types as specified (see 6.2.1).

- 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.

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

AMSC N/A

FSC 5935

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1.3 Military part number. The Military part number shall consist of the letter "M", the basic number of the specification sheet, and an assigned dash number (see 3.1) as shown in the following example:

Military designator	M24231	/1	-	001
Specification sheet number				
Dash number				

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation.

SPECIFICATIONS

FEDERAL

- L-P-390 - Plastic Molding and Extrusion Material, Polyethylene and Copolymers (Low, Medium, and High Density).
- L-P-393 - Plastic Molding Material, Polycarbonate, Injection and Extrusion.
- L-P-535 - Plastic Sheet (Sheeting): Plastic Strip: Poly(Vinyl Chloride) and Poly(Vinyl Chloride-Vinyl Acetate), Rigid.
- L-P-1036 - Plastic Rod, Solid: Plastic Tubes and Tubing, Heavy Walled: Polyvinyl Chloride, Rigid.
- QQ-C-465 - Copper-Aluminum Alloys (Aluminum Bronze) (Copper Alloy Numbers 606, 614, 630, 632M, and 642); Rod, Flat Products with Finished Edges (Flat Wire, Strip, and Bar), Shapes and Forgings).
- 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).
- ZZ-R-765 - Rubber, Silicone.
- ZZ-R-768 - Rubber for Mountings (Unbonded-Spool and Compression Types).

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- MIL-M-14 - Molding Plastics and Molded Plastic Parts, Thermo-setting.
- MIL-P-116 - Preservation, Methods for.
- MIL-I-631 - Insulation, Electrical, Synthetic-Resin Composition, Nonrigid.
- MIL-S-901 - Shock Tests, H.I. (High-Impact); Shipboard Machinery, Equipment and Systems, Requirements for.

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- MIL-C-915 - Cable and Cord, Electrical, For Shipboard Use, General Specification for.
- MIL-C-915/8 - Cable, Electrical, 600 Volts, Types DSS, TSS, FSS and 7SS.
- MIL-C-915/22 - Cable, Electrical, 300 Volts, Type TSP (Including Variation Type TSPA).
- MIL-C-915/48 - Cable, Electrical, Type 2SWF.
- MIL-B-1083 - Balls, Bearing, Ferrous and Non Ferrous (For Use in Bearings and Valves).
- MIL-P-4861 - Packing, Preformed, Rubber, Packing; Packaging of.
- MIL-S-8660 - Silicone Compound, NATO Code Number S-736.
- MIL-P-15024 - Plates, Tags and Bands for Identification of Equipment.
- MIL-P-15024/5 - Plates, Identification.
- MIL-W-16878 - Wire, Electrical, Insulated, General Specification for.
- MIL-W-16878/1 - Wire, Electrical, Polyvinyl Chloride (PVC) Insulated, 105°C, 600 Volts.
- MIL-E-17555 - Electronic and Electrical Equipment, Accessories, and Provisioned Items (Repair Parts): Packaging of.
- MIL-P-20689 - Plastic Plastisol (For Coating Metallic Objects).
- MIL-E-21562 - Electrodes and Rods - Welding, Bare, Nickel Alloy.
- MIL-S-21952 - Steel (HY-80 and HY-100) Bars, Alloy.
- MIL-E-22200/3 - Electrodes, Welding, Covered: Nickel Base Alloy; and Cobalt Base Alloy.
- MIL-S-22473 - Sealing, Locking, and Retaining Compounds: (Single-Component).
- MIL-S-22698 - Steel Plate and Shapes, Weldable Ordinary Strength and Higher Strength: Hull Structural.
- MIL-C-23020 - Cable, Coaxial (For Submarine Use).
- MIL-C-23020/4 - Cable, Coaxial (Submarine Use) Type RC-264C/U.
- MIL-M-24041 - Molding and Potting Compound, Chemically Cured, Polyurethane.
- MIL-C-24643/3 - Cable, Electrical, 600 Volts, Types LSSHOF, LSDHOF, LSTHOF, and LSFHOF.
- MIL-C-24643/33 - Cable, Electrical, Type LS2SWU (Including Variation LS2SWUA).
- MIL-C-24643/38 - Cable, Electrical, 600 Volts, Type LSECM (Including Variation LSECMA).
- MIL-P-25732 - Packing, Preformed, Petroleum Hydraulic Fluid Resistant, Limited Service at 275°F (135°C).

(See supplement 1 for list of associated specification sheets.)

STANDARDS

FEDERAL

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

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- MIL-STD-129 - 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 - Test Methods for Electronic and Electrical Component Parts.
- MIL-STD-248 - Welding and Brazing Procedure and Performance Qualification.
- MIL-STD-271 - Nondestructive Testing Requirements for Metals.
- MIL-STD-278 - Fabrication Welding and Inspection; and Casting Inspection and Repair for Machinery, Piping and Pressure Vessels in Ships of the United States Navy.
- MIL-STD-454 - Standard General Requirements for Electronic Equipment.

