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Superseding AS50151

Connectors, Electrical, Circular Threaded, AN Type,  
General Specification For

FSC 5935

## RATIONALE

Incorporate Ammendments AS50151-A1 and AS50151-A2 into document.

## 1. SCOPE

## 1.1 Scope

This specification covers circular threaded 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).

## 1.2 Classification

Electrical connectors covered by this specification are divided into the following classes, series, and receptacle styles.

## 1.2.1 Classes

The classes of electrical connectors are as follows:

Class A – Solid shell solder contact connectors

Class B – Split shell solder contact connectors

Class C – Solder contact connectors for use with pressurized equipment

Class D – Crimp and solder contact connectors for use in high-impact shock conditions

Class DJ – Crimp contact connectors with backshell connector assembly for use in high impact shock conditions

Class E – Environment resistant solder contact connectors

Class F – Environment resistant solder contact connectors, with clamp

Class H – Hermetic solder contact connectors

Class K – Crimp and solder firewall connectors

Class L – Fluid resistant crimp contact connectors

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- Class P – Environment resistant potted solder contact connectors
- Class R – Crimp and solder contact connector with grommet seal without clamp
- Class U – Fluid resistant crimp contact connectors
- Class W – General purpose crimp contact connectors

### 1.2.2 Series

The series of electrical connectors are as follows:

- Series I – Solder contact connectors
- Series II – Front release, crimp contact connectors
- Series III – Rear release, crimp contact connectors
- Series IV – Connector accessories

### 1.2.3 Receptacle Styles

The receptacle styles of electrical connectors are as follows:

Flange (box or wall)

Jam nut

Cable connecting

Solder mounting

## 2. APPLICABLE DOCUMENTS

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of the other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

### 2.1 General

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

## 2.2 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), [www.sae.org](http://www.sae.org).

AIR1351	Manufacturers' Identification of Aerospace Electrical and Electronic Wiring Devices and Accessories
AMS-QQ-P-416	Plating, Cadmium (Electrodeposited). (DoD Adopted)
AMS-QQ-S-763	Steel, Corrosion Resistant, Bars, Wire, Shapes, and Forgings
AS22759	Wire, Electrical, Fluoropolymer-Insulated, Copper Or Copper Alloy. (DoD Adopted)
AS31091	Boots, Heat-Shrinkable, Strain-Relief, Straight
AS31551	Connector, Electric, Rear Accessory Design Standard. (Inactive for new design)
AS31971	Gage Pin for Socket Contact Engagement Test
AS34021	Connector, Receptacle, Electric, Box Mounting, Front Release, Crimp Contact, AN Type with
AS34121	Connectors, Receptacle, Electric, Wall Mounting, Front Release, Crimp Contact, AN Type - with Accessory Threads
AS34591	Connectors, Plug, Electrical, Self-Locking, Coupling Nut, Rear Release, Crimp Contact, AN Type
AS39029	Contacts, Electrical Connector, General Specification For. (DoD Adopted)
AS39029/29	Contacts, Electrical Connector, Pin, Crimp Removable (For MIL-C-5015 Series AS34501 And MIL-C-83723 Series 2 Connectors). (DoD Adopted)
AS39029/30	Contacts, Electrical Connector, Socket, Crimp Removable (For MIL-C-83723 Series II Connectors). (DoD Adopted)
AS39029/44	Contacts, Electrical Connector, Pin, Crimp Removable (For MIL-C-5015 Series AS34001 Connectors). (DoD Adopted)
AS39029/45	Contacts, Electrical Connector, Socket, Crimp Removable (For MIL-C-5015 Series AS34001 Connectors). (DoD Adopted)
AS85049	Connector Accessories, Electrical, General Specification For. (DoD Adopted)
AS85049/11	Connector Accessories, Electrical, Backshell, Environmental, Cable Sealing, Straight, Category 1A (For MIL-C-5015 Crimp, MIL-C-26482 Series 2, MIL-C-81703 Series 3, And MIL-C-83723 Series III Connectors) (DoD Adopted)
AS85049/52	Connector Accessories, Electrical, Strain Relief, Non-Environmental, Selflocking And Non Self-Locking, Straight, Category 4B (For MIL-C-5015 Crimp, MIL-C-26482 Series 2, MIL-C-81703 Series 3, And MIL-C-81723 Series III Connectors) (DoD Adopted)

## 2.2.1 Connectors, Solder Contact \*

AS31001	Connector, Receptacle, Electric Wall Mounting, Solder Contacts, AN Type. (Inactive for new design)
AS31011	Connector, Plug, Electric, Cable Connecting, Solder Contacts, AN Type. (Inactive for new design)
AS31021	Connector, Receptacle, Electric, Box Mounting, Solder Contacts, AN Type. (Inactive for new design)
AS31031	Connector, Receptacle, Electric, Potting Seal, Solder Contacts, AN Type. (Inactive for new design)
AS31061	Connector, Plug, Electrical, Straight, Solder Contacts, AN Type. (Inactive for new design)
AS31071	Connector, Plug Electric, Quick Disconnect. (Inactive for new design)
AS31081	Connectors, Plug, Electric, Solder Contact, 90 Degree, AN Type. (Inactive for new design)
AS31421	Connector, Receptacle, Electrical, Box Mounting, Solder Contact, Hermetic, AN Type. (Inactive for new design)
AS34361	Connector, Plug, Electric, Solder Contact, Utility. (Inactive for new design)
AS34411	Connector, Plug, Electric, Utility. (Inactive for new design)
AS35071	Connector, Plug, Electric, Solder Contact, Quick Disconnect, Utility.
AS25183	Connector, Plug Electric, Potting Seal, Solder Contacts, AN Type. (Inactive for new design)

## 2.2.2 Connectors, Crimp Contact, Front Release\*

AS34001	Connectors, Receptacle, Electric, Wall Mounting, Front Release, Crimp Contact, AN Type. (Inactive for new design)
AS34011	Connectors, Receptacle, Electric, Cable Connecting, Front Release, Crimp Contact, AN Type. (Inactive for new design)
AS34021	Connector, Receptacle, Electric, Box Mounting, Front Release, Crimp Contact, AN Type with. (Inactive for new design)
AS34041	Connectors, Receptacle, Electric, Jam Nut Mounting, Front Release, Crimp Contact, AN Type. (Inactive for new design)
AS34061	Connectors, Plug, Electric, Front Release, Crimp Contact AN Type. (Inactive for new design)
AS34081	Connector, Plug, Electric, 90 Degree Assembly, Crimp Contact, AN Type.
AS34091	Connectors, Plug, Electric, 45 Degrees Assembly, Crimp Contact, AN Type.
AS34121	Connectors, Receptacle, Electric, Wall Mounting, Front Release, Crimp Contact, AN Type-With Accessory Threads.

### 2.2.3 Connectors, Crimp Contact, Rear Release\*

- AS34501 Connector, Receptacle, Electric, Wall Mounting, Rear Release, Crimp Contact, AN Type.
- AS34511 Connector, Receptacle, Electrical, Cable Connecting, Rear Release, Crimp Contact, AN Type. (Inactive for new design)
- AS34521 Connector, Receptacle, Electric, Box Mounting, Rear Release, Crimp Contact, AN Type with.
- AS34541 Connectors, Receptacle, Electrical, Jam Nut Mounting, Rear Release, Crimp Contact, AN Type.
- AS34561 Connectors, Plug, Electrical, Rear Release, Crimp Contact, AN Type.

### 2.2.4 Connector Accessories\*

- AS31051 Connector, Receptacle, Electric Dummy Stowage. (Inactive for new design)
- AS25042 Cover, Electrical Connector; Plug, AN Type.
- AS25043 Cover, Electrical Connector, Receptacle, AN Type.

\* SAE AS50151 detail specification

## 2.3 U.S. Government Publications

Available from the Document Automation and production Service (DAPS), Building 4/D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-6257, <http://assist.daps.dla.mil/quicksearch/>.

### 2.3.1 Specifications and Standards

The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, these documents are listed in the Department of Defense ASSIST database: <https://assist.daps.dla.mil/quicksearch/>.

#### 2.3.1.1 SPECIFICATIONS

##### 2.3.1.1.1 FEDERAL

L-P-410 Plastic, Polyamide (Nylon), Rigid, Rods, Tubes, Flats, Molded and Cast Parts.

##### 2.3.1.1.2 DEPARTMENT OF DEFENSE

- 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-PRF-5606 Hydraulic Fluid, Petroleum Base; Aircraft, Missile, and Ordnance. (Inactive for new design)
- MIL-S-7742 Screw Threads, Standard, Optimum Selected Series: General Specification for. (Inactive for new design)
- MIL-PRF-7808 Lubricating Oil, Aircraft Turbine Engine, Synthetic Base.
- MIL-PRF-8516 Sealing Compound, Synthetic Rubber, Electric Connectors and Electric Systems, Chemically Cured.
- MIL-W-16878 Wire, Electrical, Insulated, General Specification for.

MIL-DTL-22520	Crimping Tools, Terminal, General Specification for.
MIL-PRF-23586	Sealing Compound (With Accelerator), Silicone Rubber, Electrical.
MIL-W-25038	Wire, Electrical, High Temperature, Fire Resistant, and Flight Critical, General Specification for.
MIL-DTL-81381	Wire, Electric, Polyamide-Insulated, Copper or Copper Alloy.
MIL-I-81969/14	Installing and Removal Tools, Connector, Electrical Contact, Type III, Class 2, Composition B.
MIL-I-81969/15	Installing and Removal Tools, Connector, Electrical Contact, Type II, Class 2, Composition A.
MIL-I-81969/17	Installing and Removal Tools, Connectors, Electrical Contact, Type I, Class 1, Composition C.
MIL-I-81969/19	Installing and Removal Tools, Connector, Electrical Contact, Type II, Class 1, Composition C.
MS3187	Plug, End Seal, For MIL-C-26482, MIL-C-5015, MIL-C-81703, and MIL-C-83723 Electrical Connectors (Inactive for New Design)
MS27488	Plug, End Seal, Electrical Connector
MS28900	Packing, Preformed, For Electrical Use. (Inactive for new design)
MS33678	Connector, Receptacle, Electric, Integral Mounting
MS33695	Contacts, Video Coaxial Connector.
MS90376	Cap, Dust, Plastic, Electric Connector.

### 2.3.1.2 STANDARDS

#### 2.3.1.2.1 FEDERAL

FED-STD-H28 Screw-Thread Standards for Federal Services.

#### 2.3.1.2.2 DEPARTMENT OF DEFENSE

MIL-STD-167-1 Mechanical Vibrations of Shipboard Equipment (Type I-Environmental and Type II-Internally Excited).

MIL-STD-1285 Marking of Electrical and Electronic Parts.

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.

### 2.4 Non-Government Publications

The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of the documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

#### 2.4.1 ANSI Publications

Available from American national Standards Institute, 25 West 43<sup>rd</sup> Street, New York, NY 10036-8002, Tel: 212-642-4900, [www.ansi.org](http://www.ansi.org).

