MILITARY SPECIFICATION

CONNECTORS, ELECTRIC, CIRCULAR, MINIATURE, RACK AND PANEL OR PUSH-PULL COUPLING, ENVIRONMENT RESISTING

This specification is mandatory for use by all activities of the Department of the Navy.

1. SCOPE

1.1 Scope. This specification covers three series of environment resisting, circular, miniature electrical connectors (plugs and receptacles) with removable crimp and/or nonremovable solder contacts, and accessories.

1.1.1 Series description. The connectors are identified as series 1, 2, or 3, and are designed to provide contact protection during mating. They have the following features:

Series 1 - Push-pull coupling, single key solder type nonremovable contacts (-55° C to +125° C).

Series 2 - Rack and panel or push-pull coupling, single key, removable front release crimp contacts (-55° C to +175° C).

Series 3 - Rack and panel, single key or push-pull coupling, five keys, removable rear release crimp contacts (-55° C to +175° C and +200° C).

1.2 Classification. Electric connectors shall be of the following classes, sizes, types, insert arrangements, and styles.

1.2.1 Coupling. Coupling shall be push-pull or rack and panel coupling (3.4.4).

1.2.2 Receptacle mounting - Mounting shall be as specified on the applicable MS standards.

(a) Flange
(b) Jam nut
(c) Solder

1.2.3 MS part number. The MS part number for qualified connectors procured in accordance with this specification shall conform to the following example:

MS3467	L	19	-	50	P	W
MS No. (see supplement	Class (1.2.3.1)	Shell size (1.2.3.2)	*	Insert arrangement (1.2.3.4)	Contact designator (1.2.3.5)	Insert position (1.2.3.6)

* For class H, the dash (-) is replaced by the termination type and shell material letter (see 1 2.3.3).

1.2.3.1 Class. The class and series of the connector shall be identified as indicated in table I.

TABLE I. Connector class and series.

Class	Series 1, 125° C	Series 2, 175° C	Series 3, 200° C
E - Grommet seal	X	X	X
P - Potting seal	X		
H - Hermetic seal	X		X
J - Inser seal with gland seal for jacketed cable	X	X	
L - Fluid resistance			X*
N - Hermetic seal, crimp			X
F - Grommet seal with strain relief clamp - obsolescent: Use E with strain relief clamp			

* L - Fluid resistant connectors, 175° C

1.2.3.2 Shell size. Shell size shall be as specified on the applicable MS standard.

1.2.3.3 Termination type and shell material, class H. The type of termination and shell material shall be designated as follows:

Type A - Solder cup termination - stainless steel shell
Type B - Eyelet termination - stainless steel shell
Type C - Solder cup termination - ferrous alloy shell
Type Y - Eyelet termination - ferrous alloy shell

1.2.3.4 Insert arrangement. The insert arrangement showing number, size, and position of contacts shall be as specified on the applicable MS standard.

1.2.3.5 Contact designator.

1.2.3.5.1 Connector with contacts.

P - Pin contact
S - Socket contact
C - Through-bulkhead contact

The P, S, and C designators are used to indicate a full complement of applicable power contacts.

1.2.3.5.2 Connector without contacts. (Not applicable to series 1 or series 3, classes H and N connectors.)

A - Less pin contact
B - Less socket contact

The A and B designators are used to indicate a connector less contacts. This will be used only when other than power contacts are to be used. (Example Shielded, coaxial, and thermocouple contacts). See 6.2.

1.2.3.5.3 Contact size designation. The contact size designation shall consist of mating end size and wire barrel size numbers separated by a dash (-). Mating end and wire barrel sizes shall be as specified in MIL-C-23216 and MIL-C-39029, as applicable.

Example

Mating end size — 16-20 — Wire barrel size

1.2 3.6 Insert position. The insert position is the angular position of the insert relative to the shell. Insert positions other than normal shall be indicated by the letter shown on the insert arran ment MS standard

1.3 Temperature. These connectors are rated for operation within a temperature range specified for each class. The upper temperature limit is the maximum internal hot-spot temperature resulting from any combination of electrical load and ambient temperature. These connectors are rated for specified operation for 1,000 hours at the specified maximum internal hot-spot temperature.

1.3.1 Variation of insulation resistance. Insulation resistance varies with temperatures as indicated in figure 1 and table II.

TABLE II. Variation of insulation resistance.

Series	Temperature	Minimum insulation resistance
1	25° C 125° C	5,000 megohms 3 megohms
2	25° C 175° C	10,000 megohms 300 megohms
3 (except class L)	25° C 200° C	10,000 megohms 500 megohms
3 - class L	25° C 175° C	10,000 megohms 500 megohms

1.3.2 Variation of service life. Service life varies with temperature as indicated in figure 2 and table III. After 1,000 hour service life requirement, the connector is not required to maintain interfacial sealing.

TABLE III. Variation of service life.

Series	Hot spot temperature	Service life
1	25° C 125° C	Continuous 1000 hours
2	25° C 175° C	Continuous 1000 hours
3 (except class L)	25° C 200° C	Continuous 1000 hours
3 class L	25° C 175° C	Continuous 1000 hours

1.3.3 Accessories. This specification covers accessories for connectors such as: Protective covers, stowage receptacles, strain relief clamps, potting boots, 90° end bells and back shell adapters.

1.3.4 Wire range accommodations. The wire ranges given in table IV shall be accommodated by the connectors and contact wire barrels as indicated.

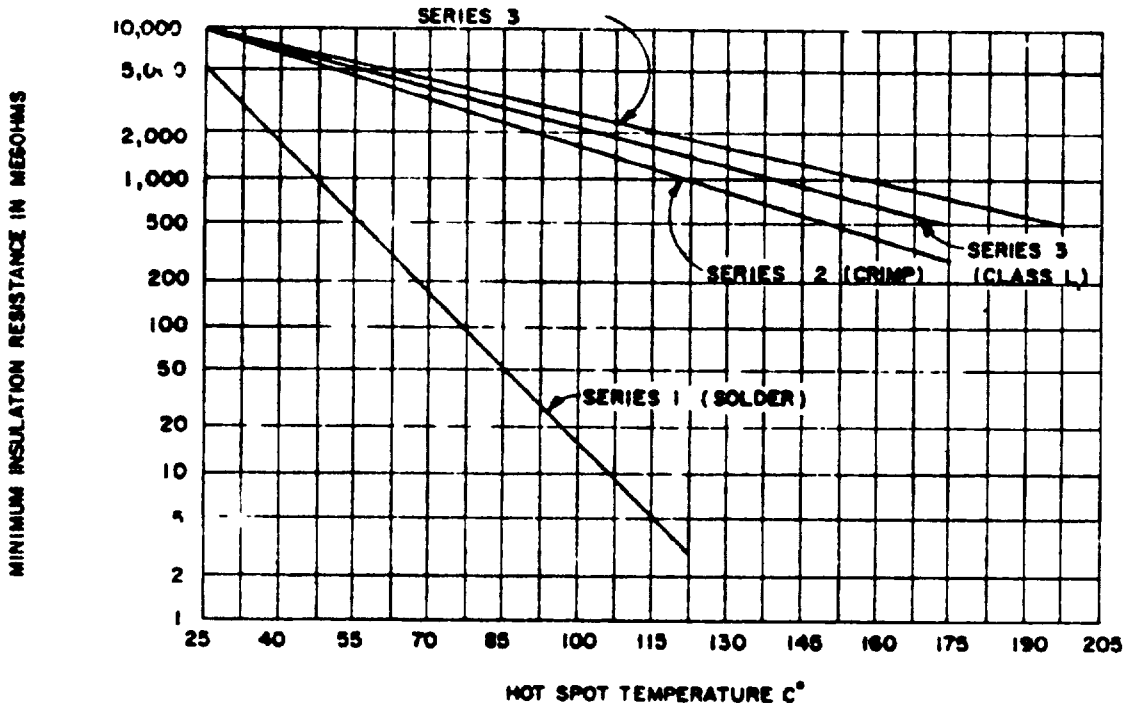


FIGURE 1. Minimum insulation resistance vs hot spot temperature.

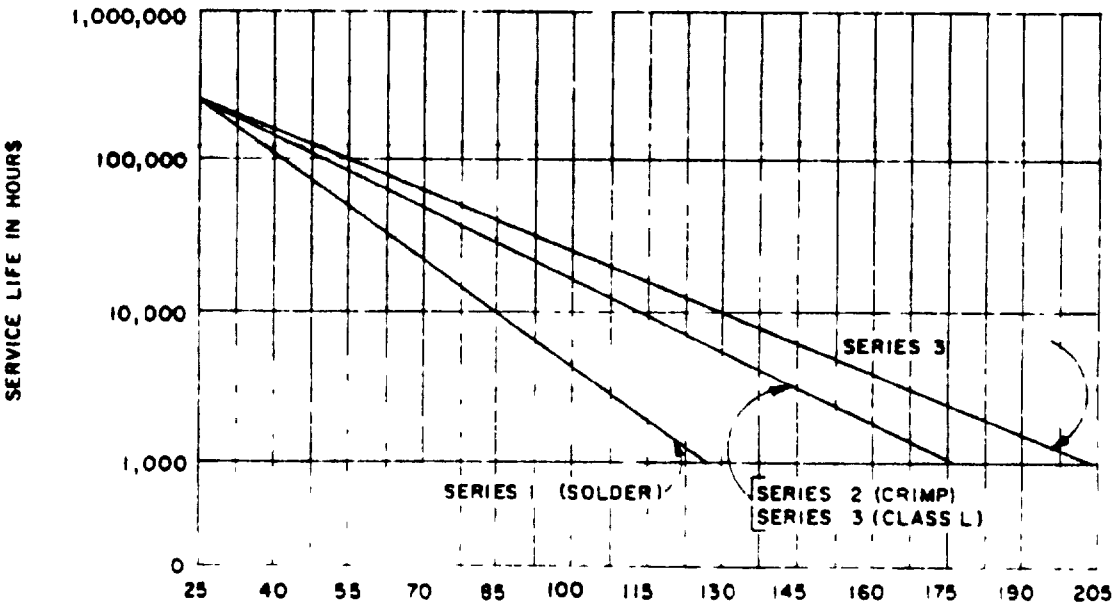


FIGURE 2 Service life vs hot spot temperature

TABLE IV. Wire range accommodations

Wire barrel size	Wire size	OD of finished wire (inch) 1/ Series 1 and 2 min	Series 1 and 2 max	Series 3 min	Series 3 max
20	24	.047 2/		.040	
	22				
	20		.085		.083
16	20	.066		.053	
	18				
	16		.109		.103
12	14	.097		.099	
	12		.142		.158

1/ Wire reference - MIL-W-22759 and MIL-W-81381.
2/ Minimum OD for solder contact connectors is .060 inch.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

SPECIFICATIONS

FEDERAL

QQ-P-35 - Passivation, Treatments, for Austenitic, Ferritic and Martensitic Corrosion-resisting Steel (Fastening Devices).
L-P-395 - Plastic Molding (and Extrusion) Material, Nylon, Glass Fiber.
QQ-A-591 - Aluminum Alloy Die Castings.
QQ-P-416 - Plating, Cadmium (Electrodeposited).
PPP-B-566 - Box, Folding, Paperboard.
PPP-B-636 - Box, Fiberboard.
PPP-B-676 - Boxes, Setup.
PPP-T-60 - Tape: Pressure-sensitive Adhesive, Waterproof, for packaging.
PPP-T-76 - Tape, Pressure-sensitive Adhesive Paper, (For Carton Sealing).

MILITARY

MIL-M-14 - Molding Plastic, and Molded Plastic Parts Thermosetting.
MIL-P-116 - Preservation, Methods of.
MIL-H-5606 - Hydraulic Fluid, Petroleum Base, Aircraft, Missile And Ordinance.
MIL-T-5624 - Turbine Fuel, Aviation, Grades JP-4 and JP-5.
MIL-S-7742 - Screw Threads, Standard, Optimum Selected Series: General Specification For.
MIL-L-7808 - Lubricating Oil, Aircraft Turbine Engine Synthetic Base.
MIL-S-8516 - Sealing Compound, Synthetic Rubber, Electric Connectors and Electric Systems, Accelerator Required.
MIL-T-10727 - Tin Plating, Electrodeposited or Hot-dipped, For Ferrous and Nonferrous Metals.
MIL-I-17214 - Indicator, Permeability, Low-mu (GO-NO-GO).
MIL-M-20693 - Molding Plastic, Polyamide (Nylon), Rigid.
MIL-C-22520 - Crimping Tools, Contact, Electric, Hand, General Specification for
MIL-W-22759 - Wire, Electric, Fluorocarbon-insulated, Copper or Copper Alloy
MIL-C-23216 - Contacts, Electric Connector, General Specification For.
MIL-L-23699 - Lubricating Oil, Aircraft Turbine Engines, Synthetic Base.
MIL-C-39029 - Contacts, Electric, General Specification For
MIL-B-45204 - Gold Plating, Electrodeposited.
MIL-C-45662 - Calibration System Requirements.
MIL-W-81381 - Wire, Electric, Polyamide-insulated, Copper and Copper Alloy.

