SAE Aerospace
An SAE International Group

AEROSPACE STANDARD

SAE AS85028 | REV. B

Issued 2004-06
Revised 2012-07

Superseding AS85028A

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

FSC 5935

RATIONALE

Revise to incorporate the qualifying activity testing as required by SAE policy, to replace MIL-STD-1344 test methods with the appropriate EIA test methods, to update references/document format with current SAE guidelines, and review specification for known technical issues.

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 °C.

1.2 Classification

1.2.1 Part Number

1.2.1.1 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 Number (1.2.1.4)	Dash Number (1.2.1.5)	Contact Designator (1.3.3)	Center Hardware (1.2.1.7)	Polarization (1.2.1.8)

1.2.1.2 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).

TO PLACE A DOCUMENT ORDER: Tel: 877-606-7323 (inside USA and Canada)
Tel: +1 724-776-4970 (outside USA)
Fax: 724-776-0790
Email: CustomerService@sae.org
SAE WEB ADDRESS: http://www.sae.org

SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/AS85028B

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

1.2.1.6.2 Contact Wire Barrel Size

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

a. No Contacts

b. 24 to 28 wire gauge

c. 20 to 24 wire gauge

d. 16 to 20 wire gauge

1.2.1.6.3 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 3.4.8).

2. APPLICABLE DOCUMENTS

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

2.1 SAE Publications

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

AMS-QQ-A-225	Aluminum and Aluminum Alloy, Bar, Rod, Wire, or Special Shapes; Rolled, Drawn, or Cold Finished; General Specification For
AS22520	Crimping Tools, Wire Termination General Specification For
AS22759	Wire, Electrical, Fluoropolymer-Insulated, Copper or Copper Alloy
AS39029	Contacts, Electrical Connector, General Specification For
AS39029/69	Connector Contact, Electrical Socket, Crimp Removable, for AS85028 Connectors
AS39029/70	Connector Contact, Electrical Pin, Crimp Removable, for AS85028 Connectors
AS81969	Installing and Removal Tools, Connector Electrical Contact, General Specification For
AS85028/1	Connector, Electric, Rectangular, Individual Contact Sealing, Polarized Center Jackscrew, Plug, Crimp Removable Pin Contacts, Class E
AS85028/2	Connector, Electric, Rectangular, Individual Contact Sealing, Polarized Center Hardware, Receptacle, Crimp Removable Socket Contacts, Class E
AS85028/3	Connector, Electric, Rectangular, Individual Contact Sealing, Polarized Center Jackscrew, Interfacial Seal, Size 16, Crimp Contacts
AS85028/4	Connector, Electric, Rectangular, Individual Contact Sealing, Polarized Center Jackscrew, Sealing Plug, Size 16, Crimp Removable Contacts
AS85028/5	Connector, Electric, Rectangular, Individual Contact Sealing, Polarized Center Jackscrew, Wire Seal, Size 16, Crimp Removable Contacts
AS85028/6	Connector, Electric, Rectangular, Individual Contact Sealing, Polarized Center Jackscrew, Replacement Tool, Wire Seal, Size 16, Crimp Removable Contacts

2.2 ASTM Publications

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

ASTM A240 Chromium and Chromium-Nickel Stainless Plate, Sheet, and Strip for Pressure Vessels and for General Applications

ASTM A342 Standard Test Methods for Permeability of Feebly Magnetic Materials

ASTM A484 Standard Specification for General Requirements for Stainless Steel Bars, Billets and Forgings

ASTM A582 Standard Specification for Free-Machining Stainless Steel Bars

ASTM A666 Steel, Sheet, Strip, Plate, and Flat Bar, Austenitic Stainless, Annealed or Cold-Worked

ASTM A693 Precipitation-Hardening Stainless and Heat-Resisting Steel Plate, Sheet, and Strip

