

AEROSPACE STANDARD

SAE AS29600

Issued 2004-04
Reaffirmed 2009-08

Connectors, Electrical, Circular, Miniature, Composite,
High Density, Quick Coupling, Environment Resistant, Removable
Crimp Contacts Associated Hardware, General Specification For
FSC 5935

NOTICE

This document has been taken directly from U.S. Military Specification MIL-C-29600, Supplement 1, Amendment 3 and contains only minor editorial and format changes required to bring it into conformance with the publishing requirements of SAE Technical Standards. The initial release of this document is intended to replace MIL-C-29600, Supplement 1, Amendment 3. Any part numbers established by the original specification remain unchanged.

The original military specification was adopted as an SAE Standard under the provisions of the SAE Technical Standards Board (TSB) Rules and Regulations (TSB 001) pertaining to accelerated adoption of government specifications and standards. TSB rules provide for (a) the publication of portions of unrevised government specifications and standards without consensus voting at the SAE committee level, and (b) the use of the existing government specification or standard format.

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1. SCOPE:

1.1 Scope:

This specification covers miniature, composite, high density, threaded coupling, self locking, circular, environment resistant, electrical connectors utilizing removable crimp contacts, and associated hardware, which are capable of continuous operation within a temperature range of -65° to +175°C. These connectors are supplied under a MIL-STD-790 reliability assurance program. See 6.1 for intended use and applications.

1.2 Description:

The connectors employ rear release removable pin and socket contacts with crimp termination. The connectors are designed to assure proper orientation of the mating halves prior to electrical circuit closure. The connectors include EMI shielding capability. They also provide electrical continuity between mated shells prior to contact engagement and have the contacts so located as to be protected from handling damage and inadvertent electrical contact. The connectors consist of a composite material with light weight characteristics and, when used with backshells and contacts specified herein, provide high levels of corrosion resistance and durability.

1.2.1 Design considerations: Connectors are designed to be used as a system with backshells and contacts specified herein. When so used, the connectors are capable of performance during or after, as applicable, under the following environmental conditions:

1.2.1.1 Temperature: -65° to +175°C.

1.2.1.2 Vibration:

- a. Random: 41.7 G RMS at rated high and low temperatures without backshell.
49.5 G RMS at ambient temperature with backshell.
- b. Sine: 60 G at ambient temperature with backshell.

1.2.1.3 Altitude: Altitudes from sea level to 100,000 feet (8 torr). Test voltage will vary with altitude (see Table XII).

1.2.1.4 Shock: Shock as represented by a 3 + 1 milliseconds base half-sine wave peaking at 300 G (see 3.23).

1.2.1.4.1 High impact shock: Per MIL-S-901.

1.2.1.5 Humidity: Humidity conditions up to 98 percent relative humidity including condensation (see 3.25).

1.2.1.6 Corrosion: 2000 hours exposure to salt-laden atmosphere (see 3.15).

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1.2.1.7 Temperature cycling: See 4.6.3.

1.2.1.8 Fluid immersion: Immersion, in jet fuel, lubrication oil, liquid coolant, hydraulic fluid, gasoline, cleaning compound, defrosting fluid, and solvents (see 3.29).

1.2.1.9 EMI shielding: EMI shielding effectiveness: 100 MHz to 10 GHz, minimum attenuation of 50 dB (see 3.27).

1.2.1.10 Electrolytic erosion: Exposure of uncoupled connector to a salt moisture environment (see 3.34).

1.2.1.11 Durability: 1500 matings and unmatings (see 3.4.1, and 3.10).

1.3 Classification:

1.3.1 Connectors: Connectors fabricated to this specification are scoop-proof, self-locking, quick coupling and are as follows:

a. Series: The series A and B connectors are not intermateable.

A - Utilize MIL-C-38999 insert arrangements.

B - Utilize MIL-C-81511 insert arrangements.

b. Types:

(1) Plugs: Straight.

(2) Receptacles: Wall mounting, both front and rear panel mounting, jam nut mounting. Contains grounding member that makes shell contact prior to contact engagement.

c. Class: R - Environment resisting - conductive shell, EMI shielded.

E - Environment resisting - conductive or nonconductive shell, non-EMI shielded.

G - Environment resisting - conductive shell, EMI shielded, space grade.

1.3.2 Contacts:

a. Styles:

(1) Connectors ordered with high performance contacts:

H - Pin
J - Socket

The H or J designators are used to indicate a full complement of applicable high performance contacts rated at 1500 cycles of durability, and shall appear in the part number marked on the connector.

(2) Connectors ordered with standard contacts:

P - Pin
S - Socket

The P or S designators are used to indicate a full complement of applicable standard contacts rated at 500 cycles of durability, and shall appear in the part number marked on the connector.

(3) Connectors ordered without contacts:

A - Less pin contacts. Application specifies 500 cycles of durability.
B - Less socket contacts.
K - Less pin contacts. Application specifies 1500 cycles of durability.
L - Less socket contacts.

The A, B, K, or L designators are used to indicate connectors ordered less contacts, and are intended to have other than all standard power contacts installed (example: shielded, coaxial and thermocouple contacts). The A, B, K, or L designator shall appear in the part number marked on the connector.

Connectors ordered less contacts, but intended for assembly with all high performance or all standard contacts, shall have the H or J designator, or the P or S designator, respectively in the part number marked on the connector the same as connectors ordered with a full complement of applicable contacts.

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1.3.3 Associated hardware:

a. Types:

- (1) Backshells.
- (2) Protective covers.
- (3) Dummy stowage receptacles.
- (4) Sealing plugs.

2. GOVERNMENT DOCUMENTS:

2.1 Specifications, standards and handbooks:

Unless otherwise specified, the following specifications, standards and handbooks of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation form a part of this specification to the extent specified herein.

SPECIFICATIONS

MILITARY

MIL-S-901	Shock Tests, H.I. (High Impact); Shipboard Machinery, Equipment and Systems, Requirements for
MIL-S-7742	Screw Threads, Standard, Optimum Selected Series: General Specification for
MIL-PRF-8516	Sealing Compound, Synthetic Rubber, Electric Connectors and Electric Systems, Chemically Cured
MIL-I-16923	Insulating Compound, Electrical, Embedding, Epoxy
MIL-C-22520	Crimping Tools, Terminal, Hand or Power Actuated Wire Termination, and Tool Kits, General Specification for
MIL-W-22759	Wire, Electric, Fluoropolymer-Insulated, Copper or Copper Alloy
MIL-PRF-23586	Sealing Compound (With Accelerator), Silicone Rubber, Electrical

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2.1 (Continued):

MIL-M-24041	Molding and Potting Compound, Chemically Cured, Polyurethane
MIL-W-25038	Wire, Electrical, High Temperature and Fire Resistant, General Specification for
MIL-C-39029	Contacts, Electrical Connector, General Specification for
MIL-A-46146	Adhesive Sealants, Silicone, RTV, Non-Corrosive (For Use With Sensitive Metals And Equipment)
MIL-C-55330	Connectors, Preparation for Delivery of
MIL-W-81381	Wire, Electric, Polyimide-Insulated, Copper or Copper Alloy
MIL-I-81550	Insulating Compound, Electrical, Embedding, Reversion Resistant Silicone
MIL-I-81969	Installing and Removal Tools, Connector, Electrical Contact, General Specification for
MIL-C-85049	Connector Accessories, Electrical General Specification For

STANDARDS

FEDERAL

FED-STD-H28	Screw-Thread Standards for Federal Services
QQ-B-575	Braid, Wire, (Copper, Tin Coated, or Silver Coated, Tubular, or Flat)

MILITARY

MIL-STD-202	Test Methods for Electronic and Electrical Component Parts
MIL-STD-790	Reliability Assurance Program for Electronic Parts Specifications
MIL-STD-889	Dissimilar Metals
MIL-STD-1285	Marking of Electrical and Electronic Parts

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2.1 (Continued):

MIL-STD-1344	Test Methods for Electrical Connectors
MIL-STD-1560	Insert Arrangements for MIL-C-38999 and
MS3425	Insert Arrangements, Electrical Connector, Shell Size 8
MS3426	Insert Arrangements, Electrical Connector, Shell Size 10
MS3428	Insert Arrangements, Electrical Connector, Shell Size 14
MS3429	Insert Arrangements, Electrical Connector, Shell Size 16
MS3430	Insert Arrangements, Electrical Connector, Shell Size 18
MS3431	Insert Arrangements, Electrical Connector, Shell Size 20
MS3432	Insert Arrangements, Electrical Connector, Shell Size 22
MS3433	Insert Arrangements, Electrical Connector, Shell Size 24
MS3435	Test Gage, Contact Location and Retention Feature, MIL-C-0081511 Series 3 and 4 Connectors
MS27488	Plug, Sealing, Electrical Connector
MIL-C-29600/10	Connectors, Electrical, Circular, Miniature, Composite, High Density, Quick Coupling, Environment Resistant, Removable Crimp Contacts, Receptacle, Flanged (Series A)
MIL-C-29600/11	Connectors, Electrical, Circular, Miniature, Composite, High Density, Quick Coupling, Environment Resistant, Removable Crimp Contacts, Receptacle, Jam Nut (Series A)
MIL-C-29600/12	Connectors, Electrical, Circular, Miniature, Composite, High Density, Quick Coupling, Environment Resistant, Removable Crimp Contacts, Plug (Series A)
MIL-C-29600/20(AS)	Connectors, Electrical, Circular, Miniature, Composite, High Density, Quick Coupling, Environment Resistant, Removable Crimp Contacts, Receptacle, Flanged (Series B)

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2.1 (Continued):

MIL-C-29600/21(AS) Connectors, Electrical, Circular, Miniature, Composite, High Density, Quick Coupling, Environment Resistant, Removable Crimp Contacts, Receptacle, Jam Nut (Series B)

MIL-C-29600/22(AS) Connectors, Electrical, Circular, Miniature, Composite, High Density, Quick Coupling, Environment Resistant, Removable Crimp Contacts, Plug (Series B)

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

2.2 Other publications:

The following document(s) form a part of this specification to the extent specified herein. The issues of the documents which are indicated as DOD adopted shall be the issue listed in the current DODISS and the supplement thereto, if applicable.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI - Z540.1 Laboratories, Calibration and Measuring and Test Equipment (DoD Adopted)

(Application for copies should be addressed to the American National Standards Institute, 11 West 42nd Street, New York, NY 10036.)

AMERICAN SOCIETY FOR QUALITY CONTROL (ASQC)

ASQC-Z1.4 Procedures, Sampling, and Tables for Inspection by Attributes (DoD adopted)

(Application for copies should be addressed to the American Society for Quality Control, P.O. Box 3005, 611 East Wisconsin Avenue, Milwaukee, WI 53201-4606.)

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2.2 (Continued):

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM-B488	Gold for Engineering Uses, Electrodeposited Coatings of (DoD adopted)
ASTM D570-81	Plastic, Water Absorption of
ASTM E595-84	Standard Test Method Total Mass Loss and Volatile Condensable Materials from Outgassing in a Vacuum
ASTM G85-85	Modified Salt Spray (Fog) Testing, Practice for

(Application for copies should be addressed to the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.)

ELECTRONIC INDUSTRIES ASSOCIATION (EIA)

EIA RS-359	EIA Standard Colors for Color identification and Coding (ANSI C-83.1-1973)
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(Application for copies should be addressed to the Electronic Industries Association, 2001 Eye Street, N.W., Washington, DC 20006.)

THE INSTITUTE FOR INTERCONNECTING AND PACKAGING ELECTRONIC CIRCUITS (IPC, INC.)

J-STD-006	Requirements for Electronic Grade Soldering Alloys and Fluxed and Non-Fluxed Solders for Electrical Soldering Applications
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(Application for copies should be addressed to the Institute for Interconnecting and Packaging Electronic Circuits (IPC, Inc), 7380 North Lincoln Avenue, Lincolnwood, IL 60646-1776.)

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2.2 (Continued):

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE-AS3582 Packing Preformed O-ring Seal AMS 3304
SAE Aerospace Information Report
AIR 1557 High Extended Vibration Environment (Oct. 79)
SAE Aerospace Information Report
AIR 1351 Manufacturer's Identification of Electrical Connector Contacts, Terminals, and Splices

(Application for copies should be addressed to the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.)

INTERNATIONAL STANDARDS ORGANIZATION

ISO/R 68-1973-ISO-Basic Profile for Triangular Screw Threads, .25 to 5 MM.
ISO/R 261-1973-ISO-Metric Screw Threads, General Plan, .25 to 300 MM.
ISO/R 262-1973-ISO-Metric Screw Threads for Screws, Bolts, and Nuts, 6 to 39 MM.
ISO/R 965-1973-
Part 1 - ISO General Purpose Metric Screw Threads, Tolerances, Principles and Basic Data.
Part 2 - ISO General Purpose Metric Screw Threads, Tolerances, Limits of Sizes for Medium Quality Commercial Bolt and Nut Threads 1.6 to 39 MM.
Part 3 - ISO General Purpose Metric Screw Threads, Tolerances, and Deviations for Constructional Threads 1.6 to 355 MM.

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

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

2.3 Order of precedence:

In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

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3. REQUIREMENTS:

3.1 Specification sheets:

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

3.2 Qualification:

Connectors furnished under this specification shall be products which are qualified for listing on the applicable Qualified Products List at the time set for opening of bids (see 4.4 and 6.3).

3.2.1 Reliability: The contractor's reliability program for assembled connectors and assembly procedures shall meet the requirements of MIL-STD-790 with the exception that the failure reporting period shall be 12 months in lieu of 6 months.

3.3 Materials:

Materials shall be as specified herein. However, when a definite material is not specified, a material shall be used which will enable the connectors and accessories to meet the performance requirements of this specification and shall be of the lightest practical weight. Acceptance or approval of any constituent material shall not be construed as a guarantee of the acceptance of the finished product.

3.3.1 Metals: Metals shall be of a corrosion-resistant type or shall be plated or treated to resist corrosion.

3.3.1.1 Dissimilar metals and compatible couples: When dissimilar metals are used in intimate contact with each other, protection against galvanic corrosion shall be provided. The use of dissimilar metals in contact, which tend toward active galvanic corrosion (particularly brass, copper or steel used in contact with aluminum or aluminum alloy) is not acceptable. However, metal plating or metal spraying on dissimilar-base metals to provide compatible couples for abutting surfaces is permitted per MIL-STD-889. The use of dissimilar metals separated by an appropriate insulating material is also permitted.

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- 3.3.1.2 Hydrolytic stability: Encapsulation and embedment materials shall be selected from the following specifications: MIL-PRF-8516, MIL-I-16923, MIL-PRF-23586, MIL-M-24041, and MIL-I-81550. The materials selected shall be capable of filling all voids and spaces around the items enclosed. For Air Force Applications use of materials other than transparent silicone in accordance with MIL-I-81550 requires procurement activity approval. When tested as specified in 4.6.36.2, the connector shells shall be without defects detrimental to performance. Connector weight shall not increase greater than 0.75 percent. When subjected to an overtorque at 150 percent of those values specified in Table III, there shall be no evidence of breaking, loosening of parts, or cracking.
- 3.3.2 Components: Materials for specific components of the connector shall be as follows:
- Shells, coupling rings, and associated hardware - Corrosion resistant, high performance resins, with or without filler materials, shall be defined by specifications listed in the DODISS or published by professional materials associations. Exceptions may be granted by the preparing activity. Use of regrind material requires the connector manufacturer to demonstrate to the qualifying activity that the regrind process does not jeopardize the intended use of the connector and the material meets the characteristics, properties, and capabilities of virgin material.
 - Insert - Reinforced epoxy resin or other rigid dielectric material.
 - Grounding members - Heat treated beryllium copper, corrosion resistant steel or conductive elastomer designed to provide electrical contact with the mating shell.
 - Gaskets, grommet and interfacial seal - Silicone, fluorosilicone, or silicone/fluorosilicone blend elastomer.
- 3.3.3 Magnetic permeability (magnetic materials): The relative permeability of the wired, assembled and fully mated connector assembly shall be less than 2.0 μ when measured in accordance with 4.6.34.
- 3.3.4 Fungus resistant: Materials used in the construction of these connectors shall be fungus inert (see 4.1.3).
- 3.3.5 Contact materials: Contacts shall be made of conductive copper alloys as specified in MIL-C-39029.
- 3.3.6 Contact plating: Contacts shall be plated to meet or exceed the performance requirements of MIL-C-39029 and withstand 1500 cycles of durability (see 4.6.5). Contact finish shall be 5 millionths minimum gold alloy over 45 millionths minimum palladium alloy, over a suitable underplate, and compatible with gold finish as defined in of MIL-C-39029.