STANDARDS

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection By Attributes.
MIL-STD-129 - Marking for Shipment and Storage.
MIL-STD-1 - Palletized and Containerized Unit Loads 40" x 48" Pallets, Skids, Runners, or Pallet-Type Base.
MIL-STD-202 - Test Methods For Electronic and Electrical Component Parts.
MIL-STD-454 - Standard General Requirements for Electronic Equipment.
MIL-STD-1285 - Marking of Electrical and Electronic Parts.
MIL-STD-1344 - Test Methods for Electrical Connectors.
MIL-STD-1353 - Electrical Connectors and Associated Hardware, Selection and Use Of.
MS3187 - Plug, Sealing, For MIL-C-26482 and MIL-C-81703 Electric Connectors
MS3192 - Contacts, Pin, Electric, Crimp, Removable.
MS3193 - Contacts, Socket, Electric, Crimp, Removable.
MS3197 - Gage Pin, for Socket Contact Engagement Test.
MS3447 - Tool, Insert-Extract, Wired Contact, Electric Connector, Size 20, 16, and 12.
MS3448 - Tool, Extract, Unwired Contact, Electric Connector, Size 20, 16, and 12
MS3460 - Test Gage, MIL-C-0026482 Series 1 or MIL-C-81703 Series 2 Contact Retention Feature.
MS3461 - Test Gage, MIL-C-0026482 Series 2 or MIL-C-81703 Series 3 Contact Retention Feature.
MS3462 - Test Gage, MIL-C-0026482 Series 2 (Class N) or MIL-C-81703 Series 3 (Class N) Contact Retention Feature.
MS24256 - Tool, Contact Connector, Assembly and Disassembly

(See Supplement 1 for list of applicable MS standards.)

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. The following document forms a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply

United States of America Standards Institute

USASI B46.1 - (ANSI) Surface Texture (Surface roughness, waviness and lay).

(Application for copies should be addressed to the United States of America Standards Institute, 10 East 40th Street, New York, New York 10016.)

Electronics Industries Association

EIA STD RS359 - Color

(Copies may be obtained from the Electronic Industry Association, 2001 Eye Street, NW, Washington, D.C. 20006.)

(Copies of "Provisions Governing Qualification SD-6" may be obtained upon application to Commanding Officer, Naval Publication and Forms Center, 5801 Taber Avenue, Philadelphia, Pa. 19120.)

3 REQUIREMENTS

3.1 Military standards for individual connectors. The individual part requirements shall be as specified herein and in accordance with the applicable MS standards listed in supplement 1

3.1.1 Precedence. In the event of conflict between this specification and the MS standard, the latter shall govern. In the event of conflict between this specification and the Applicable Documents the requirements of this specification shall govern. The MS standard takes precedence over all documents referenced therein.

3.2 Qualification. Connector assemblies and accessories furnished under this specification and the applicable MS standard shall be products which are qualified for listing on the applicable Qualified Products List (QPL) at the time set for the opening of bids (4.4 and 6.3).

3.2.1 Use of MS standard designations. MS standard designations shall not be applied to a product, except for qualification test samples (4.4), until notification has been received from the activity responsible for qualification that the product has been approved for listing on the QPL.

3.3 Materials. Materials shall be as specified herein, however, when a definite material is not specified, a material shall be used which will enable the connectors to meet the performance requirements of this specification. Acceptance or approval of any material shall not be construed as a guaranty for acceptance of the finished product.

3.3.1 Dissimilar metals. When dissimilar metals are employed in contact with each other, suitable protection against electrolytic corrosion shall be provided as specified in requirement 16 of MIL-STD-454.

3.3.2 Nonmagnetic materials. (Except rack and panel connectors and classes H and N.) All parts shall be made from materials that are classed as nonmagnetic (3.6.22).

3.3.3 Contact materials. Contacts shall be made of suitable conductive copper alloys protected from corrosion. Class N and H contacts may be ferrous alloy.

3.3.3.1 Contact plating, classes E, P, and J (series 1 and 2). Contacts shall be gold plated to a minimum of 50 microinches, over a suitable thickness of copper. Surface plating shall be type II, except 99 percent purity, grade C or D in accordance with MIL-G-45204. A soft gold underplating, type I, grade A, in accordance with MIL-G-45204 may be permitted between the copper and hard gold. Accessory members of the socket contacts need not be plated but shall comply with the requirements for dissimilar metals specified in 3.3.1.

3.3.3.2 Contact plating, class H. Unless otherwise specified (see 3.1), contact plating for class H contacts shall be 50 microinches, minimum, of electro-tin (no organic brightener) in accordance with MIL-T-10727. Preliminary plating of another metal is permissible.

3.3.3.3 Contact plating, classes E, L, and N (series 3). Contacts shall be plated as specified on the applicable military specification sheet (see MIL-C-39029).

3.3.3.4 Ductility of materials - plating. There shall be no cracks in the parent material or in the plating of either pin or socket contacts after crimp termination of wire (with the appropriate crimp tool) which could have deleterious effect on the performance of the contacts.

3.3.4 Dielectric materials.

3.3.4.1 Insert and grommet. Insert and grommet materials shall be high grade dielectric having hardness, electrical, and mechanical characteristics suitable for the purpose intended. The hermetic sealing of class H and N connectors shall be accomplished by use of a single piece vitreous material.

3.3.4.1.1 Rigid (except classes H and N). Rigid dielectric material shall be in accordance with L-P-395, MIL-M-20693, or MIL-M-14.

3.3.4.1.2 Resilient. Resilient dielectric material shall conform to the requirements specified herein.

3.3.4.1.3 Insert faces (series 1 and 2). Insert faces or sealing members to a minimum depth of 0.080 inch (0.033 inch on class H) shall be resilient within a shore A range of 30-85 for crimp connectors and class H connectors and 65-85 for solder contact connectors.

3.3.4.1.4 Insert faces (series 3) The mating face of socket inserts shall be a hard nonresilient material. The mating face of pin inserts shall be a resilient material. The mating face of pin inserts shall be resilient material within a Shore A Durometer range of 30 to 60.

3.3.5 Potting form. Potting forms shall be made of translucent nylon. The form shall incorporate a means for attachment to the connector and shall accept and bond to MIL-S-8516 potting material without treatment by the user.

3.3.6 Shells (except classes H and N) coupling ring, and metallic accessories material. Shells, compling rings, and protective covers shall be made of high grade aluminum alloys. Die castings, if used, shall conform to QQ-A-591, composition No. 13, 218, 380, or 384.

3.3.6.1 Finish. Aluminum parts and external screws of series 1 and 2 connectors shall be plated in accordance with QQ-P-416, type II, class 3, except that finish shall be olive drab (light to dark) and shall be electrically conductive. Aluminum parts of series 3 connectors shall be plated with a conductive finish. Cadmium plating shall not be used.

3.3.7 Shells (classes H and N). Shell material for referenced classes of connectors shall be as specified (3.1).

3.3.7.1 Finish, ferrous alloy. Shells shall be tin plated. Preliminary plating of another metal is permissible. The resulting finish shall be suitable for soft soldering to a mounting surface. Plating shall be in accordance with MIL-T-10727.

3.3.7.2 Finish, corrosion resistant steel. The finish for corrosion resistant steel shells shall be passivated in accordance with QQ-P-35.

3.3.8 Fungus-resistance material. All connectors, except series 1, shall be made of fungus-resistance material specified in requirement 4 of MIL-STD-454.

3.4 Design and construction. Connector assemblies and protective covers shall be designed and constructed to withstand normal handling incident to installation and maintenance in service.

3.4.1 Contacts. Contacts shall be designed so that neither the pins nor the sockets will be damaged during mating of counterpart connectors. A quantity of crimp contacts consisting of the normal complement, plus one spare contact for connector arrangements having 26 contacts or less and two spares for arrangements over 26 contacts, shall be included in the unit package. For indirect shipments, crimp contact connectors may be supplied without contacts.

3.4.1.1 Solder contacts. Solder contacts shall conform to the dimensions of figure 3A and shall be nonremovable from the insert. Solder cups shall be so designed that during soldering no components will be damaged. A vent hole or equivalent may be provided to prevent air entrapment during soldering.

3.4.1.2 Crimp contacts

3.4.1.2.1 Crimp contacts (series 2). Crimp contacts for series 2 connectors shall conform to MS3192 or MS3193 and shall be qualified to MIL-C-23216.

3.4.1.2.1.1 Insertion and removal tools (series 2). Tools required for assembly or disassembly of pin and sockets into their connector inserts shall be in accordance with MS24256.

3.4.1.2.2 Crimp contacts (series 3). Crimp contacts for series 3 connectors shall conform to MIL-C-39029/4 through /10, as applicable, and shall be qualified to MIL-C-39029.

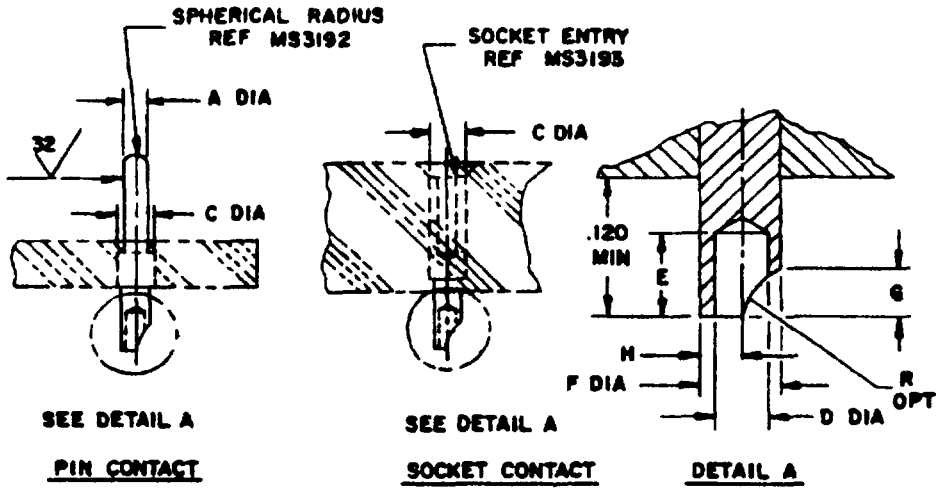


FIGURE 3 A. Contacts, solder type.

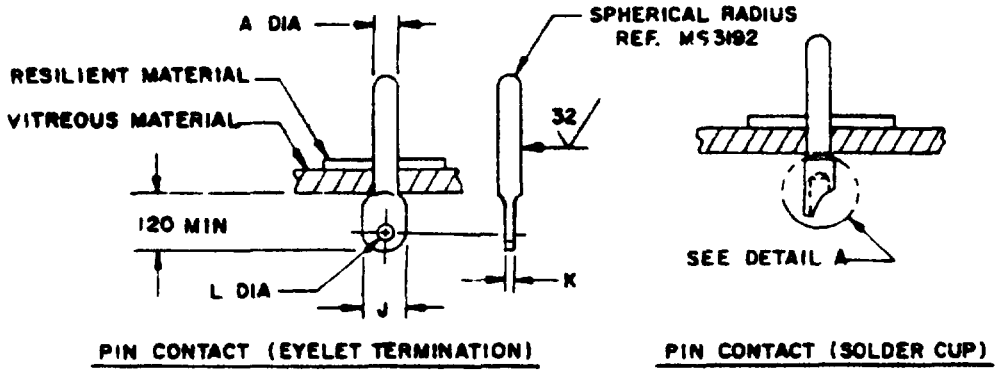


FIGURE 3 B. Contact, solder type, class H.

