

Connector, Electric, Rectangular Environment Resisting

1.0 Scope

1.1 Scope

This specification describes environment resistant, fixed insert, electric, rectangular connectors. These connectors shall be environment resisting, utilizing insertable and removable contacts. These connectors shall be capable of continuous operation within a temperature range specified.

1.1.1 Series Description

The connectors are identified as Series A, B, or C and are designed to be intermateable, one series with another.

Series A. Connector, screw coupling,
Operating temperature: -65 ° C (-85 ° F) to
+125 ° C (+257°F).

Series B. Connector, screw coupling,
Operating temperature: -65°C (-85°F) to
+150° C (+302° F).

Series C. Connector, screw coupling, high temperature
Operating temperature:
-65° C (-85° F) to +200°C (+392°F).

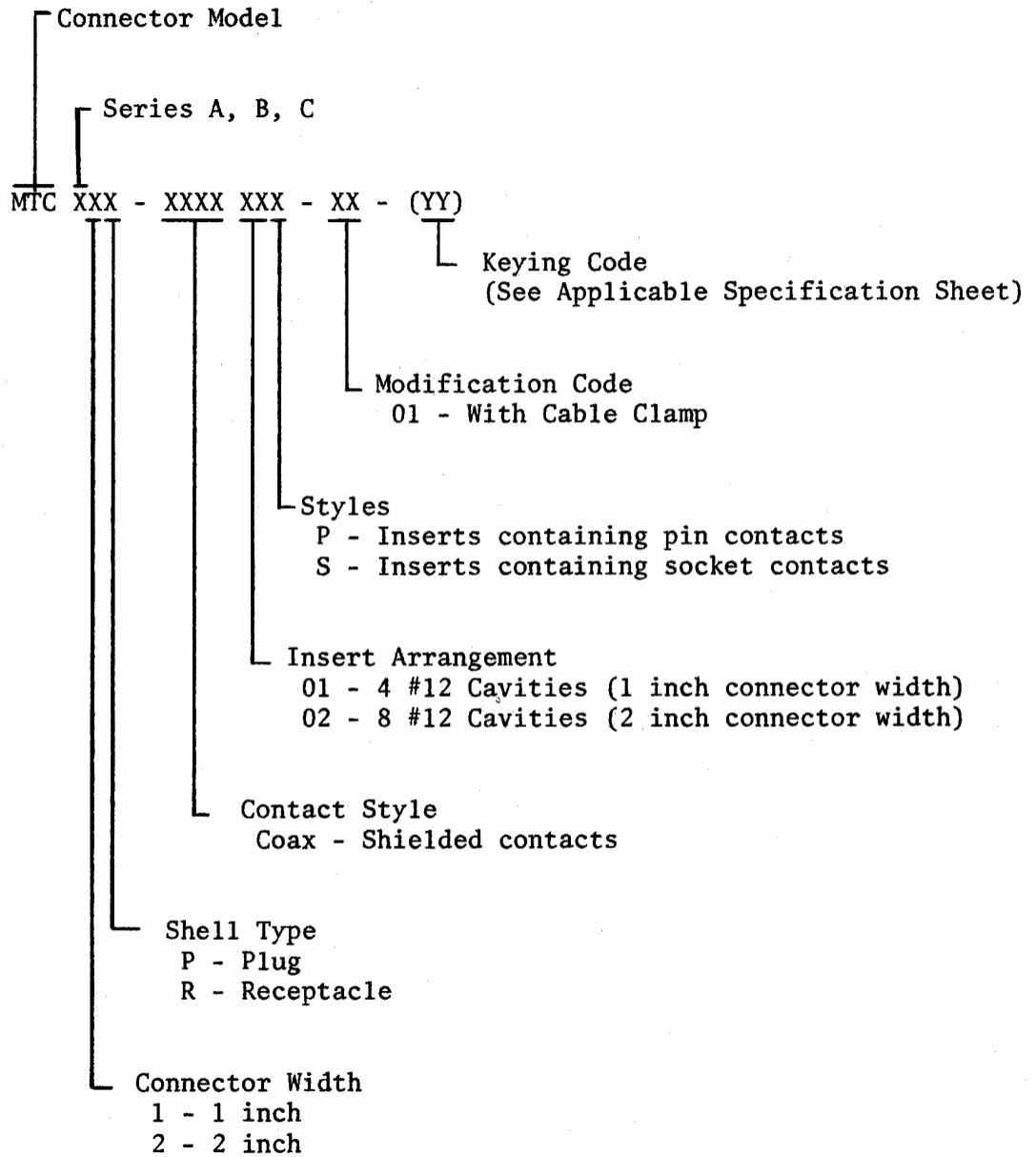
1.2 Classification

Products in accordance with this specification shall be the following types as specified in the applicable specification sheet.

1.2.1 Part Number

Part number for connectors qualified under this specification shall conform to the following example.

1.2.1 Part Number (Continued)



1.2.2 Styles

P = Inserts for use with pin contacts.

S = Inserts for use with socket contacts.

1.2.3 Types

P = Plug connector

R = Receptacle connector

1.2.4 Accessories

Accessories shall consist of the items as specified in the applicable specification sheet (see 3.1).

1.2.5 Shell Sizes

Shell sizes and insert arrangements as specified on the applicable standard.

2.0 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 this specification to the extent specified herein. In the event of conflict, this specification takes precedence over reference documents.

Specifications**Federal**

TT-T-291 Thinner, Paint, Volatile Spirits (petroleum spirits)

TT-I-735 Isopropyl Alcohol

QQ-A-591 Aluminum Alloy Die Castings

QQ-P-35 Passivation Treatments for Corrosion Resisting Steel

QQ-S-571 Solder, Tin Alloy: Tin-Lead Alloy; and Lead Alloy

QQ-S-763 Steel Bars, Shapes, and Forgings—Corrosion Resisting

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

Military

MIL-G-3056 Gasoline, Automotive, Combat

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

Military

MIL-A-8625	Anodic Coatings, for Aluminum and Aluminum Alloys
MIL-I-17214	Indicator, Permeability; Low Mu (Go-No-Go)
MIL-L-23699	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base.
MIL-C-25769	Cleaning Compound, Aircraft Surface, Alkaline Water Base
MIL-C-26074	Coating, Electroless Nickel, Requirements for
MIL-C-83723	Connectors, Electrical, Circular, Environmental, Resisting
MIL-C-38999	Connectors, Electrical, Circular, Environmental Resisting
MIL-G-45204	Gold Plating, Electrodeposited
MIL-C-45662	Calibration System Requirements
MIL-C-49059	Cable, Electrical (Flexible, Flat, Unshielded), (Flat Conductor)
MIL-W-81044	Wire, Electric, Crosslinked Polyalkene, Crosslinked Alkane-Imide Polymer, or Polyarylene Insulated, Copper or Copper Alloy
MIL-H-83282	Hydraulic Fluid, Fire Resistant Synthetic Hydrocarbon Base, Aircraft.

Standards**Federal**

FED-STD-406 Plastics, Methods of Testing

Military

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-109	Quality Assurance Terms and Definitions
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-130	Identification Marking of U.S. Military Property
MIL-STD-202	Test Methods for Electronic and Electrical Component Parts
MIL-STD-454	Standard General Requirements for Electronic Equipment
MIL-STD-1344	Test Methods for Electrical Connectors

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.

American Society for Testing and Materials (ASTM)

D-150	A-C Loss Characteristics and Dielectric Constant (Permittivity) of Solid Electrical Insulating Materials
D-256	Impact Resistance of Plastics and Electrical Insulating Materials
D-570	Water Absorption of Plastics
D-638	Tensile Properties of Plastics
D-648	Deflection Temperature of Plastics under Flexural Load
D-790	Flexural Properties of Plastics

(Application for copies should be addressed to the American Society for Test and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.)

Underwriters Laboratories, Inc. (U.L.)

UL94	Tests for Flammability of Plastic Materials
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(Copies may be obtained from Underwriters Laboratories, Inc. 333 Pfingsten Road, Northbrook, Illinois, 60062.)

Raychem Specifications Control Drawings

D-602-0094	Contact Pin, Coaxial Size 12, RG 178, RG 179
D-602-0095	Contact Socket, Coaxial Size 12, RG 178, RG 179
D-602-0104	Contact, Pin, Coaxial Size 12, Twisted Pair (24 or 26 AWG)
D-602-0105	Contact Socket, Coaxial Size 12, Twisted Pair (24 or 26 AWG)
D-602-0106	Contact Pin, Coaxial Size 12, RG 180
D-602-0107	Contact, Socket, Coaxial Size 12, RG 180
D-652-0004	Connector, Electric, Rectangular, Environmental Resisting

3.0 Requirements**3.1 Specification Sheets**

The requirements for individual connectors under this specification shall be as specified herein and in the applicable specification sheet. In the event of any conflict between the requirements of this specification and those of the applicable specification sheet, the latter shall govern.

3.2 Classification of Requirements

The requirements for the connectors are classified herein as follows:

<u>Requirement</u>	<u>Paragraph</u>
Qualification	3.3
Materials	3.4
Design and Construction	3.5
Performance	3.6

3.3 Qualification

The connectors furnished under this specification shall be products which have been tested and have passed the qualification tests specified herein.