2.1.2 Other Government publications. The following other Government publications form a part of this specification to the extent specified herein. Unless otherwise specified, the issues shall be those in effect on the date of the solicitation.

PUBLICATIONS

NAVAL SEA SYSTEMS COMMAND (NAVSEA)

S0900-00-PRO-000/MLDG MAN - Molding and Inspection Procedures for Fabricating Connector Plugs for Submarine Outboard Cables.

(Copies of specifications, standards, and publications required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted shall be those listed in the issue of the DoDISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS shall be the issue of the nongovernment documents which is current on the date of the solicitation.

AMERICAN NATIONAL STANDARDS INSTITUTE, INC. (ANSI)

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

(Application for copies should be addressed to the American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.)

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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- D 2240 - Standard Test Method for Rubber Property - Durometer Hardness. (DoD adopted)
- D 4066 - Standard Specification for Nylon Injection and Extrusion Materials (PA). (DoD adopted)
- E 10 - Standard Test Method for Brinell Hardness of Metallic Materials. (DoD adopted)
- E 18 - Standard Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials. (DoD adopted)

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

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

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets, or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede 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 in the contract or purchase order, a sample shall be subjected to first article inspection (see 4.3 and 6.3).

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 in the contract or order, material control objective quality evidence shall be prepared (see 6.2.2).

3.3.1.1 Manufacturer of the hull fitting (single and multiple cable connectors) bodies, nuts, washers, and plugs for hull inserts shall assure that the required age hardening or annealing, or both, has been done correctly. For each annealing or age hardening step, or both, traceable by the part number to every hull fitting body, nut, washer, and plug:

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- (a) When the nickel-copper-aluminum (Ni-Cu-Al) alloy bar stock is obtained in the mill annealed, age-hardened condition (annealed and age hardened by the mill) and the manufacturing processes are restricted to machining operations and welding, the chemical and physical certification obtained from the contractor of the bar stock will satisfy certification requirements when supplemented by the required traceability markings identifying the finished product to the bar stock on which the chemical and physical analysis was performed.
- (b) When the Ni-Cu-Al alloy bar stock is obtained in the mill annealed condition (annealed by the mill) and manufacturing processes are restricted to machining operations, age hardening and welding, the mill test certification on an age-hardened test bar plus records of age-hardening of finished parts, and certified calibration records of the furnace temperature measuring devices shall be maintained and furnished with the finished product. The finished parts heat treatment record shall consist of a time versus temperature plot of all age hardening heat treatments that the parts undergo, and shall identify, by part numbers, the parts to which it applies. The parts shall be age hardened by heating to 1100 to 1125 degrees Fahrenheit (°F) and held at that temperature for 16 hours followed by furnace cooling to 900°F at a rate of 15 to 25°F per hour. Step cooling may be used.

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-Al 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 in the contract or order material control objective quality evidence shall be prepared (see 6.2.2).

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.

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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 shall be 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 shall be 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 shall be subject to NAVSEA approval.

3.3.6 O-ring packings. O-ring gaskets shall conform to MIL-P-25732. Size shall be as specified (see 3.1). O-rings shall be lubricated with a light film of silicone compound in accordance with MIL-S-8660 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, plastic end caps in accordance with type I of L-P-390 shall be installed 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 way that contamination of the materials and parts themselves cannot result.

3.3.9 Recovered materials. Unless otherwise specified herein, all material and articles incorporated in the products covered by this specification shall be new and may be fabricated using materials produced from recovered materials to the maximum extent practicable without jeopardizing the intended use. The term "recovered materials" means materials which have been collected or recovered from solid waste and reprocessed to become a source of raw materials, as opposed to virgin raw materials. None of the above shall be interpreted to mean that the use of used or rebuilt products is allowed under this specification unless otherwise specifically specified.

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.

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3.4.1.1 Soldering. Soldering shall be in accordance with MIL-STD-454, requirement 5.

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 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 6.2.1), wires and cables shall be as specified (see 3.1).

3.4.2.1 Conductor color code. Unless otherwise specified (see 6.2.1), the individual conductor color code number in cables shall be connected to 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.

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 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 feather-edge 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 NAVSEA S0900-00-PRO-000/MLDC MAN to obtain the best possible bond. The molding compound shall be bonded to metal parts and cured in accordance with NAVSEA S0900-00-PRO-000/MLDC MAN. 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.

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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 6.2.1), 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 6.2.1), 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 MIL-STD-278.

3.4.5.1 Welders. Welders shall be qualified in accordance with MIL-STD-248.

3.4.5.2 Electrodes. In welding nickel-copper 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-C-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.

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 NAVSEA S0900-00-PRO-000/MLDG MAN.

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

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3.4.10 Finish. Surface finishes shall be in accordance with ANSI 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 5.1).

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:

<u>Voltage</u> (maximum)	<u>Current</u> (maximum)	<u>Power</u> (maximum)
600 volts alternating current (Vac) root mean square (rms)	For type B-16 wire; 6 amperes (see MIL-W-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 4.7.1), 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 4.7.2), electrical 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 4.7.3, 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 4.7.4).

