

AEROSPACE STANDARD

SAE AS85028

Issued 2004-06

Connector, Electrical, Rectangular, Individual Contact Sealing,
Polarized Center Jackscrew, General Specification For

FSC 5935

NOTICE

This document has been taken directly from U.S. Military specification MIL-C-85028(AS), Supplement 1 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-85028(AS), Supplement 1. Any part numbers established by the original specification remain unchanged.

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1. SCOPE:

1.1 Scope:

This specification covers environment and fluid resisting, rectangular type, rack to panel electrical connectors (plugs and receptacles). These connectors utilize individually sealing removable crimp type contacts and are capable of continuous operation from -65° to $+150^{\circ}\text{C}$.

1.2 Classification:

1.2.1 Military part number:

1.2.1.1 Military part number for connectors:

The connector part number shall consist of the letter "M", the basic number of the applicable specification sheet (see 3.1), and the applicable alpha-numeric characters, formulated as in the following example:

M85028/1-1P1RN

M85028/1	-1	P1	R	N
_____	_____	_____	_____	_____
BASIC PART NO.	DASH NUMBER	CONTACT	CENTER	POLARIZATION
(1.2.1.4)	(1.2.1.5)	DESIGNATOR	HARDWARE	(1.2.1.8)
		(1.2.1.6)	1.2.1.7)	

1.2.1.2 Military part number for connector accessories:

The part number for the accessories shall consist of the letter "M", the basic number of the specification sheet and assigned dash numbers as indicated on the applicable specification sheet (see 3.1). (Example: M85028/5-2.)

1.2.1.3 Classes:

E – Environmental and Fluid Resisting

1.2.1.4 Basic part number:

The basic part number shall be as shown on the applicable specification sheet. Revision letters shall not be included.

1.2.1.5 Dash number:

The dash number shall be as shown on the applicable specification sheet for the basic part number.

1.2.1.6 Contact designator:

1.2.1.6.1 Connectors with contacts:

The following designators are used to indicate a full complement of applicable contacts (see 3.1).

P – Pin Contacts

S – Socket Contacts

1.2.1.6.1.1 Contact wire barrel size:

Contact wire barrel size shall be indicated by one of the following:

0. No Contacts

1. 24 to 28 wire guage

2. 20 to 24 wire guage

3. 16 to 20 wire guage

1.2.1.6.2 Connectors without contacts:

The following designators are used to designate connector less contacts. They will be used only when less than a 100% complement of one size wire barrel is used. Wire barrel size shall be designated by an "O".

A – Less Pin Contacts

B – Less Socket Contacts

1.2.1.7 Center hardware designator:

The connector center hardware type shall be designated by one of the following:

R – Recessed jackscrew

J – Extended jackscrew

F – Threaded female

1.2.1.8 Polarization:

The connector center hardware polarization shall be designated by a letter as shown on Figure 2 (see paragraph 3.4.8).

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2. APPLICABLE DOCUMENTS:

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

SPECIFICATIONS

Federal

QQ-A-225/6 Aluminum Alloy Bar, Rod, and Wire, Rolled, Drawn, or Cold Finished 2024

QQ-S-764 Steel Bar, Corrosion Resisting, Free Machining

QQ-S-766 Steel Plate, Sheet, and Strip-Corrosion Resisting

Military

MIL-M-14 Molding Plastics and Molded Plastic Parts, Thermosetting

MIL-G-3056 Gasoline, Automotive, Combat

MIL-S-5002 Surface Treatments and Inorganic Coating for Metal Surfaces of Weapons Systems

MIL-H-5606 Hydraulic Fluid, Petroleum Base; Aircraft, Missile, and Ordnance

MIL-T-5624 Turbine Fuel, Aviation, Grades JP-4 and JP-5

MIL-L-7808 Lubrication Oil, Aircraft Turbine Engine, Synthetic Base

MIL-A-8243 Anti-icing and Deicing – Defrosting Fluid

MIL-A-8625 Anodic Coating for Aluminum

MIL-I-17214 Indicator, Permeability; Low-Mu (Go-No-Go)

MIL-C-22520 Crimping Tools, Terminal, Hand, Wire Termination General Specification For.