SIZE	A ±.001	C MAX	D MIN	E ±.063 -.016	F MIN	F MAX	G ±.031	H ±.010	J MAX	K MIN	L MIN
20	.040	.100	.042	.125	.061	.088	.117	.037	.085	.012	.042
16	.0625	.136	069	.188	096	.116	098	.054	.115	020	.065
12	094	.190	110		139	.156	.125	.070	.190		.096

Surface finish shall be in accordance with USAS B46.1-1962
Dimension "A" is measured over plating.
Dimensions in inches

FIGURE 3. Design for through-bulkhead and solder type contact.

3.4.1.2.2.1 Insertion and removal tools (series 3). Tools required for assembly or disassembly of pin and sockets into their connector inserts shall be in accordance with MS3197. For removal of unwired (spare) contacts, use applicable MS3448.

3.4.1.3 Shielded contacts. The shielded contacts shall conform to MIL-C-39029/7 or MIL-C-39029/8 and shall be capable of being inserted and removed from size 12 contact cavities using the same insertion/removal tool as specified for the size 12 contact (see 6.1(m)).

3.4.1.4 Through-bulkhead contacts. The engaging ends of contacts in through-bulkhead connectors shall conform dimensionally to corresponding details of figures 3A and 3B. Contacts shall be nonremovable.

3.4.2 Insert design and construction. Inserts shall be of voidless construction and shall be secured to prevent rotation within the shell. The inserts shall be nonremovable from the shell and shall be installed in the position specified on the applicable MS standard.

3.4.2.1 Inserts for crimp contact connectors. In crimp contact connectors, the insert and wire sealing grommet shall be one integral part. The design shall permit the removal and reinsertion of individual contacts without damage to any part of the insert, including contact retention members or the sealing members, using the applicable MS tools. The individual contacts shall be positively retained when installed in the insert. Reference to wire sealing members does not apply to class N connectors (see 6.1(l)).

3.4.2.2 Contact arrangement. Contacts shall be arranged in accordance with the applicable MS standard. All solder cup openings shall be oriented to face the terminus of the indexing radius indicated on the MS standard and shall be at right angles to a center line coinciding with the indexing radius.

3.4.2.3 Contact spacing. Minimum nominal center-to-center spacing and minimum dielectric thickness, contact to shell, or contact to contact shall be in accordance with the values shown in table V.

TABLE V. Minimum nominal contact spacing and minimum dielectric thickness

Connector classes	Contact size	Service rating I			Service rating II		
		Center-to-center	Dielectric		Center-to-center	Dielectric	
			Rigid	Resilient		Rigid	Resilient
E, J P L N	20	0.130	0.006	0.008	0.162	0.008	0 012
	16	168	006	.008	.190	.008	.012
	12	205	.006	.008	.230	.008	.012
H	20	.130	.006	.030	.162	.008	.030
	16	.168	.006	.030	.190	.008	.030
	12	.205	.006	.030	.230	.008	.030

3.4.2.4 Contact alinement. With all contacts in place, the alinement of pin and socket contacts shall permit engagement regardless of buildup of tolerances on hole locations, distortions of contacts due to crimping, and insert location in the shell

3.4.2.5 Contacts (class N and H connectors). Contacts shall be fused into the single piece vitreous inserts of referenced connectors. A resilient face shall be permanently bonded to the insert to insure an interfacial seal in mating.

3.4.3 Shell design, (except classes H and N). The connector shall be of single-piece shell design constructed to positively retain the insert in its specified position in the shell The shell shall be designed to accept and retain a cable adapter or other accessory

3.4.3.1 Jam nut mounting receptacle shell. The jam nut mounting receptacle shall be provided with a mounting nut, an O ring and a lock washer

3.4.3.2 Screw threads. Screw threads shall be in accordance with MIL-S-7742. Slight out-of-roundness beyond the specification tolerances is acceptable, if threads can be checked without forcing the thread gages

3.4.4 Coupling.

3.4.4.1 Push-pull. Push-pull connectors shall be coupled to counterpart connectors by means of push-pull coupling rings. Couplings shall be accomplished by a straight axial push of the push-pull rings; uncoupling by axial pull. The push-pull rings shall have concentric rings or shoulders or both to provide a gripping surface and differentiation from bayonet coupling rings.

3.4.4.1.1 Rack and panel. Rack and panel plugs shall be mated to their appropriate receptacles by securing the mounting panels of both halves in fully mated position. (The securing method shall be a part of the structure).

3.4.4.1.2 Protective covers. Protective covers (see MS3183) shall be mated to receptacle connectors by means of push-pull coupling rings. Coupling shall be accomplished by a straight axial push on the shell of the protective cover, while its coupling ring is fully pulled back. Uncoupling is accomplished by straight axial pull on the coupling ring.

3.4.4.2 Engagement of connectors.

3.4.4.2.1 Push-pull. Push-pull connectors of any arrangement, with accessories, shall be capable of being fully engaged and disengaged without the use of tools. Engagement of connectors is defined as full insertion of pins into sockets and proper sealing of the mating insert faces. Full engagement of push-pull connectors shall be indicated by an audible sound at the completion of the coupling cycle. On push-pull connectors and protective covers a positive detent shall be included in the coupling mechanism to lock connectors in the engaged position. Connectors shall have a contrasting stripe under the coupling ring which is uncovered only when the plug is fully engaged and the coupling ring is in the locked position.

3.4.4.2.2 Rack and panel. Rack and panel plugs and applicable receptacles are considered fully mated when their mounting panels are secured to the distance specified on MS3445 or MS3446, as applicable.

3.4.4.3 Shell polarization. Polarization of connectors shall be accomplished by matched key and keyway of counterpart connectors. The polarization of counterpart connectors shall take place before coupling rings are engaged, and before any pin contacts can touch the opposing socket of the counterpart connector.

3.4.4.4 Engagement seal. Connectors shall contain sealing means so that engaged connectors comply with the requirements specified herein. The design of the seal shall be such that in mated connectors all air paths between adjacent contacts and between contacts and shells are eliminated There shall be interfacial mating of the engaged connector insert to provide dielectric under compression of 0.005 inch minimum (see 6.1(1) for exception).

3.4.4.5 Lubrication. Ball lock mechanisms shall be suitably lubricated Features which are intended to provide potting compound anchorage shall be free of lubricant

3.4.4.6 Protective covers and stowage receptacles. When mated to counterpart connectors, the protective covers and stowage receptacles shall maintain the connector free of moisture and prevent air leakage

3.4.5 Wire sealing

3.4.5.1 Crimp contact connectors (except class N) Crimp contact connectors shall be provided with an integral grommet and insert capable of sealing on wires of the sizes specified in table IV

3.4.5.1.1 Solder contact connectors. Class E solder contact connectors shall be provided with a removable resilient grommet and retaining feature. The grommet shall be designed to fit firmly against the rear face of the insert and around each contact and wire termination so that any air path between terminations, and between terminals and the shell is interrupted by [illegible] material under compression of 0.005 inch, minimum.

3.4.5.2 Class P connectors. Class P connectors shall be provided with a plastic potting form suitable to accept and bond to MIL-S-8516 potting material. Inserts of class P connectors shall be designed so that potting material will adhere to the shell and insert.

3.4.5.3 Class N and H connectors. Class N and H connectors shall not be provided with a wire sealing grommet, however, the shells and inserts shall be designed so that MIL-S-8516 potting material will adhere to the insert.

3.4.5.4 Class J connectors. Class J connectors shall be provided with a resilient gland and gland nut capable of sealing on appropriate single-jacketed multiconductor cables.

3.4.5.5 Grommet sealing plugs. The grommets of all classes (except classes H and N) shall be designed to accept sealing plugs in accordance with MS3187 in lieu of wire where unwired contacts are used. Fifteen percent of the number of contacts, but not less than 1, shall be included in the unit package For indirect shipments, connectors may be supplied without grommet sealing plugs (see 6.2).

3.4.6 Accessories. The accessory design shall be free of any sharp edges or other feature that could cause damage to any wire extending through it, for the service life of the connector (see 6.2.1).

3.5 Interchangeability. All connectors and accessories having the same MS standard part number shall be completely interchangeable with respect to physical and functional capabilities.

3.5.1 Intermateability. All connectors within the same series shall be completely intermateable

(a) Series 1 push-pull plugs will intermate with all series 1, 2, and 3 receptacles.
(b) Series 3 push-pull plugs will not intermate with series 1 and 2 receptacles or MS3182 protective covers (due to five key provision).
(c) Rack and panel plugs will mate with square flange receptacles or solder mount receptacles and the series 3 single hole mount receptacles. Rack and panel plugs do not mate with the series 1 and 2 single hole mount receptacles.

3.6 Performance. Connectors and accessories shall be designed to perform as follows when subjected to the conditions and tests specified.

3.6.1 Maintenance aging. When tested as specified in 4.6.6, all crimp-contact connectors shall be capable of conforming to the requirements of this specification. Contact retention shall be performed on contacts subjected to the maintenance aging test.

3.6.2 Operation forces. When tested as specified in 4.6.2, mating and unmating of connectors and protective covers shall meet the force requirements of table VI.

TABLE VI. Coupling - force, axial (pounds).

Shell size	Maximum engagement and disengagement forces		Minimum disengagement forces	
	Push-pull	Rack and panel	Push-pull	Rack and panel 1/
3	15	18	1 2	0 14
7	20	20	1 5	0. 33
12	34	38	2 0	0. 56
19	38	46	3. 0	0. 89
27	40	46	4. 0	1. 27
37	44	50	6 0	1. 74
61	49	68	7. 0	2. 12

1/ Minimum disengagement values for rack and panel connectors apply when all mounting components and panel locking devices are relaxed.

3. 6. 3 Contact resistance. Contacts in the mated condition shall meet the contact resistance requirements of Table VIA and MIL-C-23216 or MIL-C-39029 as applicable.

TABLE VIA. Contact resistance limits.

Connector class	Mating end size	Wire size	Test current (amperes)	Millivolt drop (Maximum)	
				Initial	After corrosion
E, L, J, P,	20	24	3. 0	45	55
		22	5. 0	45	55
		20	7. 5	55	65
	16	18	10. 0	45	55
		16	13. 0	50	60
	12	14	17 0	45	55
		12	0	50	60

				Millivolt drop (maximum)			
				Initial		After Corrosion	
				Ave.	Indiv.	Ave.	Indiv.
H, N	20	20	5. 0	70	105	90	165
	16	16	10. 0	65	95	80	165
	12	12	17 0	65	95	80	165

3. 6. 4 Insulation resistance. Insulation resistance versus temperature shall be as shown on figure 1 and table II.

3 6. 4. 1 Insulation resistance at room temperature. When tested as specified in 4. 6 4. 1, insulation resistance at room temperature shall be greater than 5, 000 megohms for series 1 connectors, and greater than 10, 000 megohms for series 2 and 3 connectors.

3. 6 4. 2 Insulation resistance at elevated temperature - short time When tested as specified in 4. 6 4 2, the requirement shall be as follows·

(a) Series 1 (solder) After an exposure for 250 hours at 125° C, the insulation resistance shall be greater than 3 megohms.
(b) Series 2 (crimp) After an exposure for 250 hours at 175° C, the insulation resistance shall be greater than 300 megohms.
(c) Series 3 (class L) After an exposure for 250 hours at 175° C, the insulation resistance shall be greater than 500 megohms
(d) Series 3 (class E, H, and N) After an exposure for 250 hours at 200° C the insulation resistance shall be greater than 500 megohms

3.6.4.3 Insulation resistance at elevated temperature - long time. When tested as specified in 4.6.4.3, the requirement shall be as follows

(a) Series 1 (solder). After an exposure for 1000 hours at 105°C the insulation resistance shall be greater than 12 megohms.
(b) Series 2 (crimp). After an exposure for 1000 hours at 175°C, the insulation resistance shall be greater than 300 megohms.
(c) Series 3 (class L). After an exposure for 1000 hours at 175°C, the insulation resistance shall be greater than 500 megohms.
(d) Series 3 (classes E, H, and N) After an exposure for 1000 hours at 200°C, the insulation resistance shall be greater than 500 megohms.

3.6.5 Dielectric withstanding voltage. When tested as specified in 4.6.5.1 and 4.6.5.2, connectors shall show no evidence of breakdown or flashover. Corona shall not be considered as breakdown.

3.6.5.1 Working voltage. Maximum working voltages shall be as shown in table VII.

TABLE VII. Working voltage (ac, rms).

Condition	Service rating I	Service rating II
Sea level	600	1,000
70,000 ft.	300	450

3.6.6 Contact insertion and removal forces (crimp contact connectors only). When tested as specified in 4.6.6, the contact insertion and removal forces shall meet the requirements of table VIII.