3.4 Materials

All materials used in the manufacture of the connectors shall be of the quality and form best suited for the purpose intended. When requested by the procuring activity, certification that materials are as specified shall be forwarded by the supplier. All materials used shall conform to the requirements specified herein.

3.4.1 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.

3.4.2 Non-Magnetic Materials

All component parts of the connector shall be of a material generally considered to be non-magnetic whenever possible, unless otherwise specified by this specification or the applicable specification sheet. The relative permeability of the connector and individual contacts shall be less than 2.0 when measured with an instrument in accordance with MIL-I-17214.

3.4.3 Metallic Material

3.4.3.1 Contacts

Contacts shall be made of a conductive copper-based alloy capable of meeting the performance requirements specified herein and in the applicable specification sheets. Power Contacts per M83723-33-XXXX and M83723-34-XXXX Shielded Contacts per D-6008

3.4.3.1.1 Contact Finish

The mating surfaces of the contacts shall be gold plated in accordance with MIL-G-45204, Type I, Grade C, Class 1 over a suitable underplate. A silver underplate shall not be used.

3.4.3.2 Housing

The housing shall be die cast aluminum in accordance with QQ-A-591.

3.4.3.2.1 Housing Finish

The housing shall have a suitable finish to meet the requirements as specified herein. Housings shall have either a black anodized non-conductive finish in accordance with MIL-A-8625, Type II, Class 2 or an electrically conductive finish of electroless nickel conforming to MIL-C-26074, Class 3 or 4, Grade B.

3.4.3.3 Mounting and Mating Hardware

The mounting and mating hardware shall be corrosion-resistant steel in accordance with QQ-S-763, Class 302, 304, and 305, Condition A or QQ-S-764, Class 303, Condition A. Parts shall be passivated in accordance with QQ-P-35.

3.4.4 Dielectric Materials

3.4.4.1 Elastomeric Inserts

Interfacial seals, grommets, and other elastomeric seals as applicable shall be of a resilient dielectric material capable of meeting the performance requirements specified herein and in the applicable specification sheet.

3.4.4.2 Rigid Inserts

The rigid material used for inserts shall be made of a high grade dielectric having electrical and mechanical characteristics suitable for the purpose intended. The impact strength of the material shall be such that it will not chip, crack or break during assembly or normal service. Tests shall be performed in accordance with Table VIII as part of qualification testing. The test data results shall be included as part of the qualification test report.

3.4.4.2.1 Fungus Resistance

Materials used in the construction of these connectors shall be fungus inert per Requirement 4 of MIL-STD-454.

3.4.4.2.2 Hydrolytic Stability

All non-metallic material shall pass a test to establish hydrolytic reversion resistance. They shall meet the hydrolytic physical test requirements for a comparable material per one of the military specification tests listed in MIL-STD-454, Requirement 47.

3.5 Design and Construction

The connectors shall be designed and constructed to withstand handling and maintenance functions incident to installation and service.

3.5.1 Configuration

The connectors, contacts and inserts shall conform to the applicable specification sheet. The connectors shall consist of a rectangular plug and receptacle housing, mounting and mating hardware, and an environmental sealed, fixed insert subassembly, which will accept the insertable/removable contacts (using a M83723-31-XX tool). The insert subassembly shall be a non-removal integral unit with the required interfacial seals and grommets.

3.5.2 Envelope Dimensions

The envelope dimensions of the assembled and mated connectors shall not exceed the dimensions shown in Figure 1.

3.5.3 Housing

3.5.3.1 Configuration

3.5.3.1.1 Plug and Receptacle Connector Housing

Connectors shall be available in plug (male) and receptacle (female) versions. The receptacle shall be suitable for panel mounting or cable mounting. The connectors shall be of a single piece shell design, constructed to positively retain inserts. The shells for the connectors shall be designed to accept and retain a cable support or accessory as shown in the applicable specification sheet.

3.5.3.2 Housing Polarization

Mating portions of each housing shall have a configuration which will prevent mating when either housing is rotated 180° from the correct mating position. Polarization shall occur before engagement of the contacts or the mating hardware.

3.5.3.3 Connector Keying

Insertable and removable keying pins shall be provided in each housing to allow mating connectors to be keyed to each other in at least 16 different mating combinations. The keying shall prevent the mating of a plug or receptacle with any but a properly keyed mating plug or receptacle. Connector keying shall occur before engagement of the contacts or the mating hardware.

3.5.4 Hardware

Hardware shall be provided for mounting and mating the housing as specified in the applicable specification sheet. All threaded hardware shall be provided with suitable locking means.

3.5.5 Insert**3.5.5.1 Pin Insert Interfacial Seal**

The face of the pin seal shall be of a resilient material bonded to the insert to provide an interfacial seal. Insert entry dimensions per Figure 2.

3.5.5.2 Wire Sealing Members (Rear Grommet)

The wire sealing member shall provide suitable sealing for overall wire diameters listed in Table I and shall not be removable from the shell.

Table I
Wire Insulation Range

Contact Size	Minimum O.D. (inch)	Maximum O.D. (inch)
12	.097	.158

3.5.5.3 Rigid Inserts

The inserts shall be rigid plastic and so designed and constructed with proper sections and radii that they will not chip, crack or break during normal assembly or service. The inserts shall be non-removable, mechanically retained, and bonded to the shell. The design and construction shall be such that all air paths between cavities are eliminated. The insert engaging faces shall be designed and constructed so that all air paths between the cavities at the connector interfaces shall be eliminated when the connectors are mated. The inserts shall be designed so that positive locking of the contacts in the inserts is provided. Socket insert faces shall be of a rigid plastic material.

3.5.5.4 Contact Insertion and Extraction

The connector design shall permit individual insertion and extraction of contacts without removing the insert or sealing members. Insertion of the contacts into and extraction of the contacts from the insert shall be accomplished from the rear of the connector with the aid of tools as listed in the applicable specification sheet. (See 3.1)

3.5.5.5 Sealing Plugs

Grommet sealing plugs per MS83723-28-XX shall be used in the grommet cavities corresponding to all unwired contacts. The sealing plug shall be in accordance with the applicable specification sheet (See 3.1). The same sealing plugs may be used in both connector plug and receptacle.

3.5.5.6 Contact Arrangement

Contacts shall be arrayed within the insert in a single row as required. Number of contacts and contact spacing shall be in accordance with Table II.

Contact Number and Spacing			
Shell Size	Number of Contacts	Contact Size	Contact Spacing
1	4	12	.250
2	8	12	.250

3.5.5.7 Contact Arrangement Identification

The contact positions shall be permanently designated in contrasting color on the front face of the insert material and on the rear face of the wire sealing grommet as noted on the insert arrangement of the applicable specification sheet. The interfacial markings of the inserts shall not be raised or recessed on any sealing surfaces and shall be as indicated in Figure 3.

3.5.5.8 Socket Contacts

Socket contacts assembled in either plug or receptacle shall allow for contact float of 0.00025 to 0.0120 inch from true alignment position.

3.5.6 Contacts

3.5.6.1 Contacts shall be designed so that neither the pin nor socket will be damaged by; twisting or forcing during mating and unmating of the connectors, or by insertion into or removal of contacts from the connector with the tools required for insertion or removal. Crimp contact connectors may be supplied without contacts for indirect shipment.

3.5.6.2 Power Contacts

Power contacts to be per M83723-34-XXX and M83723-33-XXX and shielded contacts per D-6008.

3.5.7 Insertion and Removal Tools

Tools required for assembly or disassembly of pin and socket contacts into their connector inserts, shall be in accordance with the applicable specification sheet (see 3.1). Connectors may be supplied without insertion removal tool for indirect shipment.

3.5.8 Identification

The connector shall be clearly and permanently marked in the location specified on the applicable specification sheet. The characters shall be a minimum of .037 inch in height. Each connector shall be marked on the shell with the supplier's name or trademark, and part number.

3.5.9 Interchangeability

The connector plugs, receptacles, contacts, and accessories supplied to this specification shall meet the requirements of the applicable specification sheet. They shall be completely interchangeable with other components having the same part number.

3.6 Performance

When tested in accordance with the methods defined in 4.6, connector assemblies shall conform to the requirements specified herein and in the applicable specification sheet.

3.6.1 Preparation of Connectors

Connector samples shall be prepared per Paragraph 4.3.

- 3.6.2 **Examination of Product**
Contacts, connectors, and accessories shall be examined as specified in 4.6.2 and shall meet the requirements indicated herein.
- 3.6.3 **Maintenance Aging**
When tested as specified in 4.6.3, connectors shall be capable of meeting the performance requirements of this specification.
- 3.6.4 **Contact Retention**
When tested as specified in 4.6.4, the axial displacement of the contacts shall not exceed 0.012 inch. No damage to contacts or inserts shall result.
- 3.6.5 **Altitude - Low Temperature**
After stabilizing the connector at an altitude of 80,000 feet and a low temperature of -50° C, as specified in 4.6.5, the connectors shall withstand 625 Vrms/60 Hz for one minute. The voltage shall be applied between adjacent contacts and between contacts and shell. There shall be no evidence of dielectric breakdown. With the test voltage removed and the temperature and pressure stabilized at ambient conditions, the connectors shall meet the insulation resistance requirements of 4.6.10 and the dielectric withstanding voltage test of 4.6.11 at sea level.
- 3.6.6 **Temperature Cycling**
When tested as specified in 4.6.6, there shall be no damage detrimental to the operation of the connector. Any evidence of damage resulting from this test shall be cause for rejection.
- 3.6.7 **Altitude Immersion**
When tested as specified in 4.6.7, the mated connector shall meet a minimum insulation resistance of 1000 megohms. Any evidence of dielectric breakdown or flashover shall be cause for rejection.
- 3.6.8 **Insert Retention**
When tested as specified in 4.6.8, assemblies shall retain their inserts in their proper location in the shell. Evidence of cracking, breaking, separation from the shell, or loosening of parts shall be cause for rejection.