MIL-W-22759 Wire, Electric, Fluorocarbon-Insulated, Copper or Copper Alloy

MIL-L-23699 Lubrication Oil, Aircraft Turbine Engines Synthetic Base

MIL-C-39029 Contacts, Electrical, General Specification for

MIL-C-43616 Cleaning Compound, Aircraft Surfaces

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2.1 (Continued):

SPECIFICATIONS

Military (Continued)

MIL-G-45204	Gold Plating, Electrodeposited
MIL-C-45662	Calibration System Requirements
MIL-C-55330	Connectors, Preparation for Delivery of
MIL-I-81969	Tools Installing and Removal, Connector Electrical Contact, General Specification for

STANDARDS

Military

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-202	Test Methods for Electronic and Electrical Component Parts
MIL-STD-454	Standard General Requirements for Electronic Equipment
MIL-STD-1285	Marking of Electrical and Electronic Parts
MIL-STD-1344	Test Methods for Electrical Connectors
MIL-STD-1674	Insert Arrangements for MIL-C-85028 Rectangular Connectors
MIL-STD-1646	Servicing Tools for Electric Contacts and Connections
MIL-STD-1674(AS)	Insert Arrangements for MIL-C-85028(AS) Connector, Electric, Rectangular, Individual Contact Sealing, Polarized Center Jackscrew

SPECIFICATION SHEETS

MIL-C-85028/1(AS)	Connector, Electric, Rectangular, Individual Contact Sealing, Polarized Center Jackscrew, Plug, Crimp Removable Pin Contacts, Class E
MIL-C-85028/2(AS)	Connector, Electric, Rectangular, Individual Contact Sealing, Polarized Center Hardware, Receptacle, Crimp Removable Socket Contacts, Class E

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2.1 (Continued):

SPECIFICATION SHEETS

MIL-C-85028/3(AS)	Connector, Electric, Rectangular, Individual Contact Sealing, Polarized Center Jackscrew, Interfacial Seal, Size 16, Crimp Contacts
MIL-C-85028/4(AS)	Connector, Electric, Rectangular, Individual Contact Sealing, Polarized Center Jackscrew, Sealing Plug, Size 16, Crimp Removable Contacts
MIL-C-85028/5(AS)	Connector, Electric, Rectangular, Individual Contact Sealing, Polarized Center Jackscrew, Wire Seal, Size 16, Crimp Removable Contacts
MIL-C-85028/6(AS)	Connector, Electric, Rectangular, Individual Contact Sealing, Polarized Center Jackscrew, Replacement Tool, Wire Seal, Size 16, Crimp Removable Contacts
MIL-C-39029/69(AS)	Connector Contact, Electrical, Socket, Crimp Removable, for MIL-C-85028(AS) Connectors
MIL-C-39029/70(AS)	Connector Contact, Electrical, Pin, Crimp Removable, for MIL-C-85028(AS) Connectors
MIL-I-81969/21(AS)	Installing and Removal Tool, Electrical Connector, Contact Interfacial Seal, Type I, Class 1, Style B, Composition A
MIL-I-81969/22(AS)	Installing Tool, Electrical Connector, Contact Crimp Removable, Type I, Class 1, Style A, Composition A
MIL-I-81969/23(AS)	Removal Tool, Electrical Connector, Contact Crimp Removable, Type II, Class 1, Style A, Composition A

2.1.1 Availability of documents:

When requesting specifications, standards, drawings, and publications, refer to both title and number. Copies of this specification and applicable specifications required by contractors in connection with specific procurement functions may be obtained upon application to the Commanding Officer, Publications and Forms Center, Code 105, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.

2.2 Other publications:

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

H-28 HANDBOOK Screw-Thread Standards for Federal Services

(Applications for copies should be addressed to: Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.)

SD-6 Provisions Governing Qualification

(Applications for copies should be addressed to: Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, Pa. 19120.)

RS359-COLOR Electronic Industries Association

(Applications for copies should be addressed to Electronics Industries Association, 2001 Eye Street, N.W., Washington, D.C. 20006.)

USASI Y14.5-1966 Dimensioning and Tolerancing for Engineering Drawings
(ANSI)

ASA B46.1-1962 Surface Texture (Surface Roughness, Waviness and Lay)

(Application for copies should be addressed to American National Standards Institute, Inc., 1430 Broadway, New York, New York 11018.)

3. REQUIREMENTS:

3.1 Specification sheets:

The individual item requirements shall be as specified herein and in accordance with the applicable specification sheets. In the event of any conflict between requirements of this specification and the specification sheets, the latter shall govern (see 6.2).

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 Provisions governing qualification:

The provisions governing qualification are specified in SD-6 (see 2.2).