TABLE VIII. Contact insertion and removal forces.

Contact size	Force pounds maximum			
	Series 2		Series 3	
	Insertion	Removal	Insertion	Removal
20-20	20	20	15	10
16-16	20	20	15	10
12-12	30	30	15	10

3.6.7 Thermal shock. When tested as specified in 4.6.7 using the extreme temperature of table IX, there shall be no damage detrimental to the operation of the connector.

TABLE IX Temperature extremes.

Low temperature all classes	High temperature		
	Series 1	Series 2 and 3 crimp and class L	Series 3 classes E, H, and N
-55 ±3°C	125 ±3°C	175 ±3°C	200 ±3°C

3.6.8 Water pressure (class J only). When tested as specified in 4.6.8, connectors shall show no evidence of water leakage and there shall be no evidence of moisture at the interface and cable housing. The insulation resistance subsequent to exposure shall be greater than 100 megohms

3.6.9 Air leakage.

3.6.9.1 Connectors, nonremovable contacts and accessories (except classes N and H). When tested as specified in 4.6.9.1, the air leakage rate shall not be greater than 1 cubic inch-per-hour (4.55×10^{-3} cm 3 sec), including the flange "O" ring seal of all jam-nut receptacles.

3. 6. 9. 2 Connectors, classes N and H. When tested as specified in 4. 6. 9. 2, the air leakage rate shall not exceed 0. 1 micron cubic foot per hour (1 x 10^{-6} cc/sec). The specified leakage rate shall apply only through the connector and not through the flange and mounting surface area, unless solder mounted.

3. 6. 10 Durability. When tested as specified in 4. 6. 10, counterpart connectors shall show no mechanical or electrical defects detrimental to the operation of the connector.

3. 6. 11 Salt spray (corrosion). When tested as specified in 4. 6. 11, unmated connectors, stowage receptacles, protective covers, mating shells, and accessories shall show no exposure of basic metal due to corrosion which will affect performance.

3. 6. 12 Vibration. When tested as specified in 4. 6. 12, mated connectors shall not be damaged and there shall be no loosening of parts due to vibration. Connectors shall be retained in full engagement, and there shall be no interruption of electrical continuity.

3. 6. 13 Shock (specified pulse). When tested as specified in 4. 6. 13, mated connectors shall not be damaged and there shall be no loosening of parts, nor shall there be an interruption of electrical continuity.

3. 6. 14 Moisture resistance. When tested as specified in 4. 6. 14, mated connectors shall have an insulation resistance of more than 100 megohms at 25° C.

3. 6. 15 Fluid immersion. When tested as specified in 4. 6. 15, connectors shall meet the requirements of the subsequent tests specified in the applicable sequence.

3. 6. 16 Insert retention (except classes N and H). When tested as specified in 4. 6. 16. 2, inserts shall not be dislocated from the specified insert position as shown on the applicable MS drawing when an effective pressure differential of 75 lb_f/in^2 is applied.

3. 6. 16. 1 Insert retention (classes N and H). When tested as specified in 4. 6. 16. 2, class N and H inserts shall not be dislocated from the specified position when an effective pressure differential of 200 lb_f/in^2 is applied.

3. 6. 17 Gage location and retention (crimp type contacts). The axial location of series 2 pin contacts and series 3 pin and socket contacts shall be measured as specified in 4. 6. 17, using test gages conforming to MS3460 or MS3461, as applicable. Gage location measurements shall fall within the range specified on the applicable MS drawing. Test gages conforming to MS3460, MS3461, or MS3462, as applicable, shall be retained in the pin and socket cavities of series 2 and series 3 connectors, and in the rear termination cavities of class N connectors, with the axial loads specified in table X applied. The axial displacement of the test gages while under load shall not exceed 0. 012 inch.

3. 6. 18 Contact retention (see 4. 6. 18). Contacts shall be retained in their inserts with the axial loads specified in table X applied. The axial displacement of the crimp contacts shall not exceed 0. 012 inch while under load with the accessory rear hardware removed. The axial displacement of solder contacts shall not exceed 0. 012 after the load has been removed.

TABLE X. Axial loads for contact retention.

Mating end size	Axial load (pounds-minimum)
20-20	15
16-16	25
12-12	25

3 6 19 Contact engaging and separating forces (series 1 only). When tested as specified in 4. 6 19, the contact engaging and separating forces shall not exceed the applicable values specified in table XI.

3.6.20 Probe damage (series 1 only). When tested as specified in 4.6.20, socket contacts shall conform to the requirements in 3.6.19.

TABLE XI. Contact engaging and separating forces (ounces) (series 1).

MS3197 Probe	Mating end size		
	20	16	12
Minimum (with min. dia. pin)	0.75 oz	2 oz	3 oz
Maximum average (with max. dia. pin)	12 oz	24 oz	24 oz
Maximum (with max. dia. pin)	18 oz	30 oz	30 oz

3.6.21 Cover chain tensile strength. When tested as specified in 4.6.21, protective covers with chains shall withstand a 25-pound tensile test without damage.

3.6.22 Magnetic permeability. When tested as specified in 4.6.22, the relative magnetic permeability (Mu) of connector assemblies and accessories (except classes N and H, and rack and panel connectors) shall be less than 2.0.

3.6.23 External bending moment. When testing as specified in 4.6.23 using the applicable bending moment shown in table XII, there shall be no evidence of physical damage detrimental to the operation of the connector nor shall there by any interruption of electrical continuity.

TABLE XII. External bending moment.

Plug shell size	Bending moment (inch-pounds)
3	25
7	45
12	45
19	45
27	40
37	40
61	40

3.7 Marking. Each connector shall be legibly and permanently marked on the shell or on the coupling ring in accordance with MIL-STD-1285. The MS standard part number shall be as shown in 1.2.3. In addition, all rear release crimp type connectors (series 3) and backshell accessories shall be marked around the periphery of the shell with a blue color band in accordance with EIA std. RS359 to identify the connectors as having the wire side release contact system. The location of the blue band shall be in accordance with the applicable MS drawings.

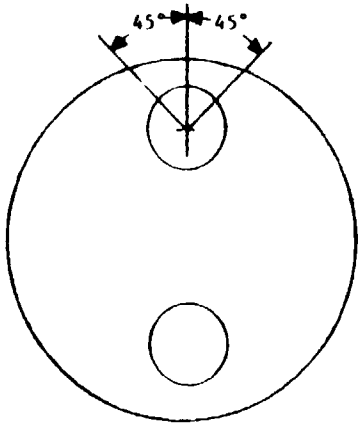
3.7.1 Inserts. Inserts shall be marked in contrasting colors as illustrated on the applicable MS standard. Raised or depressed characters shall not be used on mating faces, except for series 1 connectors. (See figure 4 for series 3 insert marking.)

3.7.2 Contact designations. Contact locations shall be designated by identifiable characters of contrasting color on the front and rear faces of the insert-grommet assembly. Positioning and arrangement of the characters shall be such that the appropriate contact cavities are identifiable and remain identifiable after completion of tests specified in table XIII.

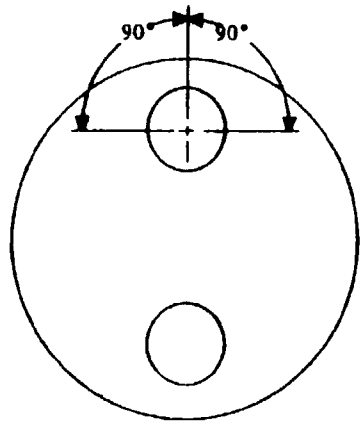
3.8 Workmanship. Connectors shall be processed in such a manner as to be uniform in quality and shall be free from pits, corrosion cracks, rough edges, chips, and other defects that will affect life, serviceability, or appearance.

4 QUALITY ASSURANCE PROVISIONS

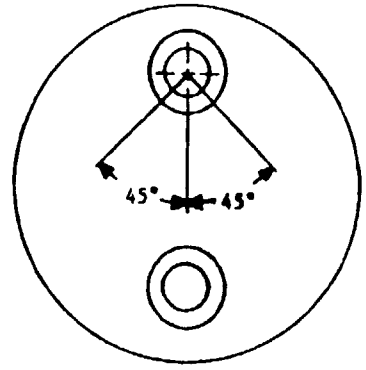
4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other



Pin and Socket
Rear Grommet Face
(See Note 1)



Socket Engaging
Face
(See Note 2)



Pin Engaging
Face
(See Note 3)

NOTES

1. Contact identification numbers on rear grommet face of socket and pin insert shall be within 45° either side of vertical centerline above the contact cavity.

2. Numbers shall be placed on socket insert engaging face as shown. The numbers shall be above the horizontal centerline of the chamfered lead-ins. Where space precludes the application of numbers an ever expanding orbital line is permissible.

3. Numbers on the engaging face of the pin insert shall be on the raised seal barrier above or elongated beside the pin contact cavity. Number shall not extend into the lower sector of the raised seal barrier which extends 45° either side of the vertical centerline.

4. On outer row of contacts individual cavity identification may be deleted from those cavities where space precludes its application.

FIGURE 4. Insert cavity identification locations (Series 3).

TABLE XIII. Sequence for qualification.
For series 1 and 2 connectors (classes E, P, H, and J).

Title	Requirement paragraph	Test paragraph	Test group 1	2	3	4	5	6
Visual and mechanical examination	3.1, 3.3 thru 3.4.5.5, 3.5, 3.7, and 3.8	4.6.1	X	X	X	X	X	X
Magnetic permeability	3.6.22	4.6.22	X	X	X	X	X	X
Maintenance aging	3.6.1	4.6.6	X	-	-	-	-	-
Contact insertion/removal forces	3.6.6	4.6.6	X	-	-	-	-	-
Gage location and retention (crimp type)	3.6.17	4.6.17	X	-	-	-	-	-
Operating forces	3.6.2	4.6.2	X	X	X	X	X	X
Insulation resistance at room temperature	3.6.4.1	4.6.4.1	X	X	X	X	X	X
Dielectric withstanding voltage (sea level)	3.6.5	4.6.5.1	X	X	X	X	X	X
Dielectric withstanding voltage (altitude)	3.6.5	4.6.5.2	X	X	X	X	X	X
Contact resistance	3.6.3	4.6.3	-	X	X	-	X	X
Thermal shock	3.6.7	4.6.7	X	-	-	X	-	-
Air leakage	3.6 9.1	4.6.9.1	X	-	-	-	-	-
Air leakage (hermetic)	3.6.9.2	4.6.9.2	-		-	X	-	-
Insulation resistance at elevated temperature								
Short time	3.6.4.2	4.6.4.2	-	X	-	-	-	-
Long time	3.6.4.3	4.6.4.3	-	-	X	-	-	-
Durability	3.6.10	4.6.10	X	-	-	X	-	
Vibration	3.6.12	4.6.12	X	-	-	X	-	
Shock (specified pulse)	3.6.13	4.6.13	X	-	-	X	-	-
Moisture resistance	3.6.14	4.6.14	X	-	-	X	-	-
Insulation resistance	3.6.4	4.6.4.1	X	-	-	X	-	-
Salt spray (corrosion)	3.6.11	4.6.11	X	-	-	X	-	-
Operating forces	3.6.2	4.6.2	X	-	-	X	-	-
Contact resistance	3.6.3	4.6.3	X	-	-	X	-	-
Fluid immersion, lubricating oil	3.6.15	4.6.15.1(b)	-	X	-	-	X	-
Fluid immersion hydraulic fluid	3.6.15	4.6.15.1(a)	-	-	X	-	-	X
Operating forces	3.6.2	4.6.2	-	X	X	-	X	X
Dielectric withstanding voltage (sea level)	3.6.5	4.6.5.1	-	X	X	-	X	X
Contact retention (solder type and class N)	3.6.18	4.6.18.1	X	X	X	X	-	-
Contact retention (crimp type, except class N)	3.6.18	4.6.18.2	X	X	X	-	-	-
Insert retention	3.6.16	4.6.16.1	X	X	X	-	-	-
Insert retention (hermetic)	3.6.16.1	4.6.16.2	-	-	-	X	X	X
Visual and mechanical examination	3.1, 3.3 thru 3.4.5.5, 3.5, 3.7, and 3.8	4.6.1	X	-	X	X	-	X

TABLE XIII. Sequence for qualification. -Continued
For series 3, classes L, H, and N connectors.