- 3.6.9 Salt Spray (Corrosion)
When tested as specified in 4.6.9, unmated connectors shall show no exposure of basic metal due to corrosion which will adversely affect performance.
- 3.6.10 Insulation Resistance
- 3.6.10.1 Insulation Resistance at Ambient Temperature
When tested as specified in 4.6.10.1, the insulation resistance between any pair of contacts and between any contact and the shell shall be greater than 5000 megohms.
- 3.6.10.2 Insulation Resistance at Elevated Temperature
When tested as specified in 4.6.10.2, the insulation resistance between any pair of contacts and between any contact and shell shall be greater than 200 megohms.
- 3.6.11 Dielectric Withstanding Voltage
When tested as specified in 4.6.11, connectors shall show no evidence of flashover or breakdown when subjected to the test voltages and altitudes of Table III.

Table III
Test Voltages, AC rms, 60 Hz

<u>Altitude</u>	<u>Service Rating I</u>	<u>Service Rating II</u>
Sea Level	1500	2300
50,000 ft.	500	750
70,000 ft.	375	500
110,000 ft.	200	200

- 3.6.12 Durability
When tested as specified in 4.6.12, connectors shall shown no damage detrimental to the operation of the connector. Failure to complete this test because of mechanical malfunction of the connector shall be cause for rejection.
- 3.6.13 Vibration
When tested as specified in 4.6.13, a current discontinuity of 1 microsecond or more, disengagement of the mated connectors, evidence of cracking, breaking or loosening of parts shall be cause for rejection.

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- 3.6.14 **Shock**
When tested as specified in 4.6.14, a current discontinuity of 1 microsecond or more, disengagement of the mated connectors, evidence of cracking, breaking, or loosening of parts shall be cause for rejection.
- 3.6.15 **Shell-to-Shell Conductivity**
When tested as specified in 4.6.15 the measured potential drop across assemblies shall not exceed 200 millivolts for classes with conductive finishes.
- 3.6.16 **Humidity**
When tested as specified in 4.6.16, wires, mated connectors shall show no deterioration and the insulation resistance shall be 100 megohms or greater.
- 3.6.17 **Ozone Exposure**
When tested as specified in 4.6.17, the connectors shall show no evidence of cracking of dielectric material or other damage due to ozone exposure that will adversely affect performance.
- 3.6.18 **Fluid Immersion**
Connectors shall mate properly after having been subjected to the test specified in 4.6.18.
- 3.6.19 **Contact Walk-Out**
When tested as specified in 4.6.19, contacts shall not become dislodged from their normal position.
- 3.6.20 **Insert/Removal Tool Abuse**
When tested as specified in 4.6.20, there shall be no evidence of damage to the contacts, the connector inserts or the contact retaining mechanism that would adversely affect performance.
- 3.6.21 **Pin Contact Stability**
When tested in accordance with 4.6.21, the total displacement of the contact lip end shall not exceed .062 inch.
- 3.6.22 **Temperature Life with Contact Loading**
When subjected to the test specified in 4.6.22, there shall be no electrical discontinuity in excess of one microsecond.
- 3.6.23 **Electrical Engagement**
When tested as specified in 4.6.23, wired and mated connectors shall provide a minimum of .040.inches of electrical engagement.
- 3.7 **Workmanship**
Connectors and accessories shall be processed in such a manner as to be uniform in

quality. They shall be free from burrs, cracks, voids, pimples, chips, blisters, pinholes, sharp cutting edges, and other defects that will affect life, serviceability, or appearance.

4.0 Quality Assurance Provisions

4.1 Responsibility for Inspection

The supplier is responsible for the performance of all the inspection tests specified herein. The supplier may utilize his own or any other inspection facility and services acceptable to the buyer. Inspection records of the examination and tests shall be kept complete and available to the buyer as specified in the contract or order for a period of 3 years after shipment of the material.

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 supplier. A calibration system to control the accuracy of the measuring and test equipment shall be maintained in accordance with MIL-C-45662.

4.2 Classification of Inspections

The examination and tests of connectors covered by this specification shall be divided into the following classifications:

<u>Classification</u>	<u>Paragraph</u>
Qualification Inspection	4.3
Acceptance Inspection	4.4

4.3 Qualification Inspection

Qualification inspection shall consist of tests to determine conformance with all applicable requirements of this specification.

4.3.1 Qualification Samples

The qualification samples shall be manufactured by normal production methods, and shall be provided as follows:

- a). One (1) mated connector pair for Groups 1, 3, and 4. Each arrangement in a given shell size shall be the densest contact arrangement for that particular contact size. All samples shall be provided with strain relief cable clamps.
- b). Two (2) mated connector pairs for Groups 2 and 5. Each arrangement in a given shell size shall be the densest contact arrangement for that particular contact size. All samples shall be provided with strain relief cable clamps.

4.3.1.1 Preparation of Samples

Connector samples shall be terminated to a workable length of suitable wire. Half the samples shall use wires with outer diameters approaching the maximum limit of Table I and the remainder with outer diameter approaching the minimum limit of Table I.

- 4.3.1.1.1 Connector samples to be tested in the mated condition shall have the jack screws torqued to nine (9) inch, pounds prior to the test commencement.

4.3.2 Qualification Test Report

The certified qualification report shall be forwarded to the activity responsible for qualification plainly identified with the following information;

Qualification Test Report for:

CONNECTORS, ELECTRIC, RECTANGULAR, ENVIRONMENT-RESISTENT

Name of Manufacturer

Manufacturer's Part Number

Table IV
Qualification Inspection

Test	Requirement Paragraph	Test Paragraph
Group I (All Classes)		
Examination of Product	3.6.2	4.6.2
Maintenance Aging	3.6.3	4.6.3
Temperature Cycling	3.6.6	4.6.6
Altitude Immersion	3.6.7	4.6.7
Insert Retention	3.6.8	4.6.8
Salt Spray (Corrosion)	3.6.9	4.6.9
Post Test Examination	-----	4.7
Group 2 (All Classes)		
Examination of Product	3.6.2	4.6.2
Maintenance Aging	3.6.3	4.6.3
Contact Retention	3.6.4	4.6.4
Altitude Low-Temperature	3.6.5	4.6.5
Temperature Cycling	3.6.6	4.6.6
Insulation Resistance at Elevated Temperature	3.6.10.2	4.6.10.2
Dielectric Withstanding Voltage at Sea Level	3.6.11.1	4.6.11.1
Dielectric Withstanding Voltage at Altitude	3.6.11.2	4.6.11.2
Durability	3.6.12	4.6.12
Vibration	3.6.13	4.6.13
Shock	3.6.14	4.6.14
Shell-to-Shell Conductivity	3.6.15	4.6.15
Humidity	3.6.16	4.6.16
Contact Retention	3.6.4	4.6.4
Post Test Examination	-----	4.7
Group 3 (Dielectrics)		
Examination of Product	3.6.2	4.6.2
Temperature Life with Contact Loading	3.6.22	4.6.22
Ozone Exposure	3.6.17	4.7.17
Insulation Resistance at Ambient Temperature	3.6.10.1	4.6.10.1
Dielectric Withstanding Voltage at Sea Level	3.6.11	4.6.11.1
Insert Retention	3.6.8	4.6.8
Post Test Examination	-----	4.7

Table IV Continued

Test	Requirement Paragraph	Test Paragraph
Group 4 (Retention System)		
Examination of Product	3.6.2	4.6.2
Contact Walk-Out	3.6.19	4.6.19
Insertion/Removal Tool Abuse	3.6.20	4.6.20
Pin Contact Stability	3.6.21	4.6.21
Contact Retention	3.6.4	4.6.4
Post Test Examination	-----	4.7
Group 5 (Fluid Immersion)		
Examination of Product	3.6.2	4.6.2
Fluid Immersion (1)	3.6.18	4.6.18
Insert Retention	3.6.8	4.6.8
Post Test Examination	-----	4.7

- (1) Connectors using the same materials as specified in D-6006 may be qualified by similarity by detailing the material similarities. Two (2) mating connectors (one pair being subjected to each of the following specified fluids). Fluid immersion per 3.6.18 except that the fluids shall be:
- a). Jet Fuel JP-5 (Sample 8 of Table VII)
 - b). Hydraulic Fluid (Sample 7 of Table VII)
- (2) Connectors shall be coupled with a jack screw torque of nine (9) inch pounds.

4.4 Acceptance Inspection

Acceptance inspection shall consist of the examination and tests listed in Table V.

Acceptance Inspection shall be performed on every lot of connectors procured under this specification.

4.4.1 Sampling for Acceptance Inspection

MIL-STD-109 shall apply for definitions of inspection terms used herein. For purposes of this specification, the following shall apply.