3.2.2 Use of military part numbers:

Military part numbers shall not be applied to a product, except for qualification test samples (see 6.3), until notification has been received from the activity responsible for qualification that the product has been approved for listing on the Qualified Products List.

3.3 Materials:

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

3.3.1 Dissimilar metals:

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

3.3.2 Nonmagnetic material:

Unless otherwise specified herein, all component parts of connectors shall be of a nonferrous material or a material generally considered to be nonmagnetic (see 3.6.8).

3.3.3 Contact Materials:

Unless otherwise specified, contacts shall be made of suitably conductive copper based alloys. All contacts shall be suitably protected from corrosion.

3.3.3.1 Contact plating:

Contacts shall be goldplate in accordance with MIL-G-45204, type II, grade B or C, class 1 over a suitable underplating (underplating shall have no silver content), except that the accessory (hood) on socket contacts shall be suitably protected from corrosion.

3.3.4 Hardware materials:

The center polarizing hardware shall (Ref. Figure 2) be of high grade aluminum alloy per QQ-A-225/6. Jackscrews and shells shall be corrosion resistant steel, type 303 per QQ-S-764.

3.3.4.1 Finish:

Aluminum parts shall be anodized per MIL-A-8625, type II, dyed gray. All other metal parts shall be electrolytic polish per MIL-S-5002 or protected to meet the performance requirements of this specification.

3.3.5 Dielectric materials:

3.3.5.1 Plastic insert material:

Plastic insert material shall be a high grade rigid dielectric having electrical and mechanical characteristics suitable for the purpose intended. The material shall conform to MIL-M-14F, type SDG-F.

3.3.5.2 Resilient seal material:

Materials shall be high grade resilient dielectric having hardness, electrical and mechanical characteristics suitably for the purpose intended.

3.4 Design, construction and physical dimensions:

Connectors shall be of the design, construction, and physical dimensions specified herein and in the individual specification sheets. Connectors shall be designed so that neither the pins nor the sockets will be damaged during normal mating of counterpart connectors.

3.4.1 Contacts:

Contacts shall conform to MIL-C-39029.

3.4.1.1 Insertion and removal:

The connector design shall permit individual insertion and removal of contacts and seals. Installation of the contacts shall be accomplished using a Pull-Thru type tool as shown on MIL-I-81969/22. The removal of individual contacts shall be accomplished using a removal tool as shown on MIL-I-81969/23. The individual interfacial seals shall be installed and removed from the contacts using a seal installation and removal tool as shown on MIL-I-81969/21. The individual wire seals shall be replaced using a tool as shown on applicable specification sheet.

3.4.1.2 Insert arrangement:

The insert arrangements shall be in accordance with MIL-STD-1674(AS).

3.4.2 Sealing plugs:

Insulated plugs shall be provided for sealing spare contact holes. The sealing plug shall be specified on the individual specification sheet. Connectors shall pass all tests required herein with any quantity of the contact holes sealed with the plugs. The same sealing plug shall be used in both the plug and receptacle (see 6.2).

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3.4.5 Interfacial seal:

The interfacial seal shall be specified on the individual specification sheet.

3.4.6 Wire seal:

The wire seal shall be specified on the individual specification sheet.

3.4.7 Protective connector shields and accessories:

Unless otherwise specified, protective shells, connector shields and other accessories shall be made of a high grade aluminum alloy conforming to QQ-A-250 or corrosion-resistant steel conforming to QQ-S-766, Series 300 (nonmagnetic), or other material satisfactory to the Government. There shall be no assembly of protective shells, connector shields or other accessories made of different material than specified herein.

TABLE I. Contact size and wire range accommodations.

Contact Size	Wire Size Accommodation	Wire Range Accommodation (diameter over insulation)	
		Min.	Max.
		Inch	Inch
16-24	24, 26, 28	.041 (1.04)	.055 (1.39)
16-20	20, 22, 24	.051 (1.29)	.070 (1.77)
16-16	16, 18, 20	.066 (1.68)	.087 (2.20)

3.4.8 Polarization:

Polarization of connectors shall be accomplished by means of three integral keys and suitable matching keyways on the counterpart center boss. (Ref. Figure 2). Polarization shall be accomplished before initial engagement of the contacts.

3.4.9 Screw Threads:

Screw threads shall be in accordance with Handbook H-28.