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3.5.5 Hardness.

3.5.5.1 Ni-Cu-Al. Ni-Cu-Al alloy parts shall have a Brinell hardness within the range of 248 to 321 or 24 to 34 Rockwell "C" (see 4.7.5.1).

3.5.5.2 Rubber packing. Rubber packing shall have a durometer hardness as specified in 3.1 when tested as specified in 4.7.5.2.

3.5.6 Bonding (type I). Type I fittings shall withstand the bonding test as applicable (see figures 1 and 2) when tested as specified in 4.7.6.

3.5.7 Underwater explosion (types III and IV). Unless otherwise specified (see 6.2.1), the underwater explosion requirement and test procedures for types III and IV fittings shall be as specified in 4.7.7.

3.5.8 Operation (types I through V). Types I through V fittings shall operate as specified herein when tested as specified in 4.7.8.

3.5.9 Dye penetrant (types II through VI). Types II through VI fittings shall withstand the dye penetrant test (see 4.7.9) 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 4.7.10).

3.5.11 Vibration. The pressure-proof fittings shall withstand vibration in accordance with type I of MIL-STD-167-1 when tested (see 4.7.11).

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-P-15024, 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. Electrochemical etching and vibra tool etching are considered satisfactory. Lettering shall be 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 marking 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 1/8-inch minimum.

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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 markings shall consist of the military part number and the manufacturer's symbol. Markings shall be a part of the mold, embossed, 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 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.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.1.2 Inspection system. When specified in the contract or order an inspection system program plan shall be prepared (see 6.2.2).

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

- (a) First article inspection (see 4.3).
- (b) Quality conformance inspection (see 4.4).

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4.3 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 in the contract or order, a first article inspection report shall be prepared (see 6.2.2).

4.3.1 Sample size. One complete pressure-proof fitting assembly or one single item (see 4.7.12) 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.

4.3.2 Inspection routine. Samples shall be subjected to the first article inspection specified in table I, in the order shown.

4.4 Quality conformance inspection.

4.4.1 Inspection of product for delivery. Inspection of product for delivery shall consist of groups A, B, and C quality conformance inspections specified in table I. When specified in the contract or order, a quality conformance inspection report shall be prepared (see 6.2.2).

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TABLE 1. FIRST ARTICLE, QUALITY CONFORMANCE AND SINGLE ITEM INSPECTION.

Inspection	Requirement	Test method	First article							Quality 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	4.6.1	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	4.7.8	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
GROUP B																							
Insulation resistance	3.5.1	4.7.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Continuity check	3.5.3	4.7.3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
O-ring	3.4.8	4.6.1	X	X	X	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	4.7.5.1	-	X	X	X	X	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Durometer	3.5.5.2	4.7.5.2	-	-	-	X	X	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dye penetrant	3.5.9	4.7.9	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Bonding (non-destructive)	3.5.6	4.7.6.1	X	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
Vibration	3.5.11	4.7.11	X	X	X	X	X	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Shock	3.5.10	4.7.10	X	X	X	X	X	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Underwater explosion shock 4/	3.5.7	4.7.7	-	-	-	X	X	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydrostatic pressure (24 hours) 1/ 3/	3.5.4	4.7.4.1	X	X	X	X	X	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydrostatic pressure (2 hours) 2/ 3/	3.5.4	4.7.4.2	-	-	-	-	-	-	-	X ^{3/}	X	X	X	X	X	X	-	X	X	X	X	X	X
Dielectric with-standing voltage	3.5.2	4.7.2	X	X	X	X	X	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GROUP C																							
Bonding (destructive)	3.5.6	4.7.6.2	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

See footnotes at top of next page.

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- 1/ The insulation resistance test (see 4.7.1) 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.

4.4.1.1 Inspection lot. An inspection lot shall consist of complete pressure-proof fittings or single items (see 4.7.12) of the same military part number, produced under essentially the same conditions, and offered for inspection at one time.

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

4.4.1.2 Noncompliance. If a sample fails to pass group C inspection, the manufacturer shall notify the cognizant inspection activity of such failure and take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected and which are considered subject to the same failure. Acceptance and shipment of the product shall be discontinued until corrective action, acceptable to the inspection activity has been taken. After the corrective action has been taken, group B inspection shall be repeated on additional sample units (all tests and examinations, or the test which the original sample failed, at the option of the inspection activity). Group A inspection may be reinstituted; however, final acceptance and shipment shall be withheld until the group B inspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure shall be furnished to the cognizant inspection activity and NAVSEA.

4.5 Material control objective quality evidence.

4.5.1 When specified in the contract or order, material control quality evidence shall be prepared (see 6.2.2). 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 shall be accompanied by material control objective evidence that the material is in accordance with all the requirements of the applicable specification. The following information shall 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 3.3.1.1).
- (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.

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- (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 Administration Services Management Area (DCASMA) representative.