Title	Requirement paragraph	Test paragraph	Test group 1	2	3	4	5	6
Visual and mechanical examination	3.1, 3.3 thru 3.4.5.5, 3.5, 3.7, and 3.8	4.6.1	X	X	X	X	X	X
Magnetic permeability	3.6.22	4.6.22	X	X	X	X	X	X
Maintenance aging	3.6.1	4.6.6	X	-	-	-	-	-
Contact insertion/removal forces	3.6.6	4.6.6	X	-	-	-	-	-
Gage location and retention (crimp type)	3.6.17	4.6.17	X	-	-	X	-	-
Operating forces	3.6.2	4.6.2	X	X	X	X	X	X
Insulation resistance at room temperature	3.6.4.1	4.6.4.1	X	X	X	X	X	X
Dielectric withstanding voltage (sea level)	3.6.5	4.6.5.1	X	X	X	X	X	X
Dielectric withstanding voltage (altitude)	3.6.5	4.6.5.2	X	X	X	X	X	X
Contact resistance	3.6.3	4.6.3	-	X	-	-	X	X
Thermal shock	3.6.7	4.6.7	X	-	X	X	-	-
Air leakage (hermetic)	3.6.9.2	4.6.9.2	-	-	-	X	-	-
Insert retention	3.6.16	4.6.16.1	X	-	X	-	-	-
Vibration	3.6.12	4.6.12	X	-	X	X	-	-
Shock (specified pulse)	3.6.13	4.6.13	X	-	X	X	-	-
Insulation resistance at elevated temperature								
Short time	3.6.4.2	4.6.4.2	-	X	-	-	-	-
Long time	3.6.4.3	4.6.4.3	X	-	X	-	-	-
Durability	3.6.10	4.6.10	-	X	-	X	-	-
Moisture resistance	3.6.14	4.6.14	X	-	X	X	-	-
Insulation resistance	3.6.4	4.6.4.1	X	-	X	X	-	-
Salt spray (corrosion)	3.6.11	4.6.11	-	X	-	X	-	-
Operating forces	3.6.2	4.6.2	X	X	-	X	-	-
Contact resistance	3.6.3	4.6.3	X	-	-	X	-	-
Fluid immersion, lubricating oil	3.6.15	4.6.15.1(b)	-	X	-	-	X	-
Fluid immersion, hydraulic fluid	3.6.15	4.6.15.1(a)	-	-	X	-	-	X
Operating forces	3.6.2	4.6.2	-	X	X	-	X	X
Dielectric withstanding voltage (sea level)	3.6.5	4.6.5.1	-	-	-	-	X	X
Dielectric withstanding voltage (altitude)	3.6.5	4.6.5.2	X	X	X	-	-	-
Contact retention (solder type and class N)	3.6.18	4.6.18.1	-	-	-	X	-	-
Contact retention (crimp type, except class N)	3.6.18	4.6.18.2	X	X	X	-	-	-
Insert retention	3.3.16	4.6.16.1	X	X	X	-	-	-
Insert retention (hermetic)	3.6.16.1	4.6 16.2	-	-	-	X	X	X
Air leakage (hermetic)	3.6.9.2	4.6.9.2	-	-	-	X	-	-
Visual and mechanical examination	3.1, 3.3 thru 3.4.5.5, 3.5, 3.7, and 3.8	4.6.1	X	X	X	X	X	X

TABLE XIII. Sequence for qualification. -Continued
For series 3, class E connectors.

Title	Requirement paragraph	Test paragraph	Test group 1/ 1	2	3
Visual and mechanical examination	3.1, 3.3 thru 3.4.5.5, 3.5, 3.7, and 3.8	4.6.1	X	X	X
Magnetic permeability	3.6.22	4.6.22	X	X	X
Maintenance aging	3.6.1	4.6.6	X	-	-
Contact insertion/removal forces	3.6.6	4.6.6	X	-	-
Gage location and retention (crimp type)	3.6.17	4.6.17	X	-	-
Operating forces	3.6.2	4.6.2	X	X	X
Insulation resistance at room temperature	3.6.4.1	4.6.4.1	X	X	X
Dielectric withstanding voltage (sea level)	3.6.5	4.6.5.1	X	X	X
Dielectric withstanding voltage (altitude)	3.6.5	4.6.5.2	X	X	X
Contact resistance	3.6.3	4.6.3	-	X	-
Thermal shock	3.6.7	4.6.7	X	-	X
Insert retention	3.6.16	4.6.16.1	X	-	X
Vibration	3.6.12	4.6.12	X	-	X
Shock (specified pulse)	3.6.13	4.6.13	X	-	X
Insulation resistance at elevated temperature					
Short time	3.6.4.2	4.6.4.2	-	X	-
Long time	3.6.4.3	4.6.4.3	X	-	X
Durability	3.6.10	4.6.10	-	X	-
Moisture resistance	3.6.14	4.6.14	X	-	X
Insulation resistance	3.6.4	4.6.4.1	X	-	X
Salt spray (corrosion)	3.6.11	4.6.11	-	X	-
Operating forces	3.6.2	4.6.2	X	X	-
Contact resistance	3.6.3	4.6.3	X	-	-
Fluid immersion, lubricating oil	3.6.15	4.6.15.1(b)	-	X	-
Operating forces	3.6.2	4.6.2	-	X	X
Dielectric withstanding voltage (altitude)	3.6.5	4.6.5.2	X	X	X
Contact retention (crimp type, except class N)	3.6.18	4.6.18.2	X	X	X
Insert retention	3.6.16	4.6.16.1	X	X	X
Visual and mechanical examination	3.1, 3.3 thru 3.4.5.5, 3.5, 3.7, and 3.8	4.6.1	X	X	X
1/ Test groups 4, 5, and 6 not applicable					
Group 7 - Solder contacts					
Probe damage	3.6.20	4.6.20			
Contact engagement and separation	3.6.19	4.6.19			
Group 8 - Protective covers and stowage receptacles					
Visual and mechanical examination	3.1, 3.3 thru 3.4.5.5, 3.5, 3.7, and 3.8	4.6.1			
Magnetic permeability	3.6.22	4.6.22			
Operating forces	3.6.2	4.6.2			
Moisture resistance	3.6.14	4.6.14			
Cover chains, tensil strength	3.6.21	4.6.21			
Air leakage	3.6.9.1	4.6.9.3			
Group 9 - Crimp contact retention feature					
Visual and mechanical examination	3.1, 3.3 thru 3.4.5.5 3.5, 3.7, and 3.8	4.6.1			
Maintenance aging (contacts only)	3.6.1	4.6.6			

TABLE XIII. Sequence for qualification. -Continued

	Requirement paragraph	Test paragraph
Group 10 - Connector assemblies, class J		
Visual and mechanical examination	3.1, 3.3 thru 3.4.5.5, 3.5, 3.7, and 3.8	4.6.1
Magnetic permeability	3.6.22	4.6.22
Thermal shock	3.6.7	4.6.7
Water pressure	3.6.8	4.6.8
Air leakage	3.6.9.1	4.6.9.1
Group 11 - Connector receptacle strength		
External bending moment	3.6.23	4.6.23
Group 12 - Fluid immersion, series 3 (classes L, H, and N)		
Visual and mechanical examination	3.1, 3.3 thru 3.4.5.5, 3.5, 3.7, and 3.8	4.6.1
Operating forces	3.6.2	4.6.2
Thermal shock	3.6.7	4.6.7
Fluid immersion	3.6.15	4.6.15.2
Operating forces	3.6.2	4.6.2

TABLE XIV. Test cylinder OD sizes.

Shell size	Diameter (.016 inch)
3	0.194
7	.397
12	.428
19	.538
27	.616
37	.678

facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserved 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 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities or sufficient accuracy, quality and quantity to permit performance of the required inspection shall be established and maintained by the supplier. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with MIL-C-45662.

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

(a) Qualification Inspection (4.4).
(b) Quality Conformance Inspection (4.5).
(c) Qualification Verification Inspection (4.5.2).

4.3 Inspection conditions. Unless otherwise specified herein, all inspections shall be made in accordance with the test conditions specified in the "General Requirements" of MIL-STD-1344

4.3.1 Preparation of samples. Connectors, except class J, shall be wired with approximately 3 feet of wire as specified in table IV. Termination of wires to crimp contacts shall be made in accordance with MIL-C-22520, solder contacts shall be made in accordance with requirements 5 of MIL-STD-454.

4.4 Qualification inspection. Qualification inspection shall consist of the examinations and tests performed in the sequence specified in table XIII, as applicable, on the appropriate qualification test samples specified in 4.4.1 and authorized for testing by the qualifying activity. After receipt of the letter of authorization from the activity responsible for qualification, the applicant shall submit three copies of his test reports (certified by the Government inspector indicating the extent to which the tests were witnessed), together with samples required by the qualifying activity.

4.4.1 Samples. Samples of each item for which qualification is desired shall be tested in the sequence specified in table XIII, as applicable. Specific details shall be as follows:

(a) A sufficient number of crimp contact connectors (series 2 and 3) shall be supplied to provide a minimum of 110 contact cavities of the size of contacts for which qualification of the crimp contact retention feature is desired.
(b) Each connector (series 1, 2, and 3) subjected to qualification testing shall be provided with a counterpart connector for those tests requiring mating assemblies. Separate samples are required for crimp contact connectors and solder contact connectors. The counterpart connectors provided shall be new, previously qualified connectors or new connectors submitted for qualification testing. Manufacturers not producing mating connectors shall submit data substantiating that tests were performed with approved counterpart connectors.

4.4.1.1 Connector assemblies (classes E, P and L). Six complete connector assemblies class E or L, wall mount receptacles and straight push-pull or rack and panel plugs, per contact size for which qualification is requested shall be provided.

(a) Two samples shall have pin contacts in the plug and socket contacts in the receptacle. Both halves of the samples shall be wired with approximately 3 feet of wire approaching the minimum OD specified in table IV. These samples shall be subjected to the tests of table XIII, group 1.
(b) Four samples shall have socket contacts in the plug and pin contacts in the receptacle. Both halves of each sample shall be wired with approximately 3 feet of wire approaching the maximum OD specified in table IV. These samples shall be divided into two equal groups and subjected to all the tests of table XIII, groups 2 and 3 respectively. In addition, all group 3 samples shall be subjected to the test specified in table XIII, group 11.
(c) When class L connectors are being tested, an additional seven complete connector assemblies shall be subjected to the tests specified in table XIII, group 12. These connectors shall be wired with nominal OD wire selected from table IV.
(d) Qualification of class L connectors shall admit qualification of class E connectors and vice versa (except the requirements of (c) above shall be met by class L connectors in either case).
(e) Qualification of these samples shall admit qualification of other types and the balance of insert patterns containing contact sizes previously qualified, in respective classes, by similarity. If qualification of class E is not sought, samples of class P shall be submitted for class E in the foregoing, except that nominal gage wire be used.

4.4.1.2 Connector assemblies (classes N and H). Three each receptacles of classes N and H shall be provided together with counterpart class E or L straight push-pull plugs.

(a) All halves shall be wired with approximately 3 feet of wire of nominal gage.
(b) The samples shall be divided into three equal groups and subjected to all the tests of table XIII, groups 4, 5, and 6. One group of connectors shall be assigned to each test sequence.
(c) An additional seven class N and seven class H receptacles together with counterpart class L straight push-pull plugs shall be subjected to the tests specified in table XIII, group 12. These connectors shall be wired with nominal OD wire.
(d) Qualification of these samples shall admit qualification of other types, mounting, and the balance of insert patterns in each respective class by similarity.

4. 4. 1. 3 Connector assemblies (class J). One mated pair of class J connector assemblies, in each shell size, shall be subjected to the tests of table XIII, group 10. The connectors need not be wired but shall be assembled using a solid polycholoprene cylinder of suitable length and OD in accordance with table XIV. The Shore A Durometer of the test cylinder shall be from 75 to 85. Qualification of these samples will admit qualification of all class J assemblies if class E is being qualified at the same time or has been previously qualified to this specification. If not, class J assemblies shall be subjected to all of the tests of table XIII, groups 1 and 2.

4. 4 1. 4 Socket contacts (except crimp type). Fifty of each socket contact configuration shall be subjected to the probe damage test (4. 6. 20). Solder type sockets or sockets that are not completely assembled before installing in the insert (e. g., class H, socket style), may be provided and tested in connectors, group 7, table XIII.

4. 4. 1. 5 Protective covers and stowage receptacles. Two each protective covers and stowage receptacles of each shell size, with mating class E and L connectors, shall be subjected to the tests of group 8, table XIII.