3.4.10 Interchangeability:

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

3.5 Marking:

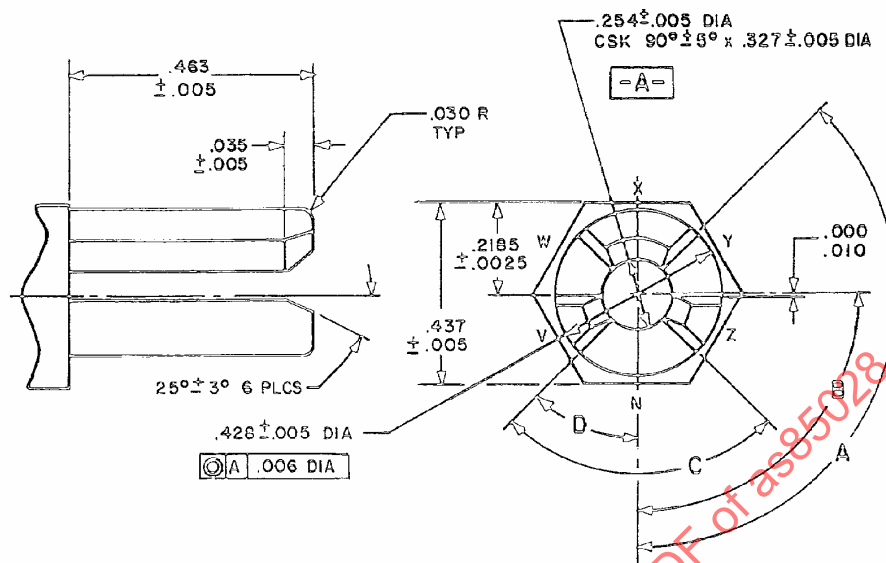
Connectors shall be clearly and permanently marked in the location specified on the applicable specification sheet. The characters shall be a minimum of .047 inch in height. Each connector shall be marked with the manufacturer name or trade mark, the appropriate military part number, and the date of manufacture (year and week). For indirect shipments of connectors without contacts, the complete military part number of the connector with contacts shall be marked on the connector.

3.5.1 Insert Marking:

The contact identification and arrangement shall be as specified. Letters or numerals shall be raised and clearly legible or shall appear in legible contrasting colors. Positioning and arrangement of the numerals shall be such as to avoid confusion between contacts. Markings shown in MIL-STD-1674 (AS) are for the pin insert front and socket rear. Socket face and pin rear are opposite.

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POLARIZATION	A $\pm 0^\circ 30'$	B $\pm 0^\circ 30'$	C $\pm 0^\circ 30'$	D $\pm 0^\circ 30'$
N, V, W	135°	90°	90°	45°
X, Y, Z	140°	90°	80°	40°

FIGURE 2. Polarization – Keys and Keyways.

To polarize the connector, the boss is mounted in the insert with largest opening adjacent to desired position ("N" polarization shown).

in.	mm.
.0025	.06
.005	.13
.010	.25
.030	.76
.035	.89
.2185	5.55
.254	6.45
.327	8.31
.428	10.87
.437	11.10
.463	11.76

NOTES:

- Dimensions are in inches.
- Metric equivalents (to the nearest .01 mm) are given for general information only and are based upon 1 inch = 25.4 mm.

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3.6 Performance:

3.6.1 Maintenance aging:

When tested as specified in 4.6.2, connectors shall meet the requirements of 3.6.4 and all the environmental requirements.

3.6.2 Contact resistance:

When tested as specified in 4.6.8, contact resistance for mated pairs of pin and socket contacts shall be as specified in Table II A or B.

TABLE II A. Contact resistance.
(Silver plated wire)

Mating End Size	Wire Size Range	Wire Size	Test Current Amperes	Maximum Voltage Drop Millivolts			
				25° +3°C -0°		25° +3°C -0°	After Conditioning
				Max	Max Avg.	Max	Max Avg.
16	16	16	13.0	49	45	59	51
16	16	20	7.5	46	42	56	48
16	20	20	7.5	46	42	56	48
16	20	24	3.0	45	41	54	46
16	24	24	3.0	45	41	54	46
16	24	28	1.5	54	49	65	56

TABLE II B. Contact resistance.
(Nickel plated wire)

Mating End Size	Wire Size Range	Wire Size	Test Current Amperes	Maximum Voltage Drop Millivolts			
				25° +3°C -0°		25° +3°C -0°	After Conditioning
				Max	Max Avg.	Max	Max Avg.
16	16	16	13.0	74	68	89	77
16	16	20	7.5	69	63	84	72
16	20	20	7.5	69	63	84	72
16	20	20	3.0	68	62	81	69
16	24	24	3.0	68	62	81	69
16	24	28	1.5	81	74	98	84

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3.6.3 Thermal shock:

When subjected to the temperature extremes of Table III in accordance with 4.6.3, there shall be no damage detrimental to the operation of the connector.