ANSI-Z540.1 Laboratories, Calibration, and Measuring and Test Equipment

#### 2.4.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, [www.astm.org](http://www.astm.org).

- ASTM-B85 Aluminum-Alloy Die Castings. (DoD adopted)
- ASTM-A342 Materials, Feebly Magnetic, Permeability of. (DoD adopted)
- ASTM-B488 Gold for Engineering Uses, Electrodeposited Coatings of. (DoD adopted)
- ASTM-A582 Free-Machining Stainless and Heat Resisting Steel Bars. (DoD adopted)
- ASTM-B700 Standard Specification for Electrodeposited Silver for Engineering Use
- ASTM-B733 Metals, Autocatalytic Electroless Nickel-Phosphorus Coating On. (DoD adopted)

#### 2.4.3 EIA Publications

Available from Electronic Industries Alliance, 2500 Wilson Boulevard, Arlington, VA 22201-3834, Tel: 703-907-7500, [www.eia.org](http://www.eia.org).

- EIA-364-02 Air Leakage Test Procedure for Electrical Connectors. (DOD Adopted)
- EIA-364-03 Altitude Immersion Test Procedure for Electrical Connectors. (DOD Adopted)
- EIA-364-05 Contact Insertion, Release and Removal Force Test Procedure for Electrical Connectors. (DOD Adopted)
- EIA-364-06 Contact Resistance Test Procedures for Electrical Connectors. (DOD Adopted)
- EIA-364-09 Durability Test Procedure for Electrical Connectors and Contacts. (DOD Adopted)
- EIA-364-010 Fluid Immersion Test Procedure for Electrical Connectors. (DOD Adopted)
- EIA-364-020 Withstanding Voltage Test Procedure for Electrical Connectors, Sockets and Coaxial Contacts. (DOD Adopted)
- EIA-364-021 Insulation Resistance Test Procedure for Electrical Connectors, Sockets, and Coaxial Contacts. (DOD Adopted)
- EIA-364-025 Probe Damage Test Procedure for Electrical Connectors. (DOD Adopted)
- EIA-364-026 Salt Spray Test Procedure for Electrical Connectors, Contact and Sockets. (DOD Adopted)
- EIA-364-027 Mechanical Shock (Specified Pulse) Test Procedure for Electrical Connectors. (DOD Adopted)
- EIA-364-028 Vibration Test Procedure for Electrical Connectors and Sockets. (DOD Adopted)
- EIA-364-029 Contact Retention Test Procedure for Electrical Connectors. (DOD Adopted)

EIA-364-031	Humidity Test Procedure for Electrical Connectors and Sockets. (DOD Adopted)
EIA-364-032	Thermal Shock (Temperature Cycling) Test Procedure for Electrical Connectors and Sockets. (DOD Adopted)
EIA-364-035	Insert Retention Test Procedure for Electrical Connectors. (DOD Adopted)
EIA-364-037	Contact Engagement and Separation Force Test Procedure for Electrical Connectors. (DOD Adopted)
EIA-364-045	Firewall Flame Test Procedure for Electrical Connectors. (DOD Adopted)
EIA-364-083	Shell To Shell and Shell-To-Bulkhead Resistance Test Procedure for Electrical Connectors. (DOD Adopted)

#### 2.4.4 IPC - ASSOCIATION CONNECTING ELECTRONICS INDUSTRIES

Available from IPC, 3000 Lakeside Drive, Bannockburn, IL 60015, Tel: 847-597-2862, [www.ipc.org](http://www.ipc.org).

J-STD-001	Requirements for Soldered Electrical and Electronic Assemblies
J-STD-006	Electronic Grade Solder Alloys and Fluxed and Non-Fluxed Solid Solders for Electronic Soldering Applications Requirements For.

#### 2.5 Order of Precedence

In the event of a conflict between the text of this document and the references cited herein (except for related associated specifications, or MS sheets), the text of this document shall take precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

### 3. REQUIREMENTS

#### 3.1 MS Sheets

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

#### 3.2 Qualification

The connectors furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.3 and 6.14).

#### 3.3 Materials

##### 3.3.1 Dissimilar Metals

When dissimilar metals are employed in contact with each other in a connector or in a mated pair of connectors, protection against galvanic corrosion shall be provided (see 6.17).

##### 3.3.2 Nonmagnetic Materials (except class H and K connectors)

All parts shall be made of materials which are classed as nonmagnetic except for classes H and K connectors (see 1.2 and 3.6).

### 3.3.3 Contacts

#### 3.3.3.1 Contact Materials

Contacts shall be made of conductive materials. Thermocouple contacts shall be made of a material compatible with the thermocouple wire to which attachment is intended (see 6.16).

#### 3.3.3.2 Contact Plating

##### 3.3.3.2.1 Contact Plating (solder type, except class H)

Contacts shall be silver plated in accordance with ASTM-B700 or gold plated in accordance with ASTM-B488 over silver plating in accordance with ASTM-B700. The resultant minimum thickness of contact plating shall be 100 micro-inches. Accessory members of the socket contacts need not be plated but shall meet the requirements for dissimilar metals specified in 3.3.1.

##### 3.3.3.2.2 Contact Plating (class H connectors)

Contacts shall be gold plated to a thickness of not less than 50 microinches in accordance with ASTM-B488, type 3, code C, over an underplate approved by the qualifying activity (see 6.14). A silver underplate shall not be used.

##### 3.3.3.2.3 Contact Plating (thermocouple)

Thermocouple contacts shall be cadmium plated in accordance with SAE AMS-QQ-P-416, or otherwise protected from corrosion. Accessory members of the socket contacts need not be plated, but shall meet 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 dielectric having hardness, electrical, and mechanical characteristics capable of meeting the requirements of this specification.

##### 3.3.4.1.1 Connectors (except solder contact class A, B, C, H, K, and P)

The mating faces of pin 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 and rear release style P connectors the Shore A Durometer range shall be 35 to 85 with a thickness of not less than 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 pin 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-PRF-8516 or MIL-PRF-23586 potting material without treatment by the user.

### 3.3.6 Shells, Coupling Rings, and Backshells

- a. Connector shells and coupling rings, except for class D, H, and K, shall be made of aluminum alloys. Die castings, if used, shall conform to ASTM-B85, composition number GPASC84B.
- b. Class D shells and coupling rings shall be made of a heat treated wrought aluminum alloy meeting the requirements of this specification.
- c. Class H and K shells and coupling rings shall be made of ferrous alloy.
- d. Class H, K, L, and U shells and coupling rings shall be made of non-magnetic corrosion-resistant steel in accordance with SAE AMS-QQ-S-763, 300 series, or ASTM-A582, type XM-1 or 303. Class D and DJ shells and coupling rings shall be made of non-magnetic corrosion resistant steel in accordance with SAE AMS-QQ-S-763, series 316 class.
- e. Backshells shall be fabricated and finished with the same materials as the connectors.

#### 3.3.6.1 Finish

The resultant finish on all connectors shall be electrically conductive.

#### WARNING

This document includes cadmium as a plating material. The use of cadmium has been restricted and/or banned for use in many countries due to environmental and health concerns. The user should consult with local officials on applicable health and environmental regulations regarding its use.

- a. The finish of class A, B, C, E, F, P, and R connectors with aluminum alloy shells, coupling rings and external screws shall be cadmium plated in accordance with SAE AMS-QQ-P-416, type II, and class 3. A preliminary plating of another metal is permissible. The resultant finish on cadmium plate connectors shall be olive drab (light to dark). Stainless steel in accordance with SAE AMS-QQ-S-763 is an acceptable alternative for external screws.
- b. The finish of class D connectors with wrought aluminum shells and coupling rings, class W connectors with aluminum alloy shells and coupling rings, and external screws for these classes shall be cadmium plated in accordance with SAE AMS-QQ-P-416, type II, and class 3 over nickel. The resultant finish on cadmium plated connectors shall be olive drab (light to dark). Stainless steel in accordance with SAE AMS-QQ-S-763 is an acceptable alternative for external screws.
- c. The finish of class H connectors with ferrous alloy shells and coupling rings, series II and series III class K connectors with ferrous alloy shells and coupling rings, and external screws shall be electroless nickel in accordance with ASTM-B733, class 3 or 4. A preliminary plating of another metal is permissible. Stainless steel in accordance with SAE AMS-QQ-S-763 is an acceptable alternative for external screws.
- d. The finish of series I class K connectors with ferrous alloy shells and coupling rings, series II and III class KT connectors with ferrous alloy shells and coupling rings, and external screws for these classes shall be cadmium plate in accordance with SAE AMS-QQ-P-416, type II, and class 3. The resultant finish on cadmium plated connectors shall be olive drab (light to dark). Stainless steel in accordance with SAE AMS-QQ-S-763 is an acceptable alternate plating for external screws.
- e. The finish of class DS connectors with corrosion-resistant steel shells and coupling rings shall be cadmium plate in accordance with SAE AMS-QQ-P-416, type II, class 3, and color -black. All other classes of connectors with corrosion-resistant steel shells and coupling rings shall be passivated.
- f. The finish of class HT connectors with ferrous alloy shells and coupling rings, and external screws shall be electrically conductive fused tin. Stainless steel in accordance with SAE AMS-QQ-S-763 is an acceptable alternate plating for external screws.
- g. The finish of class L and U connectors with aluminum alloy shells and coupling rings, and external screws shall be electroless nickel in accordance with ASTM-B733, class 3 or 4. Stainless steel in accordance with SAE AMS-QQ-S-763 is an acceptable alternative for external screws.

### 3.4 Design and Construction

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

Crimp contact connectors, black end configuration except AS34021, AS34121, AS34521, SAE AS34021, and SAE AS34121	Figure 1
Connector, front release, series II interface dimensions	Figures 2 and 3
Connector, rear release series III, and hermetic, interface dimensions	Figure 4, 5, and 6
Connector solder contact (pin and socket) series I configuration	Figure 7
Accessories to be used with series II and series III connectors	SAE AS85049

#### 3.4.1 Contacts

Contacts shall conform to SAE AS39029 except as otherwise required herein for solder contact connectors. Contacts shall be designed so that neither the pin nor socket contacts are damaged during mating of counterpart connectors. The quantity of crimp contacts required for the connector 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 sizes 8, 4, and 0 contacts. For other than direct shipments to the Government, crimp contact connectors are permitted to be ordered without contacts (see 6.2).

##### 3.4.1.1 Solder Contacts

Solder contacts shall conform to Figure 7.

##### 3.4.1.1.1 Mating End

The entering end of socket contacts shall be rounded or chamfered to allow for misalignment 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 4.6.22). Use of designs for solder type pin and socket contacts sizes 0, 4, and 8 which allow contacts to be readily removable from their inserts for soldering to their conductors is permitted.

##### 3.4.1.1.2 Solder Cups

Solder cups shall be designed so that during soldering no components are damaged and no liquid solder escapes. The solder cups shall be as indicated on figure 7. The solder cups of sizes 0, 4, and 8 shall be provided with a venthole or with other 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 J-STD-006, composition Sn60 or better commercial grade. If flux is used, flux residues and contaminants shall be completely removed without effecting the components. No excess solder shall be on the exterior of the solder cup.

