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23 March 1976
SUPERSEDING
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18 October 1971 and
MIL-C-5015D
17 December 1958

MILITARY SPECIFICATION

CONNECTORS, ELECTRICAL, CIRCULAR THREADED, AN TYPE, GENERAL SPECIFICATION FOR

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers circular electrical connectors with solder or removable crimp contacts (both front and rear release). These connectors are for use in electronic, electrical power, and control circuits (see 6.1).

1.1.1 Temperature. These connectors are rated for specified operation within a temperature range of -55°C (-67°F) to either 125°C (257°F), 175°C (347°F), or 200°C (392°F) depending upon the class. The upper temperature is the maximum internal hot-spot temperature resulting from any combination of electrical load and ambient conditions.

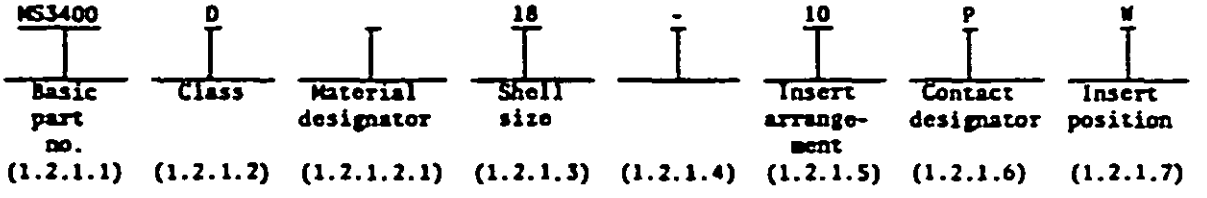
1.1.1.1 Insulation resistance. Insulation resistance limits vary with temperature (see figure 1).

1.1.1.2 Service life. Service life varies with temperature (see figure 2 and table I).

1.2 Classification. Electrical connectors shall be of the following classes, sizes, types, insert arrangements and styles as specified on the applicable military standard.

1.2.1 MS part number. The MS part number for qualified connectors procured in accordance with this specification shall conform to the following example (see 3.7):

MS3400D 18-10PW



1.2.1.1 Basic part number. The basic part number shall be as shown on the applicable MS standard (see 3.1). Revision letters shall not be included.

1.2.1.2 Classes. Connector classes shall be designated by a letter as shown in table I (classes C, E, and U connectors and certain connectors in classes A and B are inactive for design (see 3.1)).

1.2.1.2.1 Material designator. Shell and coupling ring material shall be designated by a letter in accordance with the following:

S	- Stainless steel (see 3.3.6d and 3.3.6.1d)
T	- Ferrous alloy with cadmium plate (class H, and MS3400 and MS3450 series class K) (see 3.3.6c and 3.3.6.1c)
Leave blank	- Aluminum alloy (see 3.3.6a and 3.3.6.1a and c)
	- Wrought aluminum (see 3.3.6b and 3.3.6.1a)
	- Ferrous alloy with cadmium plate (MS3100 class K) (see 3.3.6c and 3.3.6.1c)
(INACTIVE FOR DESIGN)	- Ferrous alloy with electroless nickel (class H, and MS3400 and MS3450 series class K) (see 3.3.6c and 3.3.6.1b)

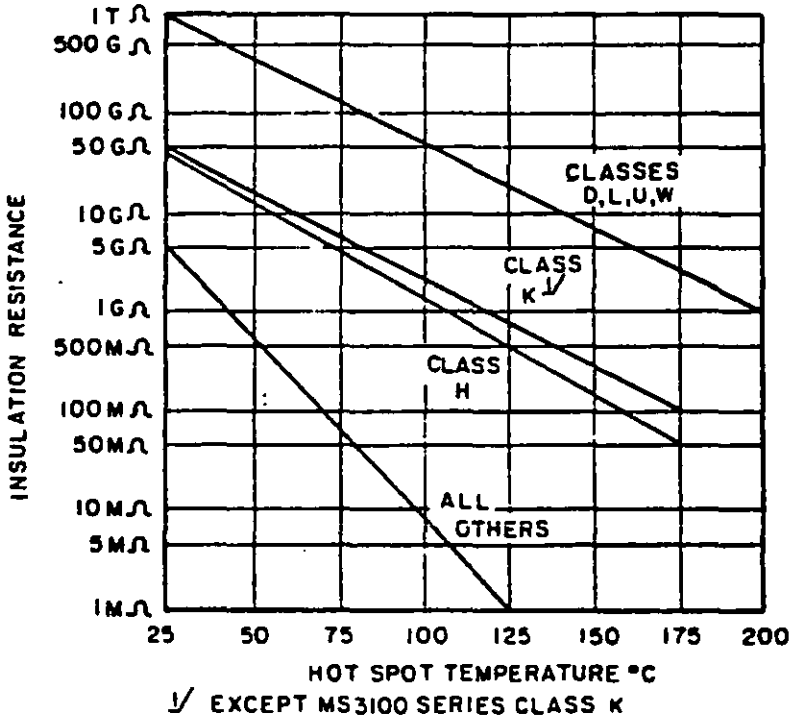


FIGURE 1. Minimum insulation resistance vs. hot spot temperature.

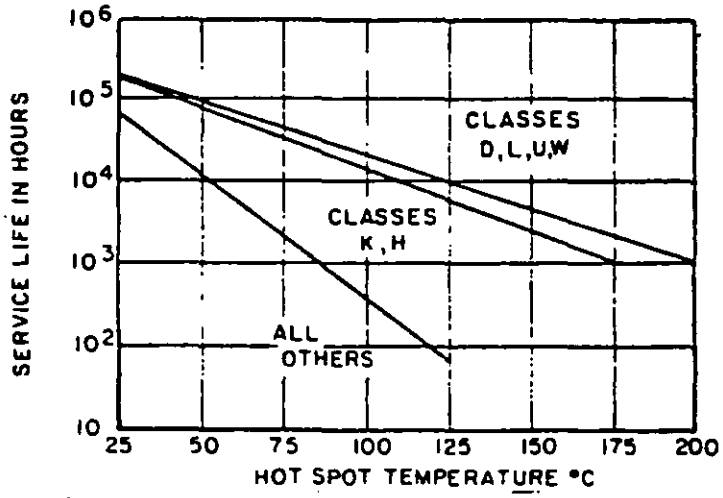


FIGURE 2. Service life vs. hot spot temperature.

TABLE I. Connector classes - physical characteristics.

Class 1/	Feature	Solder contacts MS3100 series 2/	Front release crimp contacts MS3400 series 2/	Rear release crimp contacts MS3450 series 2/	Environment resistant	Fluid resistant	Hot spot temp. (°C)	Service life	Insert material	Shells and coupling rings	
										Material	Finish
A	Solid shell	X	---	---	---	Limited	85 125	1,000 hrs 60 hrs	see 3.3.4.1	Aluminum	Cadmium, olive drab
B	Split shell	X	---	---	---	Limited	85 125	1,000 hrs 60 hrs	see 3.3.4.1	Aluminum	Cadmium, olive drab
C	Pressurized 3/	X	---	---	---	Limited	85 125	1,000 hrs 60 hrs	see 3.3.4.1	Aluminum	Cadmium, olive drab
D	High impact shock	---	X	---	X	Partial	125 175 4/	20 yrs 1,000 hrs	Silicone	Wrought aluminum 5/	Cadmium, olive drab over nickel 5/
E	3/	X	---	---	X	Limited	85 125	1,000 hrs 60 hrs	Neoprene	Aluminum	Cadmium, olive drab
F	With clamp	X	---	---	X	Limited	85 175	1,000 hrs 60 hrs	Neoprene	Aluminum	Cadmium, olive drab
H	Hermetic seal	X	---	---	X	Complete	175	1,000 hrs	Silicone	Ferrous alloy 5/	Cadmium, olive drab 5/
J	Gland seal for jacketed cable	X	---	---	X	Limited	85 125	1,000 hrs 60 hrs	Neoprene	Aluminum	Cadmium, olive drab
K	Firewall	6/	---	---	---	Limited	175 4/	1,000 hrs	---	Ferrous alloy 5/	Cadmium, olive drab 5/
		---	X	X	X	Complete			Silicone		

See footnotes at end of table.

TABLE 1. Connector classes - physical characteristics - Continued.

Class 1/	Feature	Solder contacts MS3100 series 2/	Front release crimp contacts MS3400 series 2/	Rear release crimp contacts MS3450 series 2/	Environment resistant	Fluid resistant	Hot spot temp. (°C)	Service life	Insert material	Shells and coupling rings	
										Material	Finish
L	Fluid resistant 7/	---	X	X	X	Complete	200	1,000 hrs	Silicone	Aluminum 5/	Electroless nickel 5/
P	Potting seal	X	---	---	X	Limited	85 125	1,000 hrs 60 hrs	see 3.3.4.1	Aluminum	Cadmium, olive drab
R	Grommet seal without clamp	X	---	---	X	Limited	85 125	1,000 hrs 60 hrs	Neoprene	Aluminum	Cadmium, olive drab
U	- 3/	---	X	X	X	Partial	200	1,000 hrs	Silicone	Aluminum 5/	Electroless nickel 5/
W	General purpose	---	X	X	X	Partial	125 175 4/	20 yrs 1,000 hrs	Silicone	Aluminum	Cadmium, olive drab
DJ	High impact shock with backshell connector assembly	---	X	---	X	Partial	125 175 4/	20 yrs 1,000 hrs	Silicone	Wrought aluminum	Cadmium, olive drab over nickel

1/ See applicable MS standard for active or inactive status.
2/ Only MS3450 series is authorized for Air Force new design; hermetic receptacles (MS3100 series) may be used where existing system design dictates.
3/ Inactive for new design, use class L.
4/ Hot spot test requirement for inserts and seals shall be 200°C.
5/ Also available in stainless steel (see 1.2.1.2.1 and 3.3.6).
6/ Crimp contacts.
7/ Upgrade to 200°C.

1.2.1.3 Shell sizes. Shell sizes shall be as follows: 1/

8S	16	32
10S	16S	36
10SL	18	40
12	20	44
12S	22	48
14	24	
14S	28	

1.2.1.4 Class H terminations. For class H receptacles, the type of termination shall be designated by replacing the dash (-) with a letter in accordance with the following:

C - Solder cup termination
Y - Eyelet termination

1.2.1.5 Insert arrangement. The insert arrangement indicates service rating, and quantity, size and position of contacts as shown on the applicable MS standard.

1.2.1.6 Contact designator.

1.2.1.6.1 Connectors with contacts. The following designators are used to indicate a full complement of applicable power contacts (see 3.4.1):

C - Feedthrough contacts
D 2/ - 16-22 pin contacts in lieu of 16-16 or where applicable, it indicates a full complement of 12-16 pin contacts in lieu of 12-12.
E 2/ - 16-22 socket contacts in lieu of 16-16 or where applicable, it indicates a full complement of 12-16 socket contacts in lieu of 12-12.
P - Pin contacts
S - Socket contacts

1.2.1.6.2 Connectors without contacts. The following designators are used to indicate a connector less contacts. They will be used only when other than power contacts are to be installed in the connector. Examples of this are shielded, thermocouple and coaxial contacts (see 6.2).

A - Less pin contacts
B - Less socket contacts

1.2.1.7 Insert position. The insert position is the angular position of the insert relative to the shell key or keyway. Insert positions other than normal shall be indicated by the letter shown on the insert arrangement MS standard.

1.2.2 Coupling. Connectors shall have threaded coupling except for quick disconnect MS3107 and MS3507.

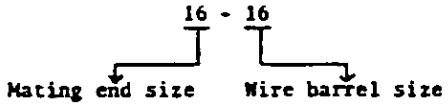
1.2.3 Receptacle mounting. Receptacle mounting shall be designated as follows:

Flange
Jam nut
Solder

1/ Class DJ only: 10S, 12S, 14S, and 16S become 10, 13, 15, and 17 respectively; 10SL becomes 11, no alternate positions allowed.
2/ For MS3400 series classes D and L only.

1.2.4 Contact size designation. The contact size designation for solder contacts shall be the mating end size. The contact size designation for crimp contacts shall be the mating end and wire barrel sizes as specified in MIL-C-23216.

Example of crimp contact:



1.3 Wire range accomodations. The wire ranges given in table II shall be accomodated by the connectors as indicated.

TABLE II. Wire range accommodations.

Contact size	Wire size	OD of finished wire (inch) 1/					
		Solder contact connectors		Crimp contact connectors			
				Front release		Rear release	
		Min 2/	Max	Min 2/	Max	Min 2/	Max
16-16	20 18 16	.064	.130	.066	.130	.053	.103
12-12	14 12	.114	.170	.097	.170	.085	.158
8-8	10 8	.164	.255	.132	.255	.132	.255
4-4	6 4	.272	.370	.237	.370	.237	.370
0-0	2 0	.415	.550	.360	.550	.360	.550

1/ Wire reference - MIL-W-16878, MIL-W-22759, MIL-W-81381, and MIL-C-915.
2/ For OD smaller than that specified, see 6.1.2.

2. APPLICABLE DOCUMENTS

2.1 Issues of documents. 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

L-P-410 - Plastic, Polyamide (Nylon), Rigid: Rods, Tubes, Flats, Molded and Cast Parts.
QQ-A-591 - Aluminum Alloy Die Castings.
QQ-P-416 - Plating, Cadmium (Electrodeposited).
QQ-S-365 - Silver Plating, (Electrodeposited), General Requirements for.
QQ-S-571 - Solder, Tin Alloy: Tin-Lead Alloy; and Lead Alloy.

SPECIFICATIONS - Continued

FEDERAL - Continued

QQ-S-763	-	Steel Bars, Wire, Shapes, and Forgings, Corrosion-Resisting.
QQ-S-764	-	Steel Bar, Corrosion Resisting, Free Machining.

MILITARY

MIL-S-901	-	Shock Tests H.I. (High-Impact): Shipboard Machinery, Equipment and Systems, Requirements for.
MIL-C-915	-	Cable and Cord, Electrical for Shipboard Use, General Specification for.
MIL-G-3056	-	Gasoline, Automotive, Combat.
MIL-H-5606	-	Hydraulic Fluid, Petroleum Base; Aircraft, Missile, and Ordnance.
MIL-J-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-A-8243	-	Anti-icing and Deicing-Defrosting Fluid.
MIL-S-8516	-	Sealing Compound, Polysulfide Rubber, Electric Connectors and Electric Systems, Chemically Cured.
MIL-L-9236	-	Lubricating Oil, Aircraft Turbine Engine, 400F.
MIL-W-16878	-	Wire, Electrical, Insulated, High Temperature.
MIL-I-17214	-	Indicator, Permeability; Low-MU (Go-No-Go).
MIL-C-22520	-	Crimping Tools, Terminal, Tool Kits, Hand or Power Actuated, Wire Termination, General Specification for.
MIL-W-22759	-	Wire, Electric, Fluoropolymer-Insulated, Copper or Copper Alloy.
MIL-C-23216	-	Contacts, Electric Connector, General Specification for.
MIL-S-23586	-	Sealing Compound, Electrical, Silicone Rubber, Accelerator Required.
MIL-L-23699	-	Lubricating Oil, Aircraft Turbine Engines, Synthetic Base.
MIL-W-25038	-	Wire, Electrical, High Temperature and Fire Resistant, Aircraft.
MIL-C-25769	-	Cleaning Compound, Aircraft Surface; Alkaline Water-base.
MIL-C-26074	-	Coatings, Electroless Nickel, Requirements for.
MIL-G-45204	-	Gold Plating, Electrodeposited.
MIL-C-45662	-	Calibration System Requirements.
MIL-C-55330	-	Connectors; Preparation for Delivery of.
MIL-W-81381	-	Wire, Electric, Polyimide-Insulated, Copper or Copper Alloy.

STANDARDS

MILITARY

MIL-STD-105	-	Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-167-1(SHIPS)	-	Mechanical Vibrations of Shipboard Equipment (Type I - Environmental and Type II - Internally Excited)
MIL-STD-202	-	Test Methods for Electronic and Electric Component Parts.
MIL-STD-454	-	Standard General Requirements for Electronic Parts.

STANDARDS - Continued

MILITARY - Continued

MIL-STD-456	- Electronic Parts, Date and Source Coding for.
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.
MIL-STD-1651	- Insert Arrangements For MIL-C-5015, MIL-C-22992 (Classes C, J and R), and MIL-C-83723 (Series II) Electrical Connectors.
MS3162	- Contacts, Pin, Electric Connector, Crimp Type, Size 0 thru 16.
MS3163	- Contacts, Socket, Electric Connector, Crimp Type, Size 0 thru 16.
MS3165	- Tool, Contact Extraction, Electrical Connector, Size 8, 4 and 0.
MS3187	- Plug, Sealing, For MIL-C-26482 and MIL-C-81703(NAVY) Electric Connectors.
MS3197	- Gage Pin For Socket Contact Engagement Test.
MS3447	- Tool, Insert-Extract, Wired Contact, Electric Connector, Size 20, 16, and 12.
MS25251	- Plug, End Seal, Electric Connector.
MS27534	- Tool, Contact Insertion-Extraction, Electrical Connector.
MS90453	- Contacts, Electric, Pin, Crimp, Removable, AN Type.
MS90454	- Contacts, Electric, Socket, Crimp, Removable, AN Type.
MS90455	- Tool, Insertion, Contact, Connector.
MS90456	- Tool, Removal, Contact, Connector.

(See Supplement 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 documents form 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.

H28 Handbook — Screw-Thread Standards for Federal Services.

(Applications for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington, D.C. 20360.)

3. REQUIREMENTS

3.1 MS standards. The individual item requirements shall be as specified herein and in accordance with the applicable MS standard. In the event of conflict between the requirements of this specification and the MS standards listed in the supplement, the latter shall govern.

3.2 Qualification. The connectors and accessories furnished under this specification shall be products which are qualified for listing on the applicable qualified products list (QPL) at the time set for opening of bids (see 4.3 and 6.3).

3.3 Materials. Materials shall be suitable for the purpose intended and where required herein shall be as specifically described.

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

3.3.2 Nonmagnetic materials (except classes H and K connectors). All parts shall be made of materials which are classed as nonmagnetic except for classes H and K connectors (see 3.6).