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3.3.7 Connectors and accessories finish: Conductive connector shells and backshells shall have a finish compatible with 500 millionths minimum tin or tin alloy, over a suitable surface preparation. Electrically conductive connector shells and backshells shall have an EMF range of -.10 to -.40 volts as specified in MIL-STD-889. Coupling rings, jam nuts, dust caps, dummy receptacles, and associated hardware shall meet the requirements of this specification.

3.3.8 Dielectric materials:

3.3.8.1 Insert and grommet: Insert and grommet materials shall have hardness, electrical, and mechanical characteristics for the purpose intended.

3.3.8.2 Insert faces: The mating face of socket inserts shall be a hard nonresilient material. The mating face of pin inserts shall be a resilient material which shall provide sufficient sealing to meet the specification performance requirements.

3.4 Design and construction:

Connectors and accessories shall be designed and constructed to withstand normal handling incident to installation and maintenance in service. Connectors shall be designed such that neither the pins nor sockets will be damaged during normal mating of counterpart connectors. Connector intermateability control dimensions shall be as specified on Figures 1 through 4, 6 through 9, and 3.4.1.2. Connector accessory interface dimensions shall be as specified in Figures 5 and Figure 10.

3.4.1 Contacts: Contacts shall be designed for crimp termination and shall be as specified to MIL-C-29600/13, /14, /23, and /24. The connectors specified herein are also capable of operating with contacts specified in MIL-C-39029/17, /18, /56 and /58, as applicable. However, when MIL-C-39029 contacts are used, the durability level of the connector system shall be 500 cycles. The quantity of contacts to be supplied with each connector unit package shall consist of a full complement of contacts plus 1 spare contact for each size used in the arrangement utilizing 26 contacts or less. For arrangements utilizing more than 26 contacts, 2 spare contacts for each size used in the arrangement shall be used.

3.4.1.1 Indirect shipment: Connectors may be ordered without contacts (see 1.3.1, 6.2 and 6.4).

3.4.1.2 Insert arrangement: Insert arrangements for MIL-C-29600 Series A connectors shall be as specified in MIL-STD-1560, as applicable (pattern 25-11 is not applicable). Insert arrangements for MIL-C-29600 Series B connectors shall be as specified in MS3425, MS3426 and MS3428 through MS3433, as applicable. The engaging end of the pin contact in assembled connectors shall be located within 0.024 inch (0.61 mm) diameter of true position and the engaging end of socket contacts in assembled connectors shall be located within 0.015 inch (0.38 mm) diameter of true position.

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3.4.1.3 Installing and removal tools: Tools required for the assembly and disassembly of the pin and socket contacts into their connector inserts shall be qualified to MIL-I-81969/16 for series B connectors, or MIL-I-81969/8 and MIL-I-81969/14 for series A connectors. One qualified MIL-I-81969/16 or MIL-I-81969/14 tool shall be enclosed in the unit package, as applicable. For indirect shipments, connectors may be ordered without installing and removal tools (see 6.2 and 6.4).

3.4.2 Insert design and construction: The entire insert and wire sealing or wire supporting member of the assemblies shall be one integral part, designed to provide sealing and support around the wires and to be nonremovable. The inserts shall be installed in the locations specified in Figures 1, 2, 6, 7 and 3.4.1.2. The rigid dielectric shall be one molded piece or no more than two pieces bonded so as to form essentially one integral piece. Inserts shall be of construction, eliminating all air paths between contacts. The design shall be such as to permit the removal and replacement of individual contacts into their connector inserts with specified installing/removal tools (see 3.4.1.3). The contact locking device shall be contained or located in the rigid dielectric insert and shall retain the contacts in accordance with the contact retention requirements specified herein (see 3.20).

The inserts shall be secured to prevent rotation or movement within the shell. All pin contact inserts shall have a resilient interface seal bonded to the front face in accordance with the applicable standards. Socket entry holes and pin barrier rings shall conform to Figures 4 and 9.

3.4.3 Sealing:

3.4.3.1 Wire sealing: Environment resisting assemblies shall be designed to meet the environmental requirements of this specification using wire of outer diameter within the applicable range as shown in Table I. Sealing to size 8 cavities of the wire sealing grommet may be accomplished by means of separate resilient bushings which shall be furnished with the connector. Connectors shall meet the requirements specified when:

- a. A full complement of wire of the applicable minimum or maximum insulation diameter is installed.
- b. Any combination of wire diameters within the extremes of (a) above are used.

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TABLE I. Wire sealing.

Contact Size	Wire Size	Outer diameter diameter of finished wire			
		Series A		Series B	
		Inches	MM	Inches	MM
22D-23	28				
	26	0.030 Minimum	0.76 Minimum	0.030 Minimum	0.76 Minimum
	24	0.054 Maximum	1.37 Maximum	0.054 Maximum	1.37 Maximum
	22				
20	24				
	22	0.040 Minimum	1.02 Minimum	0.040 Minimum	1.02 Minimum
	20	0.083 Maximum	2.11 Maximum	0.074 Maximum	1.88 Maximum
16	20				
	18	0.065 Minimum	1.65 Minimum	0.060 Minimum	1.52 Minimum
	16	0.109 Maximum	2.77 Maximum	0.103 Maximum	2.62 Maximum
12	14	0.097 Minimum	2.46 Minimum	0.097 Minimum	2.46 Minimum
	12	0.142 Maximum	3.61 Maximum	0.135 Maximum	3.43 Maximum
8	Shielded Cable	0.120 Minimum	3.05 Minimum	N/A	N/A
		0.155 Maximum	3.94 Maximum		

- 3.4.3.2 Grommet sealing plugs: Unless otherwise specified (see 3.1), the grommets of environment resisting connectors shall be designed to accept sealing plugs in accordance with MS27488 and MIL-C-85049/80 in lieu of wire where unwired contacts are employed. Fifteen percent of the number of contacts, but not less than one, shall be enclosed in the unit package. For indirect shipments, connectors may be supplied without grommet sealing plugs (see 6.4).
- 3.4.3.3 Interfacial seal: Plugs and receptacles with pin inserts shall have a resilient face with individual pin barriers (see Figures 4 and 9). The pin barrier projections shall seal in their respective lead-in chambers of the hard face socket insert. The resilient interfacial seal shall provide individual contact seals in the mated condition to ensure circuit isolation between each contact and contact to shell.
- 3.4.4 Shell: Shells, including mounting flanges, shall be of one-piece construction and shall be designed to retain their inserts in one position, both axially and with respect to rotation, by mechanical means. Adhesive may be used as a supplementary retention means for environment resisting connectors. The shells of crimp contact connectors shall have a blue color band in accordance with EIA RS-359, indicating a rear release contact retention system. The blue color band shall be located so that it is readily visible to any person servicing a mounted connector. The shell shall be designed to accept and retain a cable support or other accessory (see Figures 5 and 10).
- 3.4.4.1 Grounding members: Grounding members shall be designed to provide electrical contact with the mating shell prior to contact engagement.

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- 3.4.4.2 Jam-nut mounting receptacles: Jam-nut mounting receptacles shall be provided with mounting nut MIL-C-29600/7 all with provisions for locking and an SAE-AS3582 O-ring.
- 3.4.4.3 Screw threads: Design of screw threads shall use FED-STD-H28 as a reference. Composite threads shall be checked with ring gages made to the worst case dimensions. Slight out-of-roundness beyond the specified tolerances is acceptable if threads can accept the go gages without forcing, and meet the minimum torque values of paragraph 3.39 for accessory thread strength.
- 3.4.5 Threaded coupling: Unless otherwise specified (see 3.1), connectors shall be coupled to counterpart connectors by means of a triple start thread. An anti-decoupling mechanism shall be internal to the plug to maintain the mated connector in full engagement. The coupling ring shall be captivated and shall be knurled or fluted to facilitate coupling.
- 3.4.5.1 Ease of coupling: Counterpart connectors of any arrangement shall be capable of being fully coupled and uncoupled in a normal and accessible location without the use of tools.
- 3.4.5.2 Locking: A complete coupling shall be accomplished by clockwise rotation of the coupling nut and shall provide shell to shell bottoming. A visual red color band shall be provided on the receptacle to determine complete coupling (see MIL-C-29600/10, /11, /20, and /21).
- 3.4.5.3 Polarization of connector shells: Polarization of connector shells shall be accomplished by means of five integral keys and suitable matching keyways on the counterpart. Polarization shall be accomplished before initial engagement of the coupling ring. During axial engagement, pins shall not touch sockets or the insert face until polarization has been achieved (see Figures 3 and 8).
- 3.4.5.3.1 Alternates: Shells shall also be supplied with the keys (or keyways) rotated from the normal as indicated on Figures 3 and 8.
- 3.4.5.4 Engagement seal: Connectors shall contain sealing means so that engaged connectors comply with the requirements specified herein. A dynamic seal shall be provided to achieve a peripheral seal between the mated shells.
- 3.4.5.5 Pin to pin mating prevention: The connector shall be designed such that pin to pin contact (electrical or physical) is not possible in the event that a plug with pin contacts is inadvertently mated with a receptacle with pin contacts.
- 3.4.5.6 Lubrication: Coupling threads may be coated with a lubricant. All lubricants shall meet the performance requirements specified herein. Lubricants shall be NASA approved for space flight parts.

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3.4.6 Cavity fill: If the rear grommet design does not allow for intimate contact between it and the complete inner perimeter of the shell, the resulting cavity between the insert and the shell shall be filled with RTV silicone conforming to MIL-A-46146, or equivalent. After filling, the grommet shall be in accordance with figure 5 or 10.

3.5 Interchangeability:

All connectors having the same part number shall be completely interchangeable with each other with respect to installation and performance.

3.6 Maintenance aging:

When tested as specified in 4.6.2, the contact installation and removal forces shall not exceed the requirements of Table II.

TABLE II. Installing and removal forces.

Contact size	Installing and removal forces (maximum)	
	Pounds	Newtons
22D-23	10	44
20	20	89
16	20	89
12	30	133
8	35	156

3.7 Contact protection, connector mating (scoop-proof):

Connectors designed to provide protection in receptacles or plugs equipped with pin contacts shall not permit the edge of the mating plug or receptacle shell to touch the pin contacts. The procedure described in 4.6.37 shall be used.

3.8 Temperature cycling:

When tested as specified in 4.6.3, there shall be no damage detrimental to the operation of the connector. There shall be no blistering, peeling, or other separation of the plating.

3.9 Coupling torque:

When tested as specified in 4.6.4, the coupling torque for mating and unmating of counterpart connectors shall meet the torque requirements of Table III. The connectors used in this test shall have the complete set of contacts. Protective covers, when mated with their applicable connectors, shall also comply with the torque requirements of Table III.

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TABLE III. Coupling torque.

Shell size	Torque			
	Maximum engagement and disengagement		Minimum disengagement	
	Inch pound	Newton meters	Inch pound	Newton meters
8-9	8	0.9	2	0.2
10-11	12	1.4	2	0.2
13	16	1.8	2	0.2
14-15	20	2.3	4	0.4
16-17	24	2.7	4	0.4
18-19	28	3.2	4	0.4
20-21	32	3.6	6	0.7
22-23	36	4.1	7	0.8
24-25	40	4.5	7	0.8

3.10 Durability:

When tested as specified in 4.6.5, counterpart connectors shall show no damage detrimental to the operation of the connector and shall meet the subsequent requirements.

3.11 Altitude immersion:

Connectors shall have an insulation resistance greater than those values specified in Table IV, after being subjected to altitude immersion as specified in 4.6.6 and shall maintain a dielectric withstanding voltage at sea level as specified in 4.6.8.1.

TABLE IV. Insulation resistance.

Environmental Condition	Insulation resistance (megohms)	
	Series A	Series B
At ambient temperature	5000	5000
At elevated temperature	1000	2000
After altitude immersion	1000	5000
After humidity	100	500

3.12 Insulation resistance:

3.12.1 Insulation resistance at ambient temperature: When tested as specified in 4.6.7.1, the insulation resistance between any pair of contacts and between any contact and the shell shall be greater than 5000 megohms (see Table IV).

3.12.2 Insulation resistance at elevated temperature: When tested as specified in 4.6.7.2, the insulation resistance between any pair of contacts and between any contact and the shell shall be greater than those values specified in Table IV.

3.13 Dielectric withstanding voltage:

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When tested as specified in 4.6.8.1 or 4.6.8.2, connectors shall show no evidence of flashover or dielectric breakdown.

3.14 Insert retention:

When tested as specified in 4.6.9, unmated connectors shall retain their inserts in their proper location in the shell and there shall be no evidence of cracking, breaking, separation from the shell or loosening of parts.

3.15 Salt spray (corrosion):

When tested as specified in 4.6.10, connectors shall be without defects detrimental to the mechanical and electrical performance.

3.16 Electrical engagement:

When tested as specified in 4.6.11, wired, mated connectors shall provide a minimum of 0.050 inch (1.27 mm) electrical engagement for MIL-C-29600 Series A connectors, and .040 inch (1.02mm) electrical engagement for MIL-C-29600 Series B connectors. This requirement also applies to the outer shield and inner conductor of shielded contacts.

3.17 External bending moment:

When tested as specified in 4.6.12, connectors shall be without defects detrimental to the mechanical and electrical performance.

3.18 Gage location:

When tested as specified in 4.6.13, gage locations shall fall within the range specified on Figures 1, 2, 6, and 7.

3.19 Gage retention:

When tested as specified in 4.6.14, the applicable test gages conforming to MS3435 and Figure 20, shall be retained in the contact cavities and the axial displacement of the test gages while under load shall not exceed 0.012 inch (0.30 mm).

3.20 Contact retention:

When tested as specified in 4.6.15, the axial displacement of the contact shall not exceed 0.012 inch (0.30 mm). No damage to the contacts or inserts shall result.

3.21 Altitude - low temperature: When tested as specified in 4.6.16 the connectors shall meet the requirements of dielectric withstanding voltage as specified in 3.13 and the insulation resistance as specified in 3.12.1.

3.22 Vibration (qualification only):

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When tested as specified in 4.6.17, there shall be no electrical discontinuity greater than 1.0 microsecond and there shall be no disengagement of the mated connectors, backing off of the coupling mechanism, evidence of cracking, breaking or loosening of parts.

3.23 Shock:

When tested as specified in 4.6.18, there shall be no electrical discontinuity greater than 1.0 microsecond and there shall be no disengagement of the mated connectors, evidence of cracking, breaking or loosening of parts.

3.24 Conductivity (classes R and G only):

3.24.1 Shell-to-shell conductivity: When tested as specified in 4.6.19.1 the maximum measured resistance between the two connectors shall be 6.0 milliohms for shell sizes 17 and larger and 10 milliohms for sizes 15 and smaller. The test probes shall not puncture or damage the connector finish.

3.24.2 Shield to shell conductivity (accessories only): Unless otherwise specified (see 3.1), when tested as specified in 4.6.19.3, the maximum resistance measured between the shield terminated to the connector plug and the receptacle flange shall be 20 milliohms.

3.25 Humidity:

When tested as specified in 4.6.20, wired, mated connectors shall be without defects detrimental to the mechanical and electrical performance. Following the test, and during the final cycle, insulation resistance shall be greater than those values specified in Table IV.

3.26 Grounding member forces:

When tested as specified in 4.6.21, the axial force necessary to overcome the grounding member interference shall be greater than .25 pounds but less than 15 pounds.

3.27 EMI shielding (classes R and G only):

When tested as specified in 4.6.22.1 and 4.6.22.2 the EMI shielding capabilities of mated shells shall be not less than that specified in table V at the specified frequencies.