ASTM B2111 Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod and Wire

ASTM D5948 Standard Specification for Molding Compounds, Thermosetting

2.3 U.S. Government Publications

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

SPECIFICATIONS

Military

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

MIL-A-8625 Anodic Coating for Aluminum

MIL-C-43616 Cleaning Compound, Aircraft Surfaces

MIL-DTL-45204 Gold Plating, Electrodeposited

MIL-DTL-55330 Connectors, Preparation for Delivery of

STANDARDS

Military

MIL-STD-202 Test Methods for Electronic and Electrical Component Parts

MIL-HDBK-454 General Guidelines for Electronic Equipment

MIL-STD-1285 Marking of Electrical and Electronic Parts

MIL-STD-1674 Insert Arrangements for MIL-C-85028(AS) Connector, Electric, Rectangular, Individual Contact Sealing, Polarized Center Jackscrew

SD-6 Provisions Governing Qualification

SPECIFICATION SHEETS

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

2.4 Other Publications

Available from the Document Automation and Production Service (DAPS), Building 4D, 700 Robbins Avenue, Philadelphia, PA 19111-5094, Tel: 215-697-9495, https://assist.daps.dla.mil/quicksearch/.

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

2.5 ECA Publications

Available from ECIA (Electronic Components Industry Association), 2214 Rock Hill Road, Suite 170, Herndon, VA 20170, Tel: 571-323-0294, www.eciaonline.org.

EIA 364 Electrical Connector/Socket Test Procedures Including Environmental Classifications

EIA 364-03 Altitude Immersion Test Procedure for Electrical Connectors

EIA 364-05 Contact Insertion, Release and Removal Force Test Procedure for Electrical Connectors

EIA 364-06 Contact Resistance Test Procedure for Electrical Connectors

EIA 364-10 Fluid Immersion Test Procedure for Electrical Connectors

EIA 364-13 Mating and Unmating Force Test Procedure for Electrical Connectors

EIA 364-14 Ozone Exposure Test Procedure for Electrical Connectors

EIA 364-17 Temperature Life With or Without Electrical Load Test Procedure for Electrical Connectors and Sockets

EIA 364-20 Withstanding Voltage Test Procedure for Electrical Connectors, Sockets and Coaxial Contacts

EIA 364-21 Insulation Resistance Test Procedure for Electrical Connectors, Sockets and Coaxial Contacts

EIA 364-26 Salt Spray Test Procedure for Electrical Connectors, Contacts, and Sockets

EIA 364-29 Contact Retention Test Procedure for Electrical Connectors

EIA 364-31 Humidity Test Procedure for Electrical Connectors and Sockets

EIA 364-32 Thermal Shock (Temperature Cycling) Test Procedure for Electrical Connectors and Sockets

2.6 ANSI Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.og.

ANSI/ASME Y14.5 Dimensioning and Tolerancing

ANSI/ISO 10012-1 Quality Assurance Requirements for Measuring Equipment

2.7 ASQ Publications

Available from American Society for Quality, 600 North Plankinton Avenue, Milwaukee, WI 53203, Tel: 800-248-1946 (United States or Canada)) or +1-414-272-8575 (International), www.asq.org.

ASQC Z1.4 Sampling Procedures and Tables for Inspection by Attributes

2.8 NCSL Publications

Available from National Conference of Standards Laboratories, 2995 Wilderness Place, Suite 107, Boulder, CO 80301-5404, Tel: 303-440-3339, www.ncsli.org.

NCSL Z540-1 General Requirements for Calibration Laboratories and Measuring and Test Equipment

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 SAE Part Numbers

SAE 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-HDBK-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 gold plated in accordance with MIL-DTL-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 (Reference Figure 2) be of high grade aluminum alloy per AMS-QQ-A-225/ASTM B211. Jackscrews and shells shall be corrosion resistant steel, type 303 per ASTM A484/A582.

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-DTL-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 ASTM D5948.

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 AS39029.

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).

3.4.3 Insert Design

Inserts shall be of one piece construction and shall be such that they will not chip, crack or break in normal service or assembly. Inserts glued or bonded together shall not be used. The insert dimensions shall be as specified with the individual specification sheets and MIL-STD-1674. The insert hole configuration for the removable contacts shall conform to the dimensions shown on Figure 1. Removable contacts, when assembled, shall be recessed a minimum of 0.010 in (0.254 mm) below the rear face of the insert.