3.3.3 Contact materials. Contacts shall be made of suitably conductive materials. Contacts for class H connectors may be of ferrous alloy. Thermocouple contacts shall be made of a material compatible with the thermocouple wire to which attachment is intended and may be magnetic.

3.3.3.1 Contact plating.

3.3.3.1.1 Contact plating (solder type, except class H). Contacts shall be silver plated in accordance with QQ-S-365 or gold plated in accordance with MIL-G-45204 over silver plating in accordance with QQ-S-365. The resultant minimum thickness of contact plating shall be 100 microinches. Accessory members of the socket contacts need not be plated but shall comply with the requirements for dissimilar metals specified in 3.3.1.

3.3.3.1.2 Contact plating (class H connectors). Contacts shall be gold plated to a thickness of 50 microinches minimum in accordance with MIL-G-45204. A suitable underplating shall be used.

3.3.3.1.3 Contact plating (thermocouple). Thermocouple contacts may be cadmium plated in accordance with QQ-P-416 or otherwise suitably protected from corrosion. Accessory members of the socket contacts need not be plated but shall comply with the requirements for dissimilar metals (see 3.3.1).

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.

3.3.4.1.1 Connectors (except solder-contact classes A, B, C, H, K, and P). The mating faces of inserts of solder-contact connectors shall be a resilient material within a Shore A Durometer range of 60 to 85. On crimp contact front release connectors, the Shore A Durometer range shall be 35 to 85 for a minimum thickness of 0.090 inch. On rear release style P connectors the Shore A Durometer range shall be 35 to 85 for a minimum thickness of 0.090 inch.

3.3.4.1.2 Class H. The hermetic sealing of class H connectors shall be accomplished by the use of vitreous material. The mating faces of inserts shall be resilient material within a Shore A Durometer range of 35 to 55.

3.3.5 Potting molds. Potting molds shall be made of polyamide conforming to L-P-410. The molds shall incorporate a means for attachment to the connector and shall accept and bond to MIL-S-8516 or MIL-S-23586 potting material without treatment by the user.

3 3.6 Shells and coupling rings.

a. Unless otherwise specified, connector shells and coupling rings, except for classes D, H, and K shall be made of high grade aluminum alloys. Die castings, if used, shall conform to QQ-A-591, composition number 13, 218, 380 or SC114A.
b. Unless otherwise specified, class D shells and coupling rings shall be made of a heat-treated wrought aluminum alloy meeting the performance requirements of this specification.
c. Unless otherwise specified, classes H and K shells and coupling rings shall be made of ferrous alloy.
d. When specified (see 1.2.1.2.1), classes D, H, K, L, and U shells and coupling rings shall be made of nonmagnetic corrosion-resisting steel in accordance with QQ-S-763, 300 series classes, or QQ-S-764, 303 series and 203 EZ.

3.3.6.1 Finish. The resultant finish on all connectors shall be electrically conductive.

a. The finish of classes A, B, C, E, F, J, P, R, and W connectors and external screws with aluminum alloy shells and coupling rings shall be cadmium plate in accordance with QQ-P-416, type II, class 3. A preliminary plating of another metal is permissible. The finish of class D connectors and external screws with wrought aluminum shells and coupling rings shall be cadmium plate in accordance with QQ-P-416, type II, class 3 over nickel. The resultant finish on cadmium plated connectors shall be olive drab (light to dark).
(INACTIVE FOR DESIGN) b. The finish of classes H, and MS3400 and MS3450 series class K connectors and external screws with ferrous alloy shells and coupling rings shall be electroless nickel in accordance with MIL-C-26074, class 3 or 4, grade B.
c. The finish of classes H and K connectors and external screws with ferrous alloy shells and coupling rings shall be cadmium plate in accordance with QQ-P-416, type II, class 3. The resultant finish on cadmium plated connectors shall be olive drab (light to dark). The finish of classes L and U connectors and external screws with aluminum alloy shells and coupling rings shall be electroless nickel in accordance with MIL-C-26074, class 3 or 4, grade B. A preliminary plating of another metal is permissible on all connectors with electroless nickel finish.
d. The finish of class D connectors with corrosion-resisting steel shells and coupling rings shall be cadmium plate in accordance with QQ-P-416, type 2, class 3, color-black. All other corrosion-resisting steel connectors shall be passivated.

External screws may be stainless steel in lieu of the finish specified.

3.4 Design and construction. Connectors and accessories shall be designed and constructed to withstand normal handling incident to installation and maintenance in service. The connectors and accessories shall conform to the following:

Crimp contact connectors back-end	Figure 3.
Connectors, removable crimp contact	Figures 4, 5, 6, 7, and 8.
Accessories to be used with MS3400 and MS3450 series connectors	MS3155.

3.4.1 Contacts. Contacts shall conform to MIL-C-23216 except as otherwise required herein for solder contact connectors. Contacts shall be designed so that neither the pin nor socket contact shall 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 spare contacts for arrangements over 26 contacts shall be included in the unit package. No spares shall be supplied with 8, 4, and 0 contacts. For other than direct shipments to the Government, crimp contact connectors may be ordered without contacts, thus allowing contacts to be purchased in bulk (see 6.2).

3.4.1.1 Solder contacts. Solder contacts shall conform to figure 9.

3.4.1.1.1 Mating end. The entering end of socket contacts shall be rounded or chamfered to allow for misalinement of the entering pin. The socket contacts shall provide the spring action for maintaining the contacting pressure between the pin and the socket. Size 12 and 16 socket contacts shall be designed to exclude the entrance of a pin 0.005 inch larger than the allowable maximum diameter of a mating pin. Size 16 contacts shall pass the resistance probe damage test (see 3.27). Solder type pin and socket contacts, sizes 0, 4, and 8 may be designed so that they are readily removable from their inserts for soldering to their conductors.

3.4.1.1.2 Solder cups. Solder cups shall be designed so that during soldering no components will be damaged and no liquid solder will escape. The solder cups shall be as indicated in figure 9. The solder cups of sizes 0, 4, and 8 shall be provided with a venthole or with equivalent provisions to prevent trapping of air during soldering. The interior surface of solder cups for sizes 16 and 12, except thermocouple contacts, shall be completely tinned over 100 percent of the full circle portion and for at least 50 percent of the remainder of the solder well area; for sizes 0, 4, and 8, the interiors shall be completely tinned with solder conforming to composition Sn60 of QQ-S-571, or better commercial grade. Only alcohol and resin shall be used as a flux. No excess solder shall be on the exterior of the solder cup.

3.4.1.2 Crimp contacts. Crimp contacts shall be designed to prevent damage to the contact retention device or sealing member during insertion or removal of the contact. Front release crimp contacts shall conform to MS90453 and MS90454 and be qualified to MIL-C-23216. Rear release crimp contacts shall conform to MS3162 and MS3163 and be qualified to MIL-C-23216.

3.4.1.2.1 Installing and removal tools (front release connectors). The individual contacts shall be positively retained in the connector when installed with the applicable MS90455 or MS27534 contact insertion tool. The individual contacts shall be capable of being removed from the connector when using the applicable MS90456 contact removal tool.

3.4.1.2.2 Installing and removal tools (rear release connectors). The individual contacts shall be positively retained in the connector when installed with the applicable MS3447 or MS27534 contact insertion tool. The individual contacts shall be capable of being removed from the connector when using the applicable MS3165, MS3447, MS3483 or MS27534 contact removal tool.

3.4.2 Insert design and construction. Inserts shall be of voidless construction and secured to prevent rotation within the shell.

3.4.2.1 Insert retention.

3.4.2.1.1 Resilient inserts. All resilient inserts shall be nonremovable from the shell.

3.4.2.1 2 Hard material inserts. Hard material inserts for classes A and B connectors having provisions for more than one alternate position shall be removable from the shell. However, they shall be retained within the shell when the conduit nut or adapter is removed

3.4.2.2 Insert positioning. Removable inserts shall be keyed to prevent rotation with respect to the shell. Slots and markings for any of the alternate positions, as well as specific design details shall be as indicated on the applicable MS standard. Inserts shall be installed in the position indicated by the part number (see 6.2).

3.4.2 3 Inserts for solder contact connectors. Inserts containing nonremovable solder contacts shall not be damaged by an acceptable solder process.

3.4.2.4 Inserts for crimp contact connectors. The insert and wire sealing grommet or insulating spacer of crimp contact connectors shall be one integral part and permit the removal and reinsertion of individual contacts without damage to the sealing members.

3.4.2.5 Contact arrangement. Contacts shall be arranged in accordance with the MIL-STD-1651. Except for contacts in hard inserts, all solder cup openings, regardless of insert position, shall be oriented at right angles to and facing toward the key or keyway of the shell.

3.4'2.6 Contact spacing. Unless otherwise specified in the MS standard, minimum mechanical spacing and creepage distance shall be as shown in table III.

TABLE III. Minimum contact spacing.

Service rating	Minimum contact spacing (inch)	
	Air spacing	Creepage distance
Inst.	---	1/16
A	1/16	1/8
D	1/8	3/16
E	3/16	1/4
B	1/4	5/16
C	5/16	1

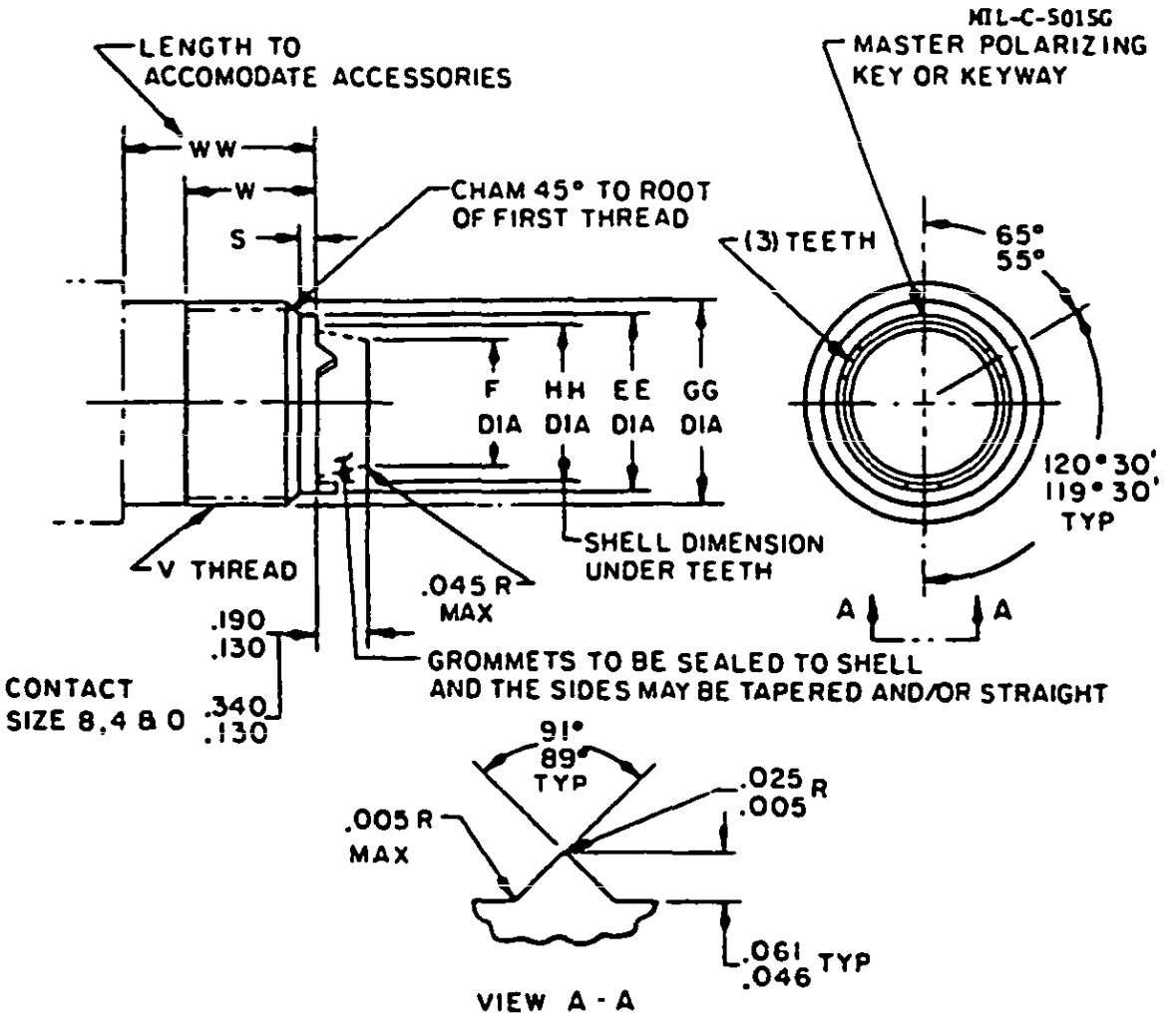
3.4.2.7 Contact alinement. Inserts for socket contacts shall provide an overall sideplay of the socket contacts of 0.005 to 0.015 inch from the required position to facilitate alinement of mating pin contacts.

3.4.2.8 Contacts for class H connectors. Contacts shall be fused into the vitreous inserts of class H connectors. A resilient face gasket shall be permanently bonded to the insert to ensure an interfacial seal in mating with an environmental resistant counterpart connector.

3.4.3 Screw threads. Screw threads intended to mate with parts of another approved manufacturer shall be UNEF, UNF, or NEF, class 2A or 2B, conforming to MIL-S-7742, except that 1-3/4-18 and 2-18 threads shall be UNS class 2A or 2B, conforming to Handbook H-28. Screw threads shall be checked after plating by means of ring and plug gages only, in accordance with Handbook H-28. Slight out-of roundness beyond the tolerances of MIL-S-7742 is acceptable if the threads can be checked without forcing the thread gages. Screw threads may be relieved provided the relief does not interfere with proper performance of the screw threads.

3.4.4 Shell design. Connector shells shall be seamless except for classes B and H and retain their inserts in a positive manner.

3.4.4.1 Lubrication. All internal coupling ring threads shall be coated with a suitable lubricant.



Shell size	V Thread Class 2A	EE	F Dia Of any exposed portion of the grommet	GG ±.000 -.010	HH ±.005	S ±.005	W Min Perf thread	WW Min
8S	.500-20 UNF	.426/.419	.275/.305	.500	.368			
10S, 10SL	.625-24 UNEF	.562/.555	.380/.405	.625	.502			
12S, 12	.750-20 UNEF	.679/.672	.516/.549	.750	.618			
14 & 14S	.875-20 UNEF	.804/.797	.590/.665	.875	.743			
16 & 16S	1.000-20 UNEF	.929/.922	.715/.790	1.000	.868	.065	.290	.310
18	1.0625-18 UNEF	.984/.977	.794/.869	1.062	.924			
20	1.1875-18 UNEF	1.109/1.102	.919/.994	1.187	1.049			
22	1.3125-18 UNEF	1.234/1.227	1.044/1.119	1.312	1.174			
24	1.4375-18 UNEF	1.359/1.352	1.159/1.244	1.437	1.299			
28	1.750-18 UNS	1.613/1.603	1.394/1.465	1.750	1.520			
32	2.000-18 UNS	1.863/1.853	1.640/1.715	2.000	1.770			
36	2.250-16 UN	2.113/2.103	1.855/1.930	2.250	1.985	.095	.467	.487
40	2.500-16 UN	2.363/2.353	2.070/2.145	2.500	2.200			
44	2.750-16 UN	2.613/2.603	2.325/2.400	2.750	2.455			
48	3.000-16 UN	2.858/2.848	2.575/2.650	3.000	2.705			

FIGURE 3. Crimp contact connectors back-end configuration except MS3402, MS3412, and MS3452.