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TABLE V. EMI shielding effectiveness.

Leakage attenuation (db) minimum	
Frequency (MHz)	Classes G and R
100	90
200	88
300	88
400	87
800	85
1,000	85
1,500	69
2,000	65
3,000	61
4,000	58
6,000	55
10,000	50

3.28 Ozone exposure (unmated):

When tested as specified in 4.6.23, the connectors shall show no evidence of cracking of materials or other damage due to ozone exposure that will adversely affect subsequent performance.

3.29 Fluid immersion:

When tested as specified in 4.6.24, connectors shall meet the requirements for coupling torque (see 3.9) and dielectric withstanding voltage (see 3.13) when exposed to all fluids specified in Method 1016 of MIL-STD-1344.

3.29.1 Retention system fluid immersion: When tested as specified in 4.6.24.1, the insert assemblies shall meet requirements of contact retention (see 3.20). Effects of the fluids on resilient sealing members shall not be a consideration of this test.

3.30 Pin contact stability:

When tested as specified in 4.6.25, the total displacement of a reference point on the contact tip shall not exceed the amount shown in Table VI.

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TABLE VI. Pin contact stability.

Contact size	Total displacement				Force			
	Series A		Series B		Series A		Series B	
	Inches (Maximum)	MM	Inches (Maximum)	MM	Pounds	Newtons	Pounds	Newtons
23	N/A	N/A	0.025	0.635	N/A	N/A	0.25	1.1
22D	0.030	0.762	N/A	N/A	0.28	1.2	N/A	N/A
20	0.054	1.372	0.030	0.762	0.56	2.5	0.50	2.2
16	0.075	1.905	0.048	1.219	1.1	4.9	1.0	4.4
12	0.075	1.905	0.062	1.575	1.1	4.9	1.0	4.4
8	0.100	2.540	N/A	N/A	2.2	9.8	N/A	N/A

3.31 Contact walkout:

When tested as specified in 4.6.26, the contacts shall not be dislodged from their normal position.

3.32 Insertion/removal tool abuse:

When tested as specified in 4.6.27, there shall be no damage to the contacts, the connector insert, or the contact retaining mechanism. The connectors shall meet the requirements of subsequent testing.

3.33 High temperature exposure with contact retention:

When tested as specified in 4.6.28, the contacts shall support an axial load equal to 50% of the values specified in Table XIV. The contacts shall maintain their specified locations (see Figures 1, 2, 6, and 7). Electrical discontinuity shall not exceed one (1) microsecond. There shall be no visible leaching of the interfacial seal detrimental to connector performance.

3.33.1 High temperature exposure: When tested as specified in 4.6.28.1 for 1000 hours, connectors shall be without defects detrimental to the mechanical and electrical performance and shall pass succeeding tests in the qualification test sequence.

3.34 Electrolytic erosion:

When tested as specified in 4.6.29, pin contacts shall show no exposure of base metal due to electrolytic erosion. Corrosion products shall not be considered as defects.

3.35 Ice resistance:

When tested as specified in 4.6.30, connectors shall pass succeeding tests in the qualification table. Uncoupling and recoupling torque shall not exceed the values of Table III by more than 25 percent.

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3.36 Dust (fine sand):

When tested as specified in 4.6.31, connectors shall pass succeeding tests in the qualification table. Uncoupling and recoupling torque shall not exceed the values listed in Table III by more than 25 percent.

3.37 Plating adhesion:

3.37.1 Plating adhesion (solder pull): The connectors shall be subjected to a solder pull test to determine the adhesion of the plating to the composite substrate. When tested as specified in 4.6.32.1, the plating shall adhere to the substrate with a shear strength greater than 750 psi.

3.37.2 Plating adhesion (thermal shock): The connector shells shall be subjected to a thermal shock test to determine the adhesion of the plating to the composite substrate. When tested as specified in 4.6.32.2, there shall be no blistering, peeling or other separation of plating.

3.38 Impact:

When connectors are tested as specified in 4.6.33, there shall be no breaking or cracking of inserts or shells. Also, there shall be no bending of contacts nor any damage which would prevent the connectors from mating or unmating.

3.39 Accessory thread strength:

When tested as specified in 4.6.35, mated connectors shall have an accessory thread strength of 50 inch pounds minimum for shell sizes 8, 9, 10, 11, 13, 14, 15, 16, 17, 18 and 19, and 100 inch pounds minimum for shell sizes 20, 21, 22, 23, 24 and 25. There shall be no detrimental damage to the connectors.

3.40 Thermal vacuum outgassing (class G only):

When tested as specified in 4.6.38, the total mass loss (TML) shall not be greater than 1.0% and collected volatile condensable materials (CVCM) shall not be greater than 0.10%.

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3.41 Marking:

Connectors and accessories shall be molded, etched or ink stamped with the manufacturer's name or trademark, date code, assembly plant code, and the following information, as applicable. Stamping shall be in accordance with MIL-STD-1285 where space permits. The following example is illustrative:

Identification

M29600/20	R	J	18	P	1
Specification sheet no.	Class (see 1.3.1)	Shell size (see Table VII)	Insert arrangement (see 3.4.1.2)	Contact style (see 1.3.2)	Polarization (a number is required for all positions) (see 3.4.5.3 and Figs. 3 and 8)

TABLE VII. Shell size code for part numbering.

Shell Size	Code Letter
8	A
9	B
10	C
11	D
13	F
14	G
15	H
16	J
17	K
18	M
19	N
20	P
21	R
22	S
23	T
24	U
25	W

3.41.1 Contact location identification: Contact locations shall be identified as indicated on the applicable military standard. All positions shall be identified on the front and rear faces of the insert except where space limitations make this impracticable. Location of contact identifying characters shall be in close proximity to the holes but need not be placed exactly where indicated on the standard. Contact identifying characters shall be permanent and shall not be molded, raised characters on the connector interface.

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3.42 Workmanship:

The connector shall be fabricated in a manner such that the criteria for appearance, fit and adherence to specified tolerances are observed. Particular attention shall be given to neatness and thoroughness of marking parts, finish, molding and bonding. The connector shall be free from crazing, cracks, voids, pimples, chips, blisters, pinholes, sharp cutting edges, burrs and other defects that will adversely affect life, serviceability or appearance.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for inspection:

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

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

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

4.1.2 Reliability assurance program: A reliability assurance program shall be established and maintained in accordance with MIL-STD-790. Evidence of such compliance shall be verified by the qualifying activity of this specification as a prerequisite for qualification and continued qualification.

4.1.3 Fungus resistance certification: Certification of Requirement 4 of MIL-STD-454 is required (see 3.3.4).

4.2 Classification of inspection:

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The examination and testing of connectors shall be classified as follows:

- a. Qualification inspection (see 4.4).
- b. Quality conformance inspection (see 4.5).

4.3 Inspection conditions:

Unless otherwise specified herein, all inspections shall be performed in accordance with the test conditions specified in the "GENERAL REQUIREMENTS" of MIL-STD-1344.

4.4 Qualification inspection:

Qualification inspection shall be performed at a laboratory acceptable to the Government (see 6.3) on sample units produced with equipment and procedures normally used in production.

4.4.1 Initial qualification: Initial qualification approval may be granted upon successful completion of the inspections and tests of Table VIII conducted on samples of 4.4.1.1. Additional shell configurations and insert arrangements other than those actually tested may be qualified by similarity, providing that the capability to manufacture these parts is demonstrated by providing exhibit samples acceptable to the qualifying activity.

4.4.1.1 Test samples: Samples shall be subjected to qualification and group C periodic tests in the sequence specified in Table VIII.

- a. Connectors supplied for testing to Table VIII, Group 1 shall consist of two small (sizes 8 through 13), two medium (sizes 14 through 19), and two large (sizes 20 through 25), shell sizes in the most dense contact arrangements. One small, one medium, and one large shell size connector shall be exposed to all of the table VIII, group 1 tests except for plating adhesion (thermal shock). The other small, medium, and large size connectors shall be exposed to all table VIII, group 1 tests except for plating adhesion (solder pull).
- b. Sample Group 2 in Table VIII shall consist of nine mated pairs of connectors, representative of each contact size and small, medium and large shell sizes. The samples shall be divided equally for testing to the three vibration levels.
- c. Sample Groups 3 through 7 in Table VIII shall consist of a small, a medium, and a large shell size in the most dense contact arrangements. Note: Group 5 samples may be provided less inserts.

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4.4.1.1 (Continued):

- d. Connectors supplied for testing to Table VIII, Group 8, shall consist of a sufficient quantity to subject 5 contact cavities of each size to the specified tests. Elastomeric o-rings may be supplied separate from the connectors.
- e. Connectors supplied for the tests of table VIII, group 9, shall consist of twelve mating pairs, straight plugs, and wall mounting receptacles, of a medium shell size, in any representative insert and shell size arrangement. In addition, 12 elastomeric o-rings, separate from the connectors, shall be tested. One o-ring per test fluid.
- f. Connectors supplied for the tests of table VIII, group 10, shall consist of a sufficient quantity to subject 20 contact cavities of each size to each immersion fluid specified.
- g. Unplated connectors supplied for the tests of table VIII, group 11, shall consist of one small, one medium, and one large mated pair. No insert is required.

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TABLE VIII. Qualification and Group C periodic tests.

Inspection	Requirement Paragraph	Test Paragraph
<u>Group 1</u>		
Examination of product	3.1 thru 3.5, 3.41 and 3.42	4.6.1
Maintenance aging	3.6	4.6.2
Electrical engagement	3.16	4.6.11
Temperature cycling	3.8	4.6.3
Dielectric withstanding voltage (unmated at sea level)	3.13	4.6.8.1
Altitude immersion	3.11	4.6.6
Insulation resistance (ambient temperature)	3.12.1	4.6.7.1
Salt spray	3.15	4.6.10
Shell-to-shell conductivity	3.24.1	4.6.19.1
Coupling torque	3.9	4.6.4
Accessory thread strength	3.39	4.6.35
Insert retention	3.14	4.6.9
Dielectric withstanding voltage (unmated at sea level)	3.13	4.6.8.1
*Dielectric withstanding voltage (unmated at altitude)	3.13	4.6.8.2
Plating adhesion	3.37	4.6.32
Examination of product	3.1 thru 3.5, 3.41 and 3.42	4.6.1
<u>Group 2</u>		
Examination of product	3.1 thru 3.5, 3.41 and 3.42	4.6.1
Maintenance aging	3.6	4.6.2
Contact protection	3.7	4.6.37
Insulation resistance at ambient temperature	3.12.1	4.6.7.2
Coupling torque	3.9	4.6.4
Contact retention	3.20	4.6.15
Altitude-low temperature	3.21	4.6.16
Temperature cycling	3.8	4.6.3
Dielectric withstanding voltage (unmated at sea level)	3.13	4.6.8.1
Durability	3.10	4.6.5
*Vibration	3.22	4.6.17
Shock	3.23	4.6.18
Shell to shell conductivity	3.24	4.6.19
High temperature exposure	3.33.1	4.6.28.1
*Qualification only		

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Humidity	3.25	4.6.20
Dielectric withstanding voltage (unmated at sea level)	3.13	4.6.8.1
*Dielectric withstanding voltage (mated at altitude)	3.13	4.6.8.2
*Dielectric withstanding voltage (unmated at altitude)	3.13	4.6.8.2
Coupling torque	3.9	4.6.4
Contact retention	3.20	4.6.15
Examination of product	3.1 thru 3.5, 3.41 and 3.42	4.6.1
<u>Group 3</u>		
Examination of product	3.1 thru 3.5, 3.41 and 3.42	4.6.1
Maintenance aging	3.6	4.6.2
Coupling torque	3.9	4.6.4
Contact retention	3.20	4.6.15
Temperature cycling	3.8	4.6.3
Dielectric withstanding voltage (unmated at sea level)	3.13	4.6.8.1
Shell to shell conductivity	3.24	4.6.19
Ozone exposure (unmated)	3.28	4.6.23
Magnetic permeability	3.3.3	4.6.34
Insulation resistance (ambient temperature)	3.12.1	4.6.7.1
Coupling torque	3.9	4.6.4
Dielectric withstanding voltage (unmated at sea level)	3.13	4.6.8.1
Contact retention	3.20	4.6.15
*Dielectric withstanding voltage (mated at altitude)	3.13	4.6.8.2
Impact	3.38	4.6.33
Examination of product	3.1 thru 3.5, 3.41 and 3.42	4.6.1
<u>Group 4</u>		
Examination of product	3.1 thru 3.5, 3.41 and 3.42	4.6.1
Maintenance aging	3.6	4.6.2
Contact protection	3.7	4.6.37
Contact retention	3.20	4.6.15
Temperature cycling	3.8	4.6.3
Dielectric withstanding voltage (unmated at sealevel)	3.13	4.6.8.1
Durability	3.10	4.6.5
Insulation resistance (ambient temperature)	3.12.1	4.6.7.1
*Qualification only		

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External bending moment	3.17	4.6.12
Coupling torque	3.9	4.6.4
Dielectric withstanding voltage (unmated at sea level)	3.13	4.6.8.1
Contact retention	3.20	4.6.15
Insulation resistance (ambient temperature)	3.12.1	4.6.7.1
*Dielectric withstanding voltage (mated at altitude)	3.13	4.6.8.2
*Dielectric withstanding voltage (unmated at altitude)	3.13	4.6.8.2
Examination of product	3.1 thru 3.5, 3.41 and 3.42	4.6.1
<u>Group 5</u>		
Examination of product	3.1 thru 3.5, 3.41 and 3.42	4.6.1
Grounding member forces	3.26	4.6.21
Shell-to-shell conductivity	3.24.1	4.6.19.1
Salt spray	3.15	4.6.10
EMI Shielding effectiveness (classes G and R only)	3.27	4.6.22
Examination of product	3.1 thru 3.5, 3.41 and 3.42	4.6.1
<u>Group 6</u>		
Examination of product	3.1 thru 3.5, 3.41 and 3.42	4.6.1
Dielectric withstanding voltage (at sea level)	3.13	4.6.8.1
Electrolytic erosion	3.34	4.6.29
Examination of product	3.1 thru 3.5, 3.41 and 3.42	4.6.1
<u>Group 7</u>		
Examination of product	3.1 thru 3.5, 3.41 and 3.42	4.6.1
Ice resistance	3.35	4.6.30
Coupling torque	3.9	4.6.4
Dust (fine sand)	3.36	4.6.31
Coupling torque	3.9	4.6.4
Thermal vacuum outgassing	3.40	4.6.38
Examination of product	3.1 thru 3.5, 3.41 and 3.42	4.6.1
<u>Group 8</u>		
Examination of product	3.1 thru 3.5, 3.41 and 3.42	4.6.1
Gage location	3.18	4.6.13
Gage retention	3.19	4.6.14
*Qualification only		

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Pin contact stability	3.30	4.6.25
Contact walkout	3.31	4.6.26
Maintenance aging	3.6	4.6.2
*Insertion/removal tool abuse	3.32	4.6.27
High temperature exposure with contact retention	3.33	4.6.28
Shell to shell conductivity	3.24.1	4.6.19.1
Insert retention	3.14	4.6.9
Examination of product	3.1 thru 3.5, 3.41 and 3.42	4.6.1
<u>Group 9</u>		
Examination of product	3.1 thru 3.5, 3.41 and 3.42	4.6.1
Fluid immersion	3.29	4.6.24
Shell to shell conductivity	3.24.1	4.6.19.1
Coupling torque	3.9	4.6.4
Dielectric withstanding voltage (unmated at sea level)	3.13	4.6.8
Examination of product	3.1 thru 3.5, 3.41 and 3.42	4.6.1
<u>Group 10</u>		
Examination of product	3.1 thru 3.5, 3.41 and 3.42	4.6.1
Retention system fluid immersion	3.29	4.6.24.1
Contact retention	3.20	4.6.15
Examination of product	3.1 thru 3.5, 3.41 and 3.42	4.6.1
<u>Group 11</u>		
Examination of product	3.1 thru 3.5, 3.41 and 3.42	4.6.1
Hydrolytic stability	3.3.1.2	4.6.36.2
Examination of product	3.1 thru 3.5, 3.41 and 3.42	4.6.1
*Qualification only		

- 4.4.1.2 Preparation of samples: Samples provided for Table VIII, Groups 1 and 2 shall be wired with equal amounts of minimum and maximum diameter wire. The minimum and maximum diameter wire shall be in accordance with MIL-W-22759 for each contact cavity size. Samples provided for Table VIII, Groups 3 and 4, and 6 through 10, shall be wired with nominal wire in accordance with MIL-W-22759 for each contact cavity size. Connectors for test Groups 1 through 5 shall be assembled with backshells per MIL-C-29600/2. Connectors for test Group 5 shall be supplied without inserts. Connectors for test Group 11 shall be unwired and unmated. Samples provided under 4.4.1.1 shall be wired with a wire having a smooth extruded outer jacket or insulation of waterproof construction.