3.4.4 Seal Design

Interfacial and rear seals shall be designed and constructed in such a manner that they become an integral part of any individual contact. Each seal shall have the capability of being removed and replaced. The individual rear seals shall be capable of meeting the requirements of this specification when sealing on each or any combination thereof of the wire types having the insulation diameters listed in Table 1. The seal connector assembly shall be capable of meeting all the requirements of this specification.

3.4.5 Interfacial Seal

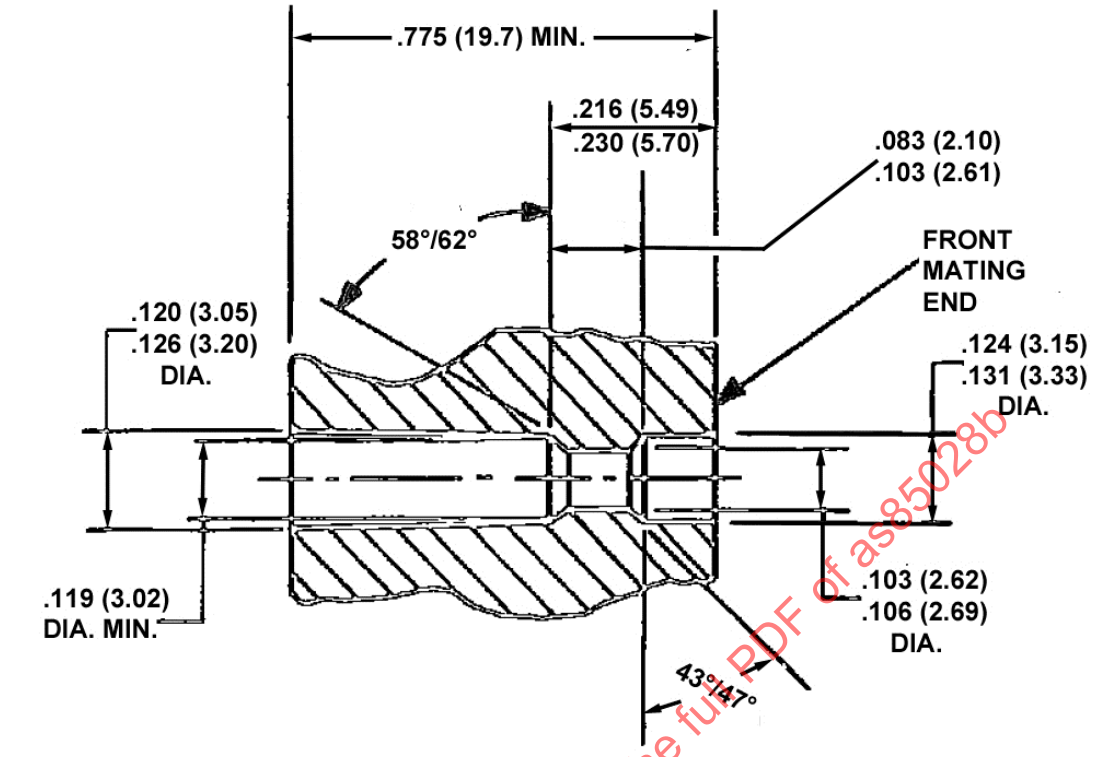
The interfacial seal shall be specified on the individual specification sheet.