TABLE III. Temperature extremes

Extremes	°C
Low	-55 ⁺⁰ / ₋₃
High	150 ⁺³ / ₋₀

3.6.4 Mating and unmating forces:

When tested as specified in 4.6.4, the mating torque required to fully mate or separate a complete connector assembly the plug and receptacle shall not exceed the applicable value listed in Table IV. When the connectors are mated to the torque values of Table IV, the maximum allowable dimension between flanges shall be .641.

TABLE IV. Mating force

Insert Arrangement	Jackscrew Mating Torque inch/pounds
52	4.0
80	6.0
104	7.0
158	10.0
212	13.0

3.6.5 Altitude immersion:

When tested as specified in 4.6.5, connectors shall maintain an insulation resistance of at least 5 gigohms and shall withstand a dielectric withstanding voltage of 3000 volts rms at sea level when tested with suitable wire.

3.6.6 Air leakage:

When tested as specified in paragraph 4.6.6, mated connectors shall not exceed a leakage rate greater than 1.0 atmospheric cubic inch per hour (4.55×10^{-3} cc/sec.).

3.6.7 Salt spray (corrosion):

When tested as specified in 4.6.7, connectors and contacts shall show no exposure of basic metal due to corrosion which will adversely effect performance. Connector shall meet all subsequent test requirements.

3.6.8 Magnetic permeability:

When tested as specified in 4.6.9, the relative permeability of the connector shall be less than 2.0.

3.6.9 Contact retention:

When tested as specified in 4.6.10, the individual contact-locking mechanism of unmated connectors shall withstand, in both directions, the axial load specified in Table V. During the test, the axial displacement of the contact shall not exceed 0.012 inch when pressures are applied from the face side.

TABLE V. Axial load

Contact Size	Axial Load
	Pounds
16- - -	25 + 3 – 0

3.6.10 Altitude – low temperature:

When tested as specified in 4.6.11, connectors shall withstand a dielectric withstanding voltage of 625 volts rms after stabilizing at an atmospheric pressure equivalent to an altitude of 80,000 feet and a temperature of $-54^{\circ} +4^{\circ}_{-0^{\circ}} \text{C}$.

3.6.11 Insulation resistance:

3.6.11.1 At ambient temperature:

When tested as specified in 4.6.12.1, the insulation resistance of connectors shall be greater than 5,000 megohms measured separately between pairs of contacts and between the shell and any contact.

3.6.11.2 At high temperature:

When tested as specified in 4.6.12.2, the insulation resistance of connectors shall be greater than 100 megohms when measured separately between any two contacts and between the shell and any contact.

3.6.12 Dielectric withstanding voltage:

3.6.12.1 Dielectric withstanding voltage (sea level):

When tested as specified in 4.6.13.1, connectors shall show no evidence of breakdown or flashover.

3.6.12.2 Dielectric withstanding voltage (altitude):

When tested as specified in 4.6.13.2, completely wired and assembled connectors shall show no evidence of breakdown or flashover.

3.6.13 Durability:

When tested as specified in 4.6.14, mated pairs of fully assembled connectors shall meet the subsequent test requirements listed in Table VI.

3.6.14 Vibration:

When tested as specified in 4.6.15, connectors shall not crack or break and there shall be no loosening of parts. Connectors shall be in full engagement during vibration. The jackscrews shall not loosen and there shall be no interruption of electrical continuity longer than 10 micro seconds.

3.6.15 Shock (specified pulse):

During and after the test specified in 4.6.16, connectors shall show no sign of damage. Mated connectors shall not be damaged and there shall be no interruption of electrical continuity longer than 10 microseconds.

3.6.16 Humidity (steady state).

When tested as specified in 4.6.17, connectors shall maintain an insulation resistance of 100 megohms or greater at 25°C.

3.6.17 Ozone exposure:

When tested as specified in 4.6.18, connectors shall evidence no cracking of materials or other damage which will adversely affect subsequent performance in the qualification test sequence.

3.6.18 Fluid immersion:

When tested as specified in 4.6.19, connectors shall meet the subsequent test requirements listed in Table VI. Connector shall mate within the forces specified in Table IV.