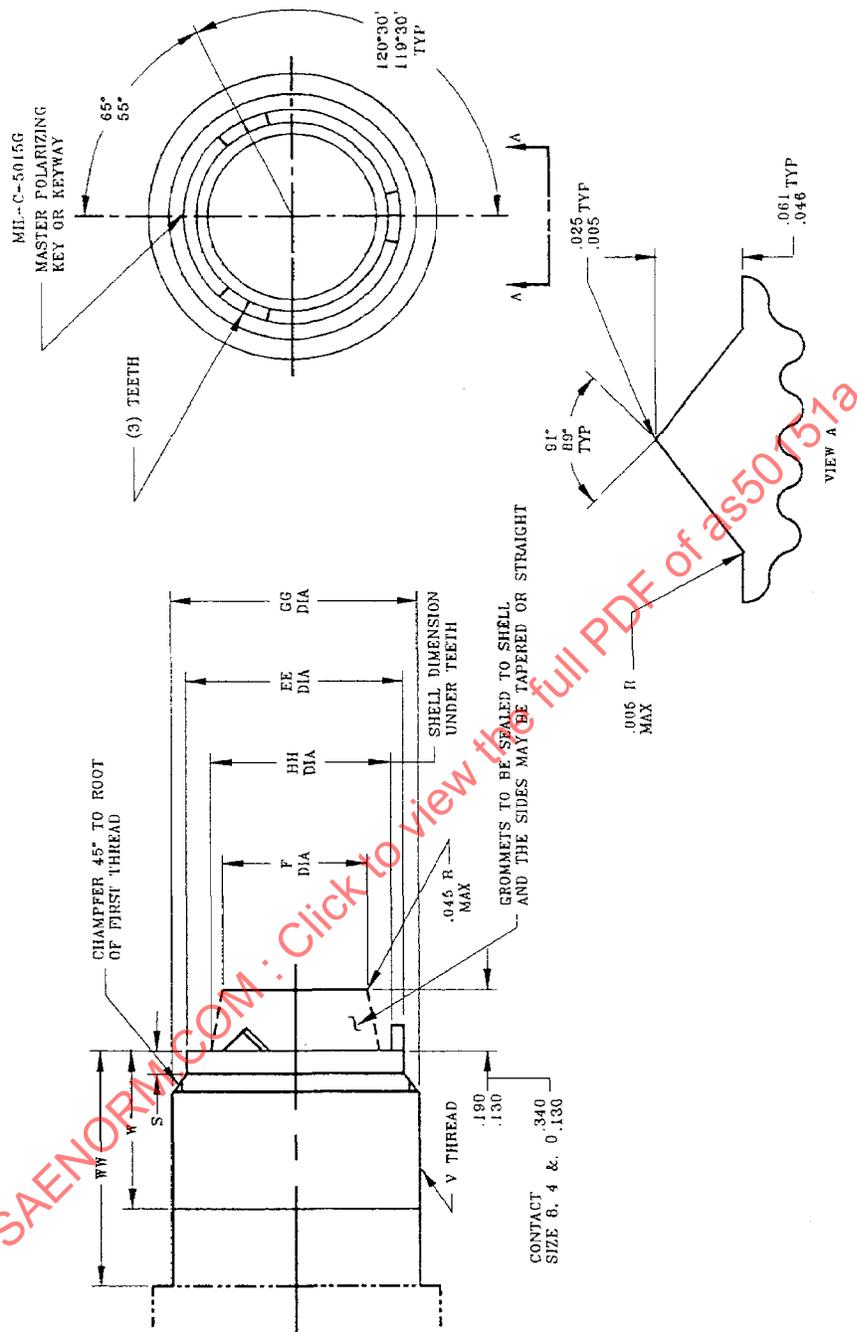


FIGURE 1 - CRIMP CONTACTS CONNECTORS BACK END CONFIGURATION EXCEPT AS34021, AS34121, AS34521, SAE AS34021 AND SAE AS34121

Shell size	V Thread class 2A	EE Dia	F Dia of any exposed portion of the grommet	GG +0.000 -0.010	HH ±0.005	S +0.005	W Min perf thread	WW Min 1/
8S	.500-20 UNF	0.426/0.419	0.275/0.305	0.500	0.368	0.065	0.290	0.310
10S, 10SL	.625-24 UNEF	0.562/0.555	0.380/0.405	0.625	0.502			
12S, 12	.750-20 UNEF	0.679/0.672	0.516/0.549	0.750	0.618			
14, 14S	.875-20 UNEF	0.804/0.797	0.590/0.665	0.875	0.743			
16, 16S	1.000-20 UNEF	0.929/0.922	0.715/0.790	1.000	0.868			
18	1.0625-18 UNEF	0.984/0.977	0.794/0.869	1.062	0.924			
20	1.1875-18 UNEF	1.109/1.102	0.919/0.994	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	0.095	0.467	0.487
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			
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			

1/ Length to accommodate accessories

FIGURE 1 (CONT'D) - CRIMP CONTACT CONNECTORS BACK END CONFIGURATION EXCEPT AS34021, AS34121, AS34521, SAE AS34021 AND SAE AS34121

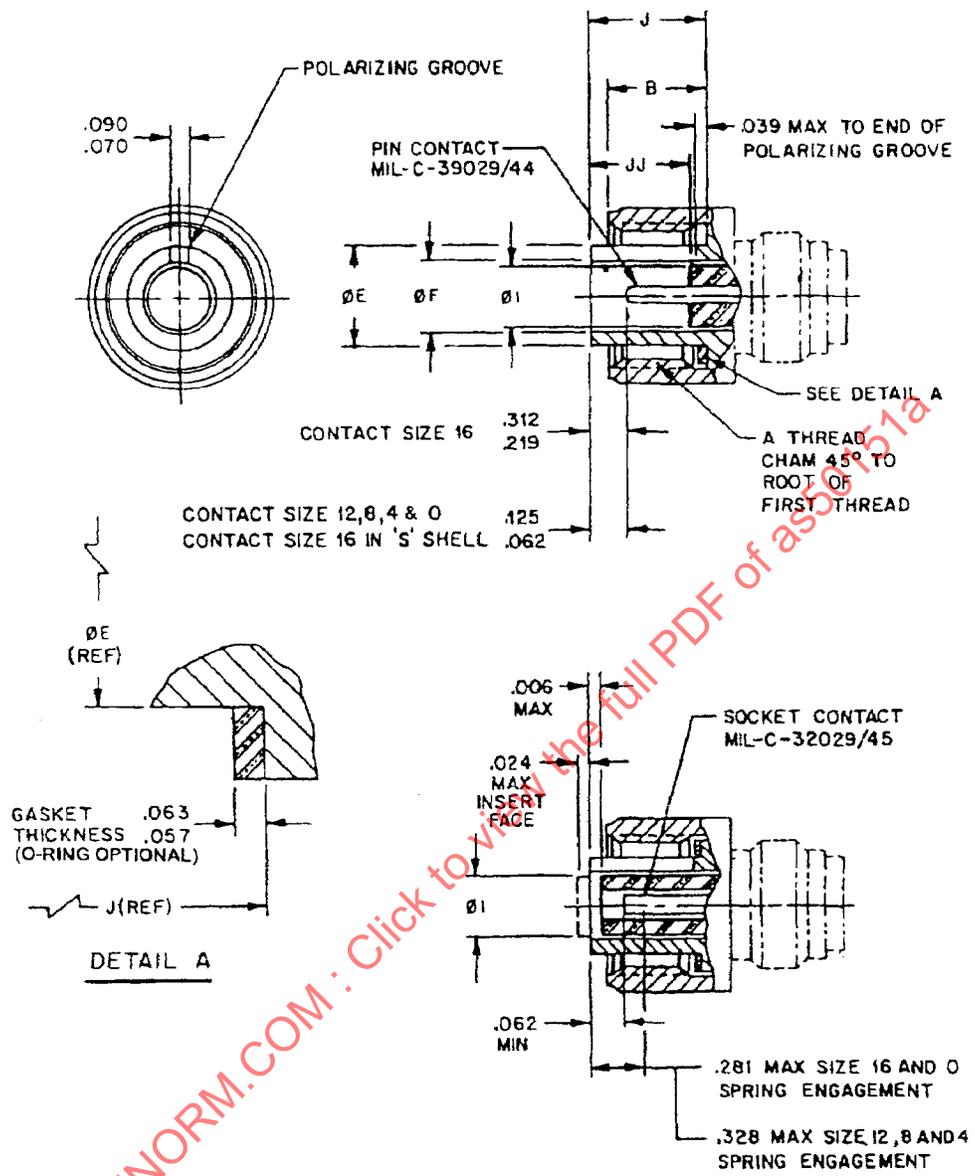
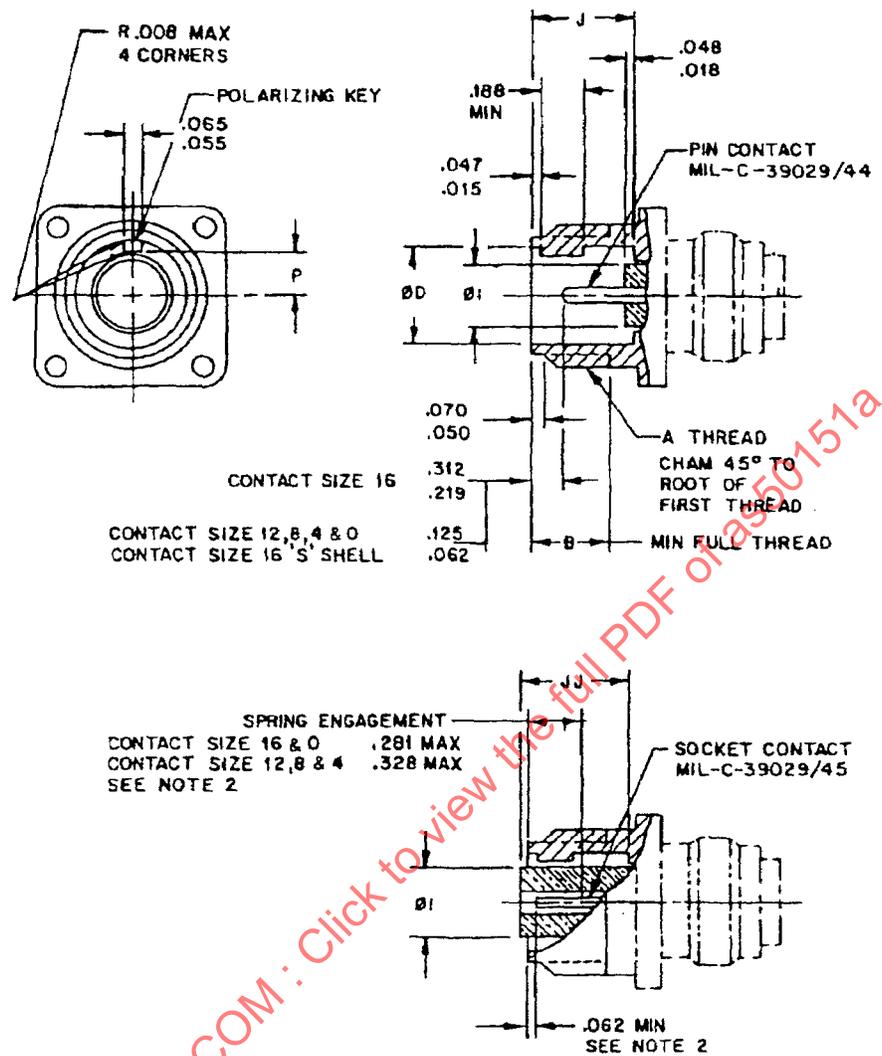


FIGURE 2 - CONNECTOR, PLUG, FRONT RELEASE, SERIES II, INTERFACE DIMENSIONS

Shell size	A Thread class 2B	B Dia +0.000 -0.062	E Dia +0.000 -0.010 <u>1/</u>	F Dia +0.015 -0.000 <u>1/</u>	I +0.000 -0.020	J ±0.005	JJ ±0.015
8S	.500-28 UNEF	0.414	0.365	0.252	0.250	0.570	0.501
10S	.625-24 UNEF		0.440	0.323	0.320		
10SL			0.446	0.398	0.397		
12S	.750-20 UNEF	0.664	0.555	0.450	0.448	0.757	0.689
12							
14S	.875-20 UNEF	0.414	0.675	0.526	0.525	0.570	0.501
14		0.664				0.757	0.689
16S	1.000-20 UNEF	0.414	0.805	0.651	0.650	0.570	0.501
16		0.664				0.757	0.689
18	1.125-18 UNEF		0.930	0.776	0.770		
20	1.250-18 UNEF		1.050	0.932	0.925		
22	1.375-18 UNEF		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 + 0.000, - 0.006 and "F" diameter tolerance is + 0.006, - 0.000.