4.5.1.1 The contractor shall pack one copy of the objective quality evidence with the item (see 5.1) 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 shall be cause for rejection of the material.

4.6 Examinations.

4.6.1 Visual and mechanical examination. Pressure-proof fittings and single items (see 4.7.12) 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).

4.7 Tests.

4.7.1 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.

4.7.2 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:

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- (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.

4.7.3 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.

4.7.4 Hydrostatic pressure.

4.7.4.1 First article test. The pressure-proof fittings shall be tested in the configuration specified for the applicable type (see 4.7.4.1.1 through 4.7.4.1.4). 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/in^2) for 5 minutes, cycle three times.
- (b) Gauge pressure 0 to 2000 pounds lb/in^2 one cycle; 24-hour duration.

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

4.7.4.1.2 Type II. Unless otherwise specified (see 4.7.4.2), the completed adapter shall be tested in the unmated condition (pins exposed to pressure side) and mated condition (mated with matching plug).

4.7.4.1.3 Types III and IV. Unless otherwise specified (see 4.7.4.2), 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).

4.7.4.1.4 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 4.7.4.1.3.

4.7.4.2 Quality conformance test. Pressure-proof fittings shall be tested as specified in 4.7.4.1, except that the fittings shall be tested in the unmated condition and the gauge pressure 0 to 2000 lb/in^2 test shall be maintained for 2 hours in lieu of 24 hours.

4.7.5 Hardness.

4.7.5.1 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 E 10 or ASTM E 18, 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.

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4.7.5.2 Durometer. Rubber packing shall be subjected to the type A test specified in ASTM D 2240 to determine compliance with 3.5.5.2.

4.7.6 Bonding.

4.7.6.1 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).

4.7.6.2 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 (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 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).

4.7.7 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.

4.7.8 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.

4.7.9 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, group III, of MIL-STD-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.

4.7.10 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.

4.7.11 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.

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4.7.12 Inspection of single items. The tests specified in 4.7.12.1 through 4.7.12.4 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 quality conformance inspections.

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

- (a) Visual and dimensional examination (see 4.6.1).
- (b) Insulation resistance and electrical continuity check (see 4.7.1 and 4.7.3).
- (c) Hydrostatic pressure test (see 4.7.4) shall be performed while insert assembly is mounted in an applicable receptacle and in an unmated condition.

4.7.12.2 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.

4.7.12.3 Packing. The durometer hardness of each packing shall be in accordance with 3.5.5.2 when subjected to the test specified in 4.7.5.2.

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

4.8 Inspection of packaging. Except when industrial packaging is specified, the sampling and inspection of the preservation and interior package marking shall be in accordance with groups A and B quality conformance inspection requirements of MIL-P-116. The sampling and inspection of the packing and marking for shipment and storage shall be in accordance with the quality assurance provisions of the applicable specification shown in section 5 and the marking requirements of MIL-STD-129. The inspection of industrial packaging shall be as specified (see 6.2.1).

5. PACKAGING

(The packaging requirements specified herein apply only for direct Government acquisition. For the extent of applicability of the packaging requirements of referenced documents listed in section 2, see 6.4.)

5.1 Packaging, packing, and marking. Pressure-proof fittings or single items shall be packaged level A or C, packed level A, B, or C as specified (see 6.2.1), 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 shall apply:

- (a) O-rings furnished separately with the hull fitting shall be individually packaged and marked in accordance with MIL-P-4861. Each packaged O-ring shall be placed within the applicable package.
- (b) Unassembled (loose) parts shall be packaged in a cloth or plastic bag and shall be placed within the applicable package (see 3.4.11).

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- (c) Prior to unit packaging, each fitting shall 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.

5.2 Marking. In addition to any special marking required (see 6.2.1), unit, intermediate, and exterior shipping containers shall be marked for shipment in accordance with MIL-STD-129 and shall include bar code markings on unit packs.

6. NOTES

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 Ordering data.

6.2.1 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).
- (e) Wires and cables required if other than specified (see 3.4.2).
- (f) Conductor color code required if other than specified (see 3.4.2.1).
- (g) When pressure-proof caps are required (see 3.4.4.1).
- (h) When sealing plugs are required (see 3.4.4.2).
- (i) Underwater explosion requirement and test procedures required for types III and IV fittings (see 3.5.7).
- (j) Inspection of industrial packaging required (see 4.8).
- (k) Levels of packaging and packing required (see 5.1).
- (l) Special marking required (see 5.2).
- (m) Wiring table to be used, where applicable (see appendix).

6.2.2 Data requirements. When this specification is used in an acquisition and data are required to be delivered, the data requirements identified below shall be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved Contract Data Requirements List (CDRL), incorporated into the contract. When the provisions of DoD FAR Supplement, Part 27, Sub-Part 27.410-6 (DD Form 1423) are invoked and the DD Form 1423 is not used, the data specified below shall be delivered by the contractor in accordance with the contract or purchase order requirements. Deliverable data required by this specification are cited in the following paragraphs.