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TABLE IX. Test wire sizes. ^{1/}

Contact size	Maximum Diameter		Minimum Diameter	
22D, 23	M22759/9, /10, /20, /21	-22	M22759/11, /12, /22 M22759/18, /19, /32, /33, /44, /45, /46	-28 -26
20	M22759/7, /8	-20	M22759/18, /19, /32, /33, /44, /45, /46 M22759/11, /12, /14, /15, /22, /23	-24 -24
16	M22759/3, /4, /7, /8	-16	M22759/14, /18, /32, /44, /45	-16
12	M22759/7, /8	-12	M81381/7, /8, /11, /12	-12
8	M17/95-RG180	shielde d	M17/176-00002	shielde d

^{1/} High-strength 20-26 AWG wire is recommended for use on vibration samples.

4.4.2 Periodic qualification: The manufacturer shall forward a report every 24 months as required by the qualifying activity. The qualifying activity shall establish the initial reporting date. The report shall consist of:

- a. A summary of the results of the tests performed for Group B inspection indicating as a minimum the number of lots that have passed and the number that have failed. The results of tests of all reworked lots shall be identified and accounted for.
- b. A summary of the results of the tests performed as well as the original data sheets or direct images thereof for group C inspection including the number and mode of failures. At the discretion of the qualifying activity, untested samples may be required at no cost to the government if the summary of the test results indicates nonconformance with the specification requirements, and corrective action acceptable to the qualifying activity has not been taken, action may be taken to remove the failing product from the qualified products list.
- c. Failure to submit the report within 30 days after the end of each reporting period may result in loss of qualification for the product. In addition to the periodic submission of inspection data, the manufacturer shall immediately notify the qualifying activity if at any time during the reporting period the inspection data indicate failure of the qualified product to meet the requirements of this specification.

4.4.2 (Continued):

- d. In the event that no production occurred during the reporting period, a report shall be submitted certifying that the company still has the capabilities and facilities necessary to produce the item. If during two consecutive reporting periods, there has been no production, the manufacturer may be required, at the discretion of the qualifying activity, to submit the products (a representative product of each device) to testing in accordance with the qualification inspection requirements.

4.4.2.1 Group C inspection (periodic tests): Periodic tests shall be performed on a 12-month and 24-month basis, beginning with the 12-month periodic test. These tests shall be accomplished within this period after notification of qualification and alternating thereafter with the 24-month periodic test. Samples submitted to either of these periodic tests shall have passed groups A and B inspections.

4.4.2.1.1 Twelve month periodic test: The following tests shall be performed:

- a. Two mated connectors, one series A in a -35 arrangement and one series B in an arrangement with size 23 contacts, of the largest shell size in regular production shall be subjected to the humidity test in accordance with 4.6.20.
- b. One mated pair of any representative shell size for each contact size qualified shall be subjected to the high temperature exposure with contact loading test in accordance with 4.6.28 for 250 hours.
- c. Two mated connectors of any representative size and arrangement, one pair being subjected to each of the specified fluids conduct the fluid immersion test in accordance with 4.6.24, except that the fluids shall be:
 - (1) MIL-PRF-5624, JP-5
Test fluid c, Method 1016, MIL-STD-1344.
 - (2) Test fluid b, Method 1016, MIL-STD-1344.
- d. One receptacle shell and one plug shell with coupling ring, of any small and large shell size of each finish style qualified, conduct the salt spray test in accordance with 4.6.10.

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- 4.4.2.1.2 Twenty-four month periodic tests: Every 24 months, mating connector sample units shall be selected and tested in accordance with the following:
- a. For each series qualified, two mated plugs and receptacles from each shell size range and having each service rating represented shall be provided. Three mated plugs and receptacles shall be provided if a manufacturer has qualified only one series. The three shell size ranges are small (size 8 through 13), medium (size 14 through 19), and large (size 20 through 25). One mated pair from each shell size range shall be fully wired with the maximum wire listed in table IX and subjected to the applicable tests of table VIII, group 1. The remaining samples shall be fully wired with the minimum wire listed in table IX and subjected to the applicable tests of table VIII, group 2.
 - b. One mating pair from each shell size range shall be subjected to the impact test in accordance with 4.6.33.
- 4.4.2.1.3 Failures: If one or more sample units fail to pass Group C inspection, the sample shall be considered to have failed.
- 4.4.2.1.4 Disposition of sample units: Sample units which have been subjected to Group C inspection shall not be delivered on the contract or purchase order.
- 4.4.2.1.5 Noncompliance: If a sample fails to pass Group C inspection, the qualifying activity shall be notified prior to implementing corrective action. The manufacturer shall take corrective action on the materials or processes or both, as necessary, and on all units which are to be corrected and which were manufactured with essentially the same materials, processes, etc., and which are considered subject to the same failure. Any shipment of the product (related lots) shall be discontinued until corrective action acceptable to the Government has been taken. After the corrective action has been taken, Group C inspection shall be repeated on additional sample units (all inspections, or the inspection which the original sample failed, at the option of the Government). Groups A and B inspections may be reinstated; however, final acceptance shall be withheld until the Group C reinspection has shown that corrective action was successful.
- 4.5 Quality conformance inspection:
- Quality conformance inspection applies to products intended for delivery and consists of Groups A and B inspection. The use of in-process controls is allowable only for those requirements that specify such.
- 4.5.1 Group A inspection: Group A inspection shall consist of the examinations and tests specified in Table X. The documentation requirements of MIL-STD-1344 do not apply.

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TABLE X. Group A inspection.

Examination or test (100% inspection)	Requirement paragraph	Test paragraph
Visual examination (4.5.1.1)	3.1 thru 3.5, 3.41 and 3.42	4.6.1
Insulation resistance at ambient temperature <u>1/</u> <u>2/</u>	3.12.1	4.6.7.1
Dielectric withstanding voltage at sea level <u>1/</u> <u>2/</u>	3.13	4.6.8.1

1/ The manufacturer may use in-process controls for this requirement.

2/ Test between two adjacent contacts.

4.5.1.1 Visual examination: Each connector shall be visually examined for completeness, configuration, workmanship and identification requirements.

4.5.2 Group B inspection: Group B inspection shall consist of the examinations and tests specified in Table XI in the order shown and shall be made on sample units which have been subjected to and have passed the Group A inspection. For Group B inspection, the documentation and standard test condition of MIL-STD-1344 do not apply.

TABLE XI. Group B inspection.

Examination or test	Requirement paragraph	Test paragraph	AQL
Visual and mechanical examination <u>1/</u>	3.1 thru 3.5, 3.41 and 3.42	4.6.1	
Major			0.25
Minor			1.0
Grounding member force <u>1/</u> <u>2/</u>	3.26	4.6.21	

1/ The manufacturer may use in-process controls for this requirement.

2/ Test 5 pieces - no failures permitted.

4.5.2.1 Sampling plan (Group B inspection): The sampling plan shall be in accordance with ASQC-Z1.4 for special inspection S-4. Major and minor defects shall be as defined in ASQC-Z1.4. The sample size shall be based on the inspection lot size. The acceptable quality level (AQL) shall be as specified in Table XI.

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4.5.2.2 Lot definition (Group B inspection): The production lot definition of MIL-STD-790 is further defined as follows:

- a. A production lot consists of all connectors covered under one military specification, manufactured from the specified raw materials, processed under the same specification and procedures, produced by the same type of equipment, and submitted for inspection at one time. Each production lot of assembled connectors shall be a group identified by a common manufacturing record through all significant assembly operations.
- b. Traceability of connectors to specific physical and chemical test reports of incoming raw materials is not required.
- c. Common manufacturing records and traceability shall begin with the start of connector assembly.

4.5.2.3 Rejected lots (Group B inspection): If an inspection lot is rejected, the manufacturer may rework the lot to correct the defects or screen out the defective units and resubmit for reinspection. Resubmitted lots shall be inspected using tightened inspection. Such lots shall be separate from new lots and shall be clearly identified as reinspected lots.

4.5.2.4 Disposition of sample units: Sample units which have passed all of Group B inspection may be delivered on the contract or purchase order if the lot is accepted and the sample units are still within specified tolerances.

4.6 Methods of inspection:

4.6.1 Examination of product (see 3.1 thru 3.5, 3.41 and 3.42): The connectors, accessories and piece parts shall be examined to insure conformance with the basic specification and the applicable specification sheets. In-process control of component parts, unrelated to lot size of furnished connectors may be utilized in lieu of examination of these components in the finished connectors to assure conformance of these component parts. 100% examination of each retention cavity for molding discrepancies, retention feature, and excessive adhesive, shall be a required in-process control for all removable contact connectors.

4.6.2 Maintenance aging (see 3.6): Connectors shall be tested in accordance with Method 2002 of MIL-STD-1344. The following details shall apply: Installing removal tool shall be in accordance with MIL-I-81969/8, MIL-I-81969/14 or MIL-I-81969/16, as specified. A minimum of 20 percent but not less than three contacts of each connector shall be tested.

4.6.3 Temperature cycling (see 3.8): Mated connectors with adapters shall be tested in accordance with test condition A of Method 1003 of MIL-STD-1344. The temperature range shall be -65°C to $+175^{\circ}\text{C}$. At the completion of the test cycle, the connectors shall be returned to room temperature for further inspection.

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- 4.6.4 Coupling torque (see 3.9): Receptacles, plugs, dummy stowage receptacles and protective covers shall be engaged with and disengaged from counterpart connectors. The forces or torques which must be applied to the coupling rings in order to facilitate full coupling and uncoupling shall be measured and recorded. The force or torque application shall be applied at a uniform rate. The color band shall not be visible at full mating.
- 4.6.5 Durability (see 3.10): Wired and assembled counterpart connectors shall be mated and unmated 1500 times at a maximum rate of 300 cycles per hour with the coupling rings operated in a manner to simulate actual service (plugs and receptacles shall be completely separated during each cycle).
- 4.6.6 Altitude immersion (see 3.11): Mated connectors shall be tested in accordance with Method 1004 of MIL-STD-1344. The following details shall apply:
- All wire ends shall be located within the chamber and exposed to the chamber atmosphere but not submerged or sealed.
 - At the end of the third cycle while the connectors are still submerged in the solution, the insulation resistance at ambient temperature shall be measured as specified in 4.6.7.1 and the dielectric withstanding voltage test shall be performed as specified in 4.6.8.1.
- 4.6.7 Insulation resistance:
- 4.6.7.1 Insulation resistance at ambient temperature (see 3.12.1): Unmated connectors shall be tested as specified in Method 3003 of MIL-STD-1344. The following details and exceptions apply:
- For Group A testing, where it is undesirable to install actual contacts in connectors, simulated contacts and special techniques may be used in performing this test.
 - The tolerance on the applied voltage shall be +10 percent.
 - Connectors shall be mated when testing after altitude immersion, altitude-low temperature, and humidity.
- 4.6.7.2 Insulation resistance at elevated temperature (see 3.12.2): Unmated connectors shall be tested as specified in Method 3003 of MIL-STD-1344. The following details and exceptions shall apply:
- The tolerance on the applied voltage shall be +10 percent.
 - Measurement shall be taken during the last 30 minutes of high temperature exposure (see 4.6.28).
 - Measurements shall be made while the connectors are still in the chamber at the specified temperature.

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4.6.8 Dielectric withstanding voltage (see 3.13):

4.6.8.1 Dielectric withstanding voltage at sea level: Wired, unmated connectors shall be tested in accordance with Method 3001 of MIL-STD-1344. Connectors shall be mated when testing after altitude immersion, humidity and altitude low temperature. The following details and exceptions apply:

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

TABLE XII. Test voltage, ac RMS, 60 Hz.

Altitude	Serv. Rating M <u>1/</u>		Serv. Rating N <u>1/</u>		Serv. Rating I <u>1/</u>		Serv. Rating II <u>1/</u>		Serv. Rating III <u>2/</u>	
	Mate d	Unmate d	Mate d	Unmate d	Mate d	Unmate d	Mate d	Unmate d	Mate d	Unmate d
Sea level	1300	1300	1000	1000	1800	1800	2300	2300	1800	1500
50,000 feet	800	550	600	400	1000	600	1000	800	1000	700
70,000 feet	800	350	600	260	1000	400	1000	500	1000	375
100,000 feet	800	200	600	200	1000	200	1000	200	1000	200

1/ Service ratings M, N, I, and II apply to insert patterns defined in MIL-STD-1560.

2/ Service rating III applies to insert patterns defined in MS3425, MS3426 and MS3428 thru MS3433. Service rating III was previously designated as service rating I, in the above MS sheets.

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4.6.8.2 Dielectric withstanding voltage at altitude: Mated connectors and unmated connector halves with pin contacts shall be tested in accordance with Method 3001 of MIL-STD-1344 with the following details and exceptions:

- a. The magnitude of the test voltage shall be as specified in Table XII.
- b. Fifty percent of the contacts available shall be tested, but in no case shall less than six dielectric withstanding voltage readings be taken. If the number of contacts is three or less, all contacts shall be tested. The test voltage shall be applied between each wired contact and each adjacent contact and the shell.
- c. The test voltage shall be maintained at the specified value for 2 seconds minimum.
- d. The leads of all test circuits shall be brought out through the walls of the chamber. There shall be no wire splices inside the chamber. The wire ends of all leads shall be unsealed.
- e. Connectors shall be tested at each of the specified altitude pressure equivalents listed below.

<u>Altitude</u>	<u>Equivalent pressure</u>
50,000 feet	87 torr
70,000 feet	33 torr
100,000 feet	8 torr

4.6.9 Insert retention (see 3.14): Unmated connectors shall be tested in accordance with Method 2010 of MIL-STD-1344 with the following details and exceptions:

- a. Force to be applied: 75 ± 5 pounds per square inch ($5.27 \pm .352$ kilograms per square centimeter). An axial displacement rate of approximately 0.5 inches per minute (1.27 centimeters per minute) shall be used to obtain the specified pressure.
- b. Connectors may be wired.

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- 4.6.10 Salt spray (corrosion): The wired, assembled 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 plug and receptacle are completely separated during each cycle. The connectors shall then be subjected to the salt spray test in accordance with Method 1001 of MIL-STD-1344. The following details and exceptions shall apply (see 3.15):
- a. For initial qualification, the connectors shall be tested for 1952 hours mated followed by 48 hours unmated. For the periodic tests, the connectors shall be tested for 452 hours mated followed by 48 hours unmated.
 - b. The connectors shall not be mounted but shall be suspended from the top of the chamber using waxed twine or string, glass rods or glass cord.
 - c. Wire ends shall be protected to prevent salt migration.
 - d. After the salt spray exposure, the remaining 1450 durability cycles as specified in 4.6.5 shall be completed.
- 4.6.11 Electrical engagement (see 3.16): Counterpart plugs and receptacles shall be wired so as to provide a complete series circuit through all contacts of the mated connector. A power source and indicator shall be provided such that the earliest point at which the circuit is completed, during normal connector mating, can be established. Connector halves shall be slowly mated by the normal mating means until first indication of a completed circuit is observed. Means shall be provided to assure that electrical contact is made between the pin and the spring of the socket contact, rather than the hood of the socket contact. The mating operation shall be held at this point and the overall connector length shall be measured from solid reference points on the connector halves. The mating operation shall then be continued until the connector halves are in the completely mated position. A second overall length measurement shall then be taken from the same reference points. The difference of these two measurements shall be no less than specified in 3.16.