FIGURE 2 (CONT'D) - CONNECTOR, PLUG, FRONT RELEASE,  
SERIES II, INTERFACE DIMENSIONS



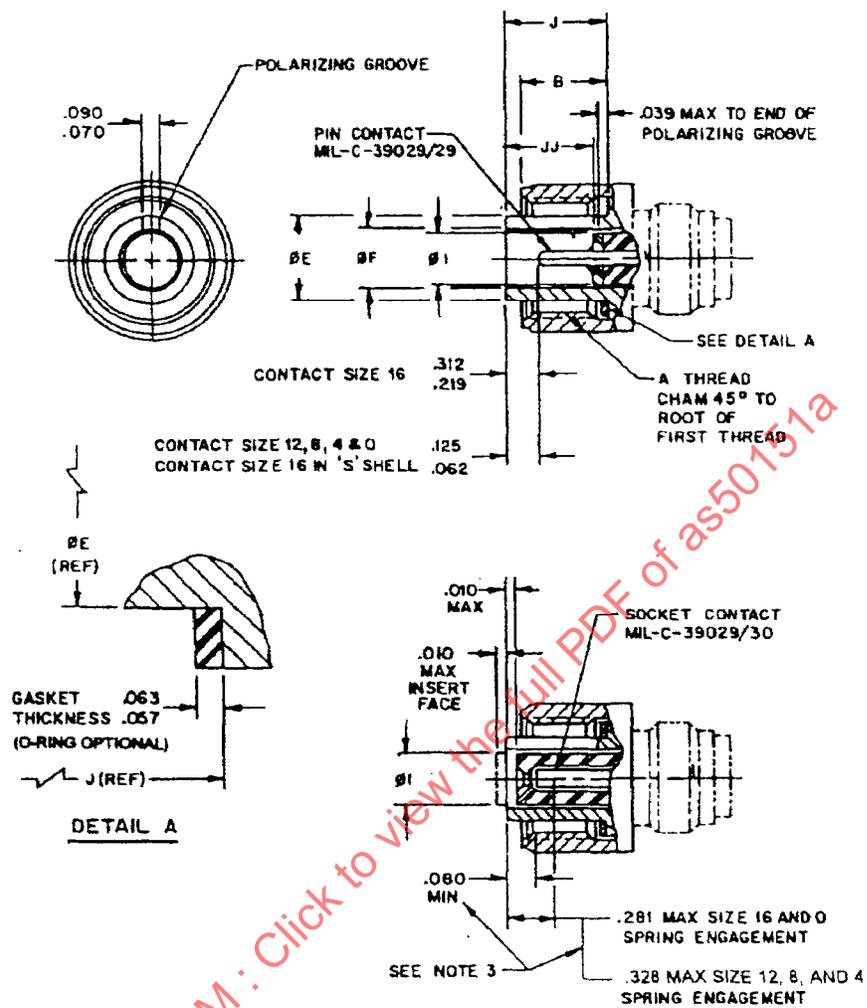
## NOTES:

1. Dimensions are in inches.
2. For contact cavity insert interface dimensions see figure 6.

FIGURE 3 - CONNECTOR, RECEPTACLE, FRONT RELEASE, SERIES II INTERFACE DIMENSIONS

Shell size	A Thread class 2A	B Min thread	D Dia +0.015 -0.000	I Dia +0.000 -0.020	J $\pm 0.005$	JJ $\pm 0.015$	P +0.010 -0.000
8S	.500-28 UNEF	0.375	0.370	0.250	0.536	0.543	0.130
10S	.625-24 UNEF		0.448	0.320			0.165
10SL				0.397			
12	.750-20 UNEF	0.625	0.558	0.448	0.724	0.731	0.224
12S		0.375			0.536	0.543	
14	.875-20 UNEF	0.625	0.678	0.525	0.724	0.731	0.263
14S		0.375			0.536	0.543	
16	1.000-20 UNEF	0.625	0.808	0.650	0.724	0.731	0.325
16S		0.375			0.536	0.543	
18	1.125-18 UNEF	0.625	0.933	0.770	0.724	0.731	0.385
20	1.250-18 UNEF		1.053	0.925			0.463
22	1.375-18 UNEF		1.178	1.020			0.510
24	1.500-18 UNEF		1.303	1.145			0.573
28	1.750-18 UNS		1.523	1.365			0.683
32	2.000-18 UNS		1.773	1.615			0.808
36	2.250-16 UN		1.985	1.830			0.915
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 3 (CONT'D) - CONNECTOR, RECEPTACLE, FRONT RELEASE,  
SERIES II INTERFACE DIMENSIONS



## NOTES:

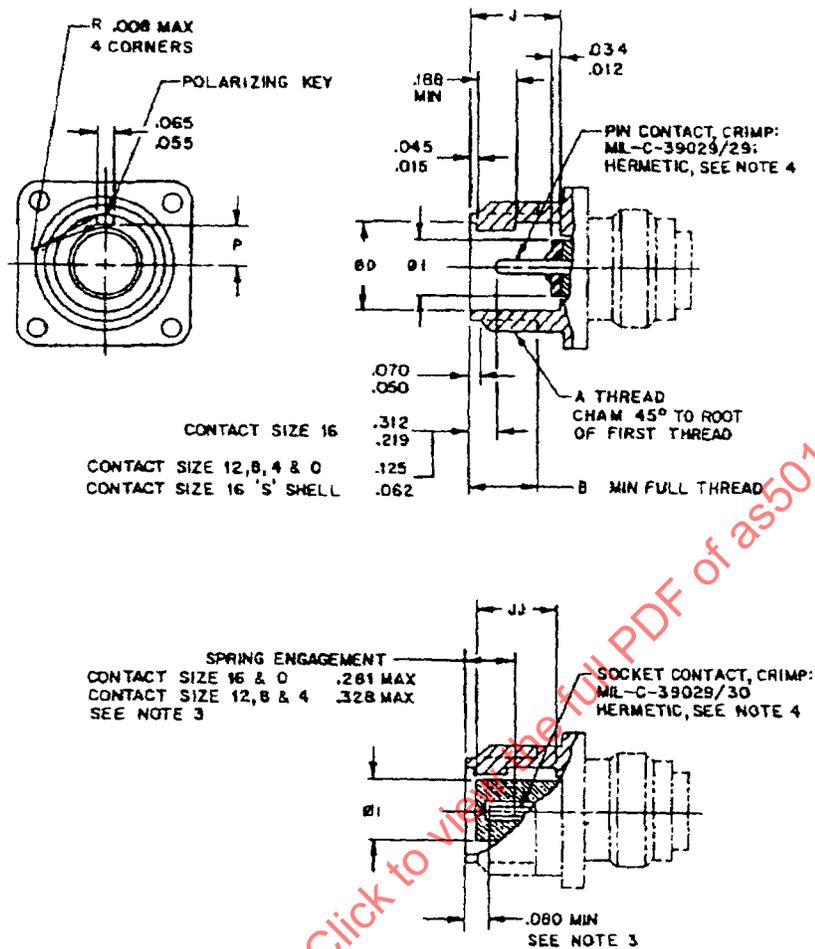
1. Dimensions are in inches.
2. For contact insert interface dimensions see figure 6.
3. Noted dimensions apply with contact fully seated back against contact retaining device.

FIGURE 4 - CONNECTOR, PLUG, REAR RELEASE, SERIES III, INTERFACE DIMENSIONS

Shell size	A Thread class 2B	B Dia +0.000 -0.062	E <u>1</u> / Dia +0.000 -0.010	F <u>1</u> / Dia +0.015 -0.000	I Dia +0.000 -0.020	J ±0.005	JJ ±0.011
8S	.500-28 UNEF	0.414	0.365	0.252	0.250	0.570	0.510
10S	.625-24 UNEF		0.440	0.323	0.320		
10SL			0.446	0.398	0.397		
12S	.750-20 UNEF	0.664	0.555	0.450	0.448	0.757	0.698
12							
14S	.875-20 UNEF	0.414	0.675	0.526	0.525	0.570	0.510
14		0.664				0.757	0.698
16S	1.000-20 UNEF	0.414	0.805	0.651	0.650	0.570	0.501
16		0.664				0.757	0.698
18	1.125-18 UNEF		0.930	0.776	0.770		
20	1.250-18 UNEF		1.050	0.932	0.925		
22	1.375-18 UNEF		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 + 0.000, - 0.006 and "F" diameter tolerance is + 0.006, - 0.000.

FIGURE 4 (CONT'D) - CONNECTOR, PLUG, REAR RELEASE,  
SERIES III INTERFACE DIMENSIONS



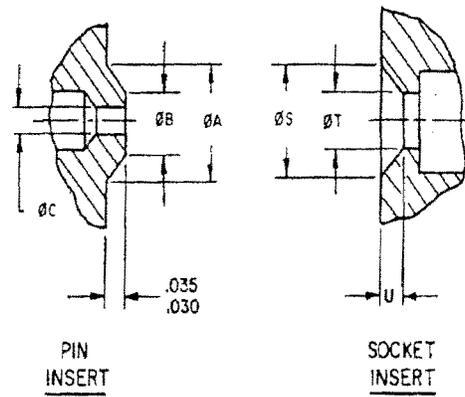
## NOTES:

1. Dimensions are in inches.
2. For contact cavity insert interface dimensions see figure 6.
3. Noted dimensions apply with contact fully seated back against contact retaining device.
4. Hermetic connector contacts shall be fixed solder type contacts with mating end conforming to figure 7 socket or pin detail as required.