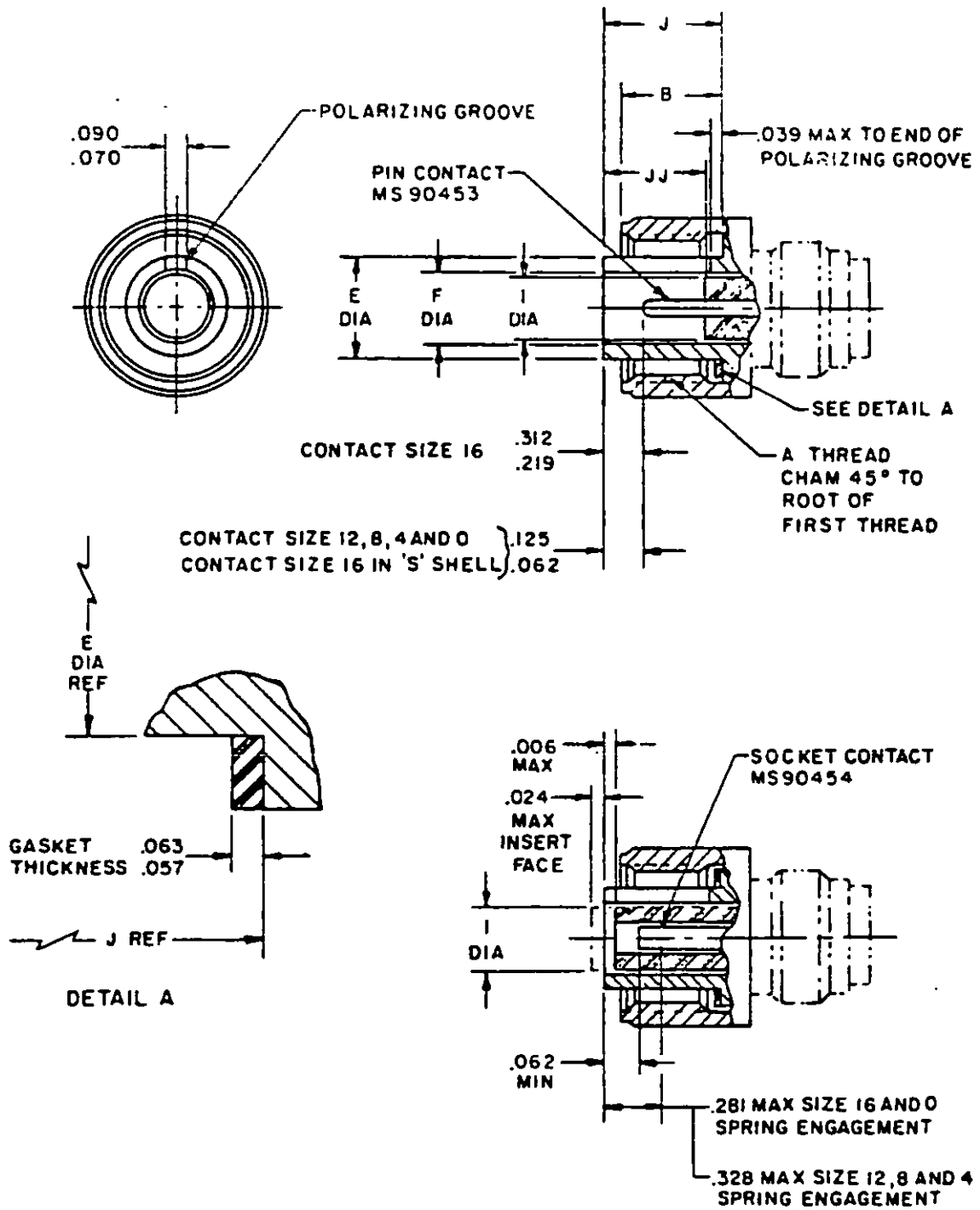
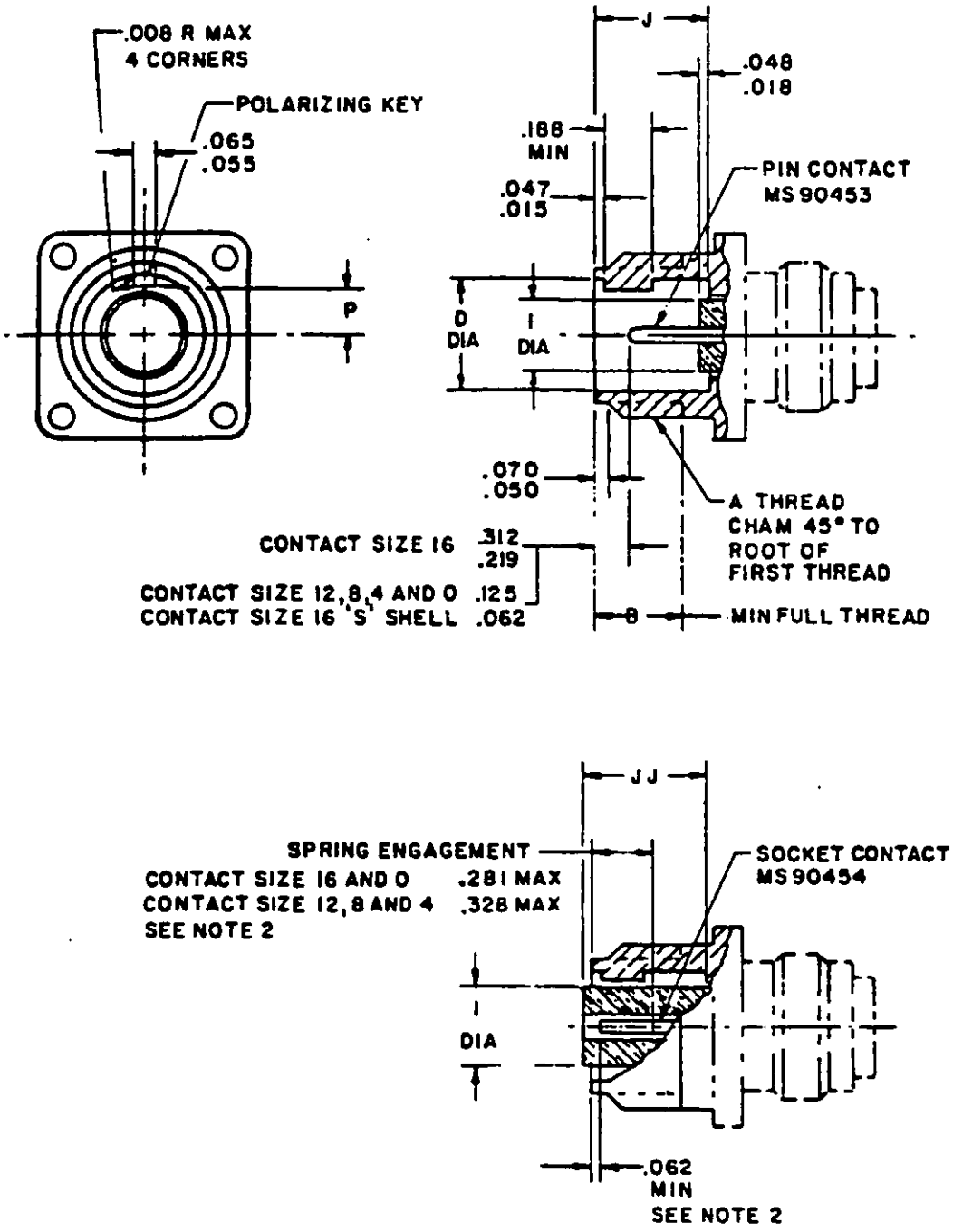


FIGURE 4. Connector, plug, front release, interface dimensions.

Shell size	A Thread Class 2B	B +.000 -.062	E 1/ Dia +.000 -.010	F 1/ Dia +.015 -.000	I Dia +.000 -.020	J ±.005	JJ ±.015
8S	.500-28 UNEF	.414	.365	.252	.250	.570	.501
10S	.625-24		.440	.323	.320		
10SL			.446	.396	.397		
12S	.750-20		.555	.450	.448		
12		.664				.757	.689
14S	.875-20	.414	.675	.526	.525	.570	.501
14		.664				.757	.689
16S	1.000-20	.414	.805	.651	.650	.570	.501
16		.664				.757	.689
18	1.125-18		.930	.776	.770		
20	1.250-18		1.050	.932	.925		
22	1.375-18		1.175	1.026	1.020		
24	1.500-18 UNEF		1.300	1.151	1.145		
28	1.750-18 UNS		1.520	1.370	1.365		
32	2.000-18 UNS		1.770	1.620	1.615		
36	2.250-16 UN		1.980	1.838	1.830		
40	2.500-16 UN		2.230	2.057	2.045		
44	2.750-16 UN		2.485	2.310	2.300		
48	3.000-16 UN		2.735	2.560	2.550		

1/ On shell size 10SL 'E' dia tolerance is +.000 -.006 and 'F' diameter tolerance is +.006 -.000.

FIGURE 4. Connector, plug, front release, interface dimensions - Continued.

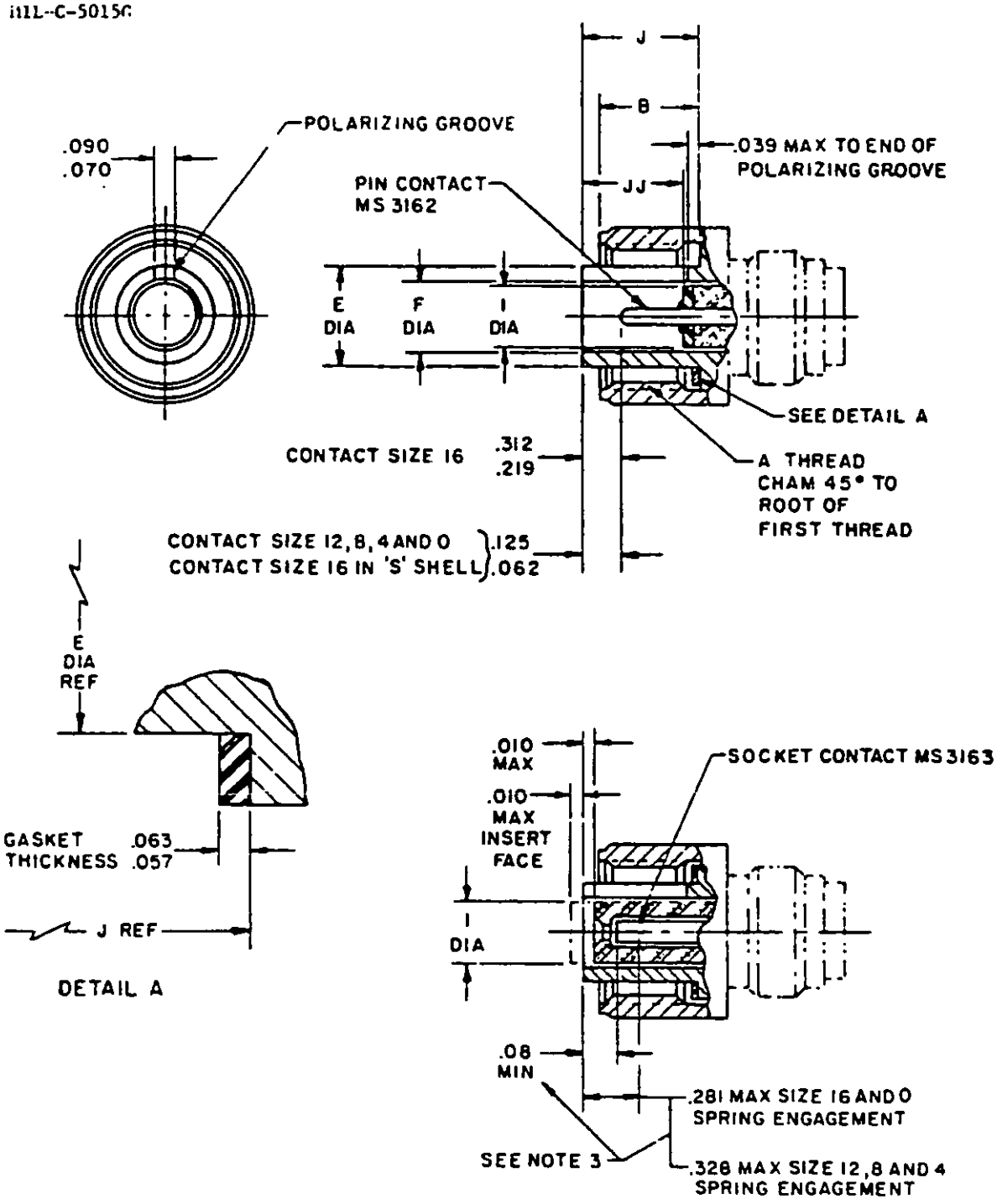


NOTES:
1. Dimensions are in inches.
2. For contact cavity insert interface dimensions see figure 8.

FIGURE 5. Connector, receptacle, front release, interface dimensions.

Shell size	A Thread Class 2A	B Min Thread	D Dia +.015 -.000	I Dia +.000 -.020	J ±.005	JJ ±.015	P +.010 -.000
8S	.500-28 UNEF	.375	.370	.250	.536	.543	.130
10S	.625-24		.448	.320			.165
10SL				.397			
12	.750-20	.625	.558	.448	.724	.731	.224
12S		.375			.536	.543	
14	.875-20	.625	.678	.525	.724	.731	.263
14S		.375			.536	.543	
16	1.000-20	.625	.808	.650	.724	.731	.325
16S		.375			.536	.543	
18	1.125-18	.625	.933	.770	.724	.731	.385
20	1.250-18		1.053	.925			.463
22	1.375-18		1.178	1.020			.510
24	1.500-18 UNEF		1.303	1.145			.573
28	1.750-18 UNS		1.523	1.365			.683
32	2.000-18 UNS		1.773	1.615			.808
36	2.250-16 UN		1.985	1.830			.915
40	2.500-16 UN		2.237	2.045			1.023
44	2.750-16 UN		2.492	2.300			1.150
48	3.000-16 UN		2.742	2.550			1.275

FIGURE 5. Connector, receptacle, front release, interface dimensions - Continued.



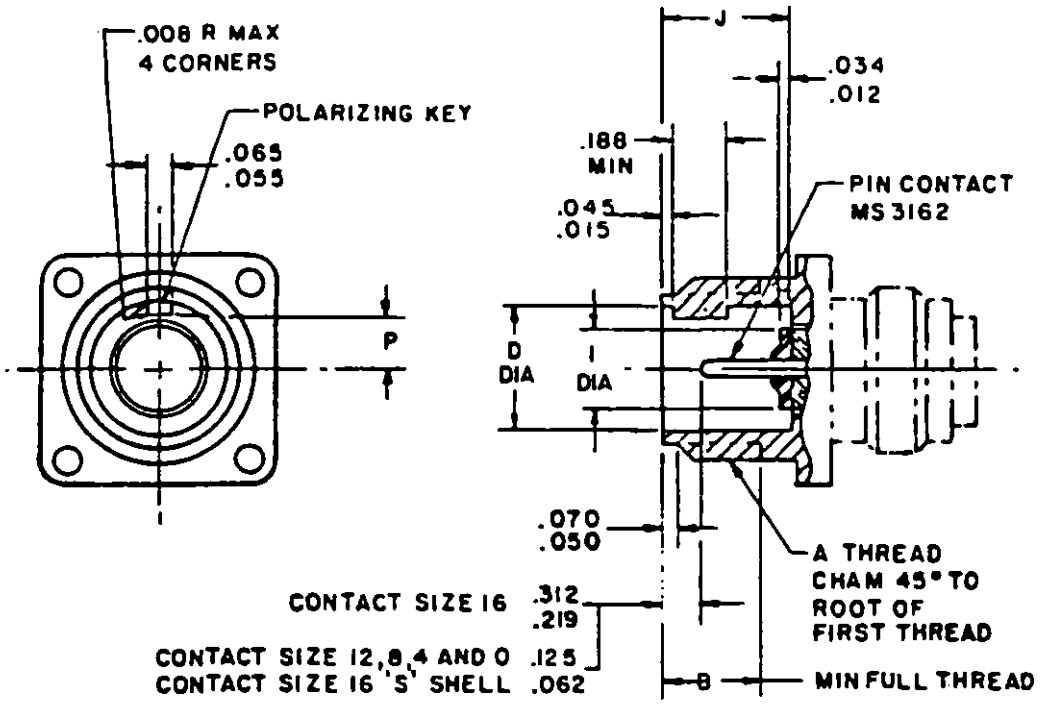
NOTES:
1. Dimensions are in inches.
2. For contact cavity insert interface dimensions see figure 8.
3. Noted dim. apply with contact fully seated back against contact retaining device.

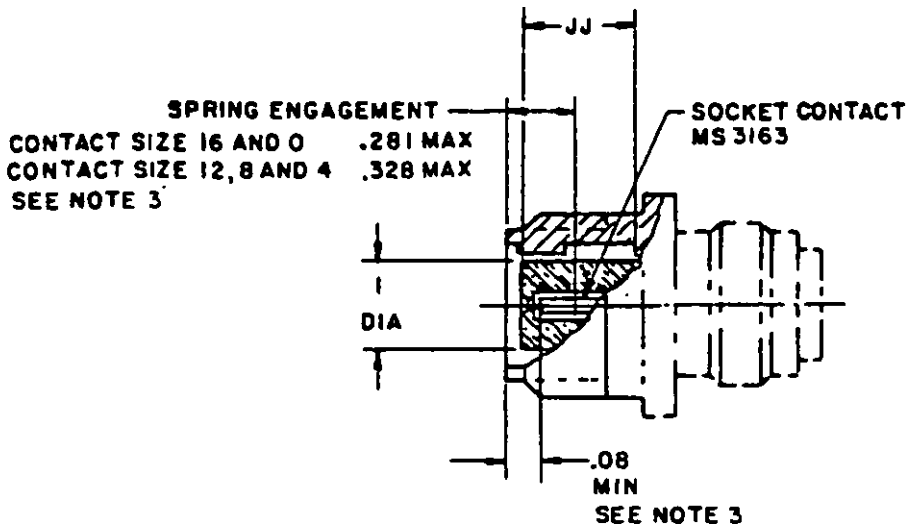
FIGURE 6. Connector, plug, rear release, interface dimensions.

Shell size	A Thread Class 2B	B +.000 -.062	E 1/ Dia +.000 -.010	F 1/ Dia +.015 -.000	I Dia +.000 -.020	J ±.005	J1 ±.011
8S	.500-28 UNEF	.414	.365	.252	.250	.570	.510
10S	.625-24		.440	.323	.320		
10SL			.446	.396	.397		
12S	.750-20		.555	.450	.448		
12		.664				.757	.698
14S	.875-20	.414	.675	.526	.525	.570	.510
14		.664				.757	.698
16S	1.000-20	.414	.805	.651	.650	.570	.510
16		.664				.757	.698
18	1.125-18		.930	.776	.770		
20	1.250-18		1.050	.932	.925		
22	1.375-18		1.175	1.026	1.020		
24	1.500-18 UNEF		1.300	1.151	1.145		
28	1.750-18 UNS		1.520	1.370	1.365		
32	2.000-18 UNS		1.770	1.620	1.615		
36	2.250-16 UN		1.980	1.838	1.830		
40	2.500-16 UN		2.230	2.057	2.045		
44	2.750-16 UN		2.485	2.310	2.300		
48	3.000-16 UN		2.735	2.560	2.550		

1/ On shell size 10SL 'E' dia tolerance is +.000 -.006 and 'F' diameter tolerance is +.006 -.000.

FIGURE 6. Connector, plug, rear release, interface dimensions - Continued.



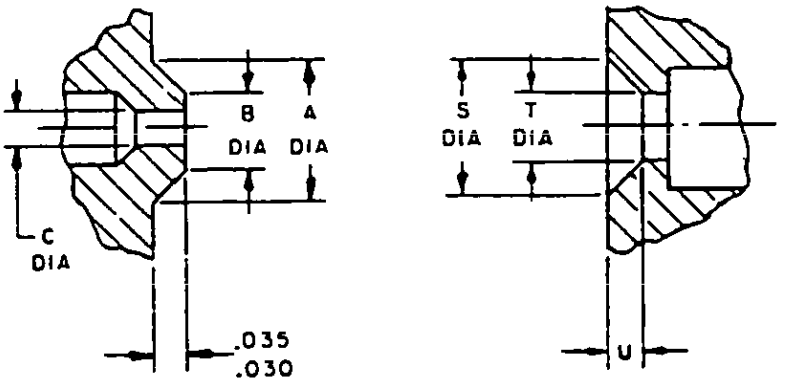


NOTES:
1. Dimensions are in inches.
2. For contact cavity insert interface dimensions see figure 8.
3. Noted dim. apply with contact fully seated back against contact retaining device.