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<u>Paragraph no.</u>	<u>Data requirement title</u>	<u>Applicable DID no.</u>	<u>Option</u>
3.3.1,	Records objective quality evidence:	UDI-II-26373	----
3.3.2.1,	for submarine safety/material		
4.5	certification		
4.1.2	Inspection system program plan	DI-R-4803	----
4.3	First article inspection report	DI-T-4902	----
4.4	Inspection and test reports	DI-T-5349	----

(Data item descriptions related to this specification, and identified in section 6 will be approved and listed as such in DoD 5010.12-L., AMSDL. Copies of data item descriptions required by the contractors in connection with specified acquisition functions should be obtained from the Naval Publications and Forms Center or as directed by the contracting officer.)

6.2.2.1 The data requirements of 6.2.2 and any task in sections 3, 4, or 5 of this specification required to be performed to meet a data requirement may be waived by the contracting/acquisition activity upon certification by the offeror that identical data were submitted by the offeror and accepted by the Government under a previous contract for identical item acquired to this specification. This does not apply to specified data which may be required for each contract regardless of whether an identical item has been supplied previously (for example, test reports).

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 Subject term (key word) listing.

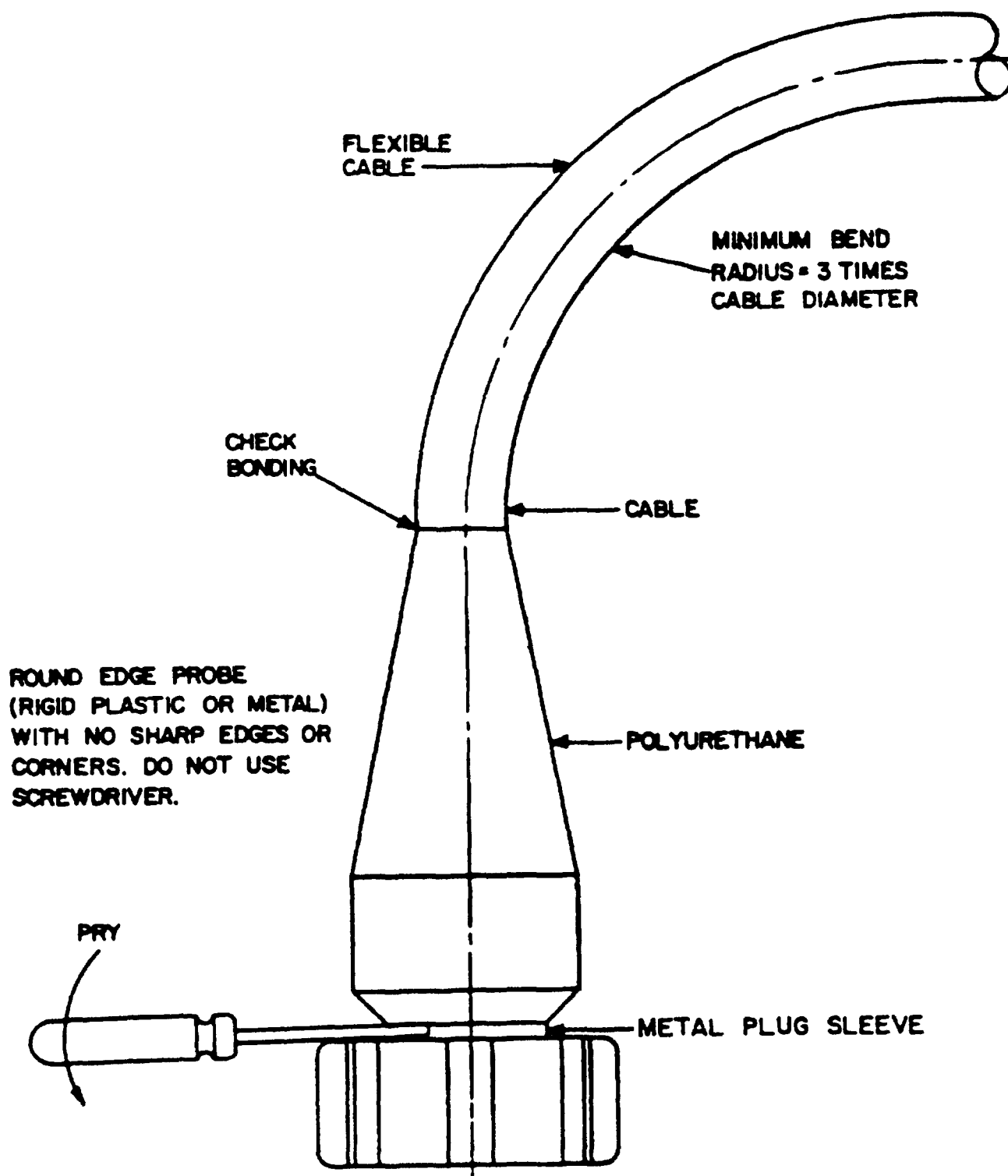
Adapter
Connector
Insert, hull
Plug
Plug, hull insert
Receptacle