3.4.6 Wire Seal

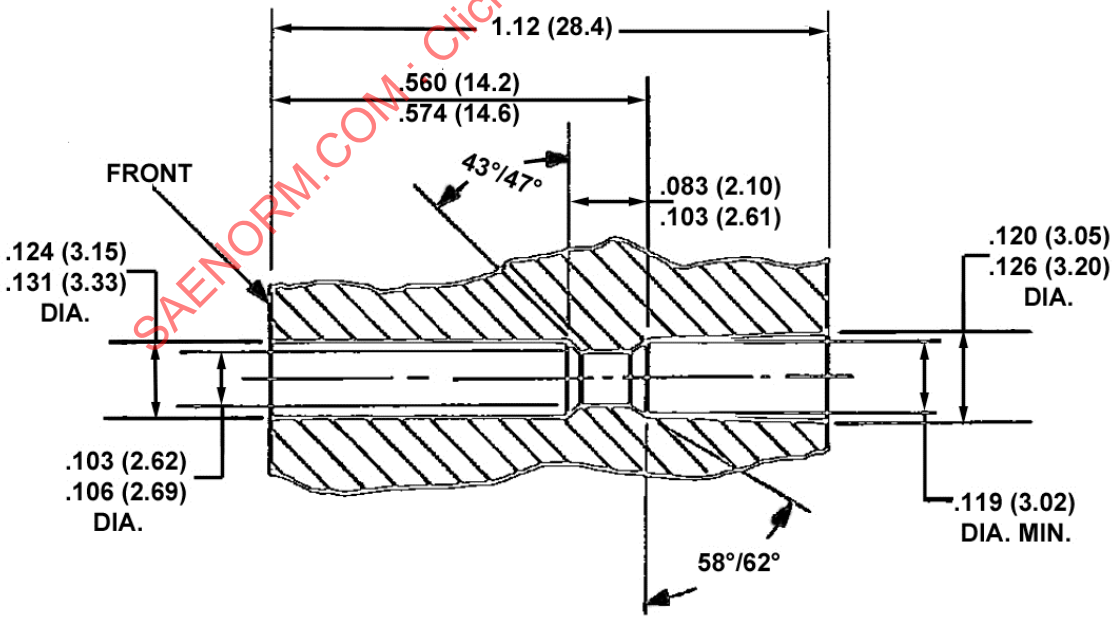
The wire seal shall be specified on the individual specification sheet.

TABLE 1 - CONTACT SIZE AND WIRE RANGE ACCOMMODATIONS.

Contact Size	Wire Size Accommodation	Wire Range Accommodation (Diameter Over Insulation)	
		Min.-Inches (mm)	Max.-Inches (mm)
16-24	24, 26, 28	0.041 (1.04)	0.055 (1.39)
16-20	20, 22, 24	0.051 (1.29)	0.070 (1.77)
16-16	16, 18, 20	0.066 (1.68)	0.087 (2.20)



PIN INSERT



SOCKET INSERT

FIGURE 1 - INSERT HOLE CONFIGURATION (CONTACT SIZE 16-16, 16-20, AND 16-24)

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 AMS-QQ-A-250 or corrosion-resistant steel conforming to ASTM A240/A666/A693, 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.

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 (see 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 0.047 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.