FIGURE 7. Connector, receptacle, rear release, interface dimensions.

Shell size	A Thread Class 2A	B Min Thread	D Dia +.015 -.000	I Dia +.000 -.020	J ±.005	JJ ±.010	P +.010 -.000
8S	.500-28 UNEF	.375	.370	.250	.536	.533	.130
10S	.625-24		.448	.320			.165
10SL				.397			
12	.750-20	.625	.558	.448	.724	.721	.224
12S		.375			.536	.533	
14	.875-20	.625	.678	.525	.724	.721	.263
14S		.375			.536	.533	
16	1.000-20	.625	.808	.650	.724	.721	.325
16S		.375			.536	.533	
18	1.125-18	.625	.933	.770	.724	.721	.385
20	1.250-18		1.053	.925			.463
22	1.375-18		1.178	1.020			.510
24	1.500-18 UNEF		1.303	1.145			.573
28	1.750-18 UNS		1.523	1.365			.683
32	2.000-18 UNS		1.773	1.615			.808
36	2.250-16 UN		1.985	1.830			.915
40	2.500-16 UN		2.237	2.045			1.023
44	2.750-16 UN		2.492	2.300			1.150
48	3.000-16 UN		2.742	2.550			1.275

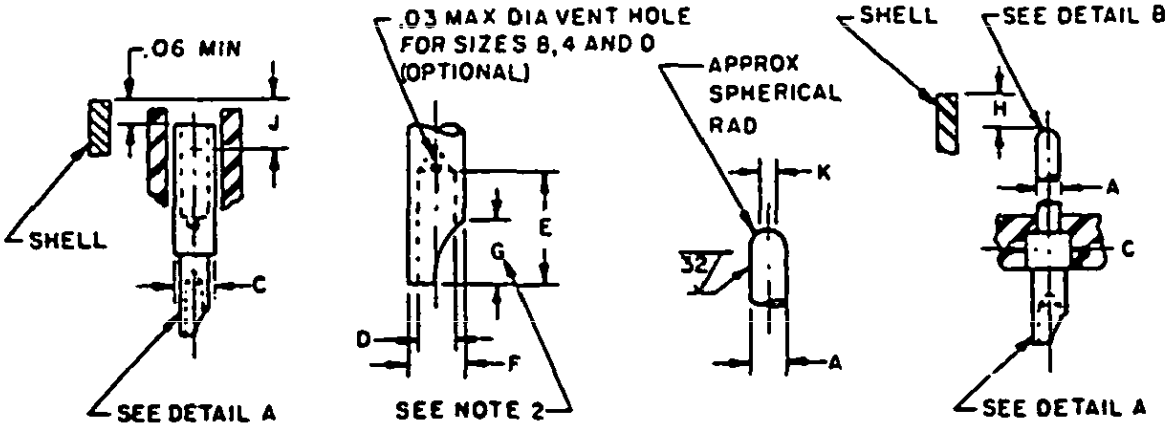
FIGURE 7. Connector, receptacle, rear release, interface dimensions - Continued.



Contact size	A Dia	B Dia	C Dia	S Dia	T Dia	U
16	.150	.135	.061	.140	.079	.035
	.140	.131	.058	.130	.072	.031
12	.208	.188	.093	.204	.111	.040
	.198	.184	.090	.193	.104	.035
8	.310	.270	.141	.306	.159	.040
	.300	.265	.138	.295	.152	.035
4	.396	.355	.224	.392	.262	.033
	.386	.350	.221	.381	.234	.027
0	.578	.537	.356	.573	.414	.033
	.568	.533	.353	.563	.366	.027

NOTE:
Dimensions are in inches.

FIGURE 8. Connector, rear release, insert entry dimensions.



Contact size	A 1/ ±.001 Dia	C 2/ Max Dia	D Min Dia	E +.063 -.000	F Dia Min	F Dia Max	H Plug & rcpt Min	H Plug & rcpt Max	J 3/ Max plug and rcpt	K Dia of flat
16	.0625	.127	.069	.250	.096	.116	.250	.312	.281	.032 Max
4/ 16S	.0625	.127	.069	.250	.096	.116	.062	.125	.281	.032 Max
12	.094	.190	.112	.375	.130	.150	.062	.125	.375	.032 Max
8	.142	.310	.205	.500	.243	.259	.062	.125	.375	.032 Max
4	.225	.441	.328	.625	.370	.397	.062	.125	.375	.105 ±.021
0	.357	.597	.464	.625	.510	.550	.062	.125	.281	.237 ±.021

1/ Applies after plating.
2/ Used for calculating mechanical spacing between contacts and between contacts and shell.
3/ Represents the distance from the end of the shell to the point at which the mating pin engages the socket contact spring.
4/ Dimensions shown are typical for shell sizes 8S, 10S, 10SL, 12S, 14S and 16S.

NOTES:
1. Dimensions are in inches.
2. Sizes 12 and 16: G max = 2/3 E, radius of cutout optional.
   Sizes 0, 4, and 8: Cutout optional.

FIGURE 9. Solder contact (pin and socket) configuration.

3.4.4.2 Snap rings and slots. Snap rings used to retain the inserts in their shells in class A or B shall be readily accessible, suitable for repeated use, and of rectangular cross section. The snap ring slots shall have square sides and sufficient depth to prevent the snap rings from sliding, pulling or twisting out of position in normal service.

3.4.5 Coupling connections. Threaded coupling rings shall be knurled, and designed so that the pin and socket contacts shall engage or disengage as the ring is respectively tightened or loosened. The coupling rings of crimp contact connector plugs shall be captive to the shell. The quick disconnect couplings shall be provided with suitable gripping surfaces and be fastened to receptacles by a device that engages the receptacle threads but can be pulled free in case of an emergency.

3.4.5.1 Safety of coupling rings. All threaded coupling rings shall be designed for safety wiring. At least two holes shall be provided for shell sizes 14 and smaller, and at least three equally spaced holes for connector sizes 16 and larger. These holes shall be of a diameter sufficient to accommodate 0.032 inch diameter wire.

3.4.5.2 Shell polarization. Polarization of connectors shall be accomplished by matched integral key and keyway of counterpart connectors. The polarization of counterpart connectors shall take place before coupling rings are engaged.

3.4.5.3 Engagement seal (connectors with resilient interfaces). Connectors with resilient interfaces, except class A, 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. Connector plug shells with threaded coupling rings shall be provided with a static peripheral seal to ensure shell to shell sealing.

3.4.6 Wire sealing.

3.4.6.1 Classes D, E, F, K, L, R, U, and W connectors. Classes D, E, F, K, R, U, and W connectors, except MS3102, MS3402, MS3412, and MS3452 shall be provided with a wiresealing grommet capable of sealing on wires of the sizes specified in table II.

3.4.6.1.1 Solder contact connectors. Classes F and R 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 with the retaining feature in the installed condition.

3.4.6.1.2 Crimp contact connectors. Crimp contact connectors shall be provided with an integral grommet and insert.

3.4.6.2 Class P connectors. Class P connectors shall be provided with a plastic potting form suitable to accept and bond to MIL-S-8516 or MIL-S-23586 potting material. Inserts of class P connectors shall be designed so that potting material will adhere to the shell and insert without treatment by the user.

3.4.6.3 Class H connectors. Class H connectors shall not be supplied with a wire sealing grommet; however, the shells and inserts shall be designed so that MIL-S-8516 or MIL-S-23586 potting compound will adhere to the insert without treatment by the user.

3.4.6.4 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 of suitable diameter and finish.

3.4.6.5 Class K connectors. Class K connectors shall meet all general and their own particular requirements specified herein, except that materials and construction required for their particular application may be used, subject to approval by the qualifying activity.

3.4.6.6 Grommet sealing plugs. The grommets of classes D, E, F, K, L, R, U, and W connectors shall be designed to accept sealing plugs in accordance with MS3187 or MS25251 in lieu of wire where unused contacts are employed. Except for contact sizes 0 and 4, sealing plugs for 15 percent of the number of contacts but not less than 1, shall be enclosed in the unit package. For indirect shipments, connectors may be ordered without grommet sealing plugs (see 6.2).

3.5 Intermateability and interchangeability.

3.5.1 Intermateability. Connectors shall be intermateable. When different types of connectors (front or rear release) or different types of contacts (crimp or solder) are used in a mated pair of connectors, the minimum performance requirements (temperature, sealing, etc.) must be met.

3.5.2 Interchangeability. All connectors and accessories having the same MS standard part number shall be completely interchangeable with each other with respect to installation (physical) and performance (function) as specified herein.

3.6 Magnetic permeability (except classes H and K). The relative magnetic permeability of connectors and accessories and connectors with thermocouple contacts shall be less than 2.0 when tested in accordance with 4.6.2.

3.7 Disengagement (MS3107 only). The axial tension required to separate the plug shell (insert removed) from a receptacle shall be 8 ±4 pounds when tested in accordance with 4.6.3.

3.8 Thermal shock. There shall be no evidence of damage detrimental to the operation of the connector after being subjected to the temperature extremes in accordance with 4.6.4.

3.9 Air leakage.

3.9.1 Solder contact receptacles (except classes A, B, H, and P, class J plugs and accessories). The air leakage rate shall not be greater than one atmospheric cubic inch per hour (4.55×10^{-3} cubic centimeters per second). The specified leakage rate shall apply through the connector and not through the flange and mounting surface area when tested in accordance with 4.6.5.1.

3.9.2 Class H receptacles. The air leakage rate shall not exceed 0.1 micron cubic foot per hour (1×10^{-6} cubic centimeters per second) when tested in accordance with 4.6.5.2. The specified leakage rate shall apply through the connector and not through the flange and mounting surface area, unless solder mounted.

3.10 Contact retention. The axial displacement of crimp contacts shall not exceed 0.025 inch and contacts shall be retained in their inserts when subjected to the axial loads specified in accordance with 4.6.6.

3.11 Dielectric withstanding voltage. Connectors shall show no evidence of breakdown or flashover when subjected to the test voltages and altitudes in accordance with 4.6.7. Corona shall not be considered as breakdown.

3.12 Vibration. Mated connectors shall not be damaged and there shall be no loosening of parts due to vibration. Counterpart connectors shall be retained in full engagement, and there shall be no interruption of electrical continuity longer than 10 microseconds when tested in accordance with 4.6.8.

3.13 Shock. Mated connectors shall not be damaged and there shall be no loosening of parts, nor shall there be an interruption of electrical continuity longer than 10 microseconds during the exposure to mechanical shock when tested in accordance with 4.6.9.

3.14 Humidity. Mated connectors shall withstand the applicable voltage in table IV for at least 5 minutes after being tested in accordance with 4.6.10.

TABLE IV. Test voltages after humidity.

Service rating	Test voltages (volts - rms)
Inst.	300
A	750
D	1350
E	1875
B	2575
C	4500

3.15 Contact resistance. Contacts in the mated condition shall meet the ambient (25°C) contact resistance requirements of MIL-C-23216 except the potential drop of class H contacts shall not exceed 125 mV initially or 200 mV after conditioning when tested in accordance with 4.6.11.

3.16 Durability.

3.16.1 Crimp contact connectors (with coupling rings). Counterpart connectors shall show no mechanical or electrical defects detrimental to the operation of the connector after 100 cycles of coupling and uncoupling in accordance with 4.6.12.1.

3.16.2 Solder contact connectors (without coupling rings). Counterpart connectors shall show no mechanical or electrical defects detrimental to the operation of the connector after 500 cycles of mating and unmating in accordance with 4.6.12.2.

3.17 Corrosion. Connectors shall show no exposure of basis metal due to corrosion which will affect performance when tested in accordance with 4.6.13.

3.18 Insulation resistance.

3.18.1 At room temperature. The insulation resistance at 25°C (77°F) shall be greater than 5,000 megohms when tested in accordance with 4.6.14.1.

3.18.2 At elevated temperature - short time (solder type only). The insulation resistance shall be as shown in figure 1 when tested in accordance with 4.6.14.3. (60 hours at 125°C).

3.18.3 At elevated temperature - long time. The insulation resistance shall be as shown in figure 1 when tested in accordance with 4.6.14.4.

3.19 Fluid immersion. Connectors shall mate properly with their counterpart connectors after fluid immersion in accordance with 4.6.15.

3.20 Firewall (class K connectors). Mated connectors shall prevent passing of a flame through the connector for at least 20 minutes when tested in accordance with 4.6.16. During this period there shall be no flame from outgassing or other causes on the end of the connector protected by the firewall. The current specified in 4.6.16 shall be applied for the first 5 minutes without break in continuity. During the next minute the connector shall draw no more than 2 amperes when a test potential of 100-125 Vac at 60 Hz is applied between adjacent contacts and between contacts and the shell.

3.21 Insert retention. Inserts shall not be dislocated from their original positions or damaged when they are subjected to the specified pressures in accordance with 4.6.17.

3.22 Moisture resistance. Mated connectors with any rear accessory hardware assembled shall maintain an insulation resistance of 100 megohms or greater at 25°C after being subjected to the moisture resistance test in accordance with 4.6.18.

3.23 Water pressure.

3.23.1 Solder contact receptacles except classes A, B, H, K, and P and class J plugs. When tested as specified in 4.6.19.1, receptacle inserts and panel seals shall show no leakage. In addition, there shall be no evidence of leakage at the interface of mated connectors, neither shall there be evidence of water penetration into the J adapters of the mated and unmated plugs. At the end of 48 hours while still immersed, the insulation resistance of mated connectors shall be 100 megohms minimum. After removal of unmated connectors from the immersion tank, the insulation resistance shall be 100 megohms minimum (see 4.6.19.1).

3.23.2 Crimp contact connectors. Mated connectors classes D, L, U, and W assembled with MS3437 type B backshells shall exhibit an insulation resistance of 100 megohms or greater after being subjected to the water pressure test. They shall show no evidence of entrance of water when subjected to the test in accordance with 4.6.14.2.

3.23.3 MS3437 type B backshells and MS3109, or MS3117 boots, except -01 through -10. Cable adapters shall show no evidence of entrance of water when subjected to the water pressure test of 4.6.14.2.

3.24 Cable pull-out (class J). Cables shall not pull out when the loads are applied in accordance with 4.6.20, nor shall the slippage exceed 1/8 inch.

3.25 External bending moment. Connectors shall exhibit no evidence of damage, as revealed by inspection with 3X magnification, when stressed using the applicable bending moment in accordance with 4.6.21.

3.26 Contact engaging and separating forces (solder contacts). The socket contact engaging and separating forces shall be within the applicable limits specified in table V when tested in accordance with 4.6.22.

TABLE V. Contact engagement and separation forces.

Contact mating end size	Minimum separation force (ounces)	Maximum average engagement force (ounces)	Maximum engagement force (ounces)
	Minimum diameter MS3197 pin	Maximum diameter MS3197 pin	Maximum diameter MS3197 pin
16	2	33	48
12	3	56	80
8	5	---	160
4	10	---	240
0	15	---	320

3.27 Resistance to probe damage (size 16 power socket contacts only). Socket contacts shall meet the requirements specified herein when subjected to the resistance to probe damage in accordance with 4.6.23.

3.28 Shell conductivity (crimp connectors). Mated connectors shall be electrically conductive from the plug accessory thread to the receptacle mounting flange or to the accessory thread on the cable connecting plug. The overall dc resistance shall not exceed 0.005 ohms for class D or 0.05 ohms for all other classes when measured in accordance with 4.6.24.

3.29 Contact insertion and removal forces (crimp connectors). The forces required to insert and remove unlocked contacts shall not exceed the requirements of table VI when tested in accordance with 4.6.25.

TABLE VI. Contact insertion and removal forces.

Contact size	Insertion and removal forces (pounds, maximum)
16	20
12	25
8	30
4	40
0	40

3.30 Altitude immersion (except classes H and K). When tested as specified in 4.6.26, the mated connectors shall meet a minimum insulation resistance of 1,000 megohms. Any evidence of dielectric breakdown or flashover shall be cause for rejection.

3.31 Random vibration. When tested as specified in 4.6.27, a current discontinuity of 1 microsecond or more, disengagement of the mated connectors, evidence of cracking, breaking or loosening of parts shall be cause for rejection.

3.32 Marking. Each connector shall be legibly and permanently marked on the shell or coupling ring in accordance with MIL-STD-1285 and MIL-STD-456. The MS part number shall be as shown in 1.2.1.

3.32.1 Insert marking. Inserts shall be marked as specified on the applicable MS standard. Manufacturer's identification is permitted. Raised or depressed characters shall not be used on insert mating faces for any markings of crimp contact connectors.

3.32.1.1 Contact designations. Contact identification on crimp contact connector inserts shall be designated by identifiable letters or numbers of contrasting color. Contact identification on solder contact inserts may be of contrasting color. Positioning and arrangement of the characters shall be such that the appropriate contact cavity is readily identifiable. All contacts shall be designated on the front face of the insert.

3.32.1.1.1 Solder contact connectors. As many contacts as practicable shall be designated on the rear face of the insert. Eighty percent of the characters on any face of the connector shall remain identifiable after completion of the tests specified in table VII.

3.32.1.1.2 Crimp contact connectors. Eighty percent of the characters on any face of the connectors shall remain identifiable after completion of the tests specified in table VIII.

3.32.1.1.3 Grommet and insulating spacers. Where space permits, wire openings on the rear face of grommets and insulating spacers shall be marked with legible characters corresponding to the insert contact designators. Raised, depressed or contrasting colored characters shall be used. It is permissible to identify only those wire openings which are located on the vertical centerline of grommets of solder contact connectors.

3.32.1.1.4 Use of MS standard designations. MS standard designations shall not be applied to a product, except for qualification test samples (see 6.3), until notification has been received from the activity responsible for qualification that the product has been approved for listing on the qualified products list (QPL).

3.33 Workmanship. Loose contacts, poor molding fabrication, loose materials, defective bonding, damaged or improperly assembled contacts, peeling, or chipping of plating or finish, galling of mating parts, nicks and burrs of metal parts and post molding warpage will be considered adequate basis for rejection of items of quality inferior for the purpose intended.

4. QUALITY ASSURANCE PROVISIONS

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

4.1.1 Test equipment and inspection facilities. Test and measuring equipment and inspection facilities of sufficient accuracy, quality and quantity to permit performance of the required inspection shall be established and maintained by the contractor. 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.