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4.6.12 External bending moment (see 3.17): The receptacle connector shall be mounted as in normal service to a rigid panel. Before mating the plug connector to the receptacle, an adapter or test torque arm shall be attached as shown on Figure 19. After mating the plug and receptacle connectors, the distance "L" from the point of load application "P" to the mounting panel shall be determined. The load to be applied at point "P" shall then be determined as the bending moment listed in Table XIII divided by the level arm "L." An axial displacement rate of approximately 0.5 inches per minute (1.27 centimeters per minute) shall be used to obtain the specified load. The applied load shall be held for 1 minute, then the load shall be released. Continuity of the contacts shall be monitored during the test. The test circuit used to monitor this shall be capable of detecting a discontinuity in excess of 1 microsecond. The connector shall be removed, unmated and inspected to 3X power magnification for damage detrimental to normal operation of the connector. For those tests not requiring indication of connector performance when tested with accessory, a similarly compatible dummy connector, duplicating mating features, may be used in place of an actual connector.

TABLE XIII. External bending moment.

Shell size	External bending moment	
	(Pound-inches)	(Newton-meters)
8-9	75	8.5
10-11	125	14.1
13	175	19.8
14-15	250	28.2
16-17	325	36.7
18-19	400	45.2
20-21	475	53.7
22-23	550	62.1
24-25	650	73.4

4.6.13 Gage location (see 3.18): Applicable test gages conforming to MS3434 and Figure 20 shall be installed in three randomly selected cavities in each connector with the accessory rear hardware removed. Connectors shall have contacts installed in the remaining cavities. An axial load of 2 pounds shall be applied to the engaging end of the gage and the location of the gage shall be measured in accordance with Figures 1, 2, 6, 7 and 9. The test shall be repeated on Series A connectors only using gage 20b to seat the pin assemblies forward in the contact cavity.

4.6.14 Gage retention (see 3.19): Test gages shall be installed in three randomly selected cavities of each connector with accessory rear hardware removed. Connectors shall have contacts installed in the remaining cavities. The axial load specified in Table XIV shall be applied to individual test gages in both directions. An axial displacement rate of 0.5 inches per minute (1.27 centimeters per minute) shall be used to obtain the specified load. Gage displacement shall be measured with respect to the connector shell after an initial load of 2 pounds (0.907 kilograms) has been applied to assure that all slack has been taken up.

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TABLE XIV. Contact retention.

Contact size	Axial Load +10 percent	
	Pounds	(Newtons)
22D-23	10	44
20	15	67
16	25	111
12	25	111
8	25	111

4.6.15 Contact retention (see 3.20): The contact retention shall be tested as specified in Method 2007 of MIL-STD-1344. The following details shall apply:

- a. Number of samples - The test shall be performed on 20 percent of the contact complement, but not less than three contacts in each connector half.
- b. Applied axial load - Preload to 3 pounds maximum (13.3 newtons). Apply load as specified in Table XIV, using an axial displacement rate of 0.5 inches per minute (1.27 centimeters per minute).
- c. Special requirements - Where the test sequence requires maintenance aging prior to contact retention, the contacts which are subjected to maintenance aging shall also be selected for contact retention.
- d. Axial direction - The applicable forces shall be applied along the longitudinal axis of individual contacts in the directions tending to displace the contacts to the rear and the front of the connector.
- e. Only the contacts to be tested need be installed in the connector.
- f. Use test probes per Figure 12.

4.6.16 Altitude-low temperature (see 3.21): Wired, mated, assembled connectors shall be subjected to the test specified in Method 1011 of MIL-STD-1344. The following details apply:

- a. No wire ends or splices inside the chamber.
- b. Dielectric withstanding voltage test to be performed at 100,000 feet (30.5 kilometers) and -65°C in accordance with 4.6.8.2.
- c. Insulation resistance test to be performed at 100,000 feet (30.5 kilometers) and -65°C in accordance with 4.6.7.1.

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- 4.6.17 Vibration (qualification only) (see 3.22): Wired and mated connectors shall be subjected to the applicable test(s) specified. Connectors shall be mounted on the vibration table by normal means. All contacts shall carry a test current of 100 milliamperes maximum and shall be continuously monitored for discontinuities throughout the test. A detector capable of detecting any discontinuities in excess of 1 microsecond shall be used. All connectors shall be fixtured in accordance with Figure 13 during vibration. Connectors shall not be torqued beyond the maximum coupling in table III.
- 4.6.17.1 Sine vibration (series A only): Connectors shall be subjected to a simple harmonic motion from 10 to 2,000 Hz in each of three mutually perpendicular axes. The level of vibration shall be velocity of 254 mm/sec from 10-50 Hz; 1.5 mm double amplitude from 50-140 Hz, and 60 G from 140-2,000 Hz. The entire frequency range from 10-2,000 Hz and back shall be traversed in 20 minutes. The vibration shall be applied for a duration of 12 hours in each of the three mutually perpendicular axes for a total of 36 hours at room ambience. All plugs shall have accessory backshells in accordance with 4.4.1.2.
- 4.6.17.2 Random vibration (series A only): Connectors shall be subjected to the test specified in Method 2005 of MIL-STD-1344. All plugs shall have accessory backshells in accordance with 4.4.1.2. The following details shall apply:
- Test Condition V - Using the vibration envelope shown on Figure 14 (derived from zone 2, outlined in Aerospace Information Report, AIR 1557).
 - Vibration to be conducted at ambient temperature.
 - Duration shall be 8 hours in the longitudinal direction and 8 hours in a perpendicular direction for a total of 16 hours.
- 4.6.17.3 Random vibration (series A only): Connectors without accessory backshells shall be subjected to the test specified in method 2005.1 of MIL-STD-1344. The following details apply:
- Test Condition VI - Letter "J".
 - Duration shall be 8 hours in longitudinal direction and 8 hours in a perpendicular direction for a total of 16 hours.
 - Vibration shall be conducted at rated temperatures. Four hours in each axis shall be conducted at -65°C while the remaining 4 hours shall be conducted at +175°C. The item under test shall be stabilized at temperature a minimum of 1 hour prior to vibration. A minimum time period of one half hour shall be provided between temperature extremes.

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- 4.6.17.4 Vibration (series B only): Connectors shall be vibrated in accordance with Method 2005, test condition IV of MIL-STD-1344. In addition, the vibration shall be conducted at the low temperature extreme of $-65 \pm 0/-3$ °C, and the high temperature extreme of $175 \pm 3/-0$ °C. The duration of vibration at the extreme temperatures shall be 25 percent of the duration specified for the standard temperature condition.
- 4.6.18 Shock (see 3.23): Wired and mated connectors shall be subjected to the applicable test specified. Connectors shall be mounted by normal means and held together by normal coupling means. All contacts shall be wired in a series circuit with 100 milliamperes maximum current through the series circuit during shock. Connectors shall be monitored for any discontinuities. A detector capable of detecting all discontinuities in excess of 1 microsecond shall be used.
- 4.6.18.1 Standard shock: Connectors shall be subjected to the test specified in Method 2004, Test Condition D, of MIL-STD-1344. The following details shall apply:
- The wire bundle shall be clamped to fixed points at least 8 inches (203.2 mm) from the rear of the connector.
- 4.6.18.2 High-impact shock: Wired and mated connectors shall be subjected to the test specified in MIL-S-901, grade A, with the following modifications and additions. Mounting fixtures shall be in accordance with MIL-S-901, light weight. The wire bundle shall be supported on a stationary frame in such a manner to provide a free flexing length between the frame and fixture of not less than 36 inches (914.4 mm).
- Test condition A. Plug shall be terminated with at least 80 percent of wired contacts.
- 4.6.19 Conductivity (classes R and G only):
- 4.6.19.1 Shell-to-shell conductivity (see 3.24.1): Mated connectors shall be subjected to the test specified in Method 3007 of MIL-STD-1344.
- 4.6.19.2 Shield to shell conductivity (accessories only) (see 3.24.2): The complete assembly (connector receptacle, plug, backshell, and shield) shall be subjected to the test specified in method 3007 of MIL-STD-1344 except the following details shall apply:
- The test current shall be caused to flow through the shield, backshell, connector plug, and connector receptacle.
 - The resistance of the mated assembly shall be measured from a point on the shield $1.00 \pm 0.25, -0.00$ inch from the rear of the plug's backshell to the mounting flange of the receptacle.
 - The shield shall be in accordance with QQ-B-575 and shall be tin plated.

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- 4.6.20 Humidity (see 3.25): Wired, mated connectors shall be subjected to the humidity test specified in Method 1002, Type II, of MIL-STD-1344. The following details and exceptions shall apply:
- a. The mated connectors shall be mounted in a vertical position.
 - b. Step 7(a) shall be performed during the last cycle.
 - c. Three hours minimum after the start of step 7(a), during the final cycle and while the connectors are still subjected to high humidity, the insulation resistance shall be measured when the chamber temperature reaches $20^{\circ}\text{C} +5^{\circ}\text{C}$ and condensation is observed on the connector.
 - d. For qualification testing, insulation resistance readings shall be made on a minimum of 50 percent of the circuits. Outer circuits shall be measured to the connector shell.
- 4.6.21 Grounding member forces (see 3.26): Plugs shall be completely mated and unmated 10 times with counterpart receptacles less inserts. On the mating of the first cycle, the forces necessary to engage the connector shall be within the values specified in 3.26. On the unmating of the last cycle, the forces necessary to separate the connectors shall be within the values specified in 3.26. An axial load shall be applied at a displacement rate of 0.5 inches per minute (1.27 centimeters per minute) to engage/separate the plug with the grounding member of the counterpart mating receptacle.
- 4.6.22 EMI shielding effectiveness (class R and G only): Connectors shall not be torqued beyond the maximum coupling torque specified in table III.
- 4.6.22.1 EMI shielding effectiveness (from 100 to 1000 MHz only) (see 3.27): The EMI shielding effectiveness of mated connectors with approved EMI backshells shall be measured in a triaxial radio frequency leakage fixture as shown on Figure 15. The EMI leakage from the conductor inside the connector in the same inner coaxial line into the outer coaxial line shall be measured at the frequencies specified in Table V within a frequency accuracy of +5%. The level of detected signal power shall be indicated by a tunable radio frequency field intensity meter isolated from the test circuit by a 3 to 10 db pad. Care shall be taken to ensure that the signal is a result of EMI leakage from within the mated connector and not due to a faulty termination inside the fixture. All terminations inside the fixture, whether to the EMI backshells or between internal conductors, shall have a leakage at least 10 db less than the test requirements. The signal source shall be set to the desired frequency. The signal shall be fed through a 3 to 10 db isolation pad to a parallel circuit consisting of a coaxial switch, double pole double throw (DPDT), connected so that the signal can be manually or electronically fed alternately to the fixture and to a variable 100 db reference attenuator. The attenuator shall be adjustable in 1 db steps and calibrated to ± 3 db.

4.6.22.1 (Continued):

- a. The insert may be removed from the connectors under test or the contacts removed and a hole drilled through the insert to accommodate a center conductor of suitable geometry to provide a good 50-ohm impedance match with the inside diameter of the mated connector shells and EMI backshells. Tapered transition may be used to provide a means of changing diameters without introducing significant discontinuities in the line. The maximum VSWR in the inner coaxial line shall be 1.5. The outer shell of the test fixture shall be so constructed as to provide a good 50-ohm impedance match with the outside diameter of the mated connector shells, coupling ring, and EMI backshells. The maximum VSWR of the outer coaxial line shall be 1.5.
- b. A sliding circumferential short shall be positioned behind the connector on the signal input end of the fixture to provide for tuning the outer coaxial line for maximum output at each test frequency. The allowable travel of this short shall be greater than 1/2 wave length at the lowest test frequency, 1.5 meters minimum for 100 MHz. The inner coaxial line shall be terminated in a fixed 50 ohm load impedance behind the connector at the output end of the fixture.
- c. The connectors used to couple together the various elements of the test system shall be of a low-leakage type which have a nominal impedance of 50 ohms, a VSWR of less than 1.5, and a minimum leakage attenuation of 100 db. The output impedance of the signal source and the input impedance of the detector shall be nominally 50 ohms with a maximum VSWR of 1.5. The input and output VSWR of the standard attenuator shall be less than 1.5 in the 20 to 100 db range.
- d. The relative signal level in the variable attenuator shall be equal to the signal level through the leakage fixture by adjusting the attenuator. The signal loss in the fixture can then be read from the setting on the variable attenuator.

4.6.22.2 EMI Shielding effectiveness (from 1 to 10 GHz): Preparation of samples, and measurements of the EMI shielding effectiveness of mated connectors shall be in accordance with the mode stirred technique specified in Method 3008 of MIL-STD-1344 (see 3.27).

4.6.23 Ozone exposure (see 3.28): The unmated connectors shall be subjected to ozone as specified in Method 1007 of MIL-STD-1344. At the end of the specified period, the samples shall be examined for signs of ozone deterioration as specified.

4.6.24 Fluid immersion (see 3.29): Unmated connector samples shall be subjected to the test specified in Method 1016 of MIL-STD-1344 (one sample per fluid). Following the fluid immersion cycles, the connectors shall be tested for coupling torque as specified in 4.6.4, dielectric withstanding voltage at sea level as specified in 4.6.8.1 within 3 hours.

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- 4.6.24.1 Retention system fluid immersion (see 3.29.1): Unmated connectors with contacts removed shall be immersed in the fluids specified in Method 1016 of MIL-STD-1344 (one sample per fluid) for 2 hours each at room temperature. After removal, excess fluid shall be drained from the connectors for 4 hours and the contacts reinstalled. Following the test, the connectors shall be subjected to contact retention as specified in 4.6.15.
- 4.6.25 Pin contact stability (see 3.30): The unmated connectors shall have 10 percent, but no less than 3, of their pin contact cavities subjected to this test. The applicable gage pin of Figure 20 shall be used for MIL-C-29600 Series A connectors. The applicable gage pin of MS3435 shall be used for MIL-C-29600 Series B connectors. The connector shall be in a holding device. The rate of load application shall not exceed 1 inch (25.4 mm) per minute. The load specified in Table VI shall be applied perpendicular to the gage pins as shown in Figure 21. With the load applied, the position of the gage pin shall be identified. The applicable load shall then be applied in the opposite direction (180°) and the total displacement of the gage pin shall be measured.
- 4.6.26 Contact walk-out (see 3.31): Two contacts in each plug and receptacle shall be tested. The contacts shall be crimped to stranded steel cable or steel core copper wire (copperweld or equivalent) of an appropriate size and installed in the connector. The unmated connector shall be mounted in a fixture as shown in Figure 16. A 3 pound (1.36 kilogram) load shall be applied to the cable. One 360° rotation of the fixture with the connector mounted shall constitute one cycle. The connector shall be subjected to 100 cycles at a rate of 10 to 20 cycles per minute.
- 4.6.27 Installing/removal tool abuse (qualification only) (see 3.32): Five contact cavities in each connector shall be subjected to the following test. Should a tool become damaged during any of the testing, it shall be replaced. Failure of a tool shall not constitute a test failure. Tools in accordance with MIL-I-81969/16 or MIL-I-81969/8, and MIL-I-81969/14 shall be used.
- 4.6.27.1 Removal tool rotation: The tool shall be inserted as if to remove a contact and a total of 3 pounds (1.36 kilograms) axial load shall be applied. With the force applied, the tool shall be rotated 180° and then removed also removing the contact. The contact shall be reinserted. The steps shall be repeated three times on each of five contacts selected.