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6.6 Changes from previous issues. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Preparing activity:
Navy - SH
(Project 5935-N279)

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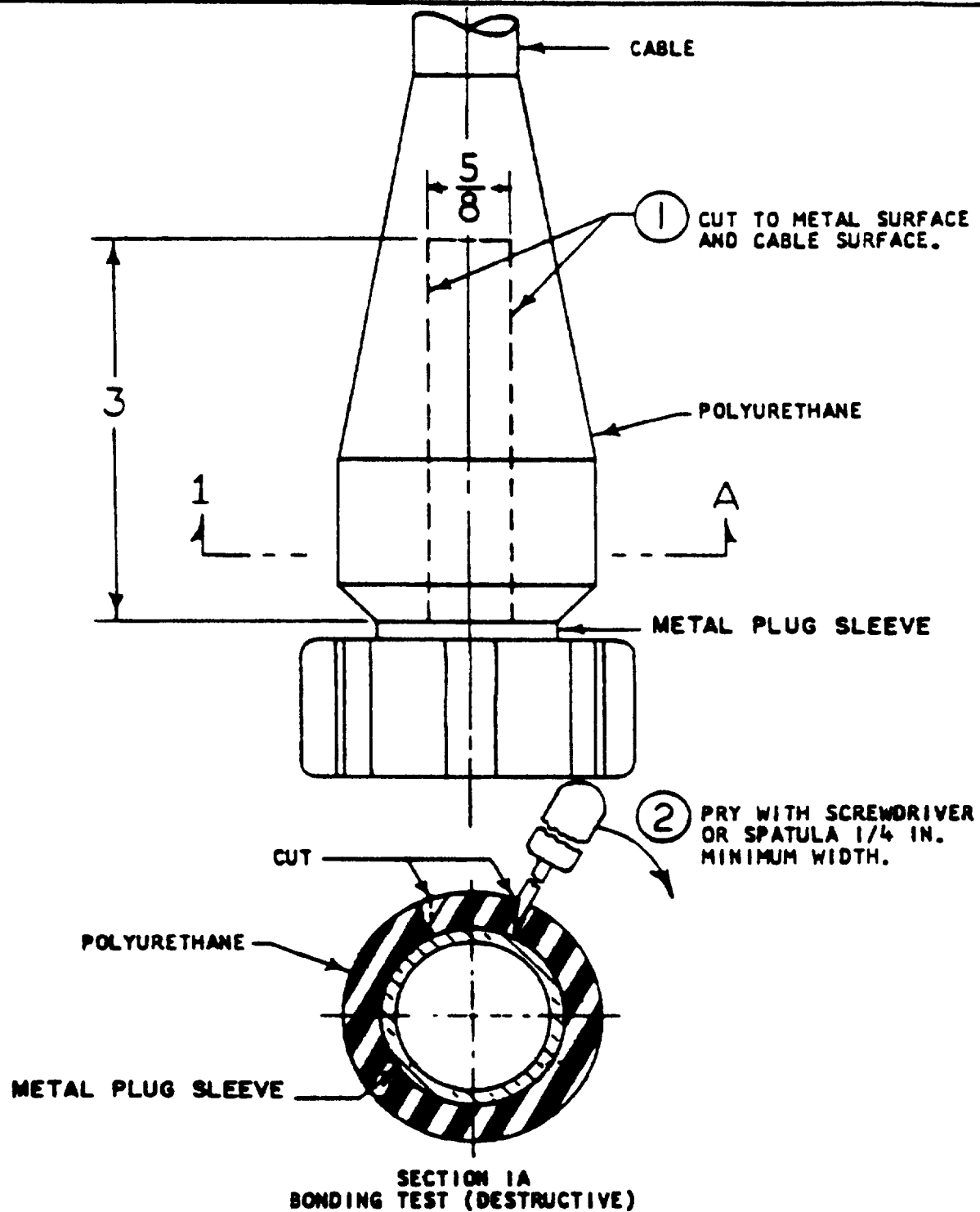


IF POLYURETHANE MATERIAL PEELS BACK TO REVEAL BARE METAL, THE PLUG ASSEMBLY SHALL BE REJECTED. REPEAT TEST AT FOUR DIFFERENT POINTS ALONG CIRCUMFERENCE

SH 9380

FIGURE 1. Bonding test (nondestructive).

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SH 9381

FIGURE 2. Bonding test (destructive).

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APPENDIX A

USAGE DATA

10. SCOPE

10.1 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.

20. APPLICABLE DOCUMENTS

20.1 Government documents.

20.1.1 Specifications. The following specification forms a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation.

SPECIFICATION

MILITARY

MIL-C-915/58 - Cable, Electrical, 600 Volts, Type MWF.

(Copies of specifications required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

30. USAGE

30.1 Table II lists the plugs, adapters, and receptacles by assembly (part) numbers and shows their respective mating connectors, also by assembly (part) number.