FIGURE 5 - CONNECTOR, RECEPTACLE, REAR RELEASE,  
SERIES III AND HERMETIC INTERFACE DIMENSIONS

Shell size	A Thread class 2A	B Min thread	D Dia +0.015 -0.000	I Dia +0.000 -0.020	J ±0.005	JJ ±0.015	P +0.010 -0.000
8S	.500-28 UNEF	0.375	0.370	0.250	0.536	0.533	0.130
10S	.625-24 UNEF		0.448	0.320			0.165
10SL			0.397				
12	.750-20 UNEF	0.625	0.558	0.448	0.724	0.731	0.224
12S		0.375			0.536	0.533	
14	.875-20 UNEF	0.625	0.678	0.525	0.724	0.721	0.263
14S		0.375			0.536	0.533	
16	1.000-20 UNEF	0.625	0.808	0.650	0.724	0.721	0.325
16S		0.375			0.536	0.533	
18	1.125-18 UNEF	0.625	0.933	0.770	0.724	0.721	0.385
20	1.250-18 UNEF		1.053	0.925			0.463
22	1.375-18 UNEF		1.178	1.020			0.510
24	1.500-18 UNEF		1.303	1.145			0.573
28	1.750-18 UNS		1.523	1.365			0.683
32	2.000-18 UNS		1.773	1.615			0.808
36	2.250-16 UN		1.985	1.830			0.915
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 (CONT'D) - CONNECTOR, RECEPTACLE, REAR RELEASE,  
SERIES III AND HERMETIC INTERFACE DIMENSIONS

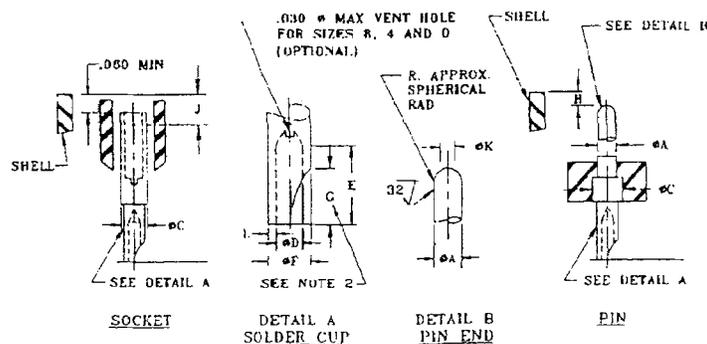


Contact Size	A Dia	B Dia	C Dia	S Dia	T Dia	U
16	0.150	0.135	0.061	0.140	0.079	0.035
	0.140	0.131	0.058	0.130	0.072	0.031
12	0.208	0.188	0.093	0.204	0.111	0.040
	0.198	0.184	0.090	0.193	0.104	0.035
8	0.310	0.270	0.141	0.306	0.159	0.040
	0.300	0.265	0.138	0.295	0.152	0.035
4	0.396	0.355	0.224	0.392	0.262	0.033
	0.386	0.350	0.221	0.381	0.234	0.027
0	0.578	0.537	0.356	0.573	0.414	0.033
	0.568	0.533	0.353	0.563	0.366	0.027

NOTE:

Dimensions are in inches.

FIGURE 6 - CONNECTOR, REAR RELEASE, SERIES III,  
INSERT ENTRY DIMENSIONS



Contact size	A $\pm 0.001$ Dia 1/	C Max Dia 2/	D Min Dia	E $+0.063$ $-0.000$	F Dia Max	H Plug min	H Recpt max	J Max plug and rept 3/	K Dia of flat	L min
16	0.0625	0.127	0.069	0.250	0.116	0.250	0.312	0.281	0.032 max	0.007
16S 4/	0.0625	0.127	0.069	0.250	0.116	0.062	0.125	0.281	0.032 max	0.007
12	0.094	0.190	0.112	0.375	0.154	0.062	0.125	0.375	0.032 max	0.009
8	0.142	0.310	0.205	0.500	0.268	0.062	0.125	0.375	0.032 max	0.017
4	0.225	0.441	0.328	0.625	0.398	0.062	0.125	0.375	0.105 $\pm 0.021$	0.021
0	0.357	0.597	0.464	0.625	0.550	0.062	0.125	0.281	0.237 $\pm 0.021$	0.021

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 7 - SOLDER CONTACT (PIN AND SOCKET),  
SERIES I CONFIGURATION

### 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 SAE AS39029/44 and SAE AS39029/45 and be qualified to SAE AS39029. Rear release contacts shall conform to SAE AS39029/29 and SAE AS39029/30 and be qualified to SAE AS39029.

#### 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 MIL-I-81969/17 contact insertion tool. The individual contacts shall be capable of being removed from the connector when using the applicable MIL-I-81969/19 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 MIL-I-81969/14 contact insertion tool. The individual contacts shall be capable of being removed from the connector when using the applicable qualified MIL-I-81969/14, and /15 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 class 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

Inserts shall be installed in the position indicated in the applicable MS sheet. 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 specified in MIL-STD-1651 (see 6.6.7).

##### 3.4.2.2.1 Crimp Contact Inserts

Crimp contact inserts shall be bonded to and non-removable from the shell.

#### 3.4.2.3 Inserts for Solder Contact Connectors

Inserts containing nonremovable solder contacts shall not be damaged by the 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 MIL-STD-1651. Except for contacts in hard insert, 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 MIL-STD-1651, minimum mechanical spacing and creepage distance shall be as shown in Table 1.

TABLE 1 - MINIMUM CONTACT SPACING

Minimum contact spacing (inch)		
Service rating	Air spacing	Creepage distance
Instrument	----	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 Alignment

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 alignment 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 bonded to the pin 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 FED-STD-H28. Screw threads shall be checked after plating by means of ring and plug gages only, in accordance with FED-STD-H28. Slight out-of-roundness beyond the tolerances of MIL-S-7742 is allowed if the threads can be checked without forcing the thread gages. Screw threads are permitted to be relieved provided the relief does not interfere with the performance of the screw threads (see 6.15).

### 3.4.4 Shell Design

Connector shells shall be seamless, except for class B, and retain their inserts.

#### 3.4.4.1 Lubrication

Connectors shall meet the requirements of this specification after all internal coupling ring threads have been coated with a lubricant.

#### 3.4.4.2 Snap Rings and Slots

When snap rings are used to retain the inserts in their shells in class A or B connectors, the snap rings shall be accessible, capable of repeated use, and of rectangular cross section. The snap ring slots shall have square sides and enough depth to prevent the snap ring from sliding, pulling, or twisting out of position.

### 3.4.4.3 Use of Retaining Devices

When retaining rings or other devices are used in the coupling ring retention system for plugs and accessories, the retention devices shall be positively captivated or utilized in such a manner that the plugs and accessories shall remain electrically functional as an assembled connector in the event of a retention device failure.

### 3.4.4.4 Rear Release Connectors

Connectors with rear release contact retention systems shall have blue color bands in accordance with the applicable MS standard.

### 3.4.5 Coupling Connections

Threaded coupling rings shall be knurled and designed so that the pin and socket contacts 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 plugs shall be provided with gripping surfaces and be fastened to receptacles by a device that engages receptacle threads, but can be pulled free in an emergency.

#### 3.4.5.1 Safety Wiring of Coupling Rings

All threaded coupling rings except SAE AS34591 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 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

Pin contact connectors with resilient interfaces, except class A, shall contain sealing means so that the engaged contacts meet with the requirements of 3.4.1. 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. Plug connectors shall have a peripheral seal. 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 Class D, E, F, K, KS, KT, L, R, U, and W Connectors

Class D, E, F, K, KS, KT, L, R, U, and W connectors, except AS31021, AS34021, AS34121, AS34521, SAE AS34021, and SAE AS34121 shall be provided with a wire sealing grommet capable of sealing on wires of the sizes specified in Table 2.

TABLE 2 - WIRE RANGE ACCOMMODATIONS.

Contact size	Wire size	Outside diameter (OD) of finished wire (inch) <sup>1/</sup>					
		Solder contact connectors		Crimp contact connectors			
				Front release		Rear release	
		min <sup>2/</sup>	max	min <sup>2/</sup>	max	min <sup>2/</sup>	max
16-22 <sup>3/</sup>	26 24 22	N/A	N/A	0.066	0.130	N/A	N/A
16-16, 12-16 <sup>4/</sup>	20 18 16	0.064	0.130	0.066	0.130	0.053	0.103
12-12	14 12	0.114	0.170	0.097	0.170	0.085	0.158
8-8	10 8	0.164	0.255	0.132	0.255	0.132	0.255
4-4	6 4	0.272	0.370	0.237	0.370	0.237	0.370
0-0	2 0	0.415	0.550	0.360	0.550	0.360	0.550

<sup>1/</sup> Wire reference MIL-W-16878, SAE AS22759, MIL-DTL-81381, and MIL-C-915.

<sup>2/</sup> For OD smaller than that specified, see 6.1.1.

<sup>3/</sup> For series II only.

<sup>4/</sup> Only crimp contact connector data applies to size 12-16 contacts.

Note: N/A Not applicable.

#### 3.4.6.1.1 Solder Contact Connectors

Class F and R solder contact connectors shall be provided with a removable resilient grommet and retaining feature. The grommet shall be designed to fit against the rear face of the insert with the retaining feature in the installed condition. 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 not less than 0.005 inch. Connector plug shells with threaded coupling rings shall be provided with a static peripheral seal to ensure shell to shell sealing.

##### 3.4.6.1.1.1 Class P Connectors

Class P connectors shall be provided with a plastic potting form capable of accepting and bonding to MIL-PRF-8516 or MIL-PRF-23586 potting material. Inserts of class P connectors shall be designed so that potting material adheres to the shell and insert without treatment by the user.

##### 3.4.6.1.1.2 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-PRF-8516 or MIL-PRF-23586 potting compound adheres to the insert without treatment by the user.

#### 3.4.6.1.2 Crimp Contact Connectors

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

#### 3.4.6.1.2.1 Grommet Sealing Plugs

Grommets shall be designed to accept sealing plugs in accordance with MS3187 or MS27488, 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 one sealing plug shall be enclosed in the unit package. For indirect shipments, connectors are permitted to be ordered without grommet sealing plugs (see 6.2). For insert arrangements containing one contact of a particular size, sealing plugs shall not be supplied (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 applicable requirements specified herein for the type or class shall be met.

#### 3.5.2 Interchangeability

All connectors and accessories having the same 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 not greater than 2.0 when tested in accordance with 4.6.2.

### 3.7 Disengagement (AS31071, AS35071)

The axial tension required to separate the plug shell (insert removed) from receptacle shall be  $8 \pm 4$  pounds, when tested in accordance with 4.6.3.

### 3.8 Temperature Cycling (thermal shock)

Connectors shall continue to meet the requirements of this specification after being subjected to the temperature extremes specified in 4.6.4.

### 3.9 Air Leakage

#### 3.9.1 Solder Contact Receptacles (except class A, B, H, and P)

The air leakage rate shall be not greater than one atmospheric cubic inch per hour ( $4.55 \times 10^{-3}$  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 ( $1 \times 10^{-6}$  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 be greater than 0.025 inch and contacts shall be retained in their inserts when subjected to the axial loads specified in 4.6.6 or 4.6.6.1.

### 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

#### 3.12.1 Sine 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 the interruption of electrical continuity shall be not longer than 10 microseconds when tested in accordance with 4.6.8.1 or 4.6.8.2.