4. 4. 1. 6 Crimp connectors. Connectors supplied in accordance with 4. 4. 1 shall be subjected to the tests specified in group 9, table XIII.

4. 4. 1. 7 Receptacles. Two receptacles for each size shell shall be subjected to the test specified in group 11, table XIII.

4. 4. 2 Inspection routine. The sample shall be subjected to the inspection specified in table XIII in the order shown.

4. 4. 3 Failures. One or more failures shall be cause for refusal to grant qualification approval.

4. 4. 4 Retention of qualification. In order to retain qualification, a summary of group C test results shall be furnished at 18-month intervals (see 4. 5. 2) and shall cover the results of group C tests performed during that period. The summary shall also include the number and type of any part failures and shall be forwarded via the Government inspector to the activity responsible for qualification. If the summary of results indicates nonconformance with specification requirements, 4. 5. 2. 2 (noncompliance) shall apply. Failure to furnish the summary shall result in loss of qualification for that product.

4. 4. 5 Assembly plants. Assembly plants must be listed on or approved for listing on the applicable qualified products list. The connector supplier listed on the QPL shall certify that the assembly plant is approved for the distribution of the supplier's parts. The assembly plant shall use only piece parts supplied by the connector supplier No testing other than visual examination is required of certified piece parts obtained from the connector supplier, except when there is cause for rejection. All assemblies produced at the assembly plant shall be subjected to the quality assurance provisions specified herein. Quality control requirements, including Government inspection surveillance, shall be the same as required for the connector supplier.

4. 4. 6 Qualification of additional connectors. For connectors of the same series which have identical contacts and differ only in shell size and/or configuration from those which have been previously qualified (or are concurrently being qualified), the suppliers test report need only provide test data necessary to validate the differing feature(s). In addition, connectors which differ in shell size shall be subjected to the following tests and the results shall be forwarded to the qualifying activity

Test	Requirement Para.	Test Para.
Visual and mechanical examination	3. 1, 3. 3 thru 3. 4. 5. 5, 3. 5, 3. 7, and 3. 8	4. 6. 1
Operating forces	3. 6. 2	4. 6. 2
Visual and mechanical examination	3. 1, 3. 3 thru 3. 4. 5. 5, 3. 5, 3. 7, and 3. 8	4. 6. 1
External bending moment (series 3, class E and L only)	3. 6. 23	4. 6. 23

4.5 Quality conformance inspection.

4.5.1 Inspection of product for delivery. Inspection of product for delivery shall consist of groups A and B inspection.

4.5.1.1 Inspection lot. An inspection lot shall consist of connectors covered by the same MS standard, produced under essentially the same conditions and offered for inspection at one time. Identical connectors, except for variations in insert arrangements, may be grouped in a lot, but representative specimens of all insert positions shall be selected proportionally where possible, from the lot for examination.

4.5.1.2 Group A inspection. Group A inspection shall consist of the examinations and test specified in table XV, in the order shown. The contractor shall furnish the certification for fungus resistance material (see 3.3.8) with each lot of connectors.

4.5.1.2.1 Sampling plan. Statistical sampling and inspection shall be in accordance with MIL-STD-105 for general inspection level II. The acceptacle quality level (AQL) shall be as specified in table XV. Major and minor defects shall be as defined in MIL-STD-105.

4.5.1.2.2 Rejected lots. If an inspection lot is rejected, the supplier may rework it to correct the defects, or screen out the defective units, and resubmit for reinspection. Resubmitted lots shall be inspected using tightened inspection. Such lots shall be separate from new lots, and shall be clearly identified as reinspected lots.

4.5.1.2.3 Disposition of sample units. If the lot is accepted, samples may be delivered on the contract or order.

TABLE XV. Group A inspection.

Examination or test	Requirement paragraph	Method paragraph	AQL % defective Major	AQL % defective Minor
Visual and mechanical examination	3.1, 3.3 thru 3.4.5.5, 3.5, 3.7, and 3.8	4.6.1	0.25	1.0
Electrical 1/				
Insulation resistance	3.6.4.1	4.6.4.1	1.0	1.0
Dielectric withstanding voltage (sea level) 2/	3.6.5	4.6.5.1	1.0	1.0

1/ All electric defects are considered major defects. (Connectors are not required to be wired for these tests.)

2/ Test voltage application time shall be 5 seconds minimum.

4.5.1.3 Group B inspection. Group B inspection shall consist of the examinations and tests specified in table XVI, in the order shown, and shall be made on sample units which have been subjected to and have passed the group A inspection. The manufacturer shall supply counterpart receptacles or plugs for inspection purposes.

4.5.1.3.1 Sampling plan. The sampling plan shall be in accordance with MIL-STD-105 for special inspection level S-3. The sample size shall be based on the inspection lot size from which the sample was selected for group A inspection. The AQL shall be 4 percent defective.

4.5.1.3.2 Rejected lots. If an inspection lot is rejected, the supplier may rework it to correct the defects, or screen out the defective units, and resubmit for reinspection. Resubmitted lots shall be inspected using tightened inspection. Such lots shall be separate from new lots, and shall be clearly identified as reinspected lots.

4.5.1.3.3 Disposition of sample units. Sample units which have been subjected to group B inspection may be delivered on the contract or order.

TABLE XVI. Group B inspection.

Examination or test 1/	Requirement paragraph	Method paragraph
Gage location and retention (crimp type)	3.6.17	4.6.17
Contact retention (solder type and class N)	3.6.18.1	4.6.18.1
Operating forces	3.6.2	4.6.2
Air leakage (classes H and N only)	3.6.9	4.6.9.2
Insert retention	3.6.16	4.6.16

1/ Connectors are not required to be wired for these tests.

4.5.2 Qulification verification inspection. Qualification verification inspection shall consist of group C. Except where the results of these inspections show noncompliance with the applicable re-requirements (see 4.5.4.2), delivery of products which have passed groups A and B shall not be delayed pending the results of these qualification verification inspections.

4.5.2.1 Sampling plan. Every 18 months, a sample of six mated specimens of each class, except class J, shall be subjected to the tests specified in table XVII, in the order shown. The sample shall be drawn from lots which have passed A and B inspection. Group C inspection may be made on test specimens which were used for and passed A and B inspection. Class E mated with class L plugs shall satisfy requirements for classes E and L. Class H and class N receptacles may be mated with either class E or class L plugs. When both class H and class N have been produced, the sample may consist of three class H and three class N receptacles. Separate samples shall be required for crimp contact and solder contact connectors (except class H and N). When more than one shell size is produced, the sample shall consist of a variety of sizes representative of those in production; or samples of the largest shell size produced with the maximum density shall be tested and shall satisfy requirements for all smaller shell sizes and contact densities.

(a) Two mated samples (except hermetics) shall be wired with approximately 3 feet of wire approaching the minimum OD specified in table IV; the other four samples shall be wired with approximately 3 feet of wire approaching the maximum OD specified in table IV. Class H and N samples and mating plugs shall be wired with approximately 3 feet or nominal gage wire (see table IV). Classes E and L samples with the minimum OD wire shall be subjected to the tests of table XVII, group 1, in the sequence given. The samples with the maximum OD wire shall be divided into two equal groups and each group shall be subjected to the tests of table XVII, groups 2 and 3, in the order given. Class H and N samples shall be divided into three groups (with equal quantities of each class per group if applicable) and each group shall be subjected to the tests of table XVII, groups 4, 5, and 6 in the order given. Periodic testing of the above samples in classes E and L shall be sufficient to demonstrate control of class P. If, however, no class E or L connectors were produced during the control period, samples of class P shall be tested. The method of selection or testing shall be as described for classes E and L, except that wire of nominal gage may be used.

(b) Two each, class J connectors, protective covers, and stowage receptacles, representative of production of any shell size, shall be selected and tested as specified in 4.4.1.4.

(c) Socket contacts, except crimp type, shall be selected and tested as specified in 4.4.1.6

TABLE XVII. Group C inspection.

Title	Requirement paragraph	Test paragraph	Test group 1	2	3	4	5	6
Maintenance aging (crimp contacts)	3.6.1	4.6.6	X			X		
Contact insertion and removal forces	3.6.6	4.6.6	X			X		
Thermal shock	3.6.7	4.6.7	X					
Air leakage	3.6.9.1	4.6.9.1	X					
Air leakage (hermetic)	3.6.9.2	4.6.9.2				X		
Insulation resistance at elevated temperature:								
Short time	3.6.4.2	4.6.4.2		X				
Long time	3.6.4.3	4.6.4.3			X			
Durability	3.6.10	4.6.10	X			X		
Vibration	3.6.12	4.6.12	X			X		
Shock (specified pulse)	3.6.13	4.6.13	X			X		
Moisture resistance	3.6.14	4.6.14	X			X		
Salt spray (corrosion)	3.6.11	4.6.11	X			X		
Operating forces	3.6.2	4.6.2	X			X		
Contact resistance	3.6.3	4.6.3	X			X		
Fluid immersion, hydraulic oil (except series 3, class E)	3.6.15	4.6.15.1(a)			X			X
Fluid immersion, lubricating fluid	3.6.15	4.6.15.1(b)		X			X	
Operating forces	3.6.2	4.6.2		X	X		X	X
Dielectric withstanding voltage: Sea level	3.6.5	4.6.5.1	X				X	X
Dielectric withstanding voltage: Altitude	3.6.5	4.6.5.2	X	X	X			
Gage location and retention (crimp type)	3.6.17	4.6.17	X	X	X			
Contact retention (solder type and class N)	3.6.18	4.6.18.1	X	X	X			
Insert retention	3.6.16	4.6.16.1	X	X	X			
Insert retention (hermetic)	3.6.16.1	4.6.16.2				X	X	X
Visual and mechanical examination	3.1, 3.3 thru 3.4.5.5, 3.5, 3.7, and 3.8	4.6.1	X	X	X	X	X	X

4.5.2.2 Noncompliance. If a sample unit fails to pass group C inspection, the supplier shall take corrective action on the material or processes, or both, warranted, and on all units of product which can be corrected and which were manufactured under essentially the same conditions with essentially the same materials, processes, etc., and which are considered subject to the same failure. Acceptance of the product shall be discontinued until corrective action, acceptable to the Government, has been taken. After the corrective action has been taken, group C inspection shall be repeated on additional sample units (all inspections or the inspection that the original sample failed, at the option of the Government). Groups A and B inspections may be reinstituted, however, final acceptance shall be withheld until the group C reinspection has shown that the corrective action was successful. In the event of failure after reinspection, information concerning the failure and the corrective action taken shall be furnished to the cognizant inspection activity and the qualifying activity

4.5.3 Inspection of preparation for delivery. Sample packages and packs and the inspection of the preservation and packaging, packing and marking for shipment and storage shall be in accordance with the requirements of section 5 and the documents specified therein.

4.6 Methods of examination and tests.

4.6.1 Visual and mechanical examination. Connectors shall be examined to verify that the materials, design and construction, interchangeability, marking and workmanship are in accordance with the applicable requirements (see 3.1, 3.3 through 3.4.5.5, 3.5, and 3.8). In process control of component parts, unrelated to lot sizes of finished connectors, may be utilized in lieu of examination of these components in the finished connectors to assure conformance of these component parts.

4.6.2 Operating force (see 3.6.2). Receptacles, plugs, dummy stowage receptacles, and protective covers shall be engaged and disengaged from counterpart connectors; the forces must be applied to the coupling rings of push-pull connectors and to the shells of rack and panel connectors or protective covers. Coupling and uncoupling forces shall be measured and recorded.

4.6.3 Contact resistance (see 3.6.3). The contact resistance shall be measured in accordance with the contact resistance test of MIL-C-23216 or MIL-C-39029, as applicable.

4.6.4 Insulation resistance.

4.6.4.1 Insulation resistance at room temperature (see 3.6.4.1). Unmated connectors shall be tested in accordance with method 3003 of MIL-STD-1344. The resistance shall be measured between all, but not more than six pairs of adjacent contacts and between all, but not more than six contacts closest to the shell and the shell. The contacts selected shall be those having the closest spacing between measurement points. For group A inspection, the test conditions of MIL-STD-1344 do not apply and simulated contacts may be used.

4.6.4.2 Insulation resistance at elevated temperature (short-time) (see 3.6.4.2). The insulation resistance shall be measured in accordance with 4.6.4.1, except the connectors shall be exposed for 250 hours at the temperature specified in 3.6.4.2. During the test sequence, measurements shall be recorded at least eight times; the interval between each series of measurements shall be not less than 24 hours. After completion of the 250 hours and while at the specified temperature in 3.6.4.2, measurements shall be recorded on all samples.