4.4.1.1 Inspection Lot

The inspection lot, as far as practicable, shall consist of all connectors of one part number, manufactured under essentially the same conditions, and offered for inspection at one time. Sufficient quantities of the mating connectors shall be available for test purposes.

4.4.1.2 Sample Unit (Visual and Dimensional Examination)

The sample unit shall be visually and dimensionally examined as specified in Table V.

4.4.1.3.1 Inspection Levels and Acceptable Quality Levels (AQL)

The inspection levels and acceptable quality levels shall be in accordance with MIL-STD-105 and shall be as specified in Table V.

Table V
Acceptance Inspection

Examination or Test	Requirement	Test Procedure	Inspection Level	AQL*(percent defective)	
				Major	Minor
Visual and Dimensional Examination	Application specification sheet 3.1, 3.4, 3.5, and 3.7	4.6.2	1	0.25	1.0
Insulation Resistance at Room Ambient Temperature (1)	3.6.10.1	4.6.10.1	S-3	1.0	----
Dielectric Withstanding Voltage (Sea Level) (1)	3.6.11	4.6.11.1	S-3	1.0	----

*AQL shall apply to individual defects in accordance with MIL-STD-105, Section 4.5.

(1) The supplier may use in-process controls for this requirement.

4.4.2 Rejected Lots

If an inspection lot is rejected, it may be replaced, reworked to correct the defect, or the defective units may be screened out. If the lot is reworked or the defective units are screened out, the lot may be resubmitted for inspection. Resubmitted lots shall be inspected using tightened inspection in accordance with MIL-STD-105. Before resubmitting, full particulars concerning the rejection and the action taken to correct the defect shall be furnished to the inspector.

4.5 Examination of Preparation for Delivery

Preparation for delivery of material ready for shipment shall be examined to determine compliance with the requirements of Section 5.

4.6 Test Procedures

4.6.1 Test Conditions

Unless otherwise specified, all tests shall be performed at ambient temperature, pressure and relative humidity as specified in the general requirements of MIL-STD-1344. A minimum of 20 percent but not less than 2 of the contacts in each assembly shall be tested.

4.6.1.1 Water Solution

Whenever immersion in a water solution is specified, the solution shall contain 0.5 percent of an anionic wetting agent in accordance with MIL-D-26937 and sufficient sodium chloride to make the solution conductive, unless otherwise specified in the test procedure. The mated connector assembly plus a minimum of 2 inches of wire or cable outside the connector shall be immersed.

4.6.2 Examination of Product (see 3.6.2)

The connectors, accessories, and piece parts shall be examined to ensure conformance with this specification and the applicable detail components not covered by the performance requirements of 3.6. In-process controls of component parts, unrelated to lot sizes of finished connectors, may be utilized in lieu of examination of these components in the finished connectors to assure conformance of these component parts. Examination in a continuing manner shall be performed to assure compliance with the following requirements:

- a). Applicable standard
- b). Materials
- c). Design and Construction
- d). Interchangeability
- e). Finish
- f). Identification of Product
- g). Workmanship

4.6.3 Maintenance Aging (see 3.6.3)

After installing all contacts, each connector shall be mated and unmated 10 times. A minimum of 20 percent, but not less than three of the contacts in each connector shall then be removed and reinserted ten times with the aid of appropriate tools.

4.6.4 Contact Retention (see 3.6.4).**4.6.4.1 Contact Retention**

The contact retention shall be tested as specified in method 2007 of MIL-STD-1344. The following details and exceptions shall apply:

- a). Number of samples
The test shall be performed on 20 percent of the contact complement, but not less than two contacts in each connector half.
- b). Applied axial load
Preload to 3 pounds maximum. Apply load as specified in Table VI.
- c). Axial direction
The applicable forces shall be applied along the longitudinal axes of individual contacts in the direction tending to displace the contacts to the rear.
- d). Only the contacts to be tested need be installed in the connector.

Table VI**Axial Load For Contact Retention Test**

<u>Contact Size</u>	<u>Axial Load</u> ⁺³ ₋₀	<u>Pounds</u>
12		30

4.6.5 Altitude Low-Temperature (see 3.6.5)

Wired, mated, assembled connectors with strain relief clamps installed shall be conditioned in a dry oven at a temperature of $-50^{\circ}\text{C} \pm 5^{\circ}\text{C}$ for a minimum of 8 hours.

- a). Reduce the chamber internal temperature to -50° ^{+0°}
_{-4° C} and maintain until the connector temperature stabilizes.
- b). Reduce the chamber internal pressure to simulate an altitude of 80,000 ft. (21 torr.).
- c). Maintain the above connector temperature and chamber pressure for one hour minimum.

- d). Apply Vrms 60 Hz. between the connector shell and all contacts for 1 minute minimum. Indication of disruptive discharge shall require reapplication and maintenance of the test voltage for 60 seconds.
- e). With the test voltage removed, increase the chamber internal pressure and temperature to standard ambient conditions and allow the connector to stabilize.
- f). With the connector mated, subject the connector to the insulation resistance test of 4.6.10.1 and the dielectric withstanding voltage test of 4.6. 11. 1.

4.6.6 Temperature Cycling (see 3.6.6)

Mated connectors shall be subjected to the temperature cycling of MIL-STD-202, Method 102A, Test Condition C except that Steps 2 and 4 shall be of 2 minutes maximum duration and the temperatures of Step 3 shall be as follows:

- a). Series A: +125° C (+257° F)
- b). Series B: +150° C (+302° F)
- c). Series C: +200° C (+392° F)

4.6.7 Altitude Immersion (see 3.6.7)

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 4.6.10.1 and the dielectric withstanding voltage test shall be performed as specified in 4.6.11.1.
- c). Paragraph 4.4 and 5.0 of Method 1004 shall not apply.

- 4.6.8 Insert Retention (see 3.6.8)
A pressure of 100±5 psig or an equivalent mechanical load, shall be applied to the front face of the connector insert. The pressure shall be uniformly applied at a rate of 10 to 20 lb psi per second and held for 5 to 10 seconds at the specified value.
- 4.6.9 Salt Spray (Corrosion) (see 3.6.9)
Unmated connectors shall be tested in accordance with Method 1001 of MIL-STD-1344. The following details and exceptions shall apply:
- a). Test condition letter - B.
 - b). The samples shall not be mounted but shall be suspended from the top using waxed twine or string, glass rods or glass cord.
- 4.6.10 Insulation Resistance (see 3.6.10).
- 4.6.10.1 Insulation Resistance at Ambient Temperature
Unmated connectors shall be tested as specified in Method 3003 of MIL-STD-1344. The following details and exceptions shall apply:
- a). For lot acceptance testing, where it is undesirable to install actual contacts in connectors, simulated contacts and special techniques may be used in performing this test.
 - b). The tolerance on the applied voltage shall be ±10%.
- 4.6.10.2 Insulation Resistance at Elevated Temperature
Unmated connectors shall be tested as specified in Method 3003 of MIL-STD-1344. The following details and exceptions shall apply:
- a). The tolerance on the applied voltage shall be ±10%.
 - b). Connectors shall be exposed to a temperature of $125^{\circ}\text{C}^{+5}_{-0}\text{C}$ for Series A, $150^{\circ}\text{C}^{+5}_{-0}\text{C}$ for Series B, and $200^{\circ}\text{C}^{+5}_{-0}\text{C}$ for Series C for 30 minutes. Measurement shall be made while the connectors are still in the chamber at the specified temperature.

4.6.11 Dielectric Withstanding Voltage (see 3.6.11)**4.6.11.1 Dielectric Withstanding Voltage (Sea Level)**

Unmated connectors shall be tested in accordance with Method 3001 of MIL-STD-1344 with the following details and exceptions:

- a). The magnitude of the test voltage shall be as specified in Table III.
- b). The test voltage shall be applied between adjacent pairs of contacts and between peripheral contacts and the shell. Fifty percent of the contacts shall be tested, but not less than three applications made.
- c). The test voltage shall be maintained at the specified value for 2 seconds minimum.
- d). For acceptance testing, simulated contacts and special techniques may be used in performing this test.

4.6.11.2 Dielectric Withstanding Voltage (Altitude)

Mated connectors shall be tested in accordance with Method 3001 of MIL-STD-1344 with the following details and exceptions:

- a). The magnitude of the test voltage shall be as specified in Table III.
- b). The test voltage shall be applied between adjacent pairs of contacts and between peripheral contacts and the shell. Fifty percent of the contacts shall be tested, but not less than three applications made.
- 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). The chamber shall be evacuated to each of the specified altitude pressure equivalents listed below.

<u>Altitude</u>	<u>Equivalent Pressure</u>
50,000 ft.	87.5 torr.
70,000 ft.	35.5 torr.
110,000 ft.	5.74 torr.

4.6.12 Durability (see 3.6.12)

Connector halves shall be mated and unmated 500 times at a rate not exceeding 250 cycles per hour. The test may be performed by hand or by mechanical means. The connector shall be fully mated during each cycle.

4.6.13 Vibration (see 3.6.13)

Wired, mated connectors shall be subjected to the test specified in Method 204B, MIL-STD-202, Test Condition A. See Figures 4 and 5. The following details shall apply:

- a). During vibration, a dc current of .1 amp shall be flowing.