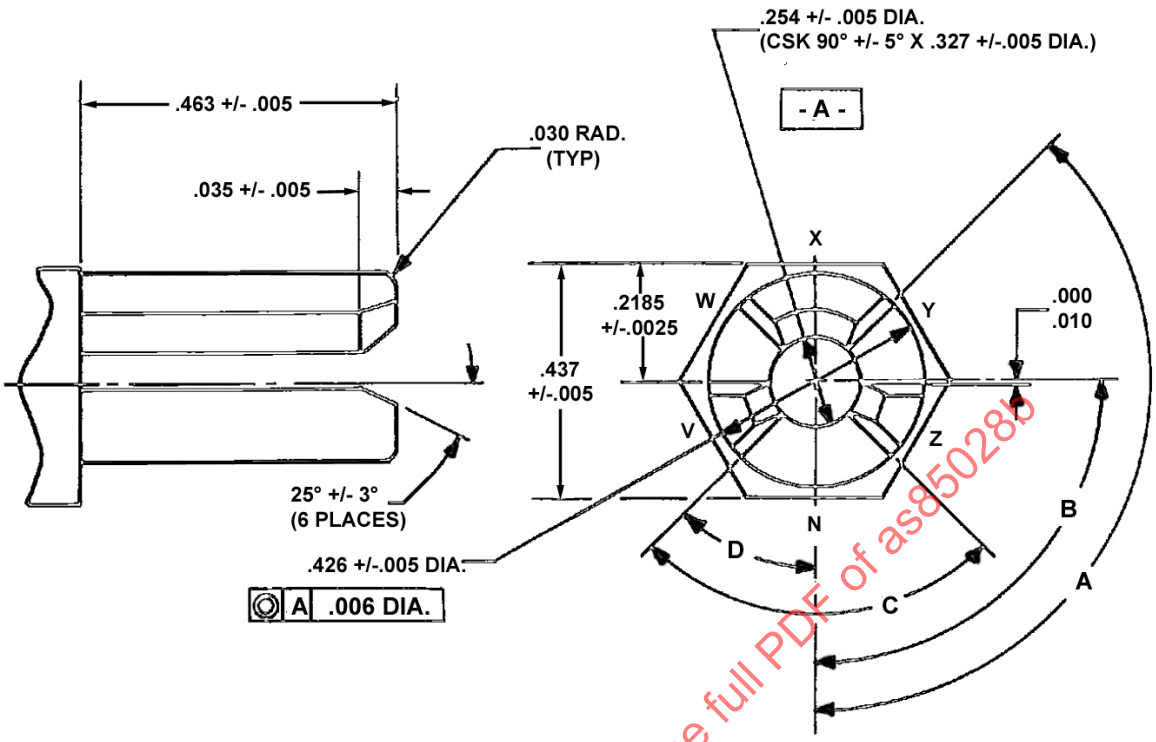
3.5.1 Insert Marking

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.

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.



POLARIZATION	A ± 0° 30’	B ± 0° 30’	C ± 0° 30’	D ± 0° 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
0.0025	0.06
0.005	0.13
0.010	0.25
0.030	0.76
0.035	0.89
0.2185	5.55
0.254	6.45
0.327	8.31
0.428	10.87
0.437	11.10
0.463	11.76

NOTES:

1. Dimensions are in inches.

2. Metric equivalents (to the nearest 0.01 mm) are given for general information only and are based upon 1 in = 25.4 mm.

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 2 A or B.

TABLE 2A - CONTACT RESISTANCE.
(SILVER PLATED WIRE)

Mating End Size	Wire Size Range	Wire Size	Test Current Amperes	Maximum Voltage Drop Millivolts			
				25 °C +3°/-0°		25 °C +3°/-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 2B - CONTACT RESISTANCE.
(NICKEL PLATED WIRE)

Mating End Size	Wire Size Range	Wire Size	Test Current Amperes	Maximum Voltage Drop Millivolts			
				25 °C +3°/-0°		25 °C +3°/-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

3.6.3 Thermal Shock

When subjected to the temperature extremes of Table 3 in accordance with 4.6.3, there shall be no damage detrimental to the operation of the connector.

TABLE 3 - 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 4. When the connectors are mated to the torque values of Table 4, the maximum allowable dimension between flanges shall be 0.641.

TABLE 4 - MATING FORCE

Insert Arrangement	Jackscrew Mating Torque in-lb
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 GΩ and shall withstand a dielectric withstanding voltage of 3000 V rms at sea level when tested with suitable wire.

3.6.6 Air Leakage

When tested as specified in 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/s).

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 affect 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 5. During the test, the axial displacement of the contact shall not exceed 0.012 in when pressures are applied from the face side.

TABLE 5 - 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 V rms after stabilizing at an atmospheric pressure equivalent to an altitude of 80 000 ft and a temperature of 54 °C +4°/-0°.

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 5000 MΩ 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 MΩ 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 6.

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 µs.

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 µs.

3.6.16 Humidity (steady state)

When tested as specified in 4.6.17, connectors shall maintain an insulation resistance of 100 MΩ 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 6. Connector shall mate within the forces specified in Table 4.

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 lb and the removal force shall not exceed 10 lb. Contacts shall be wired using wire specified in Table 1. 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 µs.