4.6.4.3 Insulation resistance at elevated temperature (long time) (see 3.6.4.3). The insulation resistance shall be measured in accordance with 4.6.4.1, except the connectors shall be exposed for 1,000 hours at the temperatures specified in 3.6.4.3. The measurements shall be at the end of 1,000 hours while the connectors are at elevated temperatures.

4.6.5 Dielectric withstanding voltage.

4.6.5.1 Dielectric withstanding voltage, sea level (see 3.6.5). Unmated connectors shall be tested in accordance with method 3001 of MIL-STD-1344. The applicable test voltages of table XVIII shall be applied between all adjacent contacts and between the shell and each contact closest to the shell. If an insert possesses more than one service rating, similar connections shall be made for the different test voltages as necessary. For group A inspection, the test conditions of MIL-STD-1344 do not apply and simulated contacts may be used.

TABLE XVIII. Dielectric withstanding voltage.

Altitude (feet)	Minimum test voltages, ac (rms)	
	Service rating I	Service rating II
Sea level	1500	2300
70,000	350	500

4.6.5.2 Dielectric withstanding voltage, altitude (see 3.6.5). The connectors shall be tested in accordance with method 105, test condition C, MIL-STD-202. After 30 minutes at the simulated altitude, the connectors shall be tested as specified in 4.6.5.1. Only the engaging faces of classes H and N shall be subjected to the high altitude. Rear faces shall be suitably protected.

4.6.6 Maintenance aging (crimp contact connectors only) (see 3.6.1). With the grommet relaxed, each contact shall be removed and reinserted once, using the appropriate MS tools. Counterpart connectors shall then be mated and unmated 10 times (mating and unmating is not required for class N connectors). A minimum of 20 percent, but not less than three of the contacts, shall be removed and reinserted nine more times. The contact insertion and removal forces shall be measured during the first and ninth insertion cycle on half, but on not less than three, of the contacts selected for this test. The forces shall be recorded and shall not exceed the requirements of table VIII.

4.6.7 Thermal shock (see 3.6.7). Unmated connectors shall be tested in accordance with method 1003, test condition B of MIL-STD-1344, except that the minimum temperature shall be -55° C and the maximum temperature shall be 175° C for series 2 crimp type connectors and for class L, series 3 connectors, and 200° C for class E, series 3 connectors. At the completion of the last cycle, the connectors shall be returned to room temperature for inspection.

4.6.8 Water pressure test (class J only) (see 3.6.8). Receptacles shall be mounted on the water tank bulkhead so that the mating end projects out of the tank. The cable end of the receptacle shall be immersed in tap water to a depth of 6 feet for 48 hours. The receptacle flang shall be sealed so that no water leaks through the connector mounting. Jam-nut mounting receptacle flanges shall be sealed only with the "O" ring seal provided.

4.6.9 Air leakage.

4.6.9.1 Connectors with solder contacts and environmental sealing adapters (see 3.6.9.1). Connectors with solder contacts and sealing adapters shall be mounted in a manner suitable for application of a 30 lb_f/in^2 pressure differential across the connectors. The leakage rates shall be measured in both directions after 30 minutes of exposure to the low temperature extremes of table X and while at the low temperature.

4.6.9.2 Connectors, classes N and H (see 3.6.9.2). Connectors shall be mounted in a manner suitable for application of a pressure differential of one atmosphere across the connectors and tested in accordance with procedure I, method 112, test condition C, MIL-STD-202. The leakage rate shall be determined while air or gas, containing not less than 10 percent of helium by volume, is applied to the connector.

4.6.9.3 Stowage receptacles and protective covers (see 3.6.9.1). Stowage receptacles and protective covers shall be mated to connectors having either contacts or inserts removed so that a pressure of 5 lb_f/in^2 can be applied against the insides of the protective covers or stowage receptacles.

4.6.10 Durability (see 3.6.10). Counterpart connectors shall be mated and unmated 500 times at a maximum rate of 300 cycles per hour with the coupling mechanism operated in a manner simulating actual service.

4.6.11 Salt spray (corrosion) (3.6.11). Unmated connectors, and accessories shall be subjected to a salt spray test in accordance with method 1001, test condition B, MIL-STD-1344. The salt concentration shall be 20 percent. The specimens shall then be dried in a circulating air oven at a temperature of 38° C ±3° C for not less than 12 hours, then shall be removed and inspected. Prior to all subsequent testing, corrosion tested connectors shall be engaged and disengaged for one cycle to remove free salt deposits. Classes H and N shall have rear end suitably protected.

4.6.12 Vibration (see 3.6.12). The connector assembly shall be mounted, as specified herein, and vibrated in accordance with method 2005, test condition IV, MIL-STD-1344. A suitable instrument shall be employed to monitor any discontinuity in excess of 1 microsecond.

4.6.13 Shock (specified pulse) (see 3.6.13). Mated connectors shall be mounted as specified (see 4.6.12) and subjected to the shock test of method 2004, test condition A, of MIL-STD-1344, except that the peak value shall be 150 g's. One shock shall be applied in each direction of the three major axes of the connectors. All contacts shall be wired in series with at least 100 milliamperes (mA) allowed to flow. A suitable instrument shall be employed to monitor any discontinuity in excess of 1 microsecond. A minimum of 8 inches of wire or cable shall be unsupported behind the rear of each connector.

4.6.14 Moisture resistance (see 3.6.14). Moisture resistance test specimens shall be subjected to the high humidity 4.6.14.1, or extreme humidity range 4.6.14.2 moisture test, as applicable. The connectors shall be wired and mated to the counterpart connectors. They shall be mounted horizontally with the wires descending into the backshell with no drip loops or splices within the chamber. The wires shall leave the chamber through vaportight seals. Connectors without rear seal grommets shall have their terminals suitably protected. Prior to the beginning of the test and at the end of the test period and while at the high humidity, the insulation resistance between each contact and other contacts shall be determined as specified in 4.6.4.

4.6.14.1 Moisture resistance at high humidity (crimp contact connectors). Mated crimp contact connectors shall be tested in accordance with MIL-STD-202, method 106.

4.6.14.2 Moisture resistance, extreme humidity range (solder contact connectors). Mated solder contact connectors shall be subjected to the following test. The test chamber shall consist of a box approximately 12 inches deep by 16 inches wide by 24 inches long, capable of being sealed, and shall be constructed of materials that, in the presence of water, will not cause deterioration of the samples. A suitable open screen tray shall be provided to support the test specimens approximately 8 inches below the top of the box. Provisions shall be made to bring out wires for measurement purposes through vaportight seals near the top of the box. Suitable controls shall be provided that will cause the chamber air temperature to vary 5° C (9° F) once each hour for 20 days, from any temperature between 22° and 28° C (72° and 82° F), causing heavy condensation to form on the samples once each hour. The bottom of the test chamber shall be covered with approximately 1/4 inch of tap water to start the test. The heat application to supply the temperature variation shall be radiation in nature and shall be applied to the underside of the test chamber.

4.6.15 Fluid immersion (see 3.6.15).

4.6.15.1 Fluid immersion (series 1, 2, and 3). Unmated connectors shall be immersed fully in the fluids specified below for the required periods. At least one connector shall be immersed in each fluid. Connectors without rear sealing grommets shall have their rear end suitably protected. After removal from the fluid each connector shall remain for 1 hour in free air at room conditions. Subsequent testing shall be performed on connectors mated with the same mating connectors used previously in the test.

(a) Hydraulic fluid conforming to MIL-H-5606 - 20 hours.
(b) Lubricating oil conforming to MIL-L-7808 - 20 hours

4.6.15.2 Fluid immersion (series 3 classes L, H, and N) (see 3.6.15). One connector shall constitute 1 sample. Each sample number shall be subjected to its corresponding test number as shown in table XIX. After testing in accordance with the individual test procedure, the connectors shall be visually (5× magnification) inspected for cracks and tears and shall be mated by hand

TABLE XIX. Fluid immersion tests.

Test number	Sample number	Test - fluid specification	Test procedure
1	1	MIL-L-7808	Immerse unmated connectors in fluid at 120° ±3° C for 5 minutes.
2	2	MIL-L-23399	Remove connectors and allow to drain for 1 hour at room temperature. Fluid shall be drained from all recesses. Mate connectors and expose to 175° C ±3° C in an air circulating oven for 22 hours. Repeat procedure for a total of 7 cycles.
3	3	MIL-H-5606	Same as above, except immerse in fluid at 85° ±3° C for 5 minutes and expose mated connectors to 104° ±3° C in an air circulating oven for 22 hours.
4	4	Glycol 1/	Same as MIL-L-7808, except fluid temperature shall be 65° ±3° C and connectors shall be mated during fluid immersion.
5	5	Alkaline cleaning solution pH10-12 2/	Rear faces of classes H and N connectors shall be suitably protected or excluded from these fluids
6	6	Coolant-dielectric fluid synthetic silicate ester base 3/	Unmated connectors shall be pre-conditioned at 175° C for 30 minutes. Immerse connectors fully in room temperature fluid for 1 minute. Remove connectors and allow to stabilize at room temperature for 1 hour.
7	7	MIL-T-5624 grade JP-5	Soak unmated connectors for 20 hours at room temperature, allow 4 hours for draining and mate by hand (1 cycle).

1/ Ethylene glycol.
2/ CEEBEE A694 or equivalent (diluted to required pH).
3/ COOLANOL 25 or equivalent.

4.6.16 Insert retention.

4.6.16.1 Insert retention (except hermetics) (see 3.6.16). Inserts in connectors less removable grommets or any accessory shall be subjected to axial loads in each direction. Loading shall be accomplished by applying air pressure or equivalent load. The pressure shall be increased gradually at a rate of approximately 10 lb_f/in^2 second until the specified pressure is reached. The insert shall retain its normal position in the connector shell for at least 5 seconds at maximum specified pressure.

4.6.16.2 Insert retention (hermetics) (see 3.6.16.1). Inserts in connectors less any accessories shall be subjected to axial loads in each direction. Loading shall be accomplished by applying hydraulic pressure or equivalent load. The pressure shall be increased gradually at a rate of 50 lb_f in^2 second until the specified pressure is reached. The insert shall retain its normal position in the connector shell for at least 5 seconds at maximum specified pressure.

4.6.17 Gage location and retention (crimp type contacts) (see 3.6.17). Applicable test gages shall be installed in three randomly selected cavities of each connector. Accessory rear hardware shall be removed, and remaining cavities shall have contacts in place. With the test gages fully seated back against the contact retention device, the axial location of the front end of the gages shall be measured relative to the reference point indicated on the applicable MS drawing. The axial load specified in table X shall then be applied to individual test gages in both directions. The load shall be applied at a rate of approximately 1 pound per second until the specified load has been reached. Gage displacement shall be measured from the insert face, after an initial load of 2 pounds has been applied to assure that all slack between the gage and the retention device has been removed. For group B inspection, gage displacement measurements are not required, and remaining contact cavities may be empty.

4.6.18 Contact retention (see 3.6.18). Axial loads in accordance with table X shall be applied to individual contacts in the direction tending to dislodge them toward the rear of the connector. The connector shall have all contacts in place during the test. The load shall be applied at a rate of approximately 1 pound per second until the specified load has been reached. A minimum of 20 percent, but not less than three, of the contacts in each connector shall be tested. Accessory rear hardware shall be removed.

4.6.18.1 Contact retention (solder type and class N) (see 3.6.18). Connectors shall be tested as specified in 4.6.18, except that the specified loads shall be maintained for a minimum period of 5 seconds and then removed. The contact displacement shall then be measured from the connector shell. For class N connectors, the test shall apply to the pin contact members only.

4.6.18.2 Contact retention (crimp type, except class N) (see 3.6.18). Connectors shall be tested as specified in 4.6.18, except that an initial load of 2 pounds shall be applied to assure that all slack between the contact and the retention device has been taken up, before measuring contact displacement. Displacement shall then be measured from the insert face with the contact under load, after the load has been applied for a minimum of 5 seconds.

4.6.19 Contact engaging and separating force (series 1) (see 3.6.19). Socket contacts shall be tested in accordance with the contact engagement and separation test of MIL-C-23216.

4.6.20 Probe damage (series 1) (see 3.6.20) Socket contacts shall be tested in accordance with method 2006 of MIL-STD-1344. The contacts may be tested while installed within the applicable connector body. Probe depth shall be 1/2, 3/4, and full value of socket bore depth.