4.1.2 Assembly plants. Assembly plants must be listed on or approved for listing on the applicable qualified products list. The qualified connector manufacturer shall certify that the assembly plant is approved for the distribution of the manufacturer's parts. The assembly plant shall use only piece parts supplied by the qualified connector manufacturer. No testing other than visual examination is required of certified piece parts obtained from the qualified connector manufacturer, except when there is cause for rejection. Assemblies produced at the assembly plant shall be subjected to inspection to assure that the assembly process conforms with that established at the qualified manufacturing plant. Quality control requirements, including Government inspection surveillance, shall be the same as required for the qualified connector manufacturer.

4.2 Classification of inspection. The inspection of connectors shall be classified as follows:

a. Qualification inspection (4.3).
b. Quality conformance inspection (4.4).

4.2.1 Inspection conditions. Unless otherwise specified, all inspections shall be performed under any combination of conditions within the following ranges. Any specified condition shall not affect the other two ambient ranges.

Temperature: 15° to 35°C (59° to 95°F).
Relative humidity: 30 to 80 percent.
Barometric pressure: 650 to 800 mm of mercury.

4.3 Qualification inspection. Qualification inspection shall consist of the examinations and tests performed in the sequence specified in tables VII and VIII on the qualification test samples specified in 4.3.2. After receipt of the letter of authorization from the agent 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), to the agent responsible for qualification.

4.3.1 Qualification of additional connectors. Qualification by similarity to qualified connectors or connectors submitted for qualification is permissible when materials, designs and manufacturing processes are identical. When materials, designs or manufacturing processes differ, sufficient testing to prove the adequacy of the affected characteristics will be required to obtain qualification by similarity. Full details of the similarity and differences, along with proposed tests, shall be submitted to the qualifying activity for approval prior to the commencing of testing.

4.3.2 Qualification samples. Samples of each item for which qualification is desired shall be tested in the sequence specified in tables VII or VIII, as applicable. Specific details on preparation of samples shall be as follows: Each connector subjected to qualification testing shall be provided with a counterpart connector for those tests requiring mating assemblies. The counterpart connectors provided for this purpose 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.

4.3.2.1 Wire-to-contact assembly. Unless otherwise specified herein, connectors shall be wired with approximately 3 feet of wire as applicable, selected from those referenced in table II. Where wired contacts are required, terminations shall be accomplished as follows.

4.3.2.1.1 Solder contacts. Solder in accordance with MIL-STD-454, requirement 5, shall be used. For class H connectors, termination of wire to solder terminals shall be accomplished with solder conforming to QQ-S-571, composition Ag 1.5 or Sn 10.

4.3.2.1.2 Crimp contacts. Crimp contacts shall be crimped with tools conforming to MIL-C-22520 as specified on the applicable contact MS standard.

TABLE VII. Qualification inspection for solder contact connectors.

Inspection	Requirement paragraph	Test paragraph
Group 1		
Visual and mechanical	3.1,3.3,3.4,3.5, 3.32, and 3.33	4.6.1
Magnetic permeability (except classes H and K)	3.6	4.6.2
Disengagement (MS3107 plug only)	3.7	4.6.3
Thermal shock	3.8	4.6.4
Air leakage (class C only)	3.9	4.6.5.1
Contact retention	3.10	4.6.6.3
Dielectric withstanding voltage	3.11	4.6.7.1
Vibration	3.12	4.6.8.1
Dielectric withstanding voltage	3.11	4.6.7.1
Shock	3.13	4.6.9.1
Humidity	3.14	4.6.10
Dielectric withstanding voltage	3.11	4.6.7.4
Contact resistance	3.15	4.6.11
Durability	3.16.2	4.6.12.2
Corrosion	3.17	4.6.13
Contact resistance	3.15	4.6.11
Insulation resistance (long time)	3.18.3	4.6.14.4
Fluid immersion	3.19	4.6.15.1
Visual and mechanical	3.1,3.3,3.4,3.5, 3.32, and 3.33	4.6.1
Group 2		
Visual and mechanical	3.1,3.3,3.4,3.5, 3.32, and 3.33	4.6.1
Firewall	3.20	4.6.16
Group 3		
Visual and mechanical	3.1,3.3,3.4,3.5, 3.32, and 3.33	4.6.1
Magnetic permeability (except classes H and K)	3.6	4.6.2
Thermal shock	3.8	4.6.4
Air leakage	3.9	4.6.5.1
Contact retention	3.10	4.6.6.3
Insert retention	3.21	4.6.17
Dielectric withstanding voltage	3.11	4.6.7.1
Vibration	3.12	4.6.8.2
Dielectric withstanding voltage	3.11	4.6.7.1
Shock	3.13	4.6.9.1
Moisture resistance	3.22	4.6.18.2
Contact resistance	3.15	4.6.11
Durability	3.16.2	4.6.12.2
Corrosion	3.17	4.6.13
Contact resistance	3.15	4.6.11
Insulation resistance (short time)	3.18.2	4.6.14.3
Fluid immersion	3.19	4.6.15.1
Visual and mechanical	3.1,3.3,3.4,3.5, 3.32, and 3.33	4.6.1

TABLE VII. Qualification inspection for solder contact connectors - Continued.

Inspection	Requirement paragraph	Test paragraph
Group 4		
Visual and mechanical	3.1,3.3,3.4,3.5, 3.32, and 3.33	4.6.1
Magnetic permeability (except classes H and K)	3.6	4.6.2
Thermal shock	3.8	4.6.4
Air leakage	3.9.1	4.6.5.2
Dielectric withstanding voltage	3.11	4.6.7.1
Insulation resistance	3.18.1	4.6.14.1
Durability	3.16.2	4.6.12.2
Vibration	3.12	4.6.8.1
Shock	3.13	4.6.9.1
Moisture resistance	3.22	4.6.18.2
Corrosion	3.17	4.6.13
Contact resistance	3.15	4.6.11
Insert retention	3.21	4.6.17
Visual and mechanical	3.1,3.3,3.4,3.5, 3.32, and 3.33	4.6.1
Group 5		
Visual and mechanical	3.1,3.3,3.4,3.5, 3.32, and 3.33	4.6.1
Magnetic permeability (except classes H and K)	3.6	4.6.2
Thermal shock	3.8	4.6.4
Air leakage	3.9	4.6.5.1
Dielectric withstanding voltage	3.11	4.6.7.1
Vibration	3.12	4.6.8.2
Dielectric withstanding voltage	3.11	4.6.7.1
Shock	3.13	4.6.9.1
Water pressure	3.23.1	4.6.19.1
Corrosion	3.17	4.6.13
Cable pull-out	3.24	4.6.20
Fluid immersion	3.19	4.6.15.1
External bending moment	3.25	4.6.21
Group 6		
Visual and mechanical	3.1,3.3,3.4,3.5, 3.32, and 3.33	4.6.1
Magnetic permeability (except classes H and K)	3.6	4.6.2
Dielectric withstanding voltage	3.11	4.6.7.1
Insulation resistance	3.18.1	4.6.14.1
Fluid immersion	3.19	4.6.15.3
Visual and mechanical	3.1,3.3,3.4,3.5, 3.32, and 3.33	4.6.1
Group 7		
Contact engaging and separating forces	3.26	4.6.22
Resistance to probe damage (size 16 only)	3.27	4.6.23
Contact engaging and separating forces	3.26	4.6.22
Corrosion (5 contacts only)	3.17	4.6.13

TABLE VIII. Qualification inspection for removable crimp contact connectors.

Inspection	Requirement paragraph	Test paragraph
Group 1		
Visual and mechanical	3.1,3.3,3.4,3.5, 3.32, and 3.33	4.6.1
Magnetic permeability (except class K)	3.6	4.6.2
Shell conductivity	3.28	4.6.24
Contact insertion and removal forces	3.29	4.6.25
Contact retention	3.10	4.6.6.1
Insulation resistance	3.18	4.6.14.1
Thermal shock	3.8	4.6.4
Dielectric withstanding voltage	3.11	4.6.7.2
Water pressure (MS3400 series only)	3.23.2	4.6.19.2
Altitude immersion (MS3450 series only)	3.30	4.6.26
Durability	3.16.1	4.6.12.1
Vibration (MS3400 series only)	3.12	4.6.8.2
Random vibration (MS3450 series only)	3.31	4.6.27
Shock	3.13	4.6.9.1
Moisture resistance	3.22	4.6.18.1
Corrosion	3.17	4.6.13
Contact resistance	3.15	4.6.11
Insert retention	3.21	4.6.17
Contact retention	3.10	4.6.6.1
External bending moment	3.25	4.6.21
Visual and mechanical	3.1,3.3,3.4,3.5, 3.32, and 3.33	4.6.1
Group 2		
Visual and mechanical	3.1,3.3,3.4,3.5, 3.32, and 3.33	4.6.1
Insulation resistance	3.18	4.6.14.1
Dielectric withstanding voltage	3.11	4.6.7.2
Dielectric withstanding voltage (altitude)	3.11	4.6.7.3
Insulation resistance (long time)	3.18.3	4.6.14.4
Contact resistance	3.15	4.6.11
Dielectric withstanding voltage	3.11	4.6.7.2
Insert retention	3.21	4.6.17
Contact retention	3.10	4.6.6.1
Visual and mechanical	3.1,3.3,3.4,3.5, 3.32, and 3.33	4.6.1
Group 3		
Visual and mechanical	3.1,3.3,3.4,3.5, 3.32, and 3.33	4.6.1
Contact insertion and removal forces	3.29	4.6.25
Contact retention	3.10	4.6.6.2
Group 4		
Visual and mechanical	3.1,3.3,3.4,3.5, 3.32, and 3.33	4.6.1
Firewall	3.20	4.6.16

TABLE VIII. Qualification inspection for removable crimp contact connectors - Continued.

Inspection	Requirement paragraph	Test paragraph
Group 5		
Visual and mechanical	3.1,3.3,3.4,3.5, 3.32, and 3.33	4.6.1
Insulation resistance	3.18	4.6.14.1
Dielectric withstanding voltage	3.11	4.6.7.2
Fluid immersion (classes K and L only)	3.19	4.6.15.3
Fluid immersion (classes D, W, and U only)	3.19	4.6.15.2
Dielectric withstanding voltage	3.11	4.6.7.2
Insert retention	3.21	4.6.17
Contact retention	3.10	4.6.6.1
Visual and mechanical	3.1,3.3,3.4,3.5, 3.32, and 3.33	4.6.1
Group 6		
Visual and mechanical	3.1,3.3,3.4,3.5, 3.32, and 3.33	4.6.1
Thermal shock	3.8	4.6.4
Dielectric withstanding voltage	3.11	4.6.7.2
Durability	3.16.1	4.6.12.1
Moisture resistance	3.22	4.6.18.1
Contact resistance	3.15	4.6.11
Visual and mechanical	3.1,3.3,3.4,3.5, 3.32, and 3.33	4.6.1
Group 7 (class D only)		
Visual and mechanical	3.1,3.3,3.4,3.5, 3.32, and 3.33	4.6.1
Thermal shock	3.8	4.6.4
Dielectric withstanding voltage	3.11	4.6.7.2
Water pressure	3.23.2	4.6.19.2
Vibration	3.12	4.6.8.2
High impact shock	3.13	4.6.9.2
Dielectric withstanding voltage	3.11	4.6.7.2
Visual and mechanical	3.1,3.3,3.4,3.5, 3.32, and 3.33	4.6.1

4.3.2.2 Solder contact connectors (classes A, B, C, and P). Qualification samples and qualification tests for solder contact connectors in classes A, B, C, and P shall consist of two complete connector assemblies of class A or C wall mounting receptacles and class A or B straight plugs, each with insert arrangements with the greatest number of contacts for which qualification is desired, in each shell size, which shall be subjected to the tests of table VII, group 1. Qualification testing of these samples will admit qualification of other shell types and the balance of insert arrangements in classes A, B, C, and P by similarity. Testing of solder contacts need not be performed if compliance of similar contacts has previously been demonstrated in conjunction with qualification testing of connectors of a different class.

4.3.2.3 Solder contact connectors (class H). Qualification samples and qualification tests for solder contact connectors in class H shall consist of the following.

4.3.2.3.1 Group 4. Two class H receptacles, with insert arrangements with the greatest number of contacts for which qualification is desired, in each shell size and in each voltage rating, together with mating class D, F, L, P, R, U, or W straight plugs, shall be subjected to the tests of table VII, group 4.

4.3.2.3.2 Group 6. Seven class H receptacles in each shell size range (small range: 8S to 16; medium range: 18 to 28; and large range: 32 to 48) with insert arrangements representing typical manufacturing shall be subjected to the group 6 tests of table VII. One sample of each shell size range shall be subjected to each fluid. Where mating plugs are required, these shall be class K or L.

Qualification testing of these samples shall admit qualification of all other shell types and the balance of shell sizes and insert arrangements in class H by similarity.

4.3.2.4 Solder contact connectors (class J). Qualification samples and qualification tests for solder contact connectors in class J shall consist of two complete connector assemblies, class J receptacles and straight plugs, for which qualification is desired, in each shell size, which shall be subjected to the tests of table VII, group 5. The connectors need not be wired but shall be assembled using a solid polychloroprene test plug of suitable length and OD in accordance with table II. Qualification testing of these samples will admit qualification of all class J assemblies if classes F and R are being qualified at the same time or have previously been qualified to this specification. If not, class J assemblies shall be wired and subjected to all of the requirements of 4.3.2.5. Qualification testing of these samples will admit qualification of other shell types in class J by similarity.

4.3.2.5 Solder contact connectors (classes F and R). Qualification samples and qualification tests for solder contact connectors in classes F and R shall consist of two complete connector assemblies, class R wall mounting receptacles and class F straight plugs, each with insert arrangements with the greatest number of contacts for which qualification is desired, in each shell size, which shall be subjected to the tests of table VII, group 3. For test purposes, contacts shall be wired per 4.3.2.1 except that for each size contact, no more than two wires of 10 percent of the wires, whichever is greater, shall be the larger of the two sizes shown in table II.

Qualification testing of these samples will admit qualification of other shell types and the balance of insert arrangements in classes F and R by similarity. Testing of solder contacts need not be performed if compliance of similar contacts has previously been demonstrated in conjunction with qualification testing of connectors of a different class.

4.3.2.6 MS3100 series connectors (class K). Qualification samples and qualification tests for MS3100 series connectors in class K shall consist of the complete connector assemblies as specified.

4.3.2.6.1 Group 1. Two complete connector assemblies, class K wall mounting receptacles and straight plugs, each with insert arrangements with the greatest number of contacts for which qualification is desired, in each shell size, shall be subjected to the tests of table VII, group 1.

4.3.2.6.2 Group 2. One complete connector assembly, class K wall mounting receptacle and straight plug, with the insert arrangement with the greatest number of contacts for which qualification is desired in each shell size, shall be wired with wire conforming to MIL-W-25038 and subjected to the tests of table VII, group 2.

Qualification testing of these samples will admit qualification of other shell types and the balance of insert arrangements in class K by similarity.

4.3.2.7 Socket contacts for solder contact connectors, group 7. Fifty of each socket contact size and configuration used in the solder contact connectors for which qualification is desired shall be subjected to the tests of table VII, group 7. Sockets which are not completely assembled prior to installation in the insert (e.g., class H, socket style), may be provided and tested in connectors.

4.3.2.8 Crimp contact connectors. Qualification samples and qualification tests for crimp contact connectors in classes D, K, L, W, and U shall be as specified in the following paragraphs. Shell sizes are grouped into three ranges (small range: 8S to 16; medium range: 18 to 28; and large range: 32 to 48) for qualification testing. Successful completion of the qualification tests in table VIII qualifies:

a. For the shell size range submitted, all shell sizes and styles within the range.
b. For the service ratings submitted, all contact arrangements complying with those service ratings.

4.3.2.8.1 Group 1. Two connectors of each class in each shell size range (small, medium, and large) with insert arrangements representing typical manufacturing, and of each contact retention system to be qualified shall be subjected to the group 1 tests of table VIII. One sample shall have the pin insert in the plug and the socket insert in the receptacle. The other sample shall have the inserts reversed. One sample shall be terminated with wire approaching the minimum OD specified in table II, and the other with maximum OD wire. The connectors shall be tested with an MS3417 strain relief clamp assembled on the back threads or other appropriate backshell hardware for which qualification is desired. The receptacles shall be wall mounting.

4.3.2.8.2 Group 2. One connector of each class (for each service rating) with insert arrangements having the maximum contact density and of each contact retention system to be qualified shall be subjected to the group 2 tests of table VIII. The plug shall have socket inserts, and the receptacle pin inserts, and shall be terminated with maximum OD wire specified in table II. Backshell hardware shall be the same as group 1, and the receptacles shall be wall mounting.

4.3.2.8.3 Group 3. Additional connectors shall be supplied to provide a minimum of 10 contact cavities of each contact size and of each contact retention system for which qualification is desired. These connectors shall be subjected to the group 3 tests of table VIII. Additional contact sizes can be qualified by completion of the group 3 tests.

4.3.2.8.4 Group 4 (class K only). One class K connector in each shell size range with insert arrangements representing typical manufacturing and of each contact retention system to be qualified shall be subjected to the group 4 tests of table VIII. Each connector shall be wired with wire conforming to MIL-W-25038.

4.3.2.8.5 Group 5. Four class D, U, and W connectors and seven class K and L connectors in each shell size range with insert arrangements representing typical manufacturing and of each contact retention system to be qualified shall be subjected to the group 5 tests of table VIII. All samples shall have the socket insert in the plug and the pin insert in the receptacle and shall be terminated with maximum OD wire specified in table II. Backshell hardware shall be the same as group 1. One sample of each class, of each shell size range and of each contact retention system to be qualified shall be subjected to each test fluid.

4.3.2.8.6 Group 6 (front and rear release connector intermateability). When requested by the qualifying activity, one connector of classes D, K, L, W, and U in each shell size range with insert arrangements representing typical manufacturing and of each release system combination (one male plug with front release mated to female receptacle with rear release, one male plug with rear release mated to female receptacle with front release, one female plug with front release mated to male receptacle with rear release and one female plug with rear release mated to male receptacle with front release) shall be subjected to group 6 tests of table VIII. Backshell hardware shall be the same as group 1 and the receptacles shall be wall mounting.