#### 3.12.2 Random Vibration

A current discontinuity of 10 microseconds or more, disengagement of the mated connectors, evidence of cracking, breaking, or loosening of parts shall be cause for rejection when tested in accordance with 4.6.8.3.

### 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 3 for 5 minutes minimum after being tested in accordance with 4.6.10.

TABLE 3 - TEST VOLTAGES AFTER HUMIDITY

Service rating	Test voltage (volts-rms)
Instrument	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 (77 °F) contact resistance requirements of SAE AS39029 except the potential drop of class H contacts shall be not greater than 125 mV initially or 200 mV after conditioning when tested in accordance with 4.6.11.

### 3.16 Durability

Counterpart connectors shall show no mechanical or electrical defects detrimental to the operation of the connector after 100 cycles of coupling and uncoupling for crimp contact connectors, or of mating and unmating for solder contact connectors when tested in accordance with 4.6.12.

### 3.17 Corrosion

Connectors shall show no exposure of the basis metal that will adversely effect performance when tested in accordance with 4.6.13.

### 3.18 Insulation Resistance

#### 3.18.1 At room Temperature

The insulation resistance shall be not less then 5000 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 on figure 8 when tested in accordance with 4.6.14.3.

#### 3.18.3 At Elevated Temperature-Long Time

The insulation resistance shall be as shown on figure 8 when tested in accordance with 4.6.14.4.

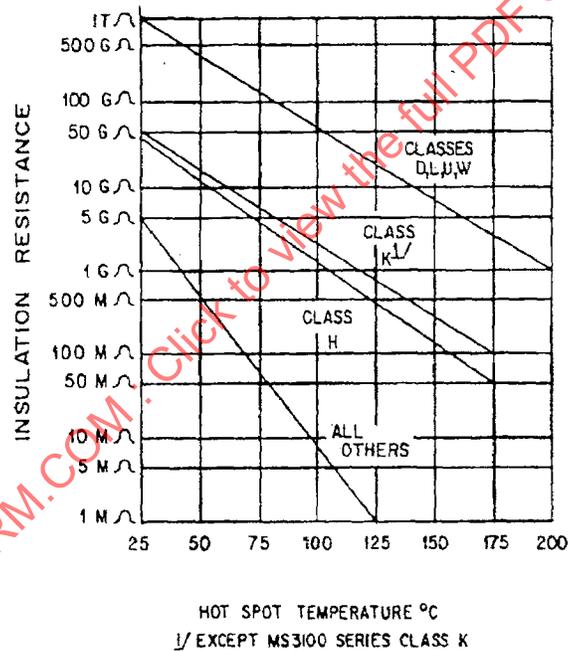


FIGURE 8 - MINIMUM INSULATION RESISTANCE VS HOT SPOT TEMPERATURE

### 3.19 Fluid Immersion

Connectors shall mate 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 Table 15 shall be applied for the first 5 minutes without a break in continuity. During the next minute the current drawn by the connector shall be not greater 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 pressures specified in 4.6.17.

### 3.22 Moisture Resistance

Mated connectors with rear accessory hardware assembled shall maintain an insulation resistance of 100 megohms or greater at 25 °C (77 °F) 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)

When tested in accordance with 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. At the end of 48 hours while still immersed, the insulation resistance of mated connectors shall be not less than 100 megohms. After removal of unmated connectors from the immersion tank, the insulation resistance shall be not less than 100 megohms (see 4.6.19.1).

#### 3.23.2 Crimp Contact Connectors

Mated connectors class D, L, U, and W assembled with SAE AS85049/11 backshells insulation resistance shall be not less than 100 megohms after being subjected to the water pressure test. They shall show no evidence of entrance of water when tested in accordance with 4.6.19.2.

### 3.24 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 4.6.20.

### 3.25 Contact Engaging and Separating Forces (solder contacts)

The socket contact engaging and separating forces shall be within the applicable limits specified in Table 4 when tested in accordance with 4.6.21.

TABLE 4 - CONTACT ENGAGEMENT AND SEPARATION FORCES

Contact mating end size	Minimum separation force (ounces) minimum diameter SAE AS31971 pin	Maximum average engagement force (ounces) maximum diameter SAE AS31971 pin	Maximum engagement force (ounces) maximum diameter SAE AS31971
16	2	33	48
12	3	56	80
8	5	N/A	160
4	10	N/A	240
0	15	N/A	320

Note: N/A – Not applicable.

### 3.26 Resistance to Probe Damage (size 16 solder socket contacts only)

Socket contacts shall meet the engagement and separation force requirements specified in 3.25 after being subjected to the resistance to probe damage in accordance with 4.6.22.

### 3.27 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 be not greater than 0.005 ohm for class D and W or 0.05 ohm for all other classes when measured in accordance with 4.6.23.

### 3.28 Contact Insertion and Removal Forces (crimp connectors)

The forces required to insert and remove unlocked contacts shall not exceed the requirements specified in Table 5 when tested in accordance with 4.6.24.

TABLE 5 - CONTACT INSERTION AND REMOVAL FORCES

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

### 3.29 Altitude Immersion (series III only)

The mated connectors insulation resistance shall be not less than 1000 megohms when tested in accordance with in 4.6.25. Any evidence of dielectric breakdown or flashover shall be cause for rejection.

### 3.30 Marking

Each connector shall be legibly and permanently marked on the shell or coupling ring in accordance with MIL-STD-1285. An example of the military part number is shown in 6.6. The date code, manufacturer name, symbol or code, and assembly plant symbol or code is required for all connector types. Metal stamping of part numbers is acceptable after plating. Metal impression marking, if used, shall show no exposure of unprotected basis metal which will adversely affect performance. Marking shall be legible after corrosion testing (see 3.17 and 4.6.13). Manufacturers' symbols or trademark shall be listed in SAE AIR1351.

#### 3.30.1 Insert Marking

Inserts shall be marked as specified in MIL-STD-1651. Manufacturer's identification is permitted. Raised or depressed characters shall not be used on insert mating faces for any markings of crimp contact connectors.

##### 3.30.1.1 Contact Designations

Contact identification on crimp connector inserts shall be designated by identifiable letters or numbers of contrasting color. Contact identification on solder contact inserts by use of contrasting color is permissible. Positioning and arrangement of the characters shall be such that the contact cavity is readily identifiable. All contacts shall be designated on the front 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 Tables 6 and 7.

##### 3.30.1.1.1 Grommet and Insulating Spacers

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 the grommets of solder contact connectors.

## 3.30.2 Use of Part Number Designations

MS sheet designations shall not be applied to a product, except for qualification test samples (see 6.14), 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).

## 3.31 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 warping of the post molding shall be a basis for rejection of items.

TABLE 6 - QUALIFICATION INSPECTION FOR SOLDER CONTACT CONNECTORS

Inspection	Requirement paragraph	Test paragraph
Group 1		
Visual and mechanical	3.1, 3.3, 3.4, 3.5, 3.30, and 3.31	4.6.1
Magnetic permeability (except class K)	3.6	4.6.2
Disengagement (AS31071, AS35071 plug only)	3.7	4.6.3
Temperature cycling	3.8	4.6.4
Contact retention	3.10	4.6.6.1
Dielectric withstanding voltage	3.11	4.6.7.1
Vibration	3.12.1	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	4.6.12
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, 3.30, and 3.31	4.6.1
Group 2		
Visual and mechanical	3.1, 3.3, 3.4, 3.5, 3.30, and 3.31	4.6.1
Firewall	3.20	4.6.16
Group 3		
Visual and mechanical	3.1, 3.3, 3.4, 3.5, 3.30, and 3.31	4.6.1
Magnetic permeability	3.6	4.6.2
Temperature cycling	3.8	4.6.4
Air leakage	3.9	4.6.5.1
Contact retention	3.10	4.6.6.1
Insert retention	3.21	4.6.17
Dielectric withstanding voltage	3.11	4.6.7.1

TABLE 6 (CONT'D) - QUALIFICATION INSPECTION FOR SOLDER CONTACT CONNECTORS

Inspection	Requirement paragraph	Test paragraph
Vibration	3.12.1	4.6.8.1
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	4.6.12
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, 3.30, and 3.31	4.6.1
Group 4		
Visual and mechanical	3.1, 3.3, 3.4, 3.5, 3.30, and 3.31	4.6.1
Temperature cycling	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	4.6.14.4
Durability	3.16	4.6.12
Vibration	3.12.1	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, 3.30, and 3.31	4.6.1
Group 5		
Visual and mechanical	3.1, 3.3, 3.4, 3.5, 3.30, and 3.31	4.6.1
Dielectric withstanding voltage	3.11	4.6.7.1
Insulation resistance	3.18.1	4.6.14.1
Fluid immersion	3.19	4.6.15.2
Visual and mechanical	3.1, 3.3, 3.4, 3.5, 3.30, and 3.31	4.6.1
Inspection	Requirement paragraph	Test paragraph
Group 6		
Contact engaging and separating forces	3.25	4.6.21
Resistance to probe damage (size 16 only)	3.26	4.6.22
Contact engaging and separating forces	3.25	4.6.21
Corrosion (5 contacts only)	3.17	4.6.13
Visual and mechanical	3.1, 3.3, 3.4, 3.5, 3.30, and 3.31	4.6.1

TABLE 7 - QUALIFICATION INSPECTION FOR CRIMP CONTACT CONNECTORS

Inspection	Requirement paragraph	Test paragraph
Group 1		
Visual and mechanical	3.1, 3.3, 3.4, 3.5, 3.30, and 3.31	4.6.1
Magnetic permeability (except class K)	3.6	4.6.2
Shell conductivity	3.27	4.6.23
Contact insertion and removal forces	3.28	4.6.24
Contact retention	3.10	4.6.6
Insulation resistance	3.18	4.6.14
Temperature cycling	3.8	4.6.4
Dielectric withstanding voltage	3.11	4.6.7.2
Water pressure (series II only)	3.23.2	4.6.19.2
Altitude immersion (series III only)	3.29	4.6.25
Durability (except dynamic corrosion classes)	3.16	4.6.12
Vibration (series II only)	3.12.1	4.6.8.1
Random vibration (series III only)	3.12.2	4.6.8.3
Shock	3.13	4.6.9
Moisture resistance	3.22	4.6.18
Corrosion (except dynamic corrosion classes)	3.17	4.6.13.2
Dynamic 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
External bending moment	3.24	4.6.20
Visual and mechanical	3.1, 3.3, 3.4, 3.5, 3.30, and 3.31	4.6.1
Group 2		
Visual and mechanical	3.1, 3.3, 3.4, 3.5, 3.30, and 3.31	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
Visual and mechanical	3.1, 3.3, 3.4, 3.5, 3.30, and 3.31	4.6.1