4.6.14 Shock (see 3.6.14)

Wired, mated-connectors shall be subjected to one shock in each direction in each of three mutually perpendicular axes. The pulse shall be an approximate half sine wave of $300g \pm 15$ percent magnitude, with a duration of 3 ± 1 milliseconds. Receptacles shall be mounted on a shock fixture by normal means. All contacts shall be wired in a series circuit and 100 to 150 milliamperes of current shall flow through the series circuit during shock. Suitable means shall be employed to monitor the current flow and to indicate any discontinuity of more than 1 microsecond. The wire bundle shall be clamped to fixed points at least 8 inches from the rear of the connector.

4.6.15 Shell-to-Shell Conductivity (see 3.6.16)

Straight plugs shall be mated with counterpart receptacles less coupling pins and inserts. Connectors shall be mated and tested. A test current of 1 ± 0.1 amperes DC shall be caused to flow through the shells of the mated assembly. Using the voltmeter/ammeter method, the voltage drop between the rear end of the plug shell and a point on the front face of the counterpart flange shall be determined.

- 4.6.16 Humidity (see 3.6.16)
Wired, mated connectors shall be subjected to the humidity test specified in Method 1002 of MIL-STD-1344. The following details and exceptions shall apply:
- a). Test condition letter - Type II omitting subcycle step 7b.
 - b). The mated connectors shall be mounted in a vertical position.
 - c). After minimum of 3 hours of step 7a of final cycle and while the connectors are still subjected to high humidity, the insulation resistance shall be measured when the chamber temperature reaches $20^{\circ} \text{C} \pm 5^{\circ} \text{C}$ and condensation is on the connectors.
- 4.6.17 Ozone Exposure (see 3.6.17)
The unmated connectors shall be subjected to ozone having a concentration from 0.010 to 0.015 percent by volume for 2 hours at room temperature. At the end of the specified period, the samples shall be examined for signs of ozone deterioration as specified.
- 4.6.18 Fluid Immersion (see 3.6.18)
Counterpart connectors shall be fully immersed as specified in Table VII for the required periods. At least one pair of mating counterpart connectors shall be immersed in each fluid. After removal from the fluid, each pair of connectors shall remain for one hour in free air at room conditions in a position to allow the fluid to drain from the insert faces. Subsequent testing shall be performed on connectors mated with the same mating connectors used previously in testing.
- 4.6.18.1 Connectors using the same materials as specified in D-6006 may be qualified by similarity per Table IV, Group 5, and Note 1.
- 4.6.19 Contact Walk-Out (see 3.6.19)
Two contacts in each plug and receptacle shall be tested. The contacts shall be crimped or soldered to stranded steel cable of an appropriate size and installed in the connector. The unmated connector shall be mounted in a test fixture as shown in Figure 8. A 3 pound 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. Contact cavities used in this test shall be excluded from further testing.

4.6.20 Insertion/Removal Tool Abuse (see 3.6.20)

Two contact cavities in each connector shall be subjected to each of the tests listed below. Different contact cavities shall be used for each 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. Contact cavities used in this test shall not be subject to further testing.

4.6.20.1 Removal Tool Rotation

The applicable contact removal tool shall be inserted as if to remove a contact and an axial load of 3 pounds 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. These steps shall be repeated three times on each of the two contacts selected.

4.6.20.2 Insertion Tool Rotation

The contact shall first be removed. With the applicable contact insertion tool, the contact shall be reinserted and an axial load of 3 pounds applied to the tool. With the force applied, the tool shall be rotated 180° and then removed. These steps shall be repeated three times on each of the two contacts selected.

Table VII
Fluids for Fluid Immersion Test

Sample Number	Test Fluid	Test Procedure
1	MIL-L-7808	Immerse unmated connectors in fluid at $120^{\circ}\pm 3^{\circ}$ for five minutes. Remove connectors and allow to drain for a minimum of one hour at room temperature. Fluid shall be drained from all recesses. Mate connectors and expose to $125^{\circ}\text{C}\pm 3^{\circ}\text{C}$ in an air circulating oven for 6 hours. Repeat procedure for a total of seven cycles
2	MIL-L-23699	
3	MIL-H-5606	
4	M2-V Chevron Oil or ST0145LB 0001	Immerse unmated connectors in fluid at $85^{\circ}\text{C}\pm 3^{\circ}\text{C}$ for five minutes. Remove connectors and allow to drain for a minimum of one hour at room temperature. Fluid shall be drained from all recesses. Mate connectors and expose to $100^{\circ}\pm 3^{\circ}\text{C}$ in an air circulating oven for 6 hours. Repeat procedure for a total of seven cycles.
5	MIL-H-83282	
6	MIL-A-8243	
7	MIL-C-25769 (Diluted for Cleaning)	Immerse mated connectors in fluid at $65^{\circ}\text{C}\pm 3^{\circ}\text{C}$ for five minutes. Remove connectors and allow to drain for a minimum of one hour at room temperature. Fluid shall be drained from all recesses. Unmate and expose connectors to $100^{\circ}\text{C}\pm 3^{\circ}\text{C}$ in an air circulating oven for 6 hours. Repeat procedure for a total of seven cycles.
8	MIL-T-5624 Grade JP-5	
9	MIL-T-5624 Grade JP-4	Same as procedure 1, except that the fluid shall be at $25^{\circ}\text{C}\pm 3^{\circ}\text{C}$, and the oven at $55^{\circ}\text{C}\pm 3^{\circ}\text{C}$ for 6 hours
10	Coolant-Dielectric Fluid Synthetic Silicate Ester Base (Coolanol 25)	Unmated connectors shall be pre-conditioned at 150°C for 30 minutes. Immerse connectors fully in room temperature fluid for 1 minute. Remove connectors and allow to stabilize at room temperature for one hour minimum. Fluid shall be drained from all recesses.

TABLE VII Continued

Sample Number	Test Fluid	Test Procedure
11	MIL-G-3056 (Type 1)	The wired, assembled, unmated connector shall be immersed in the fluid at 25°C±3°C for five minutes, removed from the fluid and exposed to free air for 24±2 hours. This conditioning cycle shall be repeated until the connector has been subjected to 5 complete cycles. For a maximum of two cycles, the exposure to free air may be extended to 50 hours.
12	One part by volume of isopropyl alcohol, per TT-I-735, Grade A or B, and three parts by volume of mineral spirits per TT-T-291, Grade 1 or P-D-680, Type 1	
13	1-1-1 Trichloroethane	
14	Azeotrope of trichlorotrifluoroethane and methylene chloride.	

4.6.20.3 Insertion Tool Thrust

The contact shall first be removed. With the applicable contact insertion tool, the contact shall be reinserted and an axial load of 10 pounds applied to the tool. These steps shall be performed only once on each of the two contacts selected. A new tool shall be used for each contact.

4.6.20.4 Removal Tool Thrust

The applicable contact removal tool shall be inserted as if to remove the contact and an axial load of 10 pounds shall be applied to the tool. The tool shall then be removed, also removing the contact. These steps shall be performed only once on each of the two contacts selected. A new tool shall be used for each contact.

4.6.21 Pin Contact Stability (see 3.6.21)

The unmated connectors shall have ten percent (but not less than one) of their pin contacts subjected to this test. Gage pins conforming dimensionally to the applicable Military Standard for the contacts shall be used. The connector shall be held in a holding device. A force of three pounds shall be applied to the exposed rod as shown on Figure 7. The rate of load application shall not exceed one inch per minute. The total pin tip displacement shall be measured as shown on Figure 7. Contact cavities used in this test shall be excluded from further testing.

4.6.22 Temperature Life with Contact Loading (see 3.6.22)

Connectors with removable contacts shall have one mating pair of contacts removed and replaced with contacts crimped or soldered to steel cable or steel cored copper wire (Copperweld) of an appropriate size. The axial location of these contacts shall be measured for conformance to the applicable dimensions of D-652-0004, as applicable, with a load of 2 pounds approximately applied to seat the contact back against the retention device. The connector shall then be mounted in a fixture as shown in Figure 8. A weight equal to 50% of the axial load specified in Table XII of MIL-C-83723 for the applicable contact size shall be suspended freely from each steel wire. A current of 100 ± 10 milliamperes, supplied from a 10.0 VDC maximum power source shall be applied to the test contacts and a suitable instrument shall be used to monitor the circuit for discontinuities in excess of one microsecond. The connector, mounted as shown in Figure 8, shall then be exposed to $125^{\circ}\text{C} \pm 3^{\circ}\text{C}$ for Series A, $150^{\circ}\text{C} \pm 3^{\circ}\text{C}$ for Series B, and $200^{\circ}\text{C} \pm 3^{\circ}\text{C}$ for Series C for a period of 1,000 hours. After the connectors return to ambient temperature, they shall be unmated and the contact locations remeasured with approximately 2 pounds axial load applied to seat the contact back against the retention device.