4.3.2.8.7 Group 7 (class D only). Two complete connector assemblies, class D wall mounting receptacles and straight plugs, each with insert arrangements with the greatest number of contacts for which qualification is desired in each shell size range shall be subjected to the tests of table VIII, group 7. One sample shall have the pin insert in the plug and the socket insert in the receptacle. The other sample shall have the socket insert in the plug and the pin insert in the receptacle. One connector shall be assembled with an MS3437 type B cable backshell and 6 feet of the applicable cable specified in table IX. The remaining connector shall be assembled with an MS3109 boot and 6 feet of the applicable cable specified in table IX.

a. For the shell size range submitted, all shell sizes and styles within those ranges.
b. For the service ratings submitted, all contact arrangements complying with those service ratings.

TABLE IX. Test cable size

3437 backshell 1/ dash no.	3109 boot dash no.	5015 shell size	Cable OD max
07/08	11	8S	.432
11/12	12	10S/10SL	.432
13/14	13	12/12S	.432
116/117	13	14/14S	.432
21/22	14	16/16S	.700
27/28	14	18	.750
33/34	15	20	.750
41/42	15	22	.750
47/48	16	24	.750
55/56	16	28	.750
65/66	17	32	1.250
71/72	17	36	1.250
79/80	18	40	1.250
87/88	18	44	1.250
95/96	18	48	1.250

1/ Type B.

Select type to match maximum cable entry and insert configuration of MIL-C-5015.

No armor to be used on test cable.

4.3.3 Qualification rejection. There shall be no failures during any examination or tests of the connectors or accessories submitted for qualification tests. After notification of any failure, the agent responsible for qualification testing (see 6.3.1) shall receive details of corrective action from the manufacturer before initiating any further tests deemed necessary to assure compliance with connector requirements.

4.4 Quality conformance inspection.

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

4.4.2 Inspection lot. An inspection lot shall consist of all connectors covered by the same MS standards, produced under essentially the same conditions, and offered for inspection at one time. In-process controls, unrelated to lot sizes of finished connectors, may be used, provided an equivalent or tighter AQL level is maintained.

4.4.2.1 Group A inspection. Group A inspection shall consist of the examination of product in accordance with 4.6.1. In addition, class H connectors shall be subjected to the air leakage test per 4.6.5.

4.4.2.1.1 Sampling plan. Statistical sampling and inspection shall be in accordance with MIL-STD-105 for general inspection level II. The acceptable quality level (AQL) shall be 1.0 for major defects and 4.0 for minor defects. Major and minor defects shall be as defined in MIL-STD-105.

4.4.2.1.2 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 inspection. Resubmitted lots shall be inspected using tightened inspection. Such lots shall be kept separate and shall be clearly identified as reinspected lots.

4.4.2.2 Group B inspection. Group B inspection shall consist of the applicable tests specified in table X and shall be made on sample units which have been subjected to and have passed group A inspection.

TABLE X. Group B inspection.

Inspection 1/	Requirement paragraph	Test paragraph
Dielectric withstanding voltage Insulation resistance	3.11 3.18.1	4.6.7.5 4.6.14.2

1/ Crimp contact connectors.

4.4.2.2.1 Sampling plan. The sampling plan shall be in accordance with MIL-STD-105 for normal inspection level S-4. 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 2.5 percent defective.

4.4.2.2.2 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.

4.4.2.2.3 Disposition of sample units. Sample units which have passed the group B inspection may be delivered on the contract or purchase order.

4.5 Periodic inspection. Periodic inspection shall consist of group C. Except where the results of these inspections show noncompliance with the applicable requirements (see 4.5.1.4), delivery of products which have passed group B shall not be delayed pending the results of these periodic inspections.

4.5.1 Group C inspection. Group C inspection shall consist of the tests specified in table XI in the order shown. Group C inspection shall be made on sample units selected from inspection lots which have passed the groups A and B inspection. Group C inspection reports shall be forwarded to the qualifying activity every 18 months as specified in the sampling plan.

4.5.1.1 Sampling plan. Every 18 months, mated connector sample units which have passed groups A and B inspection shall be subjected to the tests specified in table XI. Samples shall be selected in sufficient quantity to provide two samples per applicable test group, as determined by the contact type and the class of the samples to be tested.

TABLE XI. Group C inspection.

Inspection	Requirement paragraph	Test paragraph	Group							
			1	2	3	4	5	6	7	8
Insulation resistance	3.18.1	4.6.14.1	X	X	X	X	X	X	-	-
Dielectric withstanding voltage	3.11	4.6.7.2	X	X	X	X	X	X	-	-
Contact retention	3.10	4.6.6	X	X	-	-	X	X	X	X
Shell conductivity	3.28	4.6.24	-	-	-	-	-	-	X	X
Air leakage	3.9.1	4.6.5.1	X	X	-	-	X	X	-	-
Durability	3.16	4.6.12	X	-	X	-	X	-	X	-
Moisture resistance (except classes A, B, C, and K only)	3.22	4.6.18	X	-	X	-	-	-	X	-
Humidity (classes A, B, C, and K only)	3.14	4.6.10	X	-	-	-	-	-	-	-
Water pressure	3.23.1	4.6.19.1	-	-	-	-	X	-	-	-
Altitude immersion (MS3450 only)	3.30	4.6.26	X	-	-	-	-	-	-	-
Corrosion	3.17	4.6.13	-	X	-	X	-	X	-	X

4.5.1.1.1 Solder contact connectors (classes A, B, C, E, P, K, P, and R). Samples and tests for solder contact connectors shall consist of four mating plugs and receptacles in various shell sizes and classes representing a cross section of production. Plugs and receptacles of different classes may be mated. The samples shall be wired as specified in the applicable subparagraph of 4.3. Two complete mating connector assemblies shall be subjected to the tests of table XI, group 1 and the other two assemblies shall be subjected to the tests of table XI, group 2.

4.5.1.1.2 Solder contact connectors (class H). Samples and tests for solder contact connectors shall consist of four receptacles with suitable mating plugs in various shell sizes representing a cross section of production. Two complete mating connector assemblies shall be wired as specified in the applicable subparagraph of 4.3 and subjected to the tests of table XI, group 3. The remaining two assemblies need not be wired but shall be subjected to the tests of table XI, group 4.

4.5.1.1.3 Solder contact connectors (class J). Samples and tests for solder contact connectors shall consist of four mating plugs and receptacles in various shell sizes representing a cross section of production. The samples shall be prepared in accordance with the applicable subparagraph of 4.3.2. Two complete mating connector assemblies shall be subjected to the tests of table XI, group 5 and the other two assemblies shall be subjected to the tests of table XI, group 6.

4.5.1.1.4 Crimp contact connectors. Samples and tests for crimp contact connectors shall consist of four mating plugs and receptacles in various shell sizes and classes representing a cross section of production. Plugs and receptacles of different classes may be mated. The samples shall be wired as specified in the applicable subparagraph of 4.3.2. Two complete mating connector assemblies shall be subjected to the tests of table XI, group 7, and the other two assemblies shall be subjected to the tests of table XI, group 8.

4.5.1.1.5 Solder socket contacts. Samples and tests for solder socket contacts shall be as specified in 4.3.2.7.

4.5.1.2 Failures. If one or more sample units fail to pass group C inspection, the sample shall be considered to have failed.

4.5.1.3 Disposition of sample units. Sample units which have been subjected to group C inspection shall not be delivered on the contract or purchase order.

4.5.1.4 Noncompliance. If a sample fails to pass group C inspection, the manufacturer shall take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected and which were manufactured 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 inspection, or the inspection which 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 corrective action taken shall be furnished to the cognizant inspection activity and the qualifying activity.

4.5.2 Packaging inspection. The sampling and inspection of the preservation-packaging; packing and container marking shall be in accordance with the requirements of MIL-C-55330.

4.6 Methods of examination and tests.

4.6.1 Visual and mechanical examination. The connectors, accessories, and piece parts shall be visually and mechanically examined to ensure conformance with this specification and the applicable military standards (see 3.1,3.3, 3.4, 3.5, 3.32, and 3.33). In-process controls 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 Magnetic permeability. The relative permeability shall be checked with an indicator conforming to MIL-I-17214. The connectors or accessories may be wired or unwired, as convenient, but shall not be carrying current (see 3.6).

4.6.3 Disengagement (MS3107 only). The plug (without the insert) shall be fully mated to a securely mounted receptacle. A gradually increasing axial tension shall be applied to the plug and the force at separation measured (see 3.7).

4.6.4 Thermal shock. Accessories or unmated connectors shall be tested in accordance with method 107, condition A of MIL-STD-202 except that the temperature extremes shall be as specified in table XII. At the completion of the last cycle, the connectors shall be returned to room temperature for inspection (see 3.8).

TABLE XII. Temperature extremes.

Classes	Temperature		
	Extremes	Degrees C	Degrees F
A, B, C, E, F, J, P, R	Low	-55 +0 -3	-67 +0 -5
	High	+125 +3 -0	+257 +5 -0
D, H, K, W	Low	-55 +0 -3	-67 +0 -5
	High	+175 +3 -0	+347 +5 -0
L, U	Low	-55 +0 -3	-67 +0 -5
	High	+200 +3 -0	+392 +5 -0

4.6.5 Air leakage tests.

4.6.5.1 Solder contact receptacles (except classes A and B) and class J plugs. Solder contact receptacles and class J plugs shall be mounted in a manner suitable for application of a 30 pounds per square inch 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 XII and while at the low temperature (see 3.9.1).

4.6.5.2 Class H receptacles. Class H receptacles shall be mounted in a manner suitable for the application of 15 pounds per square inch nominal pressure differential across the receptacles and tested in accordance with method 112, test condition C, procedure I of MIL-STD-202. The leakage rate shall be determined while pressurized air or gas, containing not less than 10 percent of helium by volume is applied to the receptacle (see 3.9.2).

4.6.6 Contact retention. Axial loads in accordance with table XIII shall be applied to individual contacts. 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 3 of the contacts in each connector shall be tested (see 3.10).

4.6.6.1 Crimp contact connectors (accessory tightened). The axial loads shall be applied to the mating end of contacts with the connector accessory tightened. The load shall be applied after the slack in the contact has been taken up, and the displacement of the contacts shall be measured under load after the load has been applied for a minimum period of 5 seconds.

4.6.6.2 Crimp contact connectors (accessory removed). Connectors shall be tested as specified in 4.6.6.1, except that the accessory shall be removed prior to the test, and loads shall be applied in each direction in turn. Special contacts may be substituted for this test. The special contact shall conform to the dimensions shown on the applicable specification sheet except that a solid rod may be attached to the contact instead of wire. The solid rod diameter shall be within the specified wire insulation diameter. Contact cavities not filled with rod-contact assemblies shall be filled with wired contacts.

TABLE XIII. Contact retention axial loads.

Contact mating end size	Minimum axial load (pounds)		
	Fixed type contacts	Removable crimp type contacts 1/	Class B
16	10	25	50
12	15	30	50
8	20	50	80
4	20	60	100
0	25	75	100

1/ Except class D.

4.6.6.3 Solder contact connectors. Connectors shall be tested as specified in 4.6.6.1, except that the grommet retaining nut shall be loose and the measurement of the displacement of the contacts is not required.

4.6.7 Dielectric withstanding voltage.

4.6.7.1 Dielectric withstanding voltage (sea level). Wired, unmated connectors shall be tested in accordance with method 3001 of MIL-STD-1344 with the following details and exceptions:

a. The magnitude of the test voltage shall be as specified in table XIV.
b. Fifty percent of the contacts available shall be tested, but in no case shall less than six dielectric withstanding voltage readings be taken. If the number of contacts is three or less, all contacts shall be tested. The test voltage shall be applied between each wired contact and each adjacent contact and the shell.
c. The test voltage shall be maintained at the specified value for 2 seconds minimum.
d. For acceptance testing, simulated contacts and special techniques may be used in performing this test.

4.6.7.2 Dielectric withstanding voltage (sea level). Mated or unmated connectors, as applicable, shall be tested in accordance with method 3001 of MIL-STD-1344. The applicable test voltages of table XIV shall be applied between all but not more than six peripheral contacts. If an insert has more than one service rating, similar connections shall be made for the different test voltages as necessary (see 3.11).

4.6.7.3 Dielectric withstanding voltage (altitude). Mated connectors and unmated connector halves with pin contacts shall be tested in accordance with method 3001 of MIL-STD-1344 with the following details and exceptions:

a. The magnitude of the test voltage shall be as specified in table XIV.
b. Fifty percent of the contacts available shall be tested, but in no case shall less than six dielectric withstanding voltage readings be taken. If the number of contacts is three or less, all contacts shall be tested. The test voltage shall be applied between each wired contact and each adjacent contact and the shell.
c. The test voltage shall be maintained at the specified value for 2 seconds minimum.
d. The leads of all test circuits shall be brought out through the walls of the chamber. There shall be no wire splices inside the chamber. The wire ends of all leads shall be unsealed.
e. Only the engaging faces of classes H and J connectors shall be subjected to the high altitude. The rear face shall be suitably protected.

4.6.7.4 Dielectric withstanding voltage (after humidity). The mated connectors shall show no evidence of breakdown when the voltage indicated for the applicable service rating in table IV is applied between the two closest contacts, and between the shell and the contacts closest to the shell in accordance with method 3001 of MIL-STD-1344 except the test voltage shall be applied for 5 minutes (see 3.14).

4.6.7.5 Dielectric withstanding voltage (group B inspection). Unmated connectors or insert assemblies, as applicable, shall show no evidence of breakdown when the applicable test voltage of table XIV is applied between the two closest contacts, and between the shell (or simulated shell) and the contact closest to the shell in accordance with method 3001 of MIL-STD-1344. The period of application of voltage shall be 1 second minimum and simulated contacts may be used (see 3.11).

TABLE XIV. Dielectric withstanding test voltages.
(For maximum recommended working voltages, see 6.5.)

Service rating	Test voltages (volts - rms)	
	Sea level	70,000 ft
Inst.	1000	260
A	2000	360
D	2800	400
E	3500	440
B	4500	480
C	7000	560

4.6.8 Vibration. Complete mated connectors shall be mounted as follows and subjected to the applicable vibration test. Each receptacle shall be mounted on a suitable fixture, which, in turn, shall be attached to a vibration table. A suitable sensor shall monitor the vibration of the receptacle at a point on or near the receptacle. A counterpart plug shall be engaged with the receptacle and held by normal locking means without the use of safety wire. The wire bundles or cables shall be clamped to nonvibrating points at least 8 inches from the rear of the connectors. The clamping length shall be chosen to avoid resonance of the wire bundles or cables.

4.6.8.1 Vibration. The mated connector shall be mounted as specified in 4.6.8 and vibrated in accordance with method 2005, test condition II of MIL-STD-1344. All contacts shall be wired in series with 100 ±10 milliamperes allowed to flow. A suitable instrument shall be employed to monitor the current flow and to indicate discontinuity of contact or interruption of current flow (see 3.12).

4.6.8.2 Vibration. Mated connectors shall be mounted as specified in 4.6.8 and tested in accordance with method 2005, test condition III of MIL-STD-1344 and also in accordance with the endurance test of MIL-STD-167-1(SHIPS). All contacts shall be wired in series and a current of 100 ±10 milliamperes shall flow through the series circuit during the test. A suitable instrument shall be employed to monitor current flow and indicate discontinuity of contact or interruption of current flow (see 3.12).

4.6.9 Shock.

4.6.9.1 Shock (except class D connectors). Mated connectors shall be subjected to approximately 1/2 sine wave transient shock impulses of 50 gravity units and a duration of 11 ±1 milliseconds. One shock shall be applied in each direction of the three major axes of the connectors. Receptacles shall be mounted on the shock device or carriage. Plugs shall be engaged with the receptacles and held by normal locking means only. All contacts shall be wired in a series circuit with 100 ±10 milliamperes allowed to flow.

The wire bundles or cables shall be clamped to structures that move with the connectors. A minimum of 8 inches of wire or cable shall be unsupported behind the rear of each connector. A suitable instrument shall be employed to monitor current flow and to indicate discontinuity of contact or interruption of current flow (see 3.13).

4.6.9.2 High impact shock (class D connectors). Complete mated connectors with MS3437 type B backshells or MS3109 boots with 6 feet of unarmored cable (specified in table IX) installed shall be tested in accordance with MIL-S-901, grade A. Mounting fixtures shall be in accordance with MIL-S-901, lightweight. All contacts shall be wired in a series circuit with 100 ±10 milliamperes flowing through the series circuit during the high-impact shock. A suitable device shall be used to monitor the current flow and to indicate any discontinuity which exceeds 10 microseconds interruption of current flow. The mated connectors shall be held together only by the normal locking device. Cable or wires shall be supported on a stationary frame not closer than 36 inches from the connector assembly (see 3.13).

4.6.10 Humidity. Mated connectors shall be exposed to a relative humidity of 95 ±3 percent at a temperature of 71 ±2°C for 14 days. Immediately after exposure, without any forced drying, conduct the dielectric withstanding voltage test of 4.6.7.4. Class H receptacles and MS3102 receptacles shall have their rear portion enclosed and not exposed to humidity (see 3.14).

4.6.11 Contact resistance. The contact resistance shall be measured in accordance with the contact resistance test of MIL-C-23216 (see 3.15).

4.6.12 Durability.

4.6.12.1 Durability with coupling rings (crimp contact connectors). Counterpart crimp contact connectors shall be mated and unmated 100 times at a maximum rate of 10 cycles per hour with coupling rings attached (see 3.16.1).

4.6.12.2 Durability without coupling rings (solder contact connectors). Counterpart solder contact connectors shall be mated and unmated 500 times at a maximum rate of 600 cycles per hour with the coupling rings removed (see 3.16.2).

4.6.13 Corrosion. Unmated connectors and individual contact samples shall be tested in accordance with method 1001 of MIL-STD-1344. The following details and exceptions shall apply:

a. Test condition letter - B.
b. The samples shall not be mounted but shall be suspended from the top using waxed twine or string, glass rods or glass cord.