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 ANSI/NCSL Z540-1 or ISO 10012-1.

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 EIA 364. Performance of the inspection shall be the responsibility of the qualification applicant under authorization of the qualifying activity (NAVAIR). The qualifying activity shall authorize the applicant to begin qualification testing by written notice that describes the requirements of submission in accordance with this specification. The qualification applicant shall furnish test results, certifications, and tested product to the qualifying activity. Certifications shall be provided on government form DD Form 1718, "Certification of Qualified Products" or equivalent. The samples shall be taken from the same lot as tested by the supplier and plainly identified by attached durable tags marked with the information listed below. The tags must be stamped by the supplier and qualifying activities designated quality Assurance Representative (QAR) inspector as representative samples of the manufacturer's normal production capability. Samples submitted without the stamp will not be accepted.

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 6. Group 2 shall be performed by the Qualifying Activity; all other test groups shall be performed by the manufacturer.

TABLE 6 - QUALIFICATION INSPECTION

Examination or Test	Requirement Paragraph	Test Paragraph	Test Group 1 5/	2 6/	3 3/	4 4/
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	–
1/ 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	–	–	–
Contact insertion and removal forces	3.6.19	4.6.20	–	–	–	X
2/ 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
1/ Dielectric withstanding voltage at altitude	3.6.12.2	4.6.13.2	–	X	–	–
Durability	3.6.13	4.6.14	–	X	–	–
1/ Vibration	3.6.14	4.6.15	–	X	–	–
1/ 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 h for periodic test requalification.
3/ Dielectrics.
4/ Retention system.
5/ Group 1 performed by the Qualifying Activity for periodic qualification.
6/ Group 2 performed by the Qualifying Activity for initial qualification, all other groups performed by the manufacturer.

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% of the minimum diameter wire, 50% of the maximum diameter wire as shown in Table 7. Mating connector samples shall be divided into two similar groups. One group shall be forwarded to the Qualifying Activity for performing the tests of group 1, Table 6 in the sequence indicated. The other group shall be subjected to the tests of group 2, Table 6 in the sequence indicated.

TABLE 7 - 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

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 6 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 6 in the sequence indicated.

d. All test samples required for the Qualifying Activity testing shall comply with 4.4.1 and shall be forwarded to the Qualifying Activity prior to the start of the supplier's testing.

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

Retention of qualification inspection (Table 6, Group 1) shall be performed by the Qualifying Activity on sample units produced with equipment and procedures normally used in production. To retain qualification, the supplier shall forward their periodic qualification submittal every 36 months to the Qualifying Activity. The Qualifying Activity shall establish the initial reporting date. Failure to submit test samples/data within 30 days after the end of the sampling interval may result in loss of qualification for the products. Except where the results of these inspections show non-compliance with the applicable requirements, delivery of products which have passed group A/B inspection shall not be delayed pending the results of retention of qualification inspections.

a. A summary of the results of the tests performed for Group A/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. 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. The form of the report shall be in accordance with the Qualifying Activity requirements. If limited production has ocurred for the reporting period, the manufacturer may request the Qualifying Activity to consider a similar certification to fullfill the periodic requirement.

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 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 in Table 6, 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 EIA-364-32. Test condition shall be IV except the minimum temperature shall be -55 °C +0°/-3°. 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 EIA-364-13, method A. The following details and exceptions shall apply:

a. Force or torque requirements – See Table 4.

b. Lubrication – None.

c. Wire type, gage and length – See Table 7 and 4.4.1; length optional.

d. Rate of mating and unmating – Maximum of 10 s for each operation.

e. Applicable hardware – All hardware furnished with connector.

f. Test conditions – Standard ambient.

4.6.5 Altitude Immersion (see 3.6.5)

Mated connectors shall be tested in accordance with method EIA-363-03. 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 h minimum, the average leakage shall not exceed the requirements of 3.6.6.

4.6.7 Salt Spray (corrosion) (see 3.6.7)

Unmated connectors shall be tested in accordance with method EIA-364-26. 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.