- 4.6.23 Electrical Engagement (see 3.6.23)
Counterpart plugs and receptacles shall be wired so as to provide a complete series circuit through all contacts of the mated connector. A suitable 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 by alternately turning each of the two locking jackscrews 1/2 turn (180°) to maintain the mating surface of the plug parallel to the mating face of the receptacle at all times (Refer to Figure 9). The mating operation shall be stopped and held at the point when first indication of a completed circuit is observed. The distance "D" shall then be measured as shown in Figure 9. The mating operation shall then be continued until the connector halves are in the completely mated position with both locking jackscrews torqued to a value of 9±1 inch pounds. A second measurement of distance "D" shall then be taken from the same reference points. This measured value shall then be subtracted from the first measured value to compute a value for electrical engagement.
- 4.7 Post Test Examination
The tested connectors shall be examined to determine the effects of previous testing. Any evidence of cracking, loosening of parts, carbon tracking, excess wear, or missing parts shall be recorded.
- 5.0 Preparation for Delivery**
- 5.1 Packaging and Packing
If not otherwise specified in the procurement document, packaging and packing shall be in accordance with good commercial practice.
- 5.2 Marking
Unless otherwise specified, packages shall be marked in accordance with MIL-STD-129.
- 6.0 Notes**
- 6.1 Intended Use
Connectors covered by this specification are intended for use in making environmentally protected non-permanent electrical connections between flat cables, between round wires and flat cables, and between round wire harnesses. They may be used in applications where the maximum temperature does not exceed the values specified for the connector assembly in the specification. The maximum operating temperature specified is the combination of the temperature generated by the electrical load and the ambient temperature.
- Connector backshells (cable clamps) must be installed to meet the specified moisture sealing requirements.

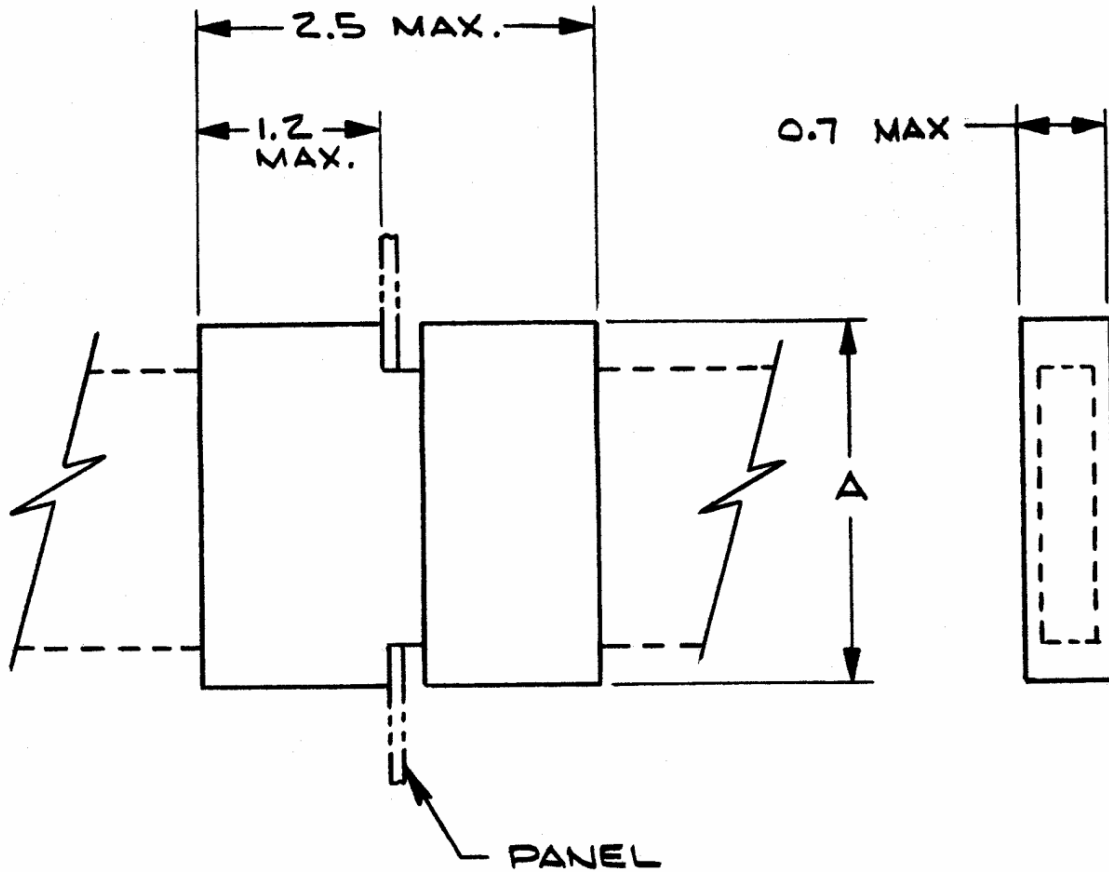


Figure 1
Envelope Maximum Dimensions Mated Connectors

Shell Size	A - IN.
1	2.1 Max
2	3.1 Max

Notes:

1. Dimensions shown are less cable clamp. Over all mated length to increase 1.0 with clamps on both plug and receptacle.

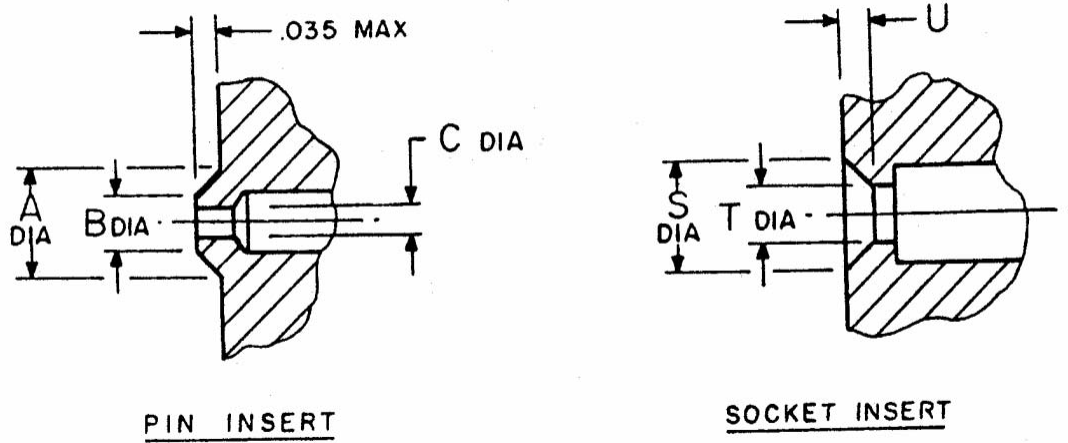


Figure 2
Connector, rear release, insert entry dimensions

CONTACT SIZE	A DIA	B DIA	C DIA	S DIA	T DIA	U DIA
16	.150	.135	.061	.140	.079	.035
	.140	.131	.058	.130	.072	.031
12	.208	.188	.093	.204	.111	.040
	.198	.184	.090	.193	.104	.035

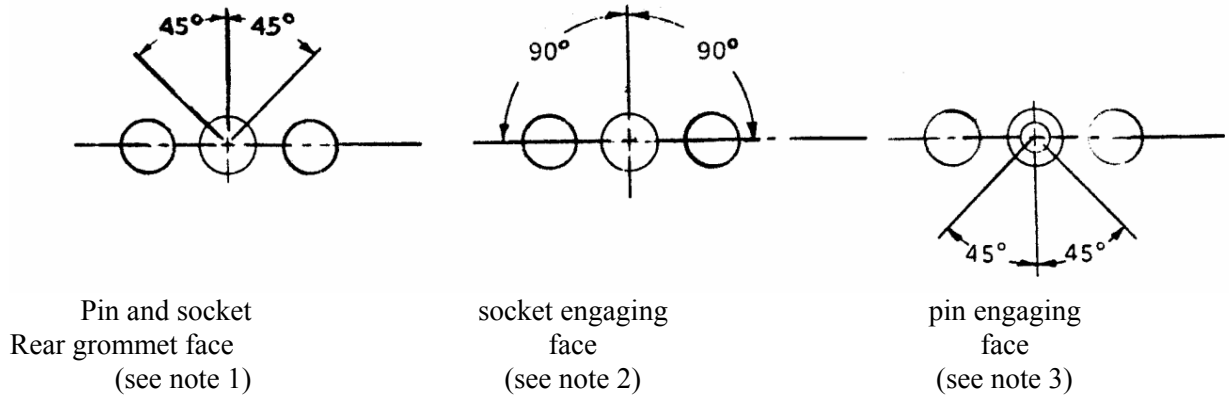


Figure 3
Insert Cavity Identification Locations

Notes:

1. Contact identification letters or numbers on rear grommet face of socket and pin insert shall be within 45° either side of vertical centerline above the contact cavity.
2. Letters or numbers shall be placed on socket insert engaging face as shown. They shall be above the horizontal centerline of the chamfered lead-ins. Where space precludes their application an ever expanding orbital line is permissible.
3. Letters or numbers on the engaging face of the pin insert shall be on the raised seal barrier above or beside the pin contact cavity. They shall not extend into the lower sector of the raised seal barrier which extends 45° either side of the vertical centerline.
4. On outer row of contacts individual cavity identification may be deleted from those cavities where space precludes its application.
5. Underscoring of lower case letters is optional.