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APPENDIX A

TABLE II. 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 degrees	THOF-3 1/	5-001; 12-001; 15-001	IV	1197004	713.5
2-001	3	Molded plug; 90 degrees	TSS-4; DSS-3 1/	6-001; 12-002; 15-001	IV	1197004	713.5
2-002	4	Molded plug; 90 degrees	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	RC264A/U 3/	9-003; 17-001	VII	---	---
3-003	9	Molded plug	RC264C/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/	10-002; 14-002	6/	1197004	713.3
4-003	30	Molded plug	MHOF-24; TSP-11 1/	10-003; 14-003	6/	1197004	713.4
4-004	40	Molded plug	MWF-30 5/; MHOF-30 1/	10-004; 14-004	—	1197004	713.4
4-005	40	Molded plug	As specified 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	IDS-3 1/	25-001 8/	IV	1197003	517.4

See footnotes at end of table.

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APPENDIX A

TABLE II. 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
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/	--	---	---
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.	11-001; 11-002; 11-003	--	1197012	737.4
12-003	4	Multi-pin receptacle	-----	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

See footnotes at end of table.

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APPENDIX A

TABLE II. 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
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

See footnotes at end of table.

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APPENDIX ATABLE II. 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
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. shld. (3)	25-002 8/	IX, X, XI	---	1270
26-002	14	Single cable connector	2 cond. shld. (4)	25-002 8/	IX, X, XI	---	1270.1
26-003	24	Single cable connector	2 cond. shld. (7)	25-002 8/	IX, X, XI	---	1270.2
27-001	14	Multi-pin receptacle	2 cond. shld. (3)	11-001	IX, X, XI	---	1271
27-002	14	Multi-pin receptacle	2 cond. shld. (4)	11-001	IX, X, XI	---	1271.1
27-003	24	Multi-pin receptacle	2 cond. shld. (7)	11-001	IX, X, XI	---	1271.2

- 1/ In accordance with MIL-C-915.
- 2/ Formerly shown in MIL-C-915; replaced by 7SS.
- 3/ Formerly shown in MIL-C-23020.
- 4/ In accordance with MIL-C-23020/4.
- 5/ In accordance with MIL-C-915/58.
- 6/ Connections shall be made in accordance with the applicable specification.
- 7/ In accordance with MIL-C-24643/33.
- 8/ This identifies hull inserts for mounting the applicable part.
- 9/ In accordance with MIL-C-24643/38.

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30.2 Tables III through XII lists the cable connections that shall be made to all plugs and receptacles.

TABLE III. Connections for two-pin receptacles and plugs.

Pin	Color
1	Black
2	White

TABLE IV. Connections for three-pin receptacles and plugs.

Pin	Cable/color		
	DSS-3	TSS-4 <u>1/</u>	THOF-3
1	Black	Black	Black
2	White	White	White
3	Shld	Red	Red

1/ Shield not connected.

TABLE V. Connections for four-pin receptacles and plugs.

Pin	Cable/color
	FSS-2 <u>1/</u>
1	Black-
2	White-
3	Red-
4	Green-

1/ Shield not connected.

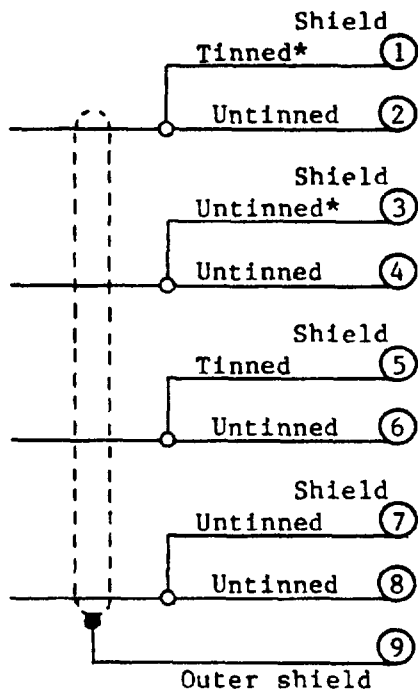
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APPENDIX A

TABLE VI. Connections for seven-pin receptacles and plugs.

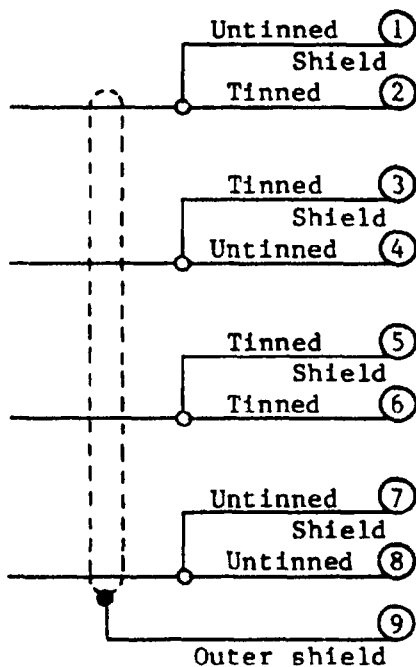
Pin	Cable/color					
	MHOF-7	MSS-6	FSS-2	TSS-4	FSS-4	7SS-2
1	Black	Black	Black	Black	Black	Black
2	White	White	White	White	White	White
3	Red	Blue	Red	Red	Red	Red
4	Green	Red	Green	-----	Green	Green
5	Orange	Yellow	-----	-----	-----	Orange
6	Blue	Green	-----	-----	-----	Blue
7	White	Both	Shld	Shld	Shld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