3.6.19 Contact insertion and removal forces:

When tested as specified in 4.6.20, the individual contact insertion force shall not exceed 15 pounds and the removal force shall not exceed 10 pounds. Contacts shall be wired using wire specified in Table I. The applicable tool specified in 3.4.1.1 shall be used for this test.

3.6.20 Contact walkout:

When tested as specified in 4.6.21, contacts shall not become dislodged from their normal position.

3.6.21 Temperature life with contact loading:

When tested as specified in 4.6.22, contacts shall maintain their specified locations as shown in Figure 1, as applicable, and there shall be no electrical discontinuity in excess of 1.0 microsecond.

3.7 Workmanship:

Connectors shall be in accordance with the requirements of this specification and shall be free from defects which will affect life, serviceability, or appearance. All corners shall be broken and smooth. Shell surfaces shall be free from blow holes, burrs, and cracks.

4. QUALITY ASSURANCE PROVISIONS:

4.1 Responsibility for inspection:

Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any commercial laboratory acceptable to 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 and inspection facilities of sufficient accuracy, quality and quantity to permit performance of the required inspection shall be established and maintained by the supplier. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with MIL-C-45662.

4.2 Classification of inspections:

The inspections specified herein are 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. Qualification testing shall consist of all tests required in Table VI.

TABLE VI. Qualification inspection

Examination or Test	Requirement Paragraph	Test Paragraph	Test Group			
			1	2	3 <u>3/</u>	4 <u>4/</u>
Examination of product	3.1, 3.3, 3.4, 3.5, 3.7	4.6.1	X	X	X	X
Maintenance aging	3.6.1	4.6.2	X	X	—	—
Magnetic permeability	3.6.8	4.6.9	—	X	—	—
Contact retention	3.6.9	4.6.10	—	X	—	—
Ozone exposure	3.6.17	4.6.18	—	—	X	—
Altitude-low temperature	3.6.10	4.6.11	—	X	—	—
Insulation resistance at ambient temperature	3.6.11.1	4.6.12.1	—	X	X	—
Thermal shock	3.6.3	4.6.3	X	X	—	—
Mating and unmating forces	3.6.4	4.6.4	X	X	X	—
Fluid immersion (one mated pair per fluid)	3.6.18	4.6.19	—	—	X	—
<u>1/</u> Altitude immersion	3.6.5	4.6.5	X	—	—	—
Air leakage	3.6.6	4.6.6	X	—	—	—
Salt spray (corrosion)	3.6.7	4.6.7	X	—	—	—
Mating and unmating forces	3.6.4	4.6.4	X	—	X	—
Contact resistance	3.6.2	4.6.8	X	—	—	—

TABLE VI. Qualification inspection (continued)

Examination or Test	Requirement Paragraph	Test Paragraph	Test Group			
			1	2	3 <u>3/</u>	4 <u>4/</u>
Contact insertion and removal forces	3.6.19	4.6.20	—	—	—	X
<u>2/</u> Temperature life with contact loading	3.6.21	4.6.22	—	—	—	X
Insulation resistance at elevated temperature	3.6.11.2	4.6.12.2	—	X	—	X
Dielectric withstanding voltage	3.6.12.1	4.6.13.1	—	X	—	X
Air leakage	3.6.6	4.6.6.	—	—	—	X
<u>1/</u> Dielectric withstanding voltage at altitude	3.6.12.2	4.6.13.2	—	X	—	—
Durability	3.6.13	4.6.14	—	X	—	—
<u>1/</u> Vibration	3.6.14	4.6.15	—	X	—	—
Shock (specified pulse)	3.6.15	4.6.16	—	X	—	—
Humidity (steady state)	3.6.16	4.6.17	—	X	—	—
Contact retention	3.6.9	4.6.10	X	X	X	—
Post test examination	—	4.6.23	X	X	X	X

1/ Original qualification only.

2/ 250 hours for periodic test requalification.

3/ Dielectrics.

4/ Retention system.

4.4.1 Sample size and inspection routine:

The number of connectors and the inspection to which they shall be subjected shall be as follows:

- (a) A minimum of two complete mating pairs of connectors, of an insert arrangement containing power contacts for which qualification is desired, shall be wired with 50 percent of the minimum diameter wire, 50 percent of the maximum diameter wire as shown in Table VII. Mating connector samples shall be divided into two similar groups. One group shall be subjected to the tests of group 1, Table VI in the sequence indicated. The other group shall be subjected to the tests of group 2, Table VI in the sequence indicated.