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- 4.6.28 High temperature exposure with contact retention (see 3.33): Connectors with removable contacts shall have one mating pair of contacts removed and replaced with contacts crimped to stranded steel cable or steel core copper wire (copperweld or equivalent) of appropriate size. The axial location of these contacts shall be measured for conformance with the applicable dimensions shown in Figures 1, 2, 4, 6, 7, and 9, with a load of 2 pounds (.907 kilograms) applied to seat the contact back against the retention device. The connector shall then be mounted in a fixture as shown in Figure 11. A weight of 50% of the axial load specified in Table XIV for the applicable contact size shall be suspended freely from each steel core wire. A current of $100 + 10$ milliamperes supplied from a 10.0 Vdc maximum power source shall be applied to the test contacts and an instrument shall be used to monitor the circuit for discontinuity in excess of one microsecond. The mated connectors, mounted as shown in Figure 11, shall then be subjected to the temperature of $175^{\circ} +3^{\circ}, -0^{\circ}\text{C}$ for a period of 1000 continuous hours. The internal temperature shall be monitored at a contact closest to the center of the connector. After the connectors return to ambient temperature, they shall be unmated and the contact locations remeasured (see Figures 1, 2, 6, and 7) with 2 pounds (.907 kilograms) axial load applied to seat the contact back against the retention device. The tested contacts shall then be replaced with unwired contacts and sealing plugs, and those cavities shall be exempted from subsequent testing.
- 4.6.28.1 High temperature exposure (see 3.33.1): Mated connectors shall be subjected to an ambient temperature of $175 +3^{\circ}, -0^{\circ}\text{C}$. The temperature shall be maintained for 1000 hours. Insulation resistance at elevated temperature (see 4.6.7.2) shall be measured in the last 30 minutes of high temperature exposure.
- 4.6.29 Electrolytic erosion (see 3.34): The wired receptacle half of the connector containing the pin contacts shall be firmly mounted in a vertical position, pins facing up. A salt-water solution (5 percent salt by weight) shall be poured onto the pin interface until the solution level just reaches the pin tips. The solution shall remain in the connector for a minimum of 30 seconds and then poured out, lightly shaking excesses from the connector. The counterpart plug shall immediately be mated with the receptacle. One cell pattern, with all contacts adjacent to a central contact at a positive polarity and the center contact at a negative polarity, shall be set up at a location giving the most uniform distribution of contacts adjacent to the center contact. A potential of 60 volts dc shall be applied between the contacts adjacent to the center contact. The contacts shall be energized for 40 hours. Following this, with the voltage disconnected, the connectors shall be unmated and the pin contacts removed. The contacts shall be examined using 10X magnification for erosion to base metal.
- 4.6.30 Ice resistance (see 3.35): Mated connectors shall be immersed in tap water for 1 minute and then placed in an ambience of -65°C for 1 hour. A minimum of three such cycles shall be performed until the connector surfaces are completely iced over. Immediately after removal from the last cycle, the frozen connectors shall be uncoupled and then recoupled. The connectors shall be uncoupled and recoupled a second time with the uncoupling and coupling torque measured in accordance with paragraph 4.6.4. The uncoupling and coupling torque shall not be measured on the first uncoupling and recoupling.

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4.6.31 Dust (fine sand) (see 3.36): Mated connectors shall be subjected to the sand and dust test of Method 110 of MIL-STD-202.

4.6.32 Plating adhesion:

4.6.32.1 Plating adhesion (solder wire) (see 3.37.1): A 14 AWG or heavier multi-stranded copper wire shall be soldered to the shells in accordance with Figure 17. Sn60 solder conforming to J-STD-006 shall be used. Prior to soldering, the area to be soldered shall be cleaned to remove any contamination. A soldering iron of 35 watts or less shall be used and the solder footprint on the part shall be about .25 inch in diameter. Heat shall not be applied to the part via the soldering iron for greater than 30 seconds. The part shall be mounted in a tensile testing machine and the wire pulled in the direction shown in Figure 17 until the plating or substrate separates or breaks. After failure, the connector shall be inspected to assure that failure resulted from plating or substrate separation or fracture. If failure has occurred due to any other cause, including, but not limited to, wire breakage, wire pull out from the solder, or solder separation from the plating, then another wire shall be soldered onto a new location and the pull test repeated. The force at separation or breakage shall be noted. Measure and determine the area of the piece pulled loose from the connector that is attached to the wire. Divide the force at separation or breakage by this area to determine the shear strength. Breakage of the substrate at a strength greater than that specified in 3.37.1 shall not be deemed a failure.

4.6.32.2 Plating adhesion (thermal shock) (see 3.37.2): Connector shells shall be subjected to the following adhesion test:

- a. The shells shall be placed in an air circulating oven at 200°C for 30 minutes.
- b. At the end of this period, they shall be removed from the oven and within 15 seconds immersed in ice water (approximately 0°C).
- c. Examine the connector shells for any blistering, peeling or other separation of plating.

4.6.33 Impact (see 3.38): Connectors shall be tested as specified in Method 2015 of MIL-STD-1344. The following conditions shall apply:

- a. Drop height shall be 6 feet (1.829M).
- b. Number of drops shall be 10.
- c. Plate shall be indexed at 36° intervals.

4.6.34 Magnetic permeability (see 3.3.3): Connectors shall be tested as specified in Method 3006 of MIL-STD-1344.

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- 4.6.35 Accessory thread strength (see 3.39): The mated connector shall be mounted to a rigid panel as in normal service. A threaded accessory with a torque wrench attached shall be threaded to the accessory end of the plug and a torque applied at a rate of 10 inch-pounds per second until the specified torque is reached. The torque shall be held for one minute and released. The test shall then be repeated on the accessory end of the receptacle. For those tests not requiring indication of connector performance when tested with accessory, a similarly compatible dummy connector, duplicating mating features, may be used in place of an actual connector.
- 4.6.36 Hydrolytic stability (see 3.3.1.2):
- 4.6.36.1 Hydrolytic stability (for insert materials only): Certification of Requirement 47 of MIL-STD-454 is required.
- 4.6.36.2 Hydrolytic stability (for shell materials only): Unplated connector shells including coupling nuts and jam-nuts shall be subjected to the following water absorption tests:
- 4.6.36.2.1 Hydrolytic stability (initial qualification): The connectors shall be subjected to the test specified in ASTM D570-81 paragraph 7.4, Long-term immersion.
- 4.6.36.2.2 Hydrolytic stability (periodic qualification): The connectors shall be subjected to the test specified in ASTM D570-81 paragraph 7.5, 2-h Boiling water immersion.
- 4.6.37 Contact protection (see 3.7): The front edge of the shell of the plug connector shall be scooped within the front aperture made by the shell of the mating receptacle. The front edge of both shells shall be in contact during this test
- 4.6.38 Thermal vacuum outgassing (class G only) (see 3.40): Connectors shall be subjected to the test specified in ASTM E595-84.

5. PACKAGING:

5.1 Packaging:

For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of material is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

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6. NOTES:

6.1 Intended use:

Connectors, contacts and associated hardware are intended for general military use as a system. Used as such, they are particularly suitable for light weight applications and corrosive environments where EMI shielding is required.

- a. Connectors specified herein are not fully intermountable with those specified in MIL-C-81511 or MIL-C-38999. See detailed specification sheets to determine if these connectors will meet the desired mounting requirements.
- b. Connectors specified herein are not intermateable with connectors from any other military specification, even though some of the internal components and subassemblies may be used by other connectors.
- c. Connectors specified herein are not intended for use with accessory hardware configured with interfaces consisting of features constructed from a metal base material.

6.1.1 Restrictions of use:

- a. Air Force - MIL-C-29600 Series B are not for use.
- b. Army - MIL-C-29600 Series B are not for use.
- c. Navy - Connectors specified herein are not for shipboard jacketed cable applications.

WARNING: MIL-C-29600 Series A Connectors are not intended for mating with MIL-C-29600 Series B Connectors. Doing so may result in damage to the contacts or the inserts of the connectors. It is specifically critical with shell sizes 10 and 11 when size 20 contacts are used and with shell size 20 and 21 when size 12 contacts are used. These connectors shall not be located next to each other in any application unless the shell keying has been selected to guarantee that the shells will never allow the mating process to begin. However, series A and B connectors are interchangeable.

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6.2 Ordering data:

Procurement documents should specify:

- a. Title, number and date of this specification.
- b. Complete part number (see 3.42).
- c. Whether contacts, sealing plugs and tools are included.

6.3 Qualification:

With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in applicable qualified products list (QPL) whether or not such products have actually been so listed by that date. The attention of the manufacturers is called to this requirement, and they are urged to arrange to have products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to the qualification of products may be obtained from the Naval Air Warfare Center Aircraft Division Patuxent River, Code 4.4.4, Building 1461, 48256 Shaw Road, Unit 4, Patuxent River, MD 20670.

6.4 Indirect shipments:

The preservation, packaging, packing and marking specified in Section 5 apply only to direct purchase by or direct shipment to the Government and are not intended to apply to contracts between the supplier and prime contractor.

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6.5 Subject term (key word) listing:

Accessories

Backshells

Composite

Connectors

Contacts

Pin

Plug

Receptacle

Socket

Threaded coupling

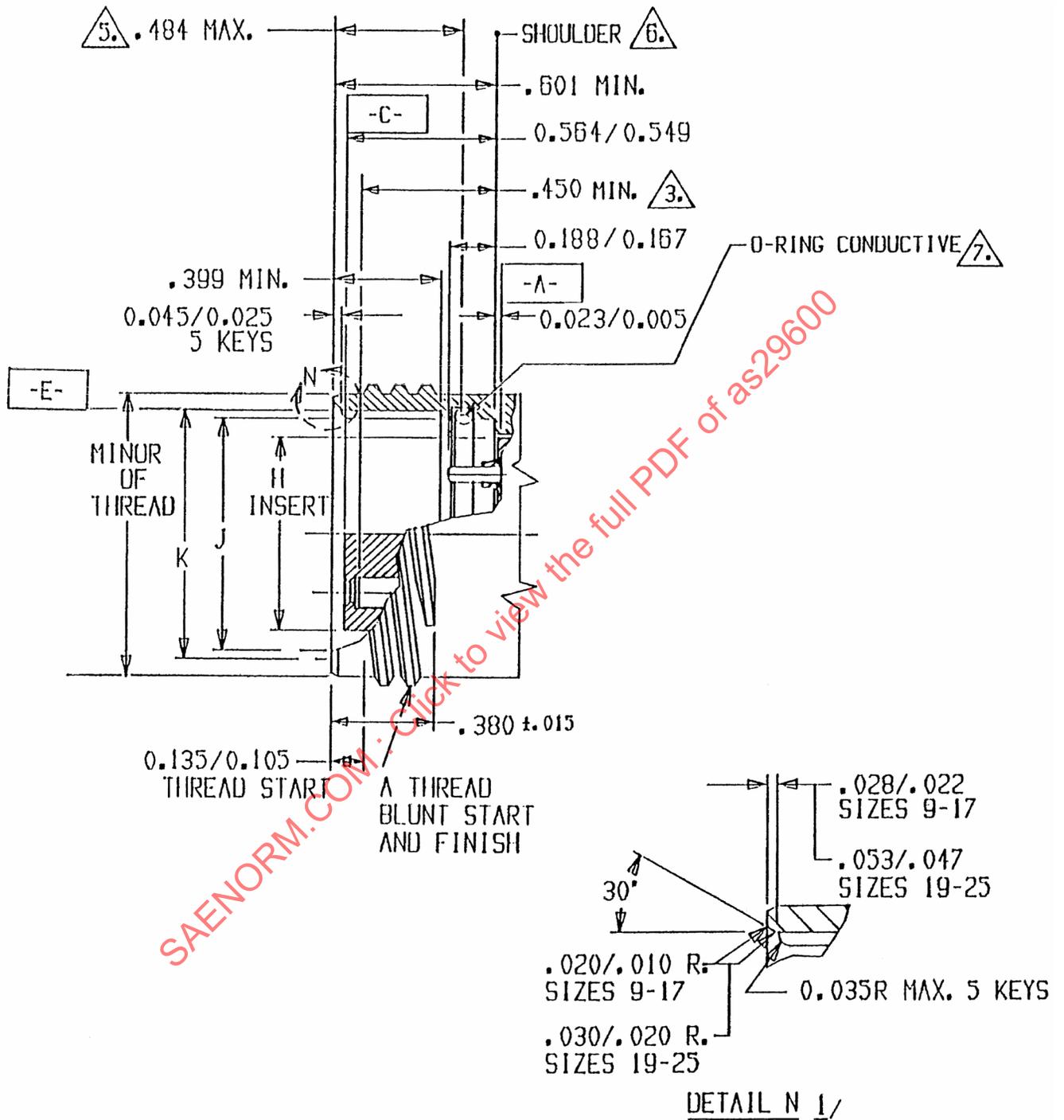
6.6 Patents:

There are no patents pending on MIL-C-29600 designs.

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SAE SUBCOMMITTEE AE-8C1, CONNECTORS OF
COMMITTEE AE-8, AEROSPACE ELECTRICAL/ELECTRONIC DISTRIBUTION SYSTEMS

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1/ Front configuration I.D. and O.D. optional chamfer and radius to facilitate mating.

Figure 1. Connector, receptacle intermateability dimensions (Series A).

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Shell Size	A Thread Mod Stub 60° .1P-.3L Class 2A				H ϕ	J ϕ	K ϕ
	Thread	Major ϕ	Pitch ϕ	Minor ϕ	$\pm .005$	± 0.003	± 0.0050
9	.6250	.6235 .6155	.5975 .5895	.5675 .5535	.285	.4080	.4745
11	.7500	.7485 .7405	.7225 .7145	.6925 .6785	.413	.5330	.5995
13	.8750	.8735 .8655	.8475 .8395	.8175 .8035	.527	.6580	.7245
15	1.0000	.9985 .9905	.9725 .9645	.9425 .9285	.652	.7830	.8495
17	1.1875	1.1855 1.1735	1.1515 1.1415	1.1135 1.0955	.777	.9090	.9755
19	1.3750	1.3730 1.3610	1.3390 1.3290	1.3010 1.2830	.866	1.0330	1.0995
21	1.5000	1.4980 1.4860	1.4640 1.4540	1.4260 1.4080	.991	1.1580	1.2245
23	1.6250	1.6230 1.6110	1.5890 1.5790	1.5510 1.5330	1.116	1.2820	1.3495
25	1.6875	1.6855 1.6735	1.6515 1.6415	1.6135 1.5955	1.241	1.4080	1.4745

Notes:

1. Dimensions are in inches unless otherwise specified.
2. Mating key positions and dimensions are shown in figure 3.
3. Distance from face of insert to the point at which a gage pin, having the same basic diameter as the mating pin and a square face, first engages the socket contact (see figure 4).
4. Rear end connector design for attachment of accessory hardware is shown in figure 5.
5. Grounding member to plug shell first contact.
6. Shoulder is point of contact to tip of plug shell at full mating.
7. Conductive o-ring material is silver filled silicone/fluorosilicone blend and meets the dimensional requirements of SAE-AS3582 or MS9021.

Figure 1. Connector, receptacle intermateability dimensions (Series A) (continued).