TABLE 7 (CONT'D) - QUALIFICATION INSPECTION FOR CRIMP CONTACT CONNECTORS

Inspection	Requirement paragraph	Test paragraph
Group 3 Visual and mechanical	3.1, 3.3, 3.4, 3.5, 3.30, and 3.31	4.6.1
Contact insertion and removal forces	3.28	4.6.24
Contact retention	3.10	4.6.6
Visual and Mechanical	3.1, 3.3, 3.4, 3.5, 3.30, and 3.31	4.6.1
Group 4 Visual and mechanical	3.1, 3.3, 3.4, 3.5, 3.30, and 3.31	4.6.1
Firewall	3.20	4.6.16
Group 5 Visual and mechanical	3.1, 3.3, 3.4, 3.5, 3.30, and 3.31	4.6.1
Insulation resistance	3.18	4.6.14
Dielectric withstanding voltage	3.11	4.6.7.2
Fluid immersion (class D, U, G, K, L, and W)	3.19	4.6.15
Dielectric withstanding voltage	3.11	4.6.7.2
Insert retention	3.21	4.6.17
Contact retention	3.10	4.6.6
Visual and mechanical	3.1, 3.3, 3.4, 3.5, 3.30, and 3.31	4.6.1
Group 6 Visual and mechanical	3.1, 3.3, 3.4, 3.5, 3.30, and 3.31	4.6.1
Temperature cycling	3.8	4.6.4
Dielectric withstanding voltage	3.11	4.6.7.2
Durability	3.16	4.6.12
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, 3.30, and 3.31	4.6.1
Group 7 (class D only) Visual and mechanical	3.1, 3.3, 3.4, 3.5, 3.30, and 3.31	4.6.1
Temperature cycling	3.8	4.6.4
Dielectric withstanding voltage	3.11	4.6.7
Water pressure	3.23.2	4.6.19.2
Vibration	3.12.1	4.6.8.2
High impact shock	3.13	4.6.9
Dielectric withstanding voltage	3.11	4.6.7
Visual and mechanical	3.1, 3.3, 3.4, 3.5, 3.30, and 3.31	4.6.1

### 3.32 Dust Caps

Dust caps in accordance with MS90376 shall be placed on the end of each connector. Hermetic connectors require caps on both ends or some other means to prevent damage to the termination end of the connector.

## 4. VERIFICATION

### 4.1 Classification of Inspections

The inspection requirements specified herein are classified as follows:

- a. Qualification inspection (4.3).
- b. Conformance inspection (4.4).
- c. Periodic inspection (4.5).

#### 4.1.1 Inspection Conditions

Unless otherwise specified herein, 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.

### 4.2 Test Equipment and Inspection Facilities

Test and measuring equipment and inspection facilities shall perform the required inspections. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with ANSI-Z540.1.

#### 4.2.1 Assembly Plants

Assembly plants shall be listed on or be approved for listing on AS50151 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 ensure 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. Assembly plants shall list their symbols or trademarks in SAE AIR1351.

### 4.3 Qualification Inspection

Qualification inspection shall consist of the examinations and tests performed in the sequence specified in Tables 6 and 7 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 one copy 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 components or to components submitted for qualification is permissible when materials, designs, and manufacturing processes are similar. The manufacturer shall provide to the qualifying activity, full details of the similarities and differences of the components and manufacturing processes, and a proposed qualification test program which will address the differences. Testing shall not begin until the manufacturer's proposal has been approved or modified by the qualifying activity.

#### 4.3.2 Qualification Samples

Samples of each item submitted for qualification shall be tested in the sequence specified in Tables 6 or 7, as required. 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. For crimp contact connectors, two cavities of each sample shall contain unwired contacts and sealing plugs in accordance with MS27488. Connectors with less than four contacts of a given contact size shall not have sealing plugs installed for that contact size.

##### 4.3.2.1 Wire-to-Contact Assembly

Unless otherwise specified (see 4.3.2.7.4), connectors shall be wired using wire selected from those specified in Table 2. Where wired contacts are required, terminations shall be accomplished as specified in 4.3.2.1.1 or 4.3.2.1.2.

###### 4.3.2.1.1 Solder Contacts

Solder in accordance with J-STD-001 shall be used. For class H connectors, termination of wire to solder terminals shall be accomplished with solder conforming to J-STD-006, composition Ag 1.5 or Sn 10.

###### 4.3.2.1.2 Crimp Contacts

Crimp contacts shall be crimped with tools conforming to MIL-DTL-22520 as specified in SAE AS39029 /29, /30, /44, or /45.

##### 4.3.2.2 Solder Contact Connectors (class A, B, C, and P)

Qualification samples and qualification tests for solder contact connectors in class 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 submitted for qualification in each shell size range, which shall pass the tests of Table 6, group 1. Qualification testing of these samples qualifies other shell types and the balance of insert arrangements in class 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 be as specified in 4.3.2.1 and 4.3.2.2.

###### 4.3.2.3.1 Group 4

Two class H receptacles in each shell size range with insert arrangements with the greatest number of contacts for which qualification is desired, together with mating class D, F, L, P, R, U, or W straight plugs, shall pass the tests of Table 6, group 4.

###### 4.3.2.3.2 Group 5

Four class H receptacles from 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 pass the group 5 tests of Table 6. Where mating plugs are required class K or L shall be used. Qualification testing of the samples qualifies 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 (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 pass the tests of Table 6, group 3. For test purposes, contacts shall be wired in accordance with 4.3.2.1 except that for each size contact, no more than two wires or 10 percent of the wires, whichever is greater, shall be the larger of the two sizes shown in Table 2. Qualification testing of these samples qualifies other shell types and the balance of insert arrangements in class 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.

#### 4.3.2.5 Series I Connectors (class K)

Qualification samples and qualification tests for series I connectors in class K shall consist of the complete connector assemblies. Qualification testing of these samples qualifies other shell types and the balance of insert arrangements in class K by similarity.

##### 4.3.2.5.1 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 pass the tests specified in Table 6, group 1.

##### 4.3.2.5.2 Group 2

Two complete connector assemblies, class K wall mounting receptacles and straight plugs, from each shell size range with insert arrangement having the greatest number of contacts for which qualification is desired, shall be assembled with wire conforming to MIL-W-25308 and pass the tests specified in Table 6, group 2.

#### 4.3.2.6 Socket Contacts for Solder Contact Connectors, Group 6

Twenty of each socket contact size and configuration used in the solder contact connectors shall pass the tests of Table 6, group 6. Sockets which are not completely assembled prior to installation in the insert such as class H, socket style, are permitted to be provided and tested in connectors.

#### 4.3.2.7 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; large range: 32 to 48) for qualification testing. Successful completion of the qualification tests in Table 7 qualifies:

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

##### 4.3.2.7.1 Group 1

Two connectors of each class with insert arrangements in each shell size range (small, medium, and large) of each contact retention system to be qualified shall pass the group 1 tests of Table 7. 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 2, and the other with maximum OD wire. The connectors shall be tested with an SAE AS85049/52 strain relief clamp assembled on the back threads or other appropriate backshell hardware. The receptacles shall be wall mounting.

#### 4.3.2.7.2 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 pass the group 2 tests of Table 7. The plug shall have socket inserts, and the receptacle pin inserts, and shall be terminated with the maximum OD wire specified in Table 2. Backshell hardware shall be the same as group 1, and the receptacles shall be wall mounted.

#### 4.3.2.7.3 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. These connectors shall pass the group 3 tests of Table 7. Additional contact sizes are permitted to be qualified by completion of the group 3 tests.

#### 4.3.2.7.4 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 pass the group 4 tests of Table 7. Each connector shall be assembled with wire conforming to MIL-W-25038.

#### 4.3.2.7.5 Group 5

Twelve class D, U, K, L, or W connectors with insert arrangements in the medium shell size range shall pass the group 5 tests of Table 7. 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 2. Backshell hardware shall be the same as group 1. If more than one contact retention system is to be qualified, a minimum of two connectors of each retention system shall be subjected to each test fluid.

#### 4.3.2.7.6 Group 6 (front and rear release connector intermateability)

If requested by the qualifying activity, one connector with insert arrangements of class D, K, L, W, and U in each shell size range 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 pass the group 6 tests of Table 7. Backshell hardware shall be the same as group 1 and the receptacles shall be wall mounting.

#### 4.3.2.7.7 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 in each shell size range shall pass the tests of Table 7, 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 a SAE AS85049/11 type B cable backshell and 6 feet of the applicable cable specified in Table 8. The remaining connector shall be assembled with an SAE AS31091 boot and 6 feet of the applicable cable specified in Table 8.

- 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 8 - TEST CABLE SIZE. 1/, 2/

SAE AS85049/11 Backshell Dash Number	SAE AS31091 Boot Dash Number (Type B)	AS50151 Shell Size	Cable OD Max
07/08	11	8S	0.432
11/12	12	10S/10SL	0.432
13/14	13	12/12S	0.432
116/117	13	14/14S	0.432
21/22	14	16/16S	0.700
27/28	14	18	0.750
33/34	15	20	0.750
41/42	15	22	0.750
47/48	16	24	0.750
55/56	16	28	0.750
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/ Select type to match maximum cable entry and insert configuration of AS50151.

2/ 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 6.14) shall receive details of corrective action from the manufacturer before initiating any further tests deemed necessary to ensure compliance with connector requirements.

#### 4.4 Conformance Inspection

##### 4.4.1 Inspection of Product for Delivery

Inspection of product for delivery shall consist of group A inspection.

##### 4.4.2 Group A Inspection

Group A inspection shall consist of all of the applicable tests specified in Table 9.

TABLE 9 - GROUP A INSPECTION

Inspection <u>1/</u>	Requirement paragraph	Test paragraph
Visual and mechanical	3.1, 3.3, 3.4, 3.5, 3.30, and 3.31	4.6.1
Air leakage (for class H only) <u>2/</u>	3.9.2	4.6.5.2
Dielectric withstanding voltage <u>2/</u> , <u>3/</u>	3.11	4.6.7.5
Insulation resistance <u>2/</u> , <u>3/</u>	3.18.1	4.6.14.2

1/ 100 percent inspection.

2/ The contractor is permitted to use in-process controls for this requirement.

3/ Crimp contact connectors only.

#### 4.5 Periodic Inspection

Periodic inspection shall consist of group B. 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 A shall not be delayed pending the results of these periodic inspections.

##### 4.5.1 Group B Inspection

Group B inspection shall consist of the tests specified in Table 10 in the order shown. Group B inspection shall be made on sample units selected from inspection lots which have passed the Group A inspection.

TABLE 10 - GROUP B INSPECTION

Inspection	Requirement Paragraph	Test Paragraph	Group					
			1	2	3	4	5	6
Insulation resistance	3.18	4.6.14	X	X	X	X	--	--
Dielectric withstanding voltage	3.11	4.6.7.2	X	X	X	X	--	--
Contact retention	3.10	4.6.6	X	X	--	--	X	X
Shell conductivity	3.27	4.6.23	--	--	--	--	X	X
Air leakage	3.9.1	4.6.5.1	X	--	--	X	--	--
Durability	3.16	4.6.12	--	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 (series II only)	3.23.1	4.6.19.1	--	--	--	--	X	--
Altitude immersion (series III only)	3.29	4.6.25	--	--	--	--	X	--
Corrosion	3.17	4.6.13	--	X	--	X	--	X

##### 4.5.1.1 Sampling Plan

Every 24 months, mated connector sample units which have passed group A inspection shall pass the tests specified in Table 10. Samples shall be selected to provide two samples per applicable test group, as determined by the contact type and the class of the samples to be tested.