TABLE VII. Test wire sizes

Contact Size	Wire Range	Maximum Wire	Minimum Wire
16	24-28	M22759/10-24	M22759/10-28
16	20-24	M22759/10-20	M22579/10-24
16	16-20	M22579/10-16	M22579/10-20

4.4.1 (Continued):

- (b) Two mated pairs of connectors, representing an insert arrangement, shall be terminated with nominal gage wire. The connectors shall be subjected to the tests of group 3, Table VI in the sequence indicated.
- (c) Two mated pairs of connectors representing an insert arrangement providing a minimum of 21 contact cavities of each appropriate contact size, shall be terminated with nominal gage wire. The connectors shall be subjected to the tests of group 4, Table VI in the sequence indicated.

4.4.2 Preparation of samples:

Preparation of test samples shall be in accordance with 4.4.1.

4.4.3 Qualification rejection:

The qualifying activity shall be notified of failures during any examination or tests of the connectors or accessories detrimental to the operation of the connector submitted for qualification tests. After notification of any failure detrimental to the operation of the connector, the activity responsible for qualification testing shall receive details of corrective action from the supplier before initiating any further tests deemed necessary to assure compliance with specification requirements.

4.4.4 Retention of qualification:

In order to retain qualification, a summary of test results shown in Table VI shall be furnished at three year intervals and shall cover the tests performed during that period. The summary shall also include the number and type of any part failures and shall be forwarded via the Government Inspector to the activity responsible for qualification. If the summary of results indicates non-conformance with specification requirements, 4.5.1.4 (non-compliance) shall apply. Failure to furnish the summary shall result in loss of qualification for that product.

4.4.5 Qualification of additional connectors:

For connectors which differ only in minor details from those which have been qualified, the supplier's test report need only provide inspection and test data necessary to validate the differences, with information on identical features for which no inspection or test was performed.

4.5 Quality conformance inspection:

4.5.1 Inspection of product for delivery:

Inspection of product for delivery shall consist of the examinations specified in 4.6.1, the dielectric withstanding voltage test specified in 4.6.13.1, and insulation resistance test specified in 4.6.12.1.

4.5.1.1 Inspection lot:

An inspection lot shall, as far as practical, consist of all connectors covered by one specification sheet, produced under essentially the same conditions, and offered for inspection at one time.

4.5.1.2 Sampling plan:

Sample connectors consisting of two mated pairs of each of the sizes of the types and termination, and each of the sizes of the types containing contacts for which retention of qualification is desired shall be selected every 24 months. Upon passing this inspection two consecutive times, the supplier may select sample connectors every 36 months. If production of a particular part number is not current, the retention of qualification tests must take place at the time production is resumed. The testing shall revert to the original schedule which is applied to a newly qualified product.

4.5.1.3 Rejected lots:

If an inspection lot is rejected, the supplier may rework it to correct the defects, or screen out the defective units, and resubmit for reinspection. Resubmitted lots shall be inspected using tightened inspection. Such lots shall be separate from new lots, and shall be clearly identified as reinspected lots. Before resubmission of the lot by the supplier for acceptance, the contractor shall fully explain to the procuring activity both the cause of previous failures and corrections without specific approval of the procuring activity. The contractor shall be required, at the discretion of the procuring activity, to show evidence of corrective action in current production.

4.5.1.4 Noncompliance:

If a sample fails to pass tests shown Table VI, the supplier shall take corrective action on the materials or processes, or both, as warranted, and on all units of product which can be corrected and which were manufactured under essentially the same conditions, with essentially the same materials, processes, etc., and which are considered subject to the same failure. Acceptance of the product shall be discontinued until corrective action, acceptable to the Government, has been taken. After the corrective action has been taken, qualification inspection shall be repeated on additional sample units (all inspection, or the inspection which the original sample failed, at the option of the Government). EXAMINATION OF PRODUCT (4.6.1) inspection may be reinstituted; however, final acceptance shall be withheld until the qualification reinspection, information concerning the failure and corrective action taken shall be furnished to the cognizant inspection activity and the qualifying activity.

4.6 Test methods:

4.6.1 Examination of product:

Connectors and associated hardware shall be examined to verify that the design, construction, physical dimensions, marking, interchangeability, and workmanship are in accordance with the applicable requirements (see 3.1, 3.3, 3.4, 3.5, and 3.7).