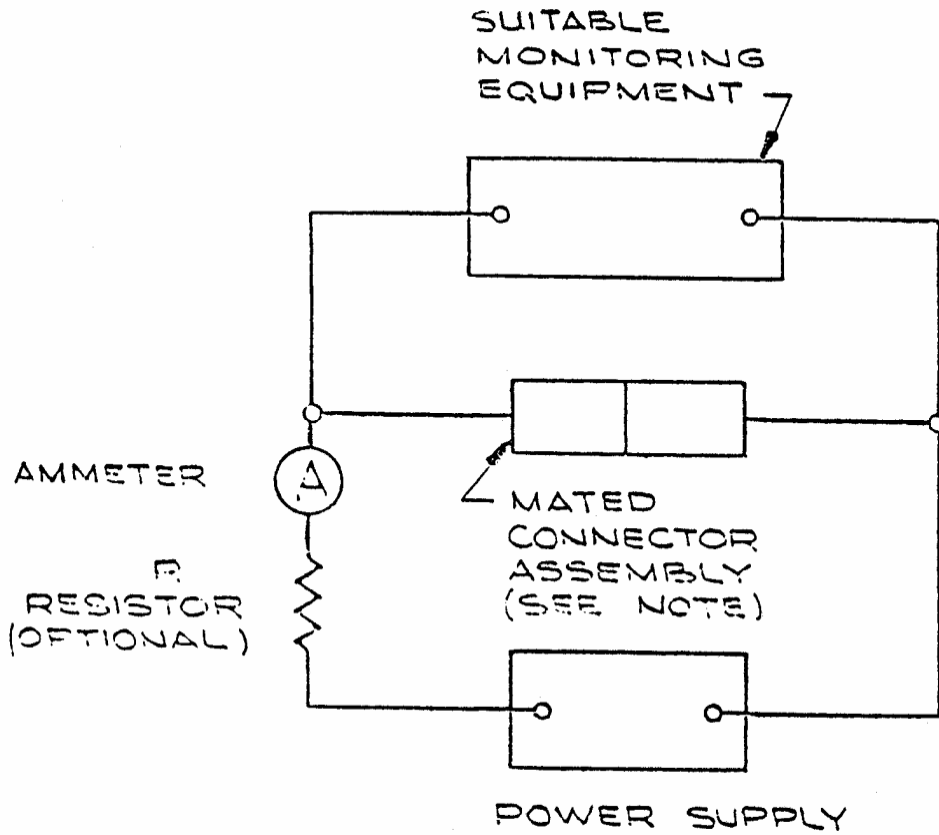
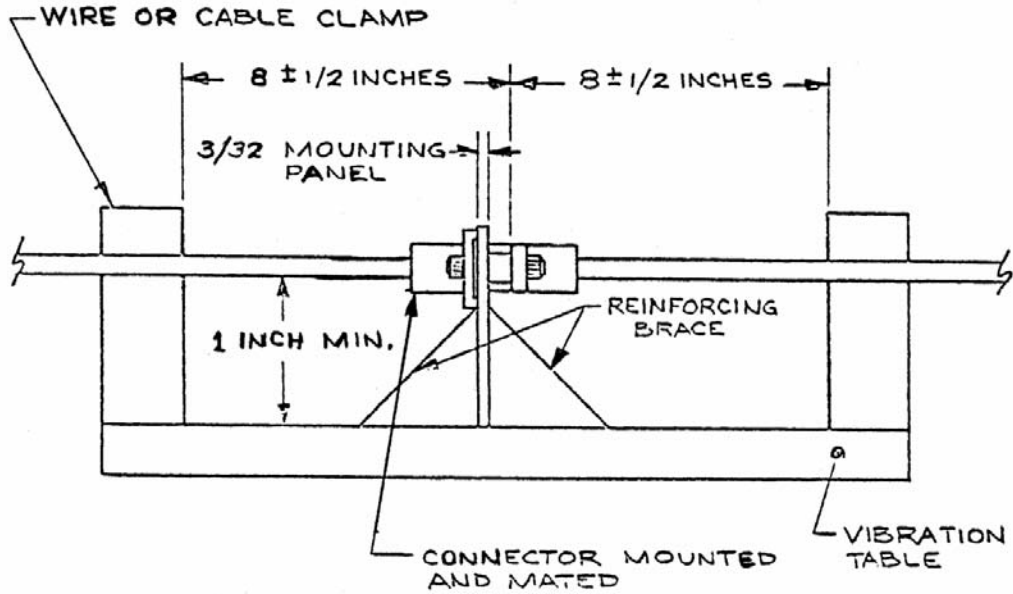
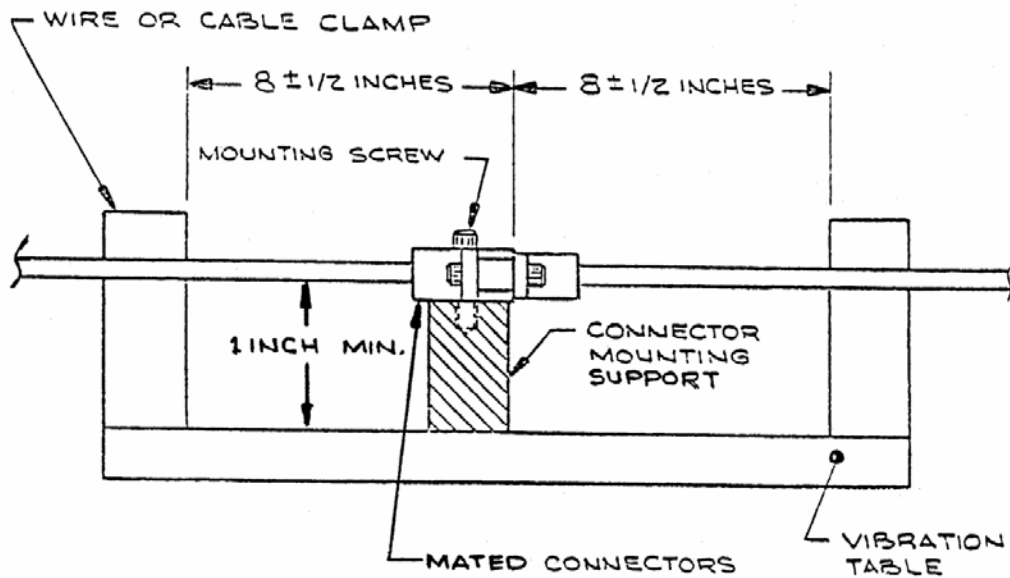