4.6.21 Cover chain tensile strength (see 3.6.21). The protective cover shall be securely held and a tensile static load of 25 pounds shall be applied to the end of the chain for 5 minutes in each direction with the axis of the chain as specified.

(a) At right angles to the axis of the holding fastener.
(b) In the same axis as that of the fastener.

4.6.22 Magnetic permeability (see 3.6.22). Permeability shall be checked with an instrument conforming to MIL-I-17214. The connectors may be wired or unwired, as convenient, but shall not be carrying current.

4.6.23 External bending moment (see 3.6.23). The receptacle connector shall be mounted as in normal service to a rigid panel. Before mating the plug connector to the receptacle, the "J" adapter or test torque arm shall be attached as shown in figure 5. After mating the plug and receptacle connectors, the distance "L" from the point of load application "P" to the mounting panel shall be determined. The load to be applied at point "P" shall then be determined as the bending moment listed in table XII divided by the lever arm "L". This load shall be applied at a rate of approximately 10 pounds per second until the required load is achieved. The load so applied shall be held for a period of 1 minute then released. Continuity of the contacts shall be monitored during testing

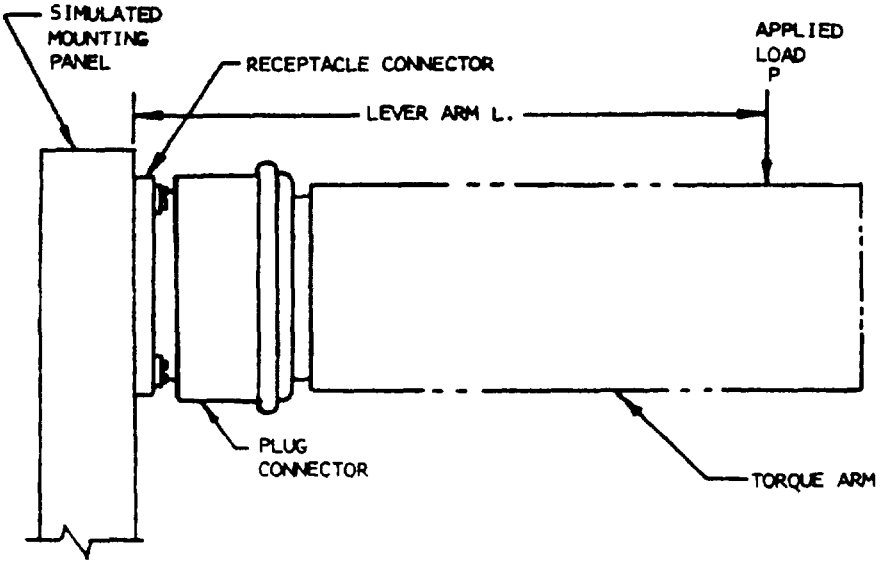


FIGURE 5 EXTERNAL BENDING MOMENT TEST SET-UP

5. PREPARATION FOR DELIVERY

5.1 Preservation and packaging. Preservation and packaging shall be level A or C, as specified (see 6.2).

5.1.1 Level A.

5.1.1.1 Cleaning. Connectors and accessories shall be cleaned in accordance with MIL-P-116, process C-1.

5.1.1.2 Drying. Connectors and accessories shall be dried in accordance with MIL-P-116.

5.1.1.3 Preservative application. Preservatives shall not be used.

5.1.1.4 Unit packaging. Connectors and accessories shall be individually packaged in accordance with the methods of MIL-P-116 specified herein insuring compliance with the general requirements paragraph under methods of preservation (unit protection) and the physical protection requirements paragraph therein.

5.1.1.4.1 Connectors. Unless otherwise specified (see 6.2), connectors shall be packaged in accordance with submethod IA-8. Unmounted hardware shall be physically protected and enclosed within the unit package in a manner that will not damage the connector or barrier.

5.1.1.4.1.1 Removable contacts. Removable crimp type contacts shall not be installed in the connector insert but shall be placed in a close fitting rigid container such as a vial or box and enclosed within the unit package. The contact container shall include any spare contacts provided.

5.1.1.4.1.2 Grommet sealing plugs. Grommet sealing plugs supplied with various connectors shall be placed in a transparent envelope and enclosed within the unit package.

5.1.1.4.2 Accessories (when separately procured). Covers and other accessories shall be packaged in accordance with method IA. Unit package quantities for other than one each shall be as specified (see 6.2).

5.1 1.5 Intermediate packaging. Connectors and accessories, packaged as described in 5.1 1.4, shall be placed in intermediate containers conforming to PPP-B-566 or PPP-B-676. Intermediate containers shall be uniform in size, shape and quantitites, shall be of minimum tare and cube and shall contain multiples of five unit packages, not to exceed 50 unit packages. No intermediate packaging is required when the total quantity shipped to a single destination is less than 50 unit packages.

5.1.2 Level C. Clean and dry connectors and accessories shall be individually packaged in a manner that will afford adequate protection against corrosion, deterioration and physical damage during shipment from supply source to the first receiving activity.

5.2 Packing Packing shall be level A, B, or C, as specified (see 6 2).

5.2.1 Level A. The packaged connectors and accessories shall be packed in fiberboard containers conforming to PPP-B-636, class weather resistant, style optional, special requirements. In lieu of the closure and waterproofing requirements in the appendix of PPP-B-636 closure and waterproofing shall be accomplished by sealing all seams, corners and manufacturer's joint with tape, two inches minimum width, conforming to PPP-T-60, class 1 or PPP-T-76 Banding (reinforcement requirements) shall be applied in accordance with the appendix to PPP-B-636 using nonmetallic tape banding only.

5 2.2 Level B. The packaged connectors and accessories shall be packed in fiberboard containers conforming to PPP-B-636 class domestic style optional special requirements. Closures shall be in accordance with the appendix thereto.

5.2.3 Level C. The packaged connectors and accessories shall be packed in shipping containers in a manner that will afford adequate protection against damage during direct shipment from the supply source to the first receiving activity. These packs shall conform to the applicable carrier rules and regulations.

5.2.4 Unitized loads. Unitized loads, commensurate with the level of packaging specified in the contract or order, shall be used whenever total quantities for shipment to one destination equal 40 cubic feet or more. Quantities less than 40 cubic feet need not be unitized. Unitized loads shall be uniform in size and quantities to the greatest extent practicable.

5.2.4.1 Level A. Connectors and accessories, packed as specified in 5.2.1, shall be placed on pallets in conformance with MIL-STD-147, load type I, with a fiberboard cap (storage aid 4) positioned over the load.

5.2.4.2 Level B. Connectors and accessories, packed as specified in 5.2.2, shall be palletized as specified in 5.2.4.1 except that the fiberboard caps shall be class domestic.

5.2.4.3 Level C. Connectors and accessories, packed as specified in 5.2.3, shall be unitized with pallets and caps of the type, size and kind commonly used for the purpose and shall conform to the applicable carrier rules and regulations.

5.3 Marking. In addition to any special marking required by the contract or order, each unit package, intermediate and exterior container and unitized load shall be marked in accordance with MIL-STD-129.

5.4 General.

5.4.1 Exterior containers. Exterior containers (see 5.2.1, 5.2.2 and 5.2.3) shall be of a minimum tare and cube consistent with the protection required and shall contain equal quantities of identical stock numbered items to the greatest extent practicable.

5.4.2 Polystyrene material. The use of polystyrene loose fill material (such as strips, strands and beads) is prohibited for packaging and packing applications.

6. NOTES

6.1 Intended use. The various classes and types of connectors are intended for application as follows (see 1.3.2):

(a) Classes E, J, and P (series 1) solder connectors are intended for use in environment-resisting applications where the operating temperature range of -55°C to 125°C is experienced. Crimp contact connectors have the additional advantage of possessing removable crimp-type contacts and a higher temperature rating (175°C). Class J connectors are intended for use with lightweight single-jacketed cable.
(b) Classes N and H connectors are intended for use in applications wherein pressures must be contained by the connectors across the walls or panels they are mounted on. Class N connectors have the additional advantage of possessing removable crimp-type contacts Class N connectors are rated at a high temperature of 200° C while class H connectors are rated at 125° C maximum for series 1, 200° C maximum for series 3.
(c) Class L and E. series 3, connectors are intended for use in environment-resisting applications where the operating temperatures are in a range of -55° C to 175° C for class L, and -55° C to 200° C for class E.
(d) Cylindrical miniature spherically oriented rack and panel plugs are intended for use in environment-resisting applications where blind mating conditions occur. Rack and panel plugs will accommodate up to .050 inches of initial misalinement in any direction between mating connectors
(e) Crimp contact connectors (except class N) should have contacts installed in all positions when the connector is wired. Sealing plugs should be installed in the gommet holes when no wire is attached to the contact in grommet sealing connectors

(f) The potting form should remain with the connector after potting.
(g) Counterpart solder and crimp contact connectors are intended to be intermateable, but performance is then reduced to that of the solder contact connector.
(h) If air leakage requirements are critical, a hermetic receptacle should be used.
(i) MS3130 series solder-type connectors do not have an interfacial seal. Therefore, these connectors should not be used where such a seal is required.
(j) For finished wire diameters less than specified in table IV, shrink-fit sleeving should be used over the wire.
(k) Where two or more wires are used in a solder cup or wire barrel, moisture sealing is not obtainable. Wires should be potted if sealing is required.
(l) Class N hermetic crimp type series do not have grommet seals. Connectors should be potted if wire sealing is required.
(m) Shielded contacts are intended for use with shielded and jacketed single conductor cables, and may be used with certain coaxial cables when impedance matching is not required. Shielded contacts are not furnished with connectors, and must be ordered separately when required. It will be the user's responsibility to prevent the inadvertant cross mating of a shielded contact with a size 12 power contact.

6.2 Ordering data. The following information is required for ordering:

(a) Title, number, and date of this specification.
(b) Title of connector or accessory, by type, class and description (1.2).
(c) Levels of preservation, packaging, packing, and applicable marking (see section 5).
(d) MS standard number (1.2.3).
(e) For indirect shipment, these connectors may be furnished without contacts or grommet sealing plugs (3.4.1).

6.2.1 Accessory hardware. Accessory hardware, such as covers, dummy stowage receptacles, or mounting hardware especially designed for these connectors, is defined in the applicable MS standard. Flange gaskets are not supplied with the receptacles (3.4.6).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are at time set for opening of bids, qualified for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the Qualified Products Lists is the Naval Air Systems Command. The Naval Ammunition Depot has been designated agent for the establishment of the QPL. Information pertaining to qualification of products may be obtained from the Commanding Officer, Naval Ammunition Depot, Crane, Indiana 47522, attn: Code 70531.

6.4 Definitions. (See MIL-STD-1353.)

6.4.1 Insulating spacer. An insulating spacer is a device intended to separate individual wires attached to the contacts of the connector.

6.4.2 Gland clamp. A gland clamp is a device intended to seal around a single-jacketed cable and is composed of a gland nut and sealing member.

6.4.3 Alternate insert position. The insert position illustrated in the applicable detail documents should be termed "normal" position. Where possible, the order of design selection of insert position should be "normal" first. This should be followed by the alternate positions as needed in the order in which they are presented in the tabulation included in the detail document covering the arrangement.

6.4.4 Rack and panel plug. A cylindrical rack and panel plug is normally attached to a panel or other supporting surface. It is used in applications where an initial misalinement exists between mating halves during blind mating. Rack and panel plugs may be provided with either pin or socket contacts.

SPECIFICATION ANALYSIS SHEET

Form Approved
Budget Bureau No. 119-R004

INSTRUCTIONS

This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification - procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity (as indicated on reverse hereof).

SPECIFICATION
MIL-C-81703(Navy) CONNECTORS, ELECTRIC, CIRCULAR, MINIATURE RACK AND PANEL OR PUSH

ORGANIZATION (of submitter) PULL COUPLING, ENVIRONMENT RESISTING STATE

CONTRACT NO.	QUANTITY OF ITEMS PROCURED	DOLLAR AMOUNT
		$

MATERIAL PROCURED UNDER A

☐ DIRECT GOVERNMENT CONTRACT ☐ SUBCONTRACT

1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?

A. GIVE PARAGRAPH NUMBER AND WORDING.

B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES.

2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID

3. IS THE SPECIFICATION RESTRICTIVE?

☐ YES ☐ NO IF "YES", IN WHAT WAY?

4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)

SUBMITTED BY (Printed or typed name and activity)	DATE

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