4.6.2 Maintenance aging (see 3.6.1):

Each contact shall be inserted, removed, and reinserted using applicable insertion and removal tools. At least 10 of the contacts in both plugs and receptacles shall be removed and inserted 9 times, using applicable insertion and removal tools. The force measurements required by 4.6.20 shall be made on the tenth insertion of all 10 contacts of each of the connectors.

4.6.3 Thermal shock (see 3.6.3):

Unmated connectors shall be tested in accordance with method 1003 of MIL-STD-1344.

Test condition letter shall be B except the minimum temperature shall be $-55^{+0}_{-3}^{\circ}\text{C}$.

Following the last cycle, the connectors shall be returned to room temperature for inspection and further testing.

4.6.4 Mating and unmating forces (see 3.6.4):

Mating and unmating forces shall be measured in accordance with Method 2013 of MIL-STD-1344. The following details and exceptions shall apply:

(a) Special mounting means – See MIL-STD-1344.

(b) Force or torque requirements – See Table IV.

4.6.4 (Continued):

- (c) Lubrication – None.
- (d) Wire type, gage and length – See Table VII and 4.4.1; length optional.
- (e) Rate of mating and unmating – Maximum of 10 seconds for each operation.
- (f) Applicable hardware – All hardware furnished with connector.
- (g) Test conditions – Standard ambient.

4.6.5 Altitude immersion (see 3.6.5):

Mated connectors shall be tested in accordance with method 1004 of MIL-STD-1344. The following details shall apply:

- (a) All wire ends shall be located within the chamber and exposed to the chamber atmosphere, but not submerged or sealed.
- (b) At the end of the third cycle while the connectors are still submerged in the solution, the insulation resistance shall be measured as specified in 4.6.12.1 and the dielectric withstanding voltage test shall be performed as specified in 4.6.13.1.

4.6.6 Air leakage:

A pressure differential of 30 PSIG shall be applied. After exposure for 2 hours minimum, the average leakage shall not exceed the requirements of paragraph 3.6.6

4.6.7 Salt spray (corrosion)(see 3.6.7):

Unmated connectors shall be tested in accordance with method 1001 of MIL-STD-1344. The following detail and exception shall apply:

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

4.6.8 Contact resistance (see 3.6.2):

Contact resistance shall be measured in accordance with method 3004 of MIL-STD-1344. Twenty percent, but not less than three contacts of the mated connectors, shall be tested. The following details and exceptions shall apply:

- (a) Test sample preparation shall be in accordance with MIL-STD-1344.
- (b) Wire size and type – See Table VII and 4.4.1.

4.6.8 (Continued):

(c) Test current shall be as specified in MIL-STD-1344.

(d) Millivolt drop – See Table II.

4.6.9 Magnetic permeability (see 3.6.8):

The wired, assembled, and fully mated connectors shall be checked for relative permeability with an indicator conforming to MIL-I-17214.

4.6.10 Contact retention (see 3.6.9):

The contact retention shall be tested as specified in method 2007 of MIL-STD-1344. An axial load, as shown in Table V shall be applied to 20 percent of the contacts in unmated connectors in both directions. A preload of 3 pounds maximum shall be initially applied to fully seat the contacts. Connectors shall have all contacts in place during the test.

4.6.11 Altitude – low temperature (see 3.6.10):

Connectors shall be conditioned in a dry oven at a temperature of $50^{\circ} \pm 5^{\circ}\text{C}$. for at least 8 hours. Wired, mated, assembled connectors in a continuous loop circuit shall be placed in a chamber in a manner that will simulate actual service usage. A suitable method must be made to energize the connector between shell and contacts.

- (a) Reduce the chamber internal temperature to -54°C (-65°F) and maintain until the specimen stabilizes.
- (b) Reduce the chamber internal pressure to simulate an altitude of 80,000 feet.
- (c) Maintain the above temperature and pressure for 1 hour minimum.
- (d) Energize the connector between the connector shell and all contacts using 625 vrms 60 Hz for 1 minute minimum. There shall be no dielectric breakdown.
- (e) With the test voltage removed, increase the chamber internal pressure and temperature to standard ambient conditions and allow specimens to stabilize.
- (f) Perform dielectric withstanding voltage and insulation resistance tests of 4.6.12.1 and 4.6.13.1. (The continuous loop circuit may be opened for these tests.) The connectors shall remain mated.