Figure 4
Typical Vibration Test Monitoring Circuit

Note: Contacts shall be connected in series



Vibration Test Setup for connectors - Panel Mounted



Vibration Test Setup Connectors - Side Mounted
Figure 5

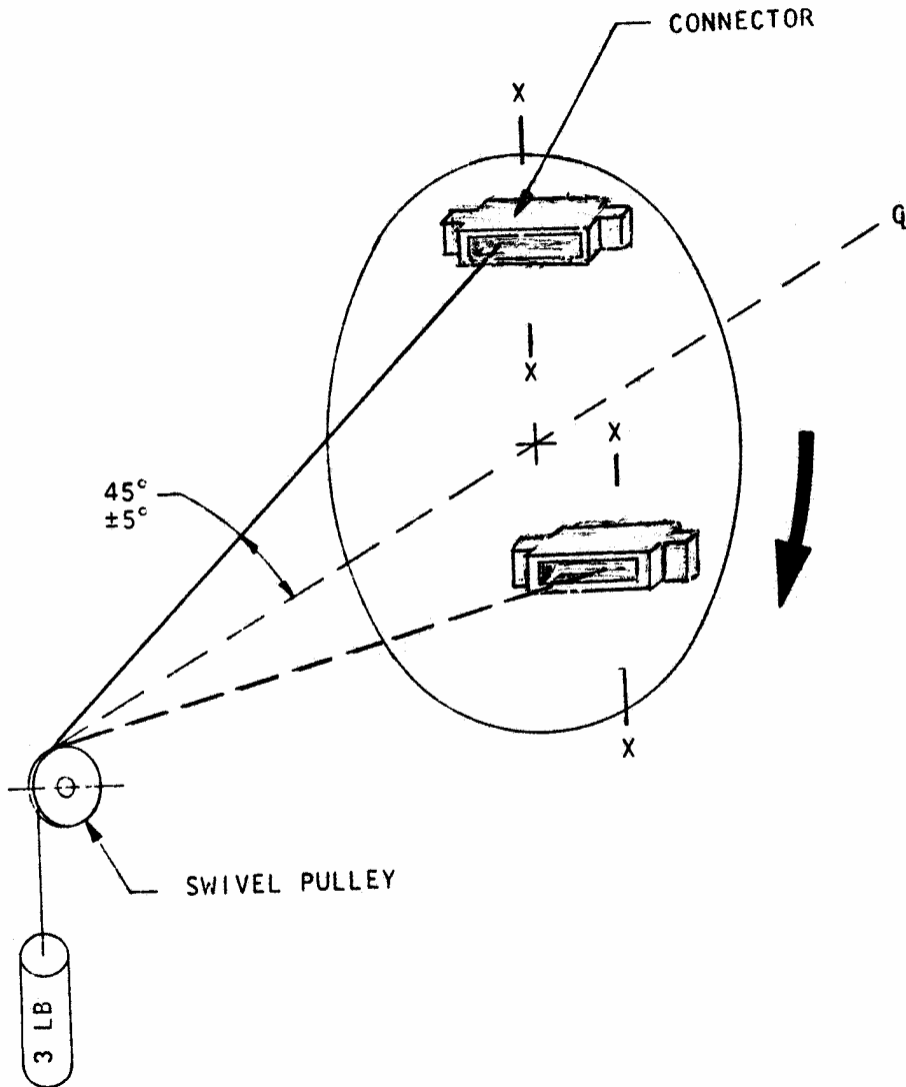


Figure 6
Contact Walk-Out Test Set-Up,

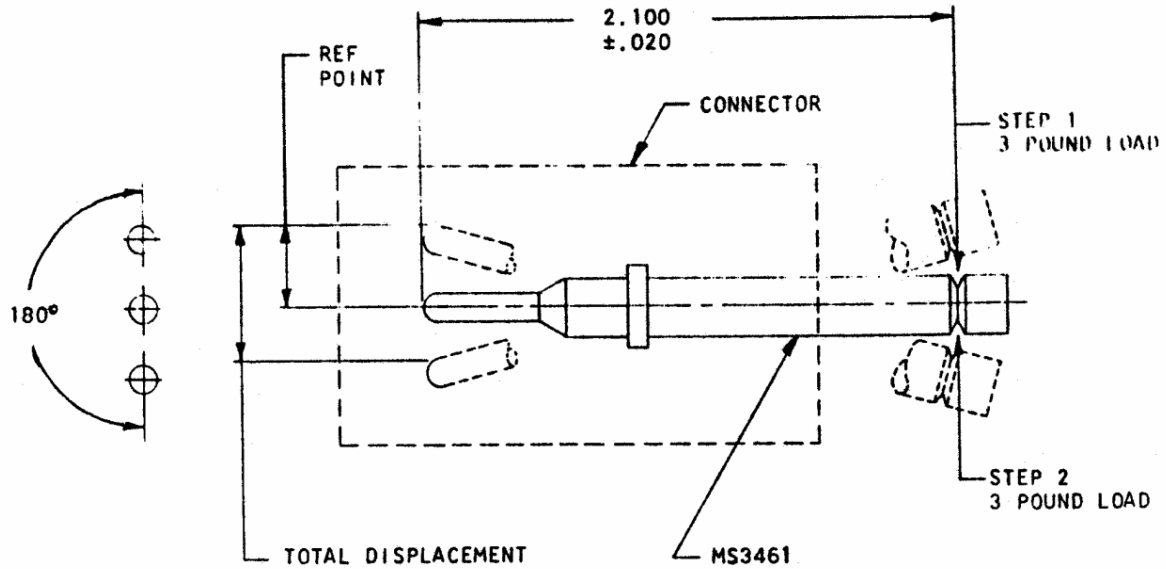


Figure 7
Pin Contact Stability Test

Step 1. - Apply load to determine reference point.

Step 2. - Apply load in opposite direction (180) and measure total deflection.

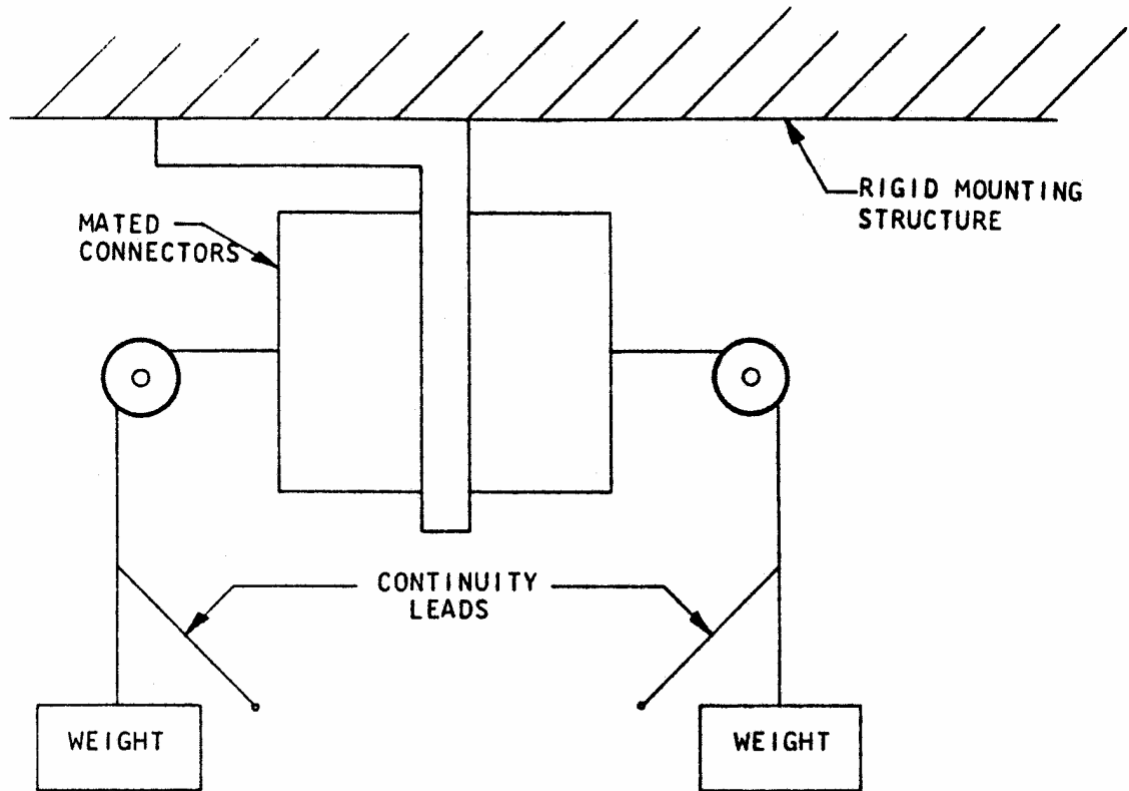


Figure 8
Fixture for temperature life
with contact loading
(orientation optional).

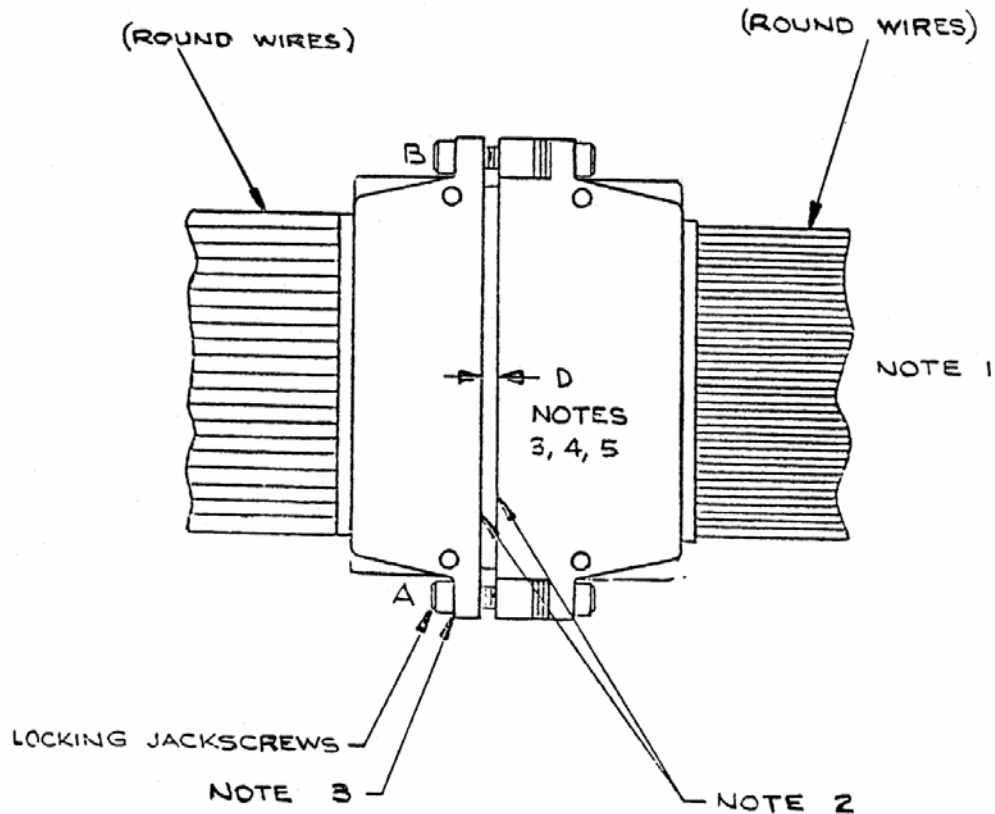


Figure 9
Measurement of Electrical Engagement

Notes:

1. All contacts are wired in an electrical series connection to a power source and indicator.
2. Maintain these surfaces parallel to each other during mating by alternately screwing the two locking jackscrews (A and B) $\frac{1}{2}$ turn (180°) each.
3. There must be no gap between the connector housing and either locking jackscrew (A or B) when measuring distance "D".
4. Measurement of distance "D" must be made with connector laying on and held flush against a smooth flat surface.
5. "D" is measured at a point centered between the jackscrews.

Table VIII
Rigid Insert Material Requirements

<u>Test per Raychem D-6006</u>	<u>Requirement</u>
Tensile Strength, psi, min.	9,000
Elongation, percent, min.	50
Heat Deflection Temperature, min., °C (F)	185 (365)
Water Absorption, percent, max	0.5
Dielectric Constant, percent, max.	5.0
Flammability, U.L.	94V-0
Smoke, D _S (Corrected), 20 minutes	15