

## MTC Connectors with Fixed Contacts

### 1.0 Introduction

1.1 Scope. This specification covers the design, performance and qualification requirements for applicable Raychem MTC (Mass Termination Connector) connectors using fixed contacts and suitable for use with round wire or flat conductor cable. This specification forms a part of Master Specification C-6100 for the Raychem Integrated Interconnection System(12S).

1.2 Description. The Raychem MTC connectors covered by this specification are high density, environment-resistant connectors used to interconnect both round wires and flat conductor cables. These connectors consist of environment-resistant plugs and receptacles. Options include electromagnetic effects (EME) shielding and pressure sealing. The shells assure proper orientation of the mating halves and electrical continuity between shells prior to contact engagement. Connectors covered by this specification have inserts holding fixed, size 26 or size 22 contacts arranged in rows. Removable inserts consist of one or more pieces, each with a single row of contacts. Fixed inserts contain one or more rows of contacts. Contact terminals for solder termination are encapsulated to provide environmental resistance. For solderless wrap termination, contacts have wrap post terminals.

1.3 Classification. Connectors covered by this specification are classified in accordance with 1.3.1 and 1.3.2.

#### 1.3.1 Connectors.

- a. Series: MTC50: Size 26 contacts on 0.05 inch nominal centers  
MTC100: Size 22 contacts on 0.1-inch nominal centers
- b. Types: Plugs: Cable mounting  
Rack mounting
- Receptacles: Cable and panel mounting  
Flanged, panel mounting  
Box mounting
- c. Classes: Environment resistant  
Environment resistant, EME shielded  
Environment resistant, pressure maintaining
- d. Shelf Finish: Anodic (nonconductive)  
Electroless nickel (conductive)  
Cadmium-plated (conductive)
- e. Shell Size: Size 1: 1-inch nominal insert width  
Size 2: 2-inch nominal insert width

- 1.3.2 Inserts.
- a. Types: Removable  
Fixed
  - b. Contact Style: Pin  
Socket
  - c. Termination Style and Temperature Rating:  
Solder tab for round wire, -65 to 125°C  
Solder tab for round wire, -65 to 150°C  
Solder tab for flat conductor cable, -65 to 125°C  
Wrap post for solderless connection, -65 to 150°C
  - d. Contact Size: Size 26: for MTC50 series connectors  
Size 22: for MTC1 00 series connectors
- 1.4 Temperature Range. Connectors covered by this specification are suitable for use over the temperature range -65° to 150°C or -65° to 125°C, depending upon the termination style (see 1.3.2). Connectors are rated for 1000-hour service when the operating temperature of the connector is the maximum rated temperature. Operating temperature is the maximum temperature reached by any point of the connector as a result of electrical current flow and ambient temperature.
- 1.5 Units. SI units in parentheses are for information only.
- 1.6 Solderability of Wire and Cable for Solder Style Terminations. Wire and cable conductors for termination to solder style MTC terminals shall be solderable at the time of termination as specified in either 1.6.1 or 1.6.2.
- 1.6.1 Round Wire Solderability. Round wires shall be capable of meeting the solderability requirements of MIL-STD-202, Method 208, using type RMA flux, except that steam aging shall not be required. Round wires which do not meet this requirement must be capable of achieving a 95percent minimum solder coating when dip tinned using type RA flux and Sn63 solder, and must be pretinned before termination. (Refer to MIL-STD-202, Method 208, for definition of 95- percent solder coating.)
- 1.6.2 Flat Conductor Cable Solderability. Flat conductor cables must be capable of achieving a 95-percent minimum solder coating when dip tinned using type RA flux and Sn63 solder, and must be pretinned before termination. (Refer to MIL-STD-202, Method 208, for definition of 95-percent solder coating.)

**2.0 Applicable Documents**

2.1 Issues of Documents. The following documents, of the issue in effect on date of order or request for proposal, form a part of this specification to the extent specified herein. This specification takes precedence over the referenced documents.