##### 4.5.1.1.1 Solder Contact Connectors (class A, B, C, E, F, 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 are permitted to be mated. The samples shall be wired as specified in 4.3.2.1. Two complete mating connector assemblies shall pass the tests of Table 10, group 1 and the other two assemblies shall pass the tests of Table 10, 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 mating plugs in various shell sizes representing a cross section of production. Two complete mating connector assemblies shall be wired as specified in 4.3.2.1 and pass the tests of Table 10, group 3. The remaining two assemblies need not be wired but shall pass the tests of Table 10, group 4.

#### 4.5.1.1.3 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 are allowed to be mated. The samples shall be wired as specified in 4.3.2.1. Two complete mating connector assemblies shall pass the tests of Table 10 group 5, and the other two assemblies shall pass the tests of Table 10, group 6.

#### 4.5.1.1.4 Solder Socket Contacts

Samples and tests for solder socket contacts shall be as specified in 4.3.2.6.

#### 4.5.1.2 Failures

If one or more sample units fail to pass group B 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 B inspection shall not be delivered on the contract or purchase order.

### 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 3.1, 3.3, 3.4, 3.5, 3.30, and 3.31. The use of in process controls to examine component parts, unrelated to lot sizes of finished connectors, is permitted in lieu of examination of these components in the finished connectors to ensure conformance of these component parts.

#### 4.6.2 Magnetic Permeability

The relative permeability shall be checked with an indicator conforming to ASTM-A342. The connectors or accessories are permitted to be wired or unwired, as convenient, but shall not carry current (see 3.6).

#### 4.6.3 Disengagement (AS31071, AS35071)

The plug (without the insert) shall be fully mated to a mounted receptacle. An increasing axial tension shall be applied to the plug and the force at separation measured (see 3.7).

#### 4.6.4 Temperature Cycling (thermal shock)

Accessories or unmated connectors shall be tested in accordance with EIA 364-032, condition I, 5 cycles, except that the temperature extremes shall be as specified in Table 11. At the completion of the last cycle, the connectors shall be returned to room temperature for inspection (see 3.8).

TABLE 11 - TEMPERATURE EXTREMES

Class	Temperature		
	Extremes	Degrees C	Degrees F
A, B, C, E, F, 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 class A, B, H, and P)

The connector shall be tested for air leakage in accordance with EIA 364-02. The pressure differential across the connector shall be 30 lb/in<sup>2</sup>. The leakage rates shall be measured in both directions while at the low temperature extremes of Table 11 (see 3.9.1).

##### 4.6.5.2 Class H Receptacles

All class H receptacles shall be mounted in a manner which will allow for the application of 15 lb/in<sup>2</sup> nominal pressure differential across the receptacles and tested in accordance with EIA 364-02. 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 12 shall be applied to the mating end of the individual contacts. The connector shall have all contacts in place during the test in accordance with EIA 364-029 (see 3.10).

TABLE 12 - CONTACT RETENTION AXIAL LOADS

Contact mating end size	Minimum axial load (pounds)		
	Fixed type contacts	Removable crimp type contact, except class D	Class D
16	10	25	50
12	15	30	50
8	20	50	80
4	20	60	100
0	25	75	100

##### 4.6.6.1 Solder Contact Connectors

Connectors shall be tested as specified in 4.6.6. The measurement of the displacement of the contacts is not required (see 3.10).

#### 4.6.7 Dielectric Withstanding Voltage (see 3.11)

##### 4.6.7.1 Dielectric Withstanding Voltage (sea level, solder contacts only)

Wired, unmated connectors shall be tested in accordance with EIA 364-020, with the following details and exceptions:

- a. The magnitude of the test voltage shall be as specified in Table 13. (For maximum recommended working voltages, see 6.1.2).
- 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. For acceptance testing, simulated contacts and special techniques are permitted to be used in performing this test.

TABLE 13 - DIELECTRIC WITHSTANDING TEST VOLTAGES

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

##### 4.6.7.2 Dielectric Withstanding Voltage (sea level, crimp contact connectors only)

Mated or unmated connectors, as required, shall be tested in accordance with EIA 364-020. Fifty percent of the contacts 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. If an insert has more than one service rating, similar connections shall be made for the different test voltages as needed.

##### 4.6.7.3 Dielectric Withstanding Voltage (altitude)

Mated connectors and unmated connector halves with pin contacts shall be tested in accordance with EIA 364-020, with the following details and exceptions:

- a. The magnitude of the test voltage shall be as specified in Table 13.
- 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 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.
- d. Only the engaging faces of class H connectors shall be subjected to the high altitude. The rear face shall be protected.

##### 4.6.7.4 Dielectric Withstanding Voltage (after humidity at sea level)

The mated connectors shall show no evidence of breakdown when the voltage indicated for the applicable service rating in Table 3 is applied between the two closest contacts and between the shell and the contacts closest to the shell in accordance with EIA 364-020, except the test voltage shall be applied for 5 minutes (see 3.11).

#### 4.6.7.5 Dielectric Withstanding Voltage (group A inspection at sea level)

Unmated connectors or insert assemblies shall show no evidence of breakdown when the applicable test voltage of Table 13 is applied between the two closest contacts, and between the shell (or simulated shell) and the contact closest to the shell in accordance with EIA 364-020. The period of application of voltage shall be two seconds minimum and simulated contacts are permitted to be used.

#### 4.6.8 Vibration

Complete mated connectors shall be mounted and pass the applicable vibration test. Each receptacle shall be mounted on a fixture, which, in turn, shall be attached to a vibration table. A 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 be attached 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. All contacts shall be wired in a series circuit, and a current that shall be not greater than 100 milliamperes shall flow through the series circuit during the test. An instrument shall be employed to monitor the current flow and to indicate discontinuity of contact or interruption of current flow (see 3.12).

##### 4.6.8.1 Sine Vibration (solder contact connectors only)

The mated connector shall be mounted as specified in 4.6.8 and vibrated in accordance with EIA 364-028, test condition II.

##### 4.6.8.2 Sine Vibration (series II only)

Mated connectors shall be mounted as specified in 4.6.8 and tested in accordance with EIA 364-028, test condition III, and also in accordance with the endurance test of MIL-STD-167-1.

##### 4.6.8.3 Random Vibration (series III only)

Wired, mated connectors shall be tested in accordance with EIA 364-028. The following details shall apply:

- a. The connector shall be mounted on the table.
- b. Test condition VI - letter J.
- c. The duration of test shall be 8 hours in the longitudinal direction and 8 hours in the perpendicular direction.

#### 4.6.9 Shock (see 3.13)

##### 4.6.9.1 Shock (except class D connectors)

Mated connectors shall be tested in accordance with EIA 364-027, test condition A. Connectors shall be mounted and mated. All contacts shall be wired in a series circuit with a current that shall be not greater than 100 milliamps. 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.

##### 4.6.9.2 High Impact Shock (class D connectors)

Complete mated connectors with SAE AS85049/11 backshells or SAE AS31091 boots with 6 feet of unarmored cable (see Table 8) 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 a current that shall be not greater than 100 milliamps flowing through the series circuit during the high impact shock. A 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 locking device. Cable or wires shall be supported on a stationary frame not closer than 36 inches from the connector assembly.

#### 4.6.10 Humidity

Mated connectors shall be exposed to a relative humidity in accordance with EIA 364-031, method II, at a room temperature of  $71 \pm 2$  °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 AS31021 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 EIA 364-06. Solder contact connectors shall be tested with the coupling ring removed (see 3.15 and 4.6.13.3).

#### 4.6.12 Durability

Counterpart connectors shall be mated and unmated 100 times at a rate that shall not be greater than 60 cycles per hour in accordance with EIA 364-09 (see 3.16).

#### 4.6.13 Corrosion

Unmated connectors and individual contact samples shall be tested in accordance with EIA 364-026. The samples shall not be mounted but suspended from the top of the chamber using waxed twine, string, glass rods, or glass cord. Wire ends shall be protected to prevent salt migration. The details and exceptions of this test shall be as specified in 4.6.13.1, 4.6.13.2, and 4.6.13.3 (see 3.17).

##### 4.6.13.1 Corrosion (class A, B, C, E, F, P, R, and class H and AS31001 series class K ferrous alloy connectors):

Test condition letter B.

##### 4.6.13.2 Corrosion (series II and series III class K ferrous alloy connectors and class L and U aluminum connectors):

Test condition letter A. The connectors shall be subjected to the salt spray test for 48 hours mated followed by 48 hours unmated.

##### 4.6.13.3 Dynamic Corrosion (classes D, W, and DJ and class H, K, L, and U stainless steel connectors):

Test condition letter D. The plugs and receptacles shall be mated and unmated 50 cycles at a rate that shall be not greater than 300 cycles per hour. The mating and unmating shall be accomplished so that the plugs and receptacles are completely separated during each cycle. The connectors shall then be subjected to the salt spray test for 952 hours mated, followed by 48 hours unmated. After salt spray exposure, the remaining number of durability cycles specified in 4.6.12 shall be completed.

#### 4.6.14 Insulation Resistance

##### 4.6.14.1 Insulation Resistance at Room Temperature (see 3.18.1)

Unmated connectors shall be tested in accordance with EIA 364-021. The following details and exceptions shall apply:

- a. For lot acceptance testing simulated contacts and special techniques, as approved by the qualifying activity (see 6.2), are permitted to be used in performing this test.
- b. The tolerance on the applied voltage shall be  $\pm 10$  percent.

##### 4.6.14.2 Insulation Resistance at Room Temperature (group A)

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 and shells are permitted to 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 shall be not less than 24 hours (see 3.18.2).

#### 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 specified in Table 14. All measurements shall be made at the end of 1000 hours while the connectors are at the elevated temperature (see 3.18.3).

TABLE 14 - INSULATION RESISTANCE AT ELEVATED TEMPERATURE (LONG TIME)

Class of connector	Minimum insulation resistance (megohms)	Test temperature
		+5 °C (41 °F) –0 °C (32 °F)
A, B, C, E, F, P, and R	30	85 °C (185 °F)
H	50	175 °C (347 °F)
K	100	175 °C (347 °F)
L, D, U, and W	1000	200 °C (392 °F)

#### 4.6.15 Fluid Immersion (see 3.19)

##### 4.6.15.1 Limited Capabilities (class A, B, C, E, F, P, and R)

Unmated connectors shall be fully immersed 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 air at room conditions. Connectors shall be fully mated with mating connectors that were immersed simultaneously in the same fluid.

- a. Hydraulic fluid conforming to MIL-PRF-5606 – 20 hours.
- b. Lubricating oil conforming to MIL-PRF-7808 – 20 hours.

##### 4.6.15.2 Complete Capabilities (class, D, K, L, H, U, and W)

Connector samples shall be tested in accordance with EIA 364-010 (one sample per fluid). Following the fluid immersion cycles, the connector shall be visually examined at 3X magnification for cracks and tears and shall be mated by hand.

#### 4.6.16 Firewall (class K conductors)

The mated, torqued, and wired connectors shall be tested in accordance with EIA 364-045 (see 3.20). The wire bundles shall be clamped to fixed points at least 8 inches behind the connectors. Test currents shall be as specified in Table 15.

TABLE 15 - FIREWALL TEST CURRENTS

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