4.6.14 Insulation resistance.

4.6.14.1 Insulation resistance at room temperature. Unmated connectors shall be tested in accordance with method 3003 of MIL-STD-1344. The following details and exceptions shall apply:

a. For lot acceptance testing, where it is undesirable to install actual contacts in connectors, simulated contacts and special techniques may be used in performing this test.
b. The tolerance on the applied voltage shall be ±10 percent.

4.6.14.2 Insulation resistance at room temperature. Insulation resistance shall be measured in accordance with 4.6.14.1 between at least two closest adjacent contacts, and between the shell and at least one contact closest to shell. Simulated contacts may be used (see 3.18.1).

4.6.14.3 Insulation resistance at elevated temperature (short time). The insulation resistance shall be measured in accordance with 4.6.14.1 except that the connectors shall have been exposed to an ambient temperature of 125°C (257°F) for 60 hours. After completion of the 60 hours and while at the 125°C temperature, measurements shall be made. During the duration of the test sequence, and while at the 125°C temperature, measurements shall be made at least two times, the interval between each series of measurements being not less than 24 hours.

4.6.14.4 Insulation resistance at elevated temperature (long time). The insulation resistance shall be measured in accordance with 4.6.14.1. Elevated temperatures and required minimum insulation resistances are as specified in table XV. All measurements shall be made at the end of 1,000 hours while the connectors are at the elevated temperature.

TABLE XV. Insulation resistance at elevated temperature (long time).

Class of connector	Minimum insulation resistance (megohms)	Test temperature °C $^{+5°}_{-0°}$
A, B, C, E, F, J, P, and R - - -	30	85
H- - - - - - - - - -	50	175
K- - - - - - - - - -	100	175
L, D, U, and W - - -	1000	200

4.6.15 Fluid immersion.

4.6.15.1 Limited capabilities (classes A, B, C, E, F, J, P, and R). Unmated connectors shall be immersed fully in the fluids specified below for the required periods. At least one connector with its mating counterpart shall be immersed in each fluid. After removal from the fluid, each connector shall remain for 1 hour in free air at room conditions. Connectors shall be fully mated with mating connectors that were immersed simultaneously in the same fluid (see 3.19).

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

4.6.15.2 Partial capabilities (classes D, U, and W). Mated connectors shall be immersed fully in the fluids specified below for 2 minutes. At least one mated connector shall be immersed in each fluid. After removal from the fluid, each connector shall remain for 24 ±2 hours in free air at room conditions. This constitutes one cycle. Each connector shall be subjected to five cycles.

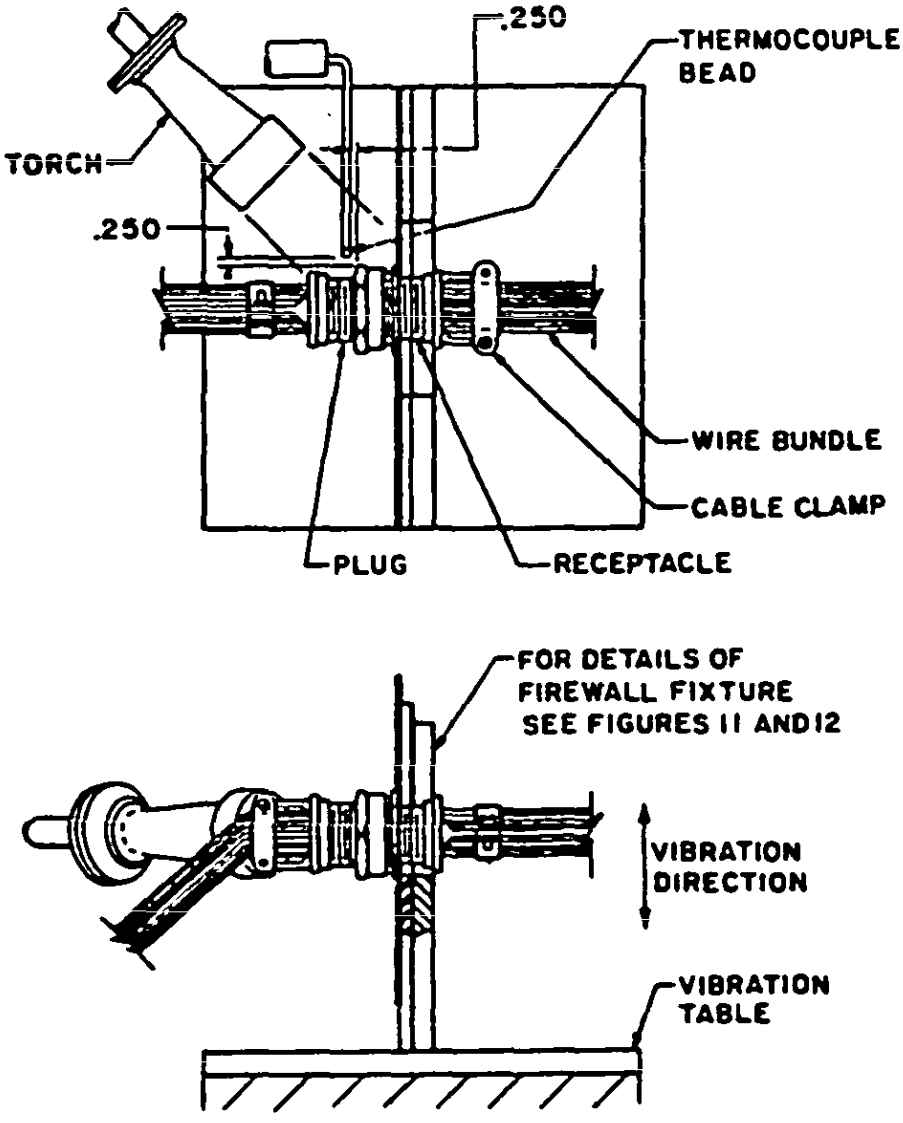
a. Hydraulic fluid conforming to MIL-H-5606.
b. Lubricating oil conforming to MIL-L-9236.
c. Skydrol (LD).
d. Aerosafe 2300.

4.6.15.3 Complete capabilities (classes K, L, and H). The connectors shall be immersed in fluids listed in table XVIII, each sample being subjected to the applicable test in the table. After testing in accordance with the individual test procedure, the connectors shall be visually (no magnification) inspected for cracks and tears and shall be mated by hand.

4.6.16 Firewall (class K connectors). The mated, torqued and wired connector shall be mounted on a fixture in accordance with figures 10, 11, and 12. The plug wire bundle shall be wrapped with glass tape or protected by suitable means to ensure that the wire bundle is capable of meeting the electrical requirements of this test. The connector assembly shall be subjected to a 1,093°C minimum (flame measured .250 inch from the assembly) for 20 minutes. The flame shall be directed at and envelope the connector plug assembly. The input to the burner shall be natural gas at a flow rate equivalent to an input of 33,000 to 37,000 BTU/hr during the entire duration of the test. Simultaneously the assembly shall be vibrated continuously at 33 Hz with a total excursion of 1/4 inch. During the first 5 minutes of the test, all contacts shall carry the dc current specified. During the 6th minute of the test, the potential specified in 3.20 shall be applied between adjacent contacts and between contacts and shell.

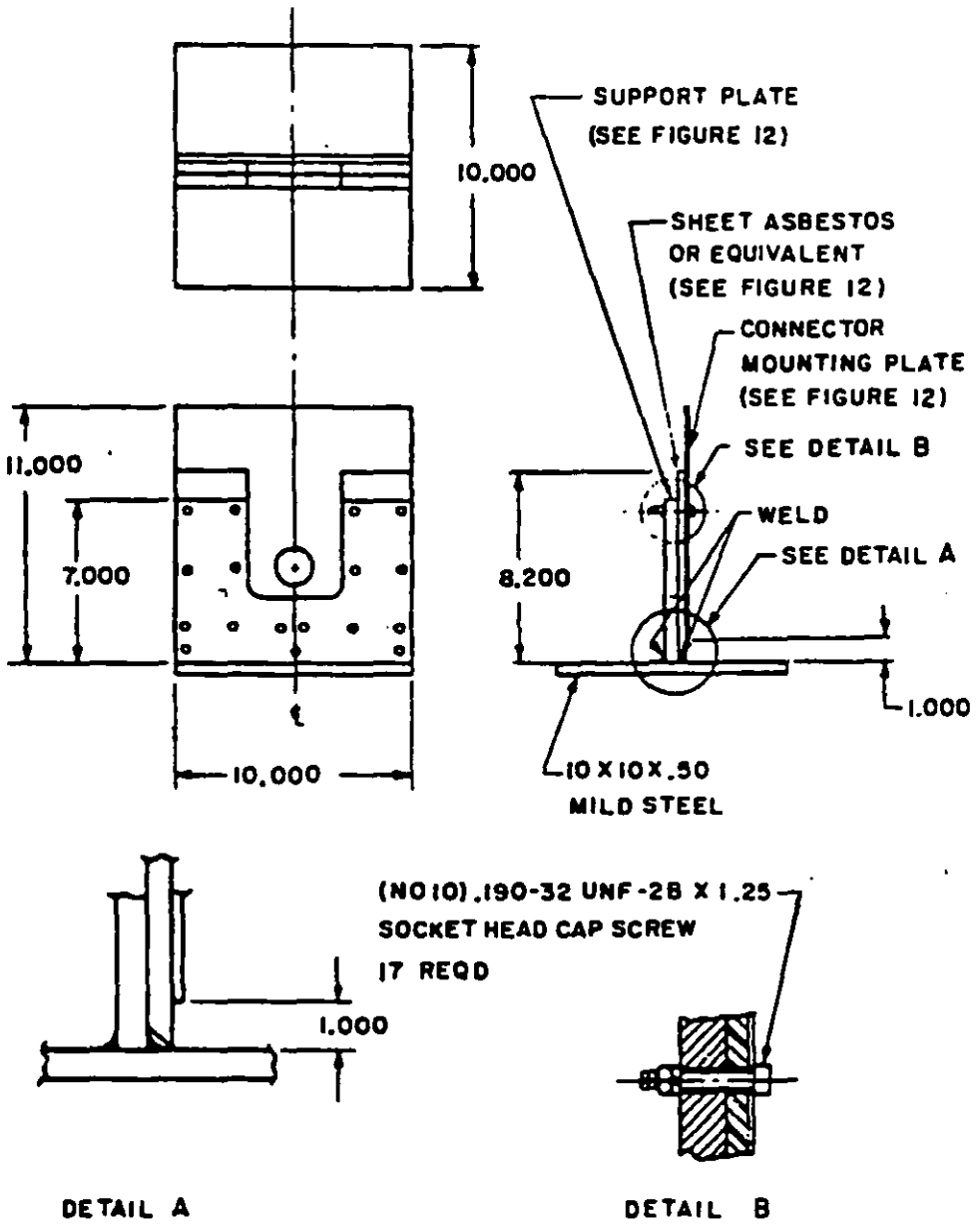
TABLE XVIII. Fluids for fluid immersion test.

Sample number	Test fluid	Test procedure
1	MIL-L-7808	Immerse unmated connectors in fluid at 120 ±3°C for 5 minutes. Remove connectors and allow to drain for a minimum of 1 hour at room temperature. Fluid shall be drained from all recesses. Mate connectors and expose to 125 ±3°C in an air circulating oven for 6 hours. Repeat procedure for a total of seven cycles.
2	MIL-L-23699	
3	MIL-H-5606	Immerse unmated connectors in fluid at 85 ±3°C for 5 minutes. Remove connectors and allow to drain for a minimum of 1 hour at room temperature. Fluid shall be drained from all recesses. Mate connectors and expose to 100 ±3°C in an air circulating oven for 6 hours. Repeat procedure for a total of seven cycles.
4	Hydraulic fluid ST0145LB0001	
5	MIL-A-8243	Immerse mated connectors in fluid at 65 ±3°C for 5 minutes. Remove connectors and allow to drain for a minimum of 1 hour at room temperature. Fluid shall be drained from all recesses. Unmate and expose connectors to 100 ±3°C in an air circulating oven for 6 hours. Repeat procedure for a total of seven cycles.
6	MIL-C-25769 (diluted for cleaning)	
7	MIL-T-5624 Grade JP-5	Same as procedure 1, except that the fluid shall be at 25 ±3°C, and oven at 55 ±3°C for 6 hours.
8	Coolant-dielectric fluid synthetic silicate ester base	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 minimum. Fluid shall be drained from all recesses.
9	Commercial regular gas MIL-G-3056 (type 1)	The wired, assembled, unmated connector shall be immersed in the fluid at 25 ±3°C for 5 minutes, removed from the fluid and exposed to free air for 24 ±2 hours. This conditioning cycle shall be repeated until the connector has been subjected to five complete cycles. For a maximum of two cycles, the exposure to free air may be extended to 75 hours.
10	One part by volume of isopropyl alcohol, per TT-I-735, grade A or B, and three parts by volume of mineral spirits per TT-T-291, grade 1 or P-D-680, type 1	
11	1-1-1 trichloroethane	
12	Azeotrope of trichlorotrifluoroethane and methylene chloride	



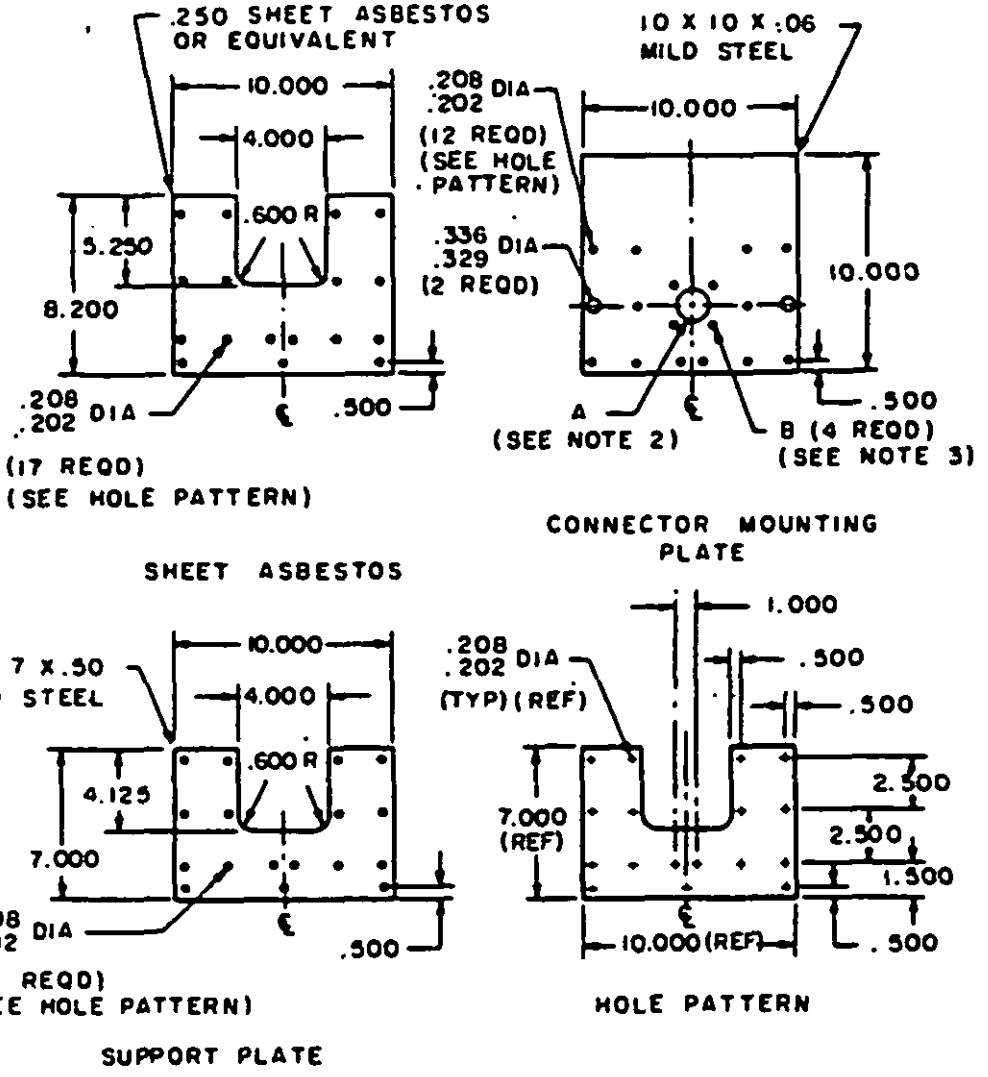
NOTE: Dimensions are in inches.

FIGURE 10. Firewall test setup.



NOTE: Dimensions are in inches.

FIGURE 11. Firewall fixture assembly (typical).



NOTES:
1. Dimensions are in inches. Unless otherwise specified, dimensions symmetrical about centerline.
2. A hole shall provide suitable clearance for the applicable connector.
3. B connector mounting holes shall be as specified on the applicable MS standard.

FIGURE 12. Firewall fixture details (typical).

TABLE XIX. Firewall test currents.

Contact size		DC test currents (amperes)
Mating end	Wire barrel end	
16	16	22
12	12	41
8	8	73
4	4	135
0	0	245

4.6.17 Insert retention. Inserts, less removable grommets or any insert supporting accessories, 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 psi/second until the pressure in table XX is reached. The insert shall retain its normal position in the connector shell for at least 5 seconds at the maximum specified pressure (see 3.21).

TABLE XX. Insert retention test pressures.

Shell size	Test pressures (psi gage)	
	All classes except H	Class H
8 through 12	150	200
14 through 18	100	
20 through 22	75	
24 through 28	60	
32 through 40	45	
44 through 48	30	

4.6.18 Moisture resistance. Moisture resistance test specimens shall be subjected to the high humidity (see 4.6.18.1) or extreme humidity range (see 4.6.18.2) moisture tests, 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 4.6.14 (see 3.22).

4.6.18.1 Moisture resistance at high humidity (crimp contact connectors). Wired, mated connectors shall be subjected to the humidity test specified in method 1002 of MIL-STD-1344. The following details and exceptions shall apply:

a. Test condition letter - type II omitting subcycle step 7b.
b. The mated connectors shall be mounted in a vertical position.
c. Step 7a shall be performed during the last cycle.
d. Three hours minimum after the start of step 7a, during the final cycle and while the connectors are still subjected to high humidity, the insulation resistance shall be measured when the chamber temperature reaches 20° +5°C and condensation is observed on the connector.
e. For qualification testing, insulation resistance readings shall be made on a minimum of 50 percent of the circuits.