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

Type RC-264A/U cable



Type RG-264C/U cable



NOTE: Copper shields shall be electrically isolated from each other and from ground. Use care in soldering not to damage the insulation.

*With blue marker.

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TABLE VIII. 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

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TABLE VIII. Connections for type TSP-31 cable. - Continued

Pair	Color	Socket no.
White and brown	White	31
	Brown	32
White and grey	White	33
	Grey	34
White and yellow	White	35
	Yellow	36
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 IX. 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

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

Group no.	Color	Socket no.
6	Black	55
	Black	54
	Black	53
	Black	51
	Black	50
	White	56
	White	52
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

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

Shielded pair no.	Color	Socket no.
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

TABLE X. Connections for 1SWF cable.

Pin no.	Color	Plug P24231/	Receptacle M24231/
1	Black	1-001	12-002
2	-----	2-001	
3	Shield		

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TABLE XI. 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	26-002	26-003
Multi-pin receptacle:		27-001	27-002	27-003

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TABLE XII. 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	26-002	26-003
Multi-pin receptacle:		27-001	27-002	27-003

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30.3 Table XIII lists the cables more commonly used and their matching plug connector assembly (part) number, as a cross reference.

TABLE XIII. 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 FSS-4	4 Shielded 4 Shielded	1-002; 2-002 <u>1</u> /; 3-002 <u>2</u> / 3-001 <u>3</u> /	0.500 .625
MHOF-7 MHOF-14 MHOF-24 MHOF-30	7 14 24 30	3-001 4-001 4-002 4-003	.500 .635 .795 .835
MSS-6 7SS-2	6 7	3-001 <u>3</u> / 3-001 <u>3</u> /	.625 .625
MWF-7 MWF-10 MWF-14 MWF-19 MWF-24 MWF-30	7 10 14 19 24 30	3-001 4-001 4-001 4-002 4-002 4-003	.500 .635 .635 .745 .836 .945
RG264A/U RG264C/U	4 Shielded 4 Shielded	3-002 3-003	.765 .765
THOF-3 THOF-9	3 3	1-001; 2-001 23-001	.450 .600
TSP-11	22	4-002	.735
TSP-31 TSS-4	62 3 Shielded	18-001 1-001; 2-001; 3-001 <u>3</u> /	.062 .500
As specified	40	4-004	
1SWF-2	1 Cond. Shlded.	(See table VIII)	.625
2SWF-3 2SWF-4 2SWF-7	3 Shielded pairs 4 Shielded pairs 7 Shielded pairs	See table XI See table XI See table XI	.625 .625 .815
2SWU-19	19 Shielded pairs	4-005 <u>2</u> /	1.380

See footnotes at top of next page.

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- 1/ Shields not connected to pins.
2/ All shields isolated and connected to pins.
3/ All shields connected to common pin.

30.4 Table XIV is a cross reference list of the symbol numbers and drawing numbers and their corresponding new military part numbers.

TABLE XIV. Cross index - symbol and drawing to assembly (part) number.

Symbol no.	Assembly (part no.) M24231/:
515	11-001
516	11-001
516.1	11-002
516.2	11-003
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

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TABLE XIV. Cross index - symbol and drawing to assembly
(part) number. - Continued

Symbol no.	Assembly (part no.) M24231/:
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
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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30.4 Table XV lists the connections for the 40-conductor plug for 2SWU-19 cable.

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

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

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TABLE XV. Connections for 40-conductor plug for 2SWU-19 cable. - Continued

Socket no.	Color	Shielded pair no.
29 30 31	Black White Shield	15
31 32 33	Shield Black White	16
34 35	Black White	17
36 37 38	Black White Shield	18
38 39 40	Shield Black White	19

30.5 Table XVI 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 XVI. Cable types for molded plugs.

System	Cable type (MIL-C-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

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TABLE XVI. Cable types for molded plugs. - Continued

System	Cable type (MIL-C-915/8)	Hyd/Trans
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

40. TECHNICAL MANUAL

40.1 For information concerning installation, maintenance, and repair of item or assemblies described in this specification, see NAVSEA S0900-00-PRO-000/MLDC MAN.

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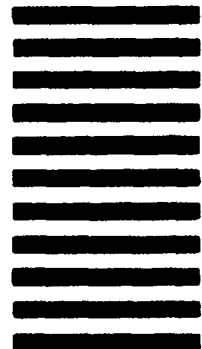
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