2.2 Department of Defense.  
Specifications

Military

|             |  |
|-------------|--|
| MIL-G-3056  | Gasoline, Automotive, Combat, Metric   |
| MIL-H-5606  | Hydraulic Fluid, Petroleum Base; Aircraft, Missile and Ordnance  |
| MIL-T-5624  | Turbine Fuel, Aviation, Grades JP-4, JP-5 and JP-5/JP-8 ST   |
| MIL-L-6082  | Lubricating Oil: Aircraft Reciprocating Engine (Piston)  |
| MIL-L-7808  | Lubricating Oil: Aircraft Turbine Engine, Synthetic Base, NATO Code Number 0-148                       |
| MIL-A-8625  | Anodic Coatings, for Aluminum and Aluminum Alloys  |
| MIL-E-9500  | Ethylene Glycol, Technical   |
| MIL-F-14256 | Flux, Soldering, Liquid (Rosin Base)   |
| MIL-F-18240 | Fastener, Externally Threaded, 250°F, Self-Locking Element For   |
| MIL-L-23699 | Lubricating Oil, Aircraft Turbine Engine, Synthetic Base   |
| MIL-C-26074 | Coatings, Electroless Nickel, Requirements For   |
| MIL-G-45204 | Gold Plating, Electrodeposited   |
| MIL-H-83282 | Hydraulic Fluid, Fire-Resistant, Synthetic Hydro carbon Base, Aircraft, Metric, NATO Code Number H-537 |
| MIL-P-83800 | Propylene Glycol, Industrial Grade   |
| MIL-C-85485 | Cable, Electric, Filter Line, Radio Frequency Absorptive   |

Federal

|          |  |
|----------|--|
| QQ-P-35  | Passivation Treatments for Corrosion-Resisting Steel   |
| TT-M-261 | Methyl Ethyl Ketone, Technical   |
| TT-T-291 | Thinner, Paint, Mineral Spirits, Regular and Odorless  |
| QQ-P-416 | Plating, Cadmium (Electrodeposited)  |
| QQ-C-530 | Copper-Beryllium Alloy Bar, Rod, and Wire (Copper Alloy Numbers 172 and 173)                           |
| QQ-S-571 | Solder, Tin Alloy: Tin-Lead Alloy; and Lead Alloy  |
| QQ-A-591 | Aluminum Alloy Die Castings  |
| QQ-B-613 | Brass, Leaded and Nonleaded: Flat Products (Plate, Bar, Sheet, and Strip)                              |
| P-D-680  | Dry Cleaning Solvent   |
| TT-1-735 | Isopropyl Alcohol  |
| QQ-B-750 | Bronze, Phosphor; Bar, Plate, Rod, Sheet, Strip, Flat Wire, and Structural and Special Shaped Sections |
| QQ-S-763 | Steel Bars, Wire, Shapes, and Forgings, Corrosion-Resisting  |

Standards

Military

|               |   |
|---------------|---|
| MIL-STD-105   | Sampling Procedures and Tables for Inspection by Attributes |
| MIL-STD-202   | Test Methods for Electronic and Electrical Component Parts  |
| MIL-STD-454   | Standard General Requirements for Electronic Equipment      |
| MIL-STD-1130  | Connections, Electrical, Solderless Wrapped                 |
| MIL-STD-1344  | Test Methods for Electrical Connectors                      |
| MIL-STD-45662 | Calibration Systems Requirements                            |

StandardsFederal

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

(Copies of Department of Defense documents may be obtained from the Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120-5099.)

2.3 American Society for Testing and Materials (ASTM).

|       |   |
|-------|---|
| D 256 | Impact Resistance of Plastics and Electrical Insulating Materials                               |
| A 484 | General Requirements for Stainless and Heat-Resisting Wrought Steel Products (Except Wire)      |
| D 570 | Water Absorption of Plastics  |
| A 582 | Free-Machining Stainless and Heat-Resisting Steel Bars, Hot-Rolled or Cold Finished             |
| D 638 | Tensile Properties of Plastics  |
| D 648 | Deflection Temperature of Plastics Under Flexural Load  |
| D 790 | Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials |
| F 814 | Specific Optical Density of Smoke Generated by Solid Materials for Aerospace Applications       |