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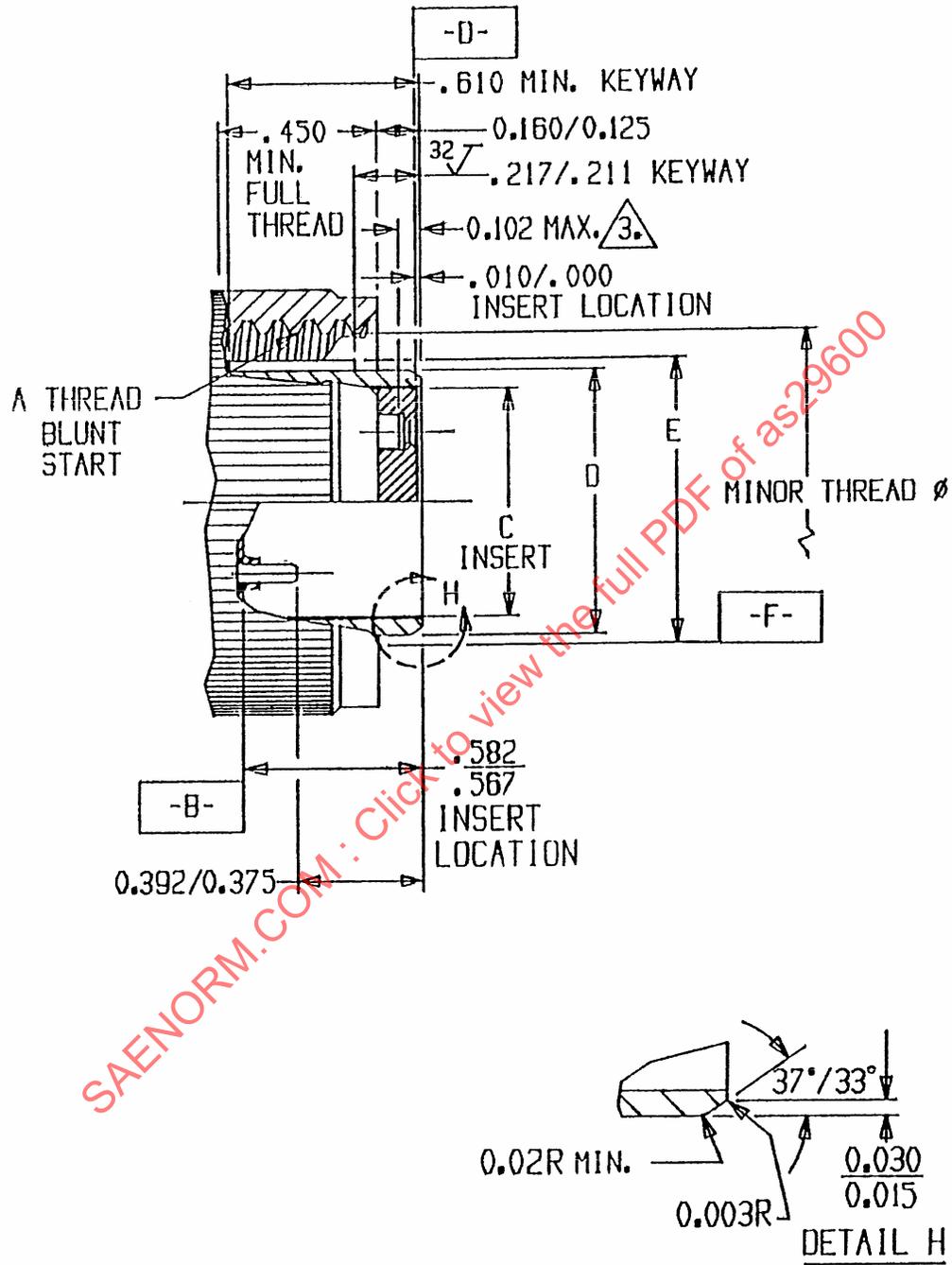


Figure 2. Connector, plug intermateability dimensions (Series A).

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Shell Size	A Thread Mod Stub 60° .1P-.3L Class 2B				C Ø ±.005	D Ø ±.003	E Ø ±.003
	Thread	Minor Ø	Pitch Ø	Major Ø			
9	.6250	.5892 .5792	.6090 .5990	.6450 .6290	.285	.385	.454
11	.7500	.7142 .7042	.7340 .7240	.7700 .7540	.413	.510	.579
13	.8750	.8392 .8292	.8590 .8490	.8950 .8790	.527	.635	.704
15	1.0000	.9642 .9542	.9840 .9740	1.0200 1.0040	.652	.760	.829
17	1.1875	1.1394 1.1274	1.1655 1.1535	1.2115 1.1915	.777	.886	.955
19	1.3750	1.3270 1.3150	1.3530 1.3410	1.3990 1.3790	.866	1.010	1.079
21	1.5000	1.4520 1.4400	1.4780 1.4660	1.5240 1.5040	.991	1.135	1.204
23	1.6250	1.5770 1.5650	1.6030 1.5910	1.6490 1.6290	1.116	1.259	1.329
25	1.6875	1.6395 1.6275	1.6655 1.6535	1.7115 1.6915	1.241	1.385	1.454

Notes:

1. Dimensions are in inches unless otherwise specified.
2. Mating key positions and dimensions are shown in figure 3.
3. Distance from face of insert to the point at which a gage pin, having the same basic diameter as the mating pin and a square face, first engages the socket contact (see figure 4).
4. Rear end connector design for attachment of accessory hardware is shown in figure 5.

Figure 2. Connector, plug intermateability dimensions (Series A) (continued).

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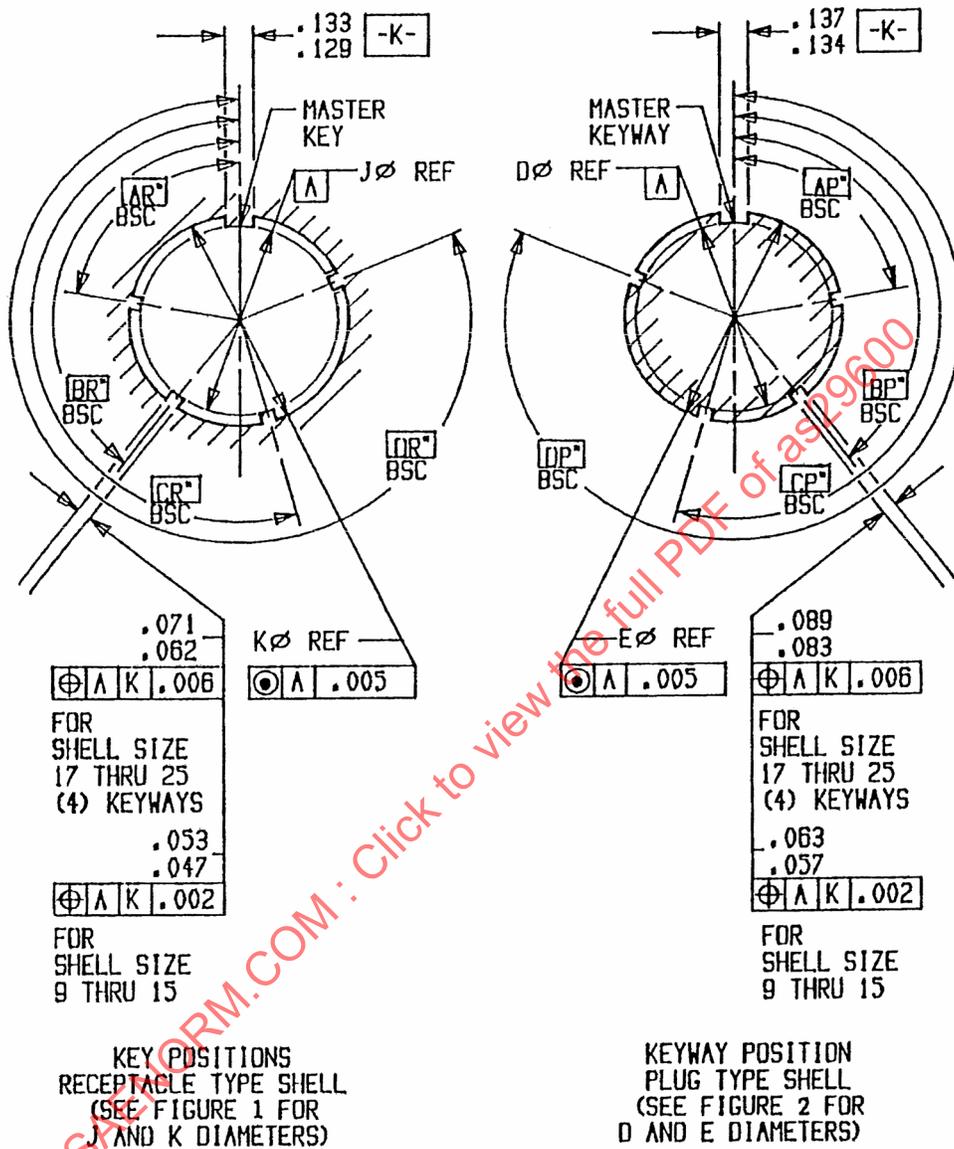


Figure 3. Connector master key/keyway polarization (Series A).

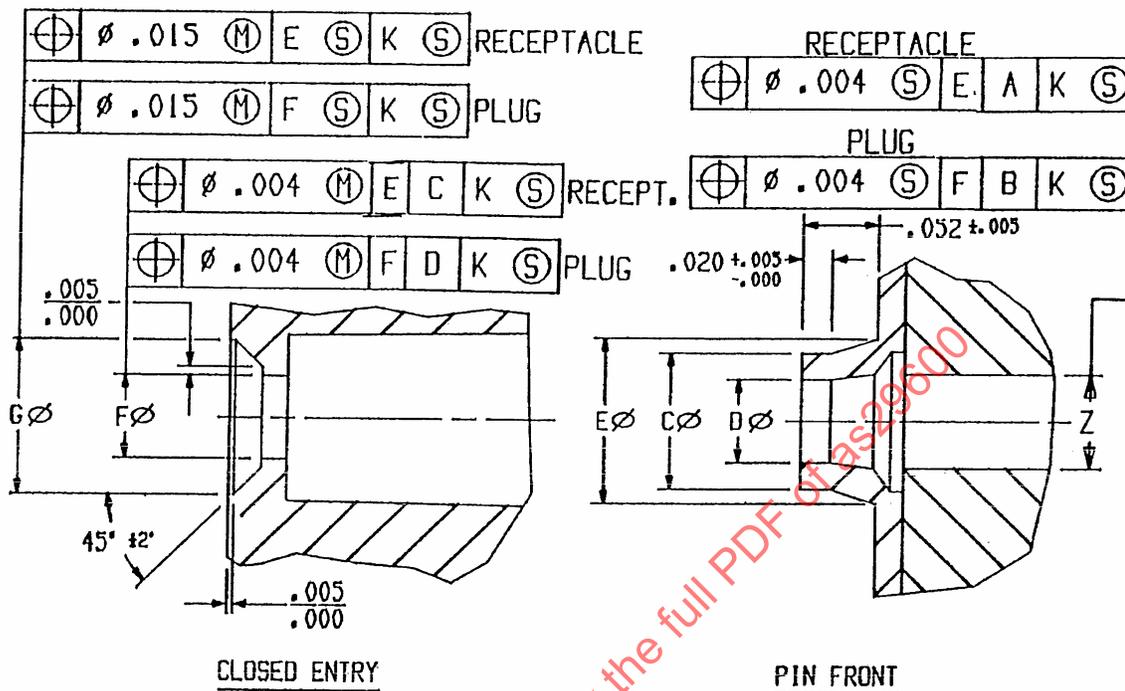
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Shell Size	Key & Keyway Arrangement	AR° or AP° BSC	BR° or BP° BSC	CR° or CP° BSC	DR° or DP° BSC
9	1	102	132	248	320
	2	80	118	230	312
	3	105	140	215	265
11 thru 15	1	113	156	182	292
	2	90	145	195	252
	3	95	141	208	236
17 thru 25	1	135	170	200	310
	2	49	169	200	244
	3	80	142	196	293

Notes: 1. Dimensions are in inches unless otherwise specified.

Figure 3. Connector master, key/keyway polarization (Series A) (continued).

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Contact Size	Detail A		Detail B		
	F \varnothing	G \varnothing	E \varnothing	C \varnothing	D \varnothing MAX
22D	.038	.067	.074	.053	.028
	.035	.063	.069	.050	
20	.052	.089	.096	.075	.038
	.049	.085	.091	.072	
16	.074	.112	.119	.098	.060
	.071	.108	.114	.095	
12	.106	.144	.151	.130	.092
	.103	.140	.146	.127	
8	.230	.268	.278	.256	.216
	.277	.264	.273	.251	

- Notes:
1. Dimensions are in inches unless otherwise specified.
 2. Datums A, C, and E are from figure 1.
 3. Datums B, D, and F are from figure 2.
 4. Datum K is from figure 3.

Figure 4. Connector interfacial seal configuration (Series A).

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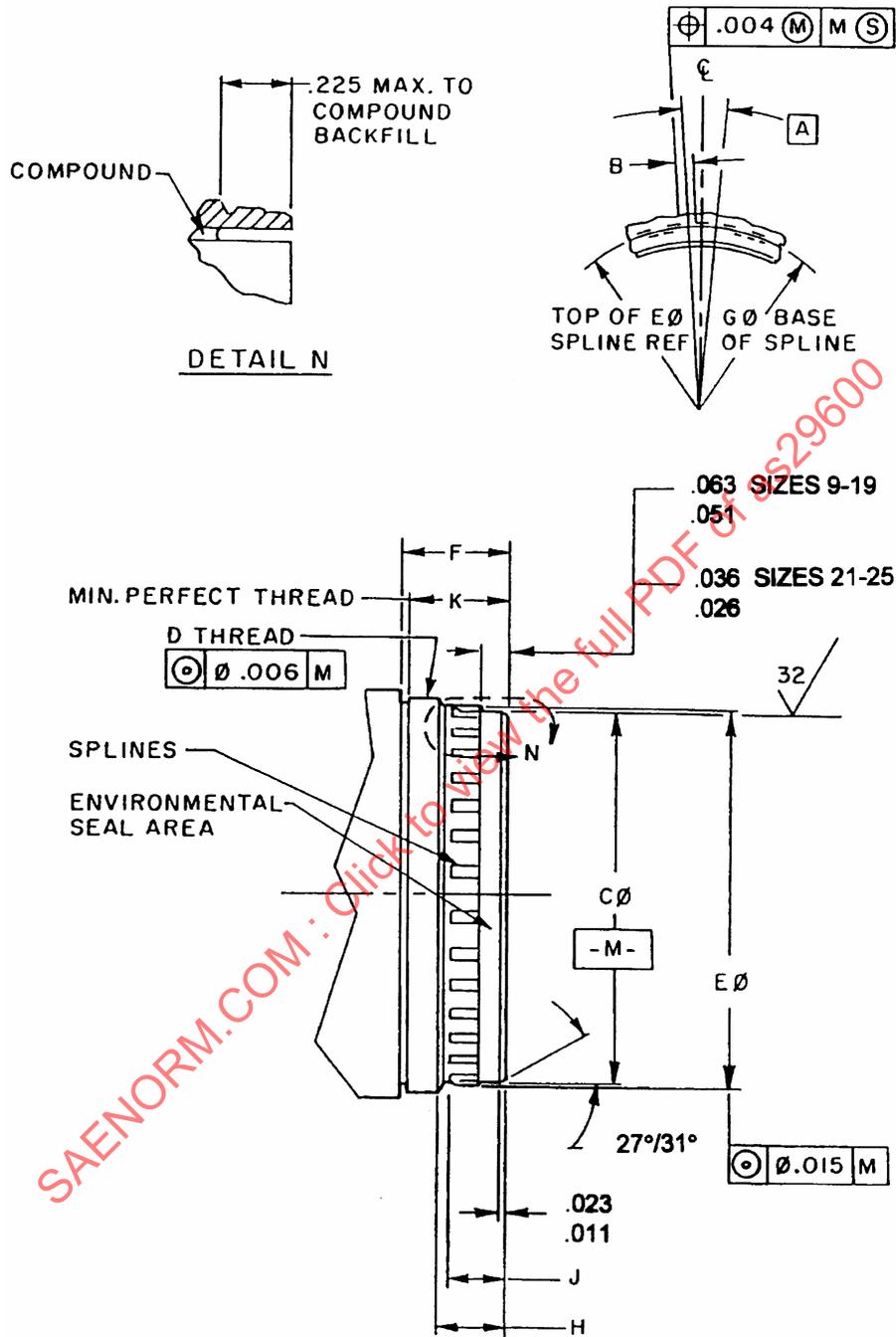


Figure 5. Connector accessory interface dimensions (Series A).