4.6.18.2 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 affect 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°F 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 radiant in nature and applied to the underside of the test chamber.

4.6.19 Water pressure

4.6.19.1 Solder contact receptacles (except classes A, B, H, K, P) and class J plugs. The connectors shall be immersed in tap water to a depth of 6 feet for 48 hours as follows:

a. Plugs with "J" adapters shall be assembled to test cylinders (see table XVI which simulate jacketed cables.
b. Receptacles shall be mounted by their normal mounting means, with mounting flange gaskets. Jam nut mounting receptacle flanges shall be sealed only with "O" ring seals provided as accompanying hardware. One-half of the wall mounting receptacles shall be front mounted and the remaining half shall be back mounted. The terminal ends of the receptacles shall be external to the tank.
c. Fifty percent of the connectors tested shall be mated, and insulation resistance of the mated immersed connectors shall be measured at the end of the 48-hour period. The other fifty percent of the connectors shall be tested unmated. Upon completion of the test, the connectors shall be removed from the tank, all external moisture removed from the connectors by shaking them at room temperature, and insulation resistance measured within one-half hour after removal from the water. All mated connectors shall be inspected for internal leakage of water at the connector interface and cable housing. All unmated plugs with "J" adapters shall be inspected for water penetration into the adapter. Receptacles, mated and unmated shall be inspected for leakage through or around the insert and for leakage of the panel seals (see 3.23.1).

4.6.19.2 Crimp contact connectors and accessories. Connectors or accessories shall be tested in accordance with 4.6.19.1 except all connectors shall be tested mated. Dummy connectors, duplicating crimp contact connector accessory interfacing features (see figure 3) may be used in lieu of actual connectors in testing the accessories.

4.6.20 Cable pull-out (class J connectors). A solid polychloroprene test plug of suitable length, with OD conforming to table XVI and a Shore A durometer of 75-85, shall be installed in the class J adapter in lieu of cable. To facilitate the application of loads, the polychloroprene test plug may be provided with a metal core. The applicable tensile load specified in table XVI shall be applied to the test plug in the direction tending to displace it toward the rear of the adapter. The load shall be applied for 1 hour and the amount of slippage between the test plug and the adapter shall be measured (see 3.24).

TABLE XVI. Cable pull-out loads.

Cable sealing range		Test plug diameter (inches)	Pull-out loads (pounds)	Cable sealing range		Test plug diameter (inches)	Pull-out loads (pounds)
Minimum diameter (inches)	Maximum diameter (inches)			Minimum diameter (inches)	Maximum diameter (inches)		
.157	.210	.157 $^{+.000}_{-.016}$	25	.700	.926	.700 $^{+.000}_{-.016}$	75
.182	.312	.182 $^{+.000}_{-.016}$		.926	1.200	.926 $^{+.000}_{-.016}$	
.282	.437	.282 $^{+.000}_{-.016}$		1.200	1.363	1.200 $^{+.000}_{-.031}$	100
.387	.515	.387 $^{+.000}_{-.016}$	50	1.363	1.611	1.363 $^{+.000}_{-.031}$	
.512	.614	.512 $^{+.000}_{-.016}$		1.575	1.865	1.575 $^{+.000}_{-.031}$	125
.575	.738	.575 $^{+.000}_{-.016}$		1.865	2.250	1.865 $^{+.000}_{-.031}$	150

4.6.21 External bending moment. The receptacle shall be mounted as in normal service to a rigid panel. Before mating the plug to the receptacle, a bending moment test arm shall be threaded onto the rear of the plug shell. The fixture shall be of any convenient design for application of the load except it must not provide support for the connector shell in front of the engaged threads (see figure 13). After mating the plug and receptacle, the bending moment listed in table XVII measured from the panel shall be applied. The load shall be applied at a rate of approximately 10 pounds per second until the required load is applied. The load shall then be held for 1 minute (see 3.25).

TABLE XVII. External bending moment.

Shell size	Bending moment (inch pounds)	
	Class D	All other classes
8S	60	40
10S, 10SL	130	90
12S, 12	270	180
14S, 14	300	200
16S, 16	370	250
18	420	280
20	450	300
22	520	350
24	570	380
28	630	420
32	750	500
36	810	540
40	870	580
44	930	620
48	990	660

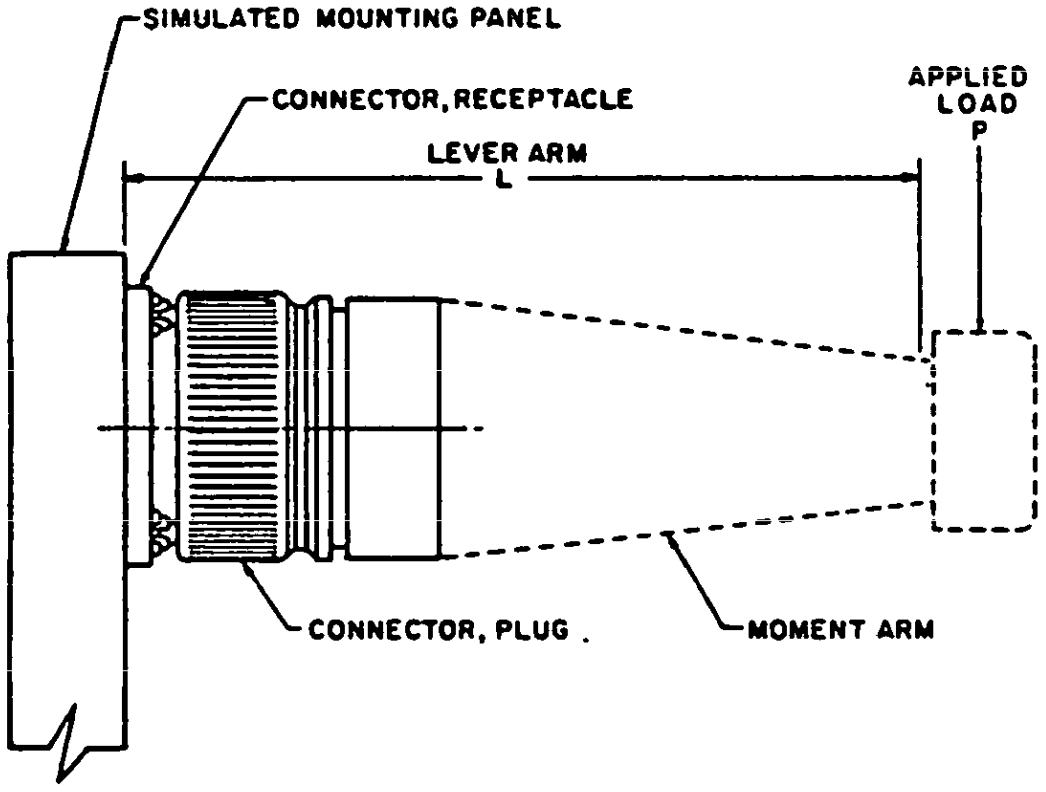


FIGURE 13. External bending moment test setup.

4.6.22 Contact engagement and separation forces. Socket contacts shall be tested in accordance with the contact engagement and separation force test of MIL-C-23216. Contacts may be tested installed in the connector inserts (see 3.26).

4.6.23 Resistance to probe damage (size 16 only). Socket contacts shall be tested in accordance with the probe damage test of MIL-C-23216. Solder contacts may be tested installed in the connector (see 3.27).

4.6.24 Shell conductivity (crimp connectors). The dc resistance of the wired, mated, assembled connectors shall be measured from a point on the rear accessory thread of the plug to the mounting flange of the receptacle. The point of measurement on the square flange receptacle shall be adjacent to the mounting holes and adjacent to the "O" ring on the front or mounting side of the flange for the single hole mount receptacle. The dc resistance shall not exceed the values specified in 3.28 when measured by the voltmeter-ammeter method. The applied potential shall be 1-1/2 volts dc maximum. A resistance shall be inserted in the circuit to limit the current to .100 +.010 amperes. Probes with spherical ends of .05 inch minimum radius shall be used to make the voltage measurements on the connectors. The probes shall not puncture or otherwise damage the connector finish (see 3.28).

4.6.25 Contact insertion and removal force (crimp contact connectors). With the grommet relaxed, a minimum of 20 percent, but not less than three of the contacts shall be removed and reinserted using the applicable tools specified in 3.4.1.2.1 or 3.4.1.2.2. The forces required to insert and remove the unlocked contacts shall be measured. Counterpart connectors shall be mated and unmated 10 times. The same contacts shall then be removed and reinserted nine more times. The contact insertion and removal forces shall be measured on the ninth cycle of half, but not less than three of the contacts selected for this test (see 3.29).

4.6.26 Altitude immersion (except classes H and K) (see 3.30). Mated connectors shall be tested in accordance with method 1004 of MIL-STD-1344. The following details shall apply:

a. All wire ends shall be located within the chamber and exposed to the chamber atmosphere, but not submerged or sealed.
b. At the end of the third cycle while the mated connectors are still submerged in the solution, the insulation resistance shall be measured as specified in 4.6.14.1 and the dielectric withstanding voltage test shall be performed as specified in 4.6.7.1.
c. Paragraphs 4.4 and 5(e) of method 1004 shall not apply.

4.6.27 Random vibration (see 3.31). Wired, mated connectors shall be subjected to method 214 of MIL-STD-202. The following details shall apply:

a. The connector shall be mounted on the table by normal means.
b. Test condition II - Letter J.
c. The duration of test shall be 8 hours in the longitudinal direction and 8 hours in the perpendicular direction.
d. All contacts shall be wired in a series circuit and 100 to 150 milliamperes shall be caused to flow during vibration.

5. PACKAGING

5.1 Packaging requirements. The packaging requirements for these connectors shall be in accordance with MIL-C-55330. In addition, unless otherwise specified in the contract or purchase order (see 6.2), one installing-removal tool for each contact size in each MS3450 series (rear release) connector (see 3.4.1.2.2) shall be placed in a transparent envelope and enclosed within the unit package.

6. NOTES

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

a. MS3100, MS3400, and MS3450 are receptacles intended for wall or bulkhead mounting and for use with conduit or cable clamp.
b. MS3101, MS3401, and MS3451 are receptacles intended for use at the end of a cable where mounting provisions are not required.
c. MS3102, MS3402, and MS3452 are receptacles intended for mounting on shielding boxes and equipment cases. They have no fittings and are for use with open wiring.
d. MS3404, MS3412, and MS3454 are receptacles intended for wall or bulkhead mounting and for use with conduit or a cable clamp.
e. MS3106, MS3406, MS3409, and MS3456 are plugs intended for use at the end of a cable to be mated with a receptacle.
f. MS3107 is a plug intended for use at the end of a cable which may require rapid disconnect from a receptacle.
g. MS3108 and MS3408 are 90° plugs intended for use at the end of a cable where space does not permit the use of a straight plug.
h. MS3103 is a receptacle intended for use in applications where a potted seal around wires is required.
i. MS25183 is a plug intended for use in applications where a potted seal around wires is required.
j. MS3459 is a plug with a self-locking coupling nut which is designed for firewall applications.
k. Class A connectors are solid shell connectors intended for nonenvironmental applications.
l. Class B connectors are split shell connectors intended for nonenvironmental applications. The split shell provides greater accessibility to solder connections, as may be needed if the cable is contained in conduit.
m. Class C receptacles are intended for use on the walls and bulkheads of pressurized compartments and on the cases of pressurized equipments. They will limit air leakage to the amount specified by 3.9.1, regardless of the type and class of plug mated with them.
n. Class D connectors are intended for use where the connectors will be subjected to high-impact shock conditions beyond the capabilities of the other class connectors. These connectors have crimp contacts which are removed from the front of the connector and a wire sealing range capable of sealing on Naval shipboard cable. These connectors also have a specified shell conductivity.
o. Class E connectors are inactive for new design.
p. Classes D, F, L, P, R, U, and W connectors are intended for use where the connector will be subject to heavy condensation and rapid changes in temperature or pressure, and where the connector is subject to high vibratory conditions. To ensure proper performance, a class D, F, L, P, R, U, or W connector plug must always be mated to a class D, F, L, P, R, U, or W receptacle. A type MS3102 (F and R), MS3402 (D, L, U, and W), or MS3412 (D, L, U, and W) receptacle does not provide moisture or vibration protection at its back end, and a type MS3100 (F and R), or MS3400 (D, L, U, and

W) should be used if such protection is desirable. Class F and F receptacles are intended for use on the walls and bulkheads of pressurized compartments and on the cases of pressurized equipments. They limit air leakage to the amount specified in 3.9.1 regardless of the type and class of plug mated to them. Potting form for class P connectors should remain with the connector after potting.

q. Class H receptacles are intended for use on hermetically sealed devices and their performance requirements are determined by the particular application. They should maintain the degree of seal required by the equipment specification and be suitable for mating with plugs conforming to the requirements of this specification.

r. Class J connectors are intended for use with unarmored single jacketed cable. A waterproof seal on the cable jacket is provided at the rear of the connector. The connector will meet all class R performance requirements when appropriate cable is installed in the back end.

s. Class K connectors are intended for use where it is necessary to maintain electrical continuity for a limited time even though the connector is subjected to continuous flame. To ensure such continuity, both receptacle and mated plug must be class K, and high-temperature wires must be used. If flame integrity only is desired, without the need for electrical continuity, a class K receptacle must be used but the mated plug may be of any type and class.

t. Class L connectors are intended for use where the connector will be subjected to elevated temperature (+175°C) and immersion in fluids listed in table XVIII. These connectors have crimp contacts and are available in both front (MS34XX) and rear (MS345X) release retention systems. These connectors have a specified shell conductivity.

u. Class U connectors are intended for use where the connector will be subject to heavy condensation and rapid changes in temperature or pressure, and where the connector is subject to high vibratory conditions and elevated temperature (+200°C). These connectors have crimp contacts and are available in both front (MS34XX) and rear (MS345X) release retention systems. In addition, these connectors provide partial fluid resistance.

v. Class W connectors are intended for general use where partial fluid resistance is required. These connectors have crimp contacts and are available in both front (MS34XX) and rear (MS345X) release retention systems.

w. Crimp contact connectors should have contacts installed in all positions when the connector is wired. Sealing plugs should be installed in the grommet holes when no wire is attached to the contact in grommet sealed connectors.

x. Counterpart solder and crimp contact connectors are intended to be intermateable. Moisture resistance capability is then reduced to that of the solder contact connectors.

y. If air leakage requirements are critical, a resilient insert receptacle or class H receptacle should be used or the connector should be potted.

6.1.1 Wire sizes to be used with contacts. It is intended that size 12 wire be crimped or soldered to at least a size 12 contact; and size 6 wire should be crimped or soldered to a size 4 contact because no size 6 contacts are provided and size 4 is the next larger. Except for class K connectors, satisfactory performance of connectors will be obtained if wire sizes are governed by table II. For wire diameters less than specified in table II, shrink-fit sleeving should be used over the wire. Where two or more wires are used in a solder cup or wire barrel, moisture sealing is not obtainable. Wires should be potted if seal is required. Electrically conductive bushings as provided for in MS3348 should be used in crimping sizes 10, 6, and 2 wire in contact sizes 8, 4, and 0 respectively.

6.2 Ordering data. Procurement documents should specify:

a. Title, number, and date of this specification.
b. Title, number, and date of the applicable MS standard and the complete part number.
c. For indirect shipment, these connectors may be furnished without contacts or grommet sealing plugs (see 3.4.1, and 3.4.6.6).

6.2.1 Accessory hardware. Accessory hardware, such as dust covers or mounting hardware especially designed for use with the crimp type contact connectors is shown on separate drawings.

6.2.2 Crimp contacts. Crimp contacts may be ordered in bulk in accordance with MIL-C-23216.

6.2.3 Solder contacts. Solder contacts are not to be ordered or qualified separately from the connectors.

6.2.4 Connector part numbers. The following applies to connector part numbers:

a. Part numbers should be in accordance with the detail document covering individual connectors (see 3.1 and supplement 1).

6.2.5 Interchangeability of MS and AN marked connectors. Connectors covered by the MS standards and AN aeronautical standard drawings and part numbers as described in 6.1 are interchangeable. Connectors bearing an MS part number may replace an AN marked connector of any modification marking, if all other identifying symbols are identical.

6.2.6 Interchangeability with pin contacts. Connectors with pin contacts bearing MS part numbers are interchangeable with connectors bearing AN part numbers, if all other portions of the part number are identical. The presence or absence of a modification letter in either type or marking has no bearing on the interchangeability of pin contact connectors.

6.2.7 Interchangeability with socket contacts. Connectors containing socket contacts and marked with an MS part number are interchangeable with connectors marked with an AN or MS part number with the same remaining identification symbol regardless of the presence of the modification letter (C). Connectors marked with AN part number but bearing no modification letter (C) shall not be used as replacement of parts for AN connectors with the modification letter (C) or with MS marked connectors unless it can be established and certified that such parts are capable of passing applicable resistance to probe damage (see 4.6.23).

AN3102-S (C) interchangeable with MS3102-S
AN3106-S (C) interchangeable with MS3106-S

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in the applicable qualified products list (QPL), 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 list is the Naval Air Systems Command, Department of the Navy, Engineering Division Code AIR-52021, Washington D.C. 20361. Information pertaining to qualification of products may be obtained from either the Naval Air Systems Command or Naval Weapons Support Center, Attn: Code 3074, Crane, Indiana 47522, agent for administration of the qualified products

list. Application for qualification tests shall be made in accordance with "Provisions Governing Qualification" (see 6.3.1).

6.3.1 Copies of "Provisions Governing Qualification" may be obtained upon application to Commanding Officer, Naval Publication and Forms Center, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

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

6.5 Working voltage. The maximum recommended sea level working voltage is shown in table XXI.

TABLE XXI. Working voltages.

Service rating	Working voltages (volts - rms)
Inst.	200
A	500
D	900
E	1250
B	1750
C	3000

Custodians:
Navy - AS
Army - EL
Air Force - 85

Review activities:
Army - MU, MI
Navy - EC
Air Force - 11, 15, 17, 80
DSA - ES

User activities:
Army -
Navy -
Air Force -

Preparing activity:
Navy - AS

Agent:
DSA - ES

(Project 5935-1990)

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