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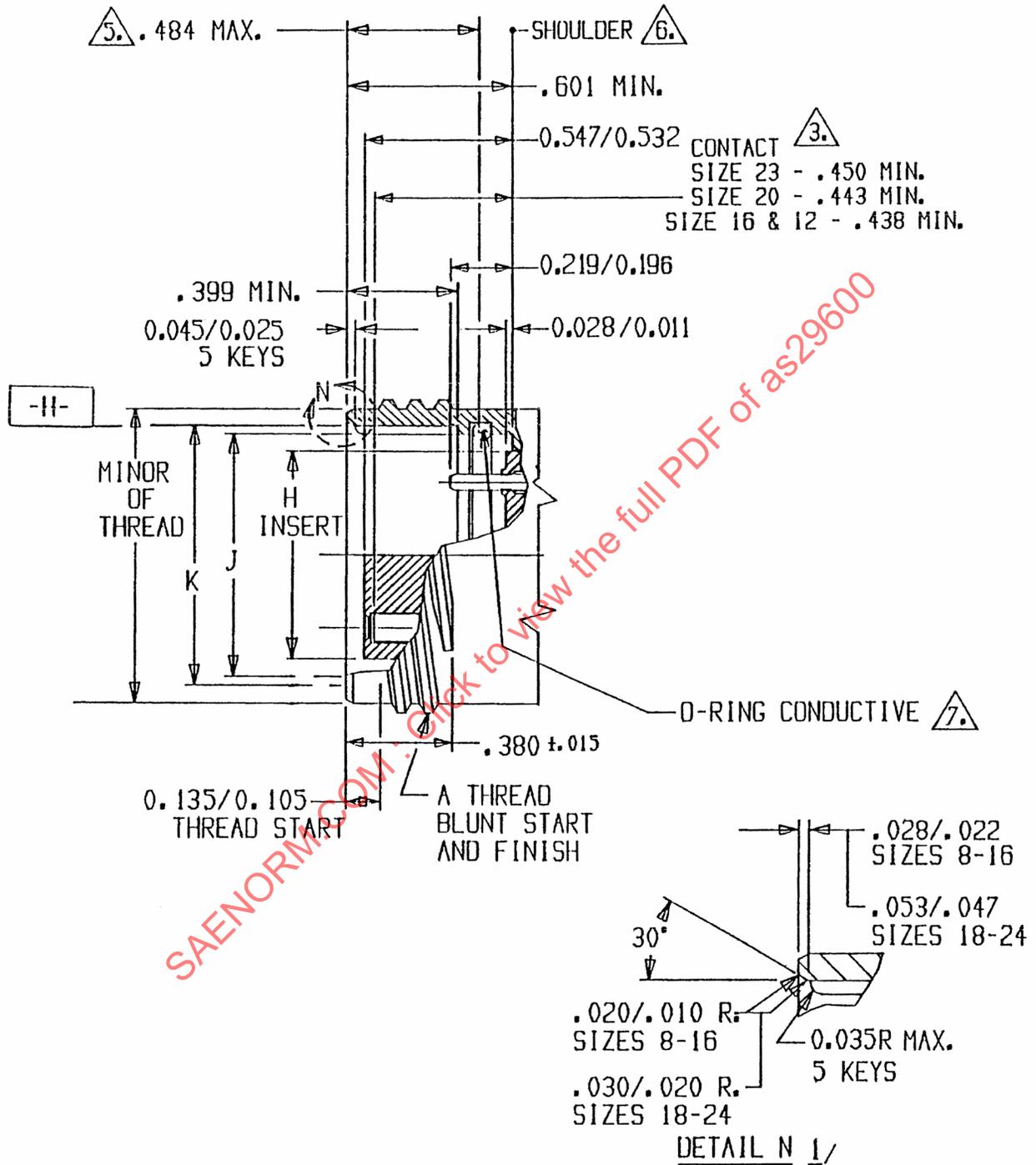
Shell size	A° Bsc	B	C	D Thread	E∅	F Min	G∅ Max	H	J Min	K Min
9	20	0.051 0.046	0.430 0.424	.500-28UNEF-2A	0.462 0.454	0.257	0.439	0.157 0.127	0.107	0.237
11	15	0.049 0.044	0.555 0.549	.625-28UN-2A	0.587 0.579		0.564			
13	12	0.048 0.043	0.676 0.670	.750-28UN-2A	0.708 0.700		0.685			
15	12	0.054 0.049	0.805 0.799	.875-28UN-2A	0.837 0.829		0.814			
17	10	0.053 0.048	0.930 0.924	1.000-28UN-2A	0.962 0.954		0.939			
19	9	0.053 0.048	1.055 1.049	1.125-28UN-2A	1.087 1.079		1.064			
21	9	0.059 0.054	1.180 1.174	1.250-28UN-2A	1.212 1.204	0.276	1.189	0.158 0.128	0.108	0.263
23	9	0.062 0.057	1.305 1.299	1.375-28UN-2A	1.337 1.329		1.314			
25	9	0.069 0.064	1.430 1.424	1.500-28UN-2A	1.462 1.454		1.439			

Notes:

1. Dimensions are in inches unless otherwise specified.
2. Dimensions apply after plating.

Figure 5. Connector accessory interface dimensions (Series A) (continued).

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1/ Front configuration I.D. and O.D. optional chamfer and radius to facilitate mating.

Figure 6. Connector, receptacle intermateability dimensions (Series B).

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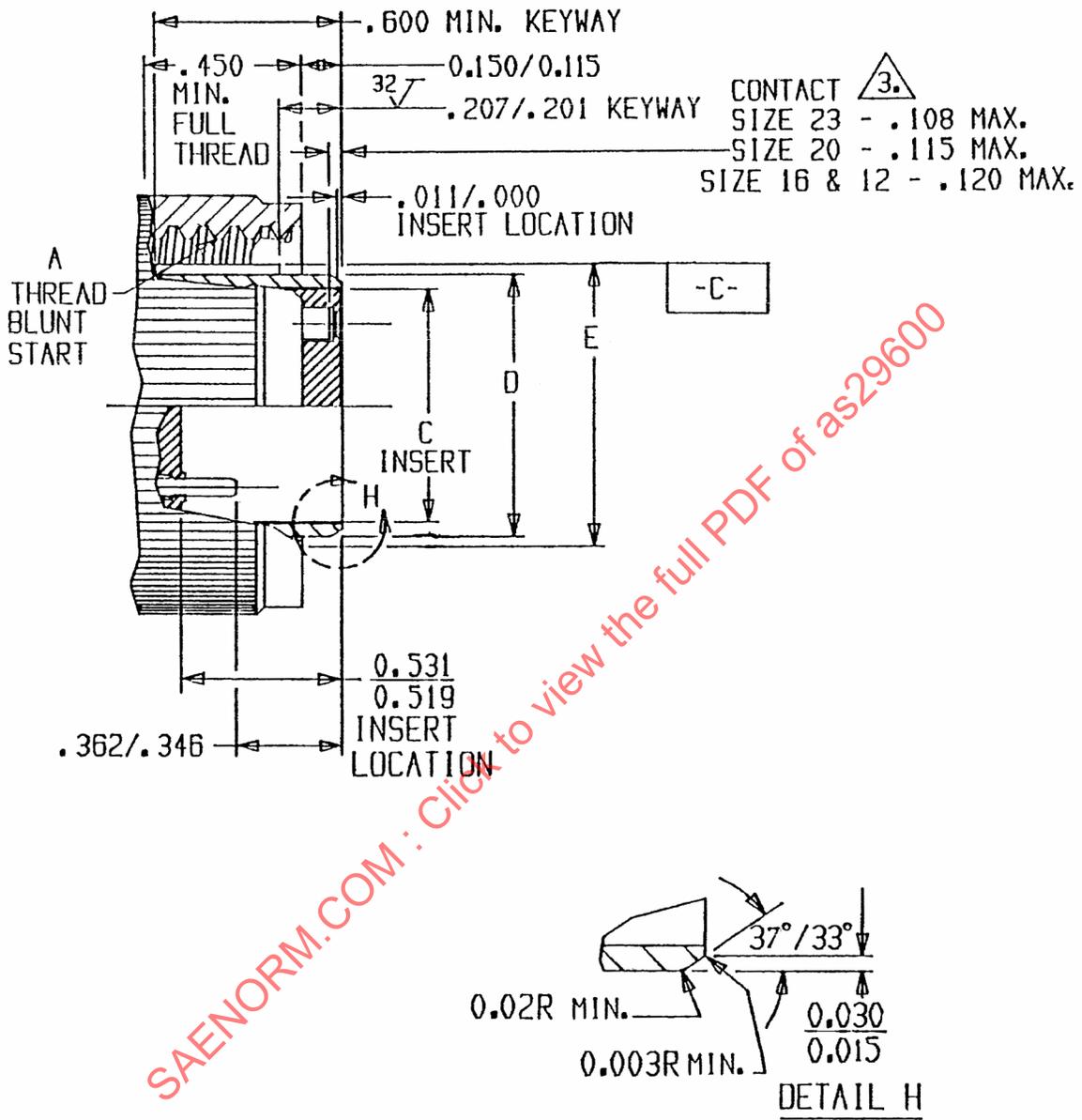
Shell Size	A Thread Mod Stub 60° .1P-.3L Class 2A				H ϕ	J ϕ	K ϕ
	Thread	Major ϕ	Pitch ϕ	Minor ϕ	$\pm .005$	± 0.003	± 0.0050
8	.6250	.6235	.5975	.5675	.285	.4080	.4745
		.6155	.5895	.5535			
10	.7500	.7485	.7225	.6925	.410	.5330	.5995
		.7405	.7145	.6785			
14	1.0000	.9985	.9725	.9425	.660	.7830	.8495
		.9905	.9645	.9285			
16	1.1875	1.1855	1.1515	1.1135	.786	.9090	.9755
		1.1735	1.1415	1.0955			
18	1.3750	1.3730	1.3390	1.3010	.911	1.0330	1.0995
		1.3610	1.3290	1.2830			
20	1.5000	1.4980	1.4640	1.4260	1.036	1.1580	1.2245
		1.4860	1.4540	1.4080			
22	1.6250	1.6230	1.5890	1.5510	1.161	1.2820	1.3495
		1.6110	1.5790	1.5330			
24	1.6875	1.6855	1.6515	1.6135	1.286	1.4080	1.4745
		1.6735	1.6415	1.5955			

Notes:

1. Dimensions are in inches unless otherwise specified.
2. Mating key positions and dimensions are shown in figure 8.
3. Distance from face of insert to the point at which a gage pin, having the same basic diameter as the mating pin and a square face, first engages the socket contact (see figure 9).
4. Rear end connector design for attachment of accessory hardware as shown in figure 10.
5. Grounding member to plug shell first contact.
6. Shoulder is point of contact to tip of plug shell at full mating.
7. Conductive o-ring material is silver filled silicone/fluorosilicone blend and meets the dimensional requirements of SAE-AS3582.

Figure 6. Connector, receptacle intermateability dimensions (Series B) (continued).

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Figure 7. Connector, plug intermateability dimensions (Series B).

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Shell Size	A Thread Mod Stub 60° .1P-.3L Class 2B				C Ø ±.005	D Ø ±.003	E Ø ±.003
	Thread	Minor Ø	Pitch Ø	Major Ø			
8	.6250	.5892 .5792	.6090 .5990	.6450 .6290	.285	.385	.454
10	.7500	.7142 .7042	.7340 .7240	.7700 .7540	.410	.510	.579
14	1.0000	.9642 .9542	.9840 .9740	1.0200 1.0040	.660	.760	.829
16	1.1875	1.1394 1.1274	1.1655 1.1535	1.2115 1.1915	.786	.886	.955
18	1.3750	1.3270 1.3150	1.3530 1.3410	1.3990 1.3790	.911	1.010	1.079
20	1.5000	1.4520 1.4400	1.4780 1.4660	1.5240 1.5040	1.036	1.135	1.204
22	1.6250	1.5770 1.5650	1.6030 1.5910	1.6490 1.6290	1.161	1.259	1.329
24	1.6875	1.6395 1.6275	1.6655 1.6535	1.7115 1.6915	1.286	1.385	1.454

Notes:

1. Dimensions are in inches unless otherwise specified.
2. Mating key positions and dimensions are shown in figure 8.
3. Distance from face of insert to the point at which a gage pin, having the same basic diameter as the mating pin and a square face, first engages the socket contact (see figure 9).
4. Rear end connector design for attachment of accessory hardware as shown in figure 10.

Figure 7. Connector, plug intermateability dimensions (Series B) (continued).

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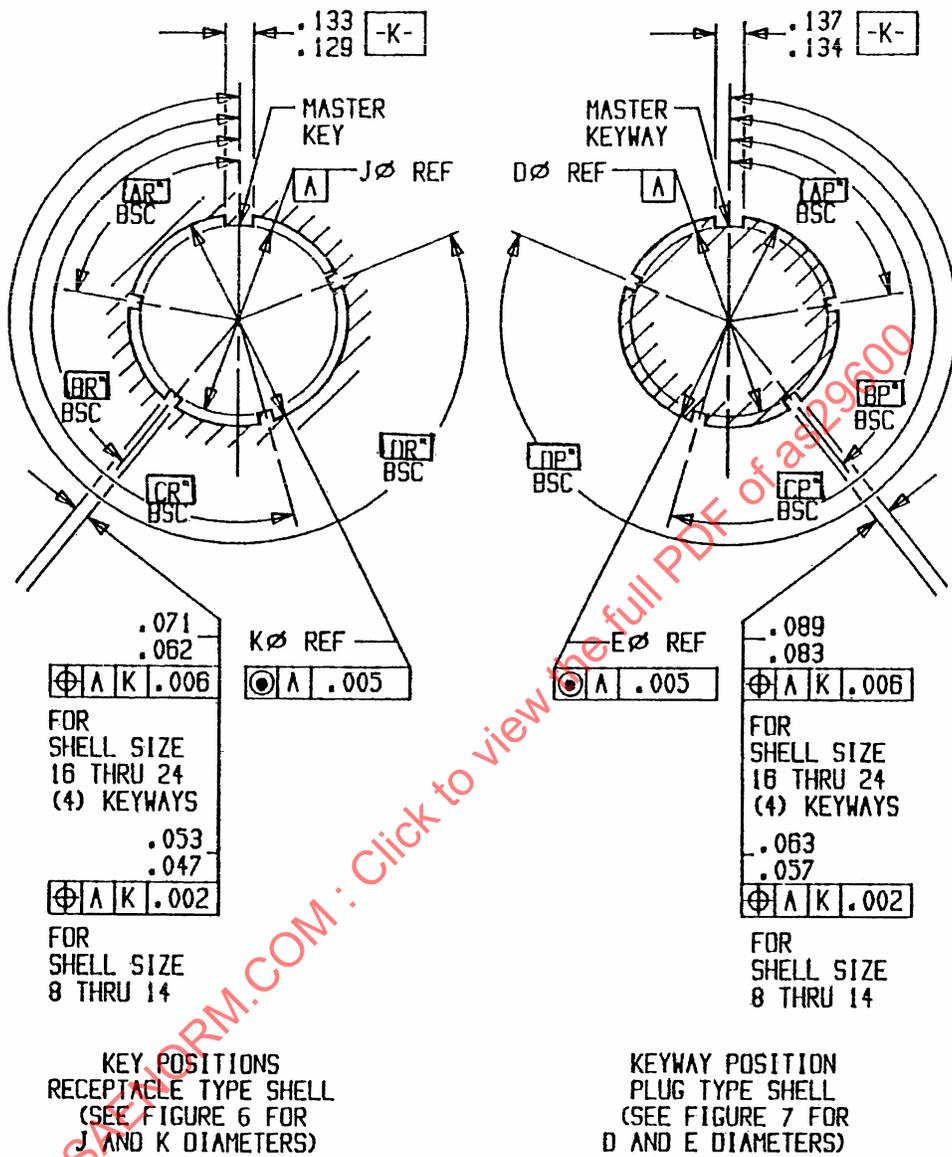


Figure 8. Connector master key/keyway polarization (Series B).

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Shell Size	Key & Keyway Arrangement	AR ^o or AP ^o BSC	BR ^o or BP ^o BSC	CR ^o or CP ^o BSC	DR ^o or DP ^o BSC
8	1	105	140	215	265
	2	102	132	248	320
	3	80	118	230	312
10 and 14	1	95	141	208	236
	2	113	156	182	292
16 thru 24	3	90	145	195	252
	1	80	142	196	293
	2	135	170	200	310
	3	49	169	200	244

Notes:

1. Dimensions are in inches unless otherwise specified.

Figure 8- Connector master key/keyway polarization (Series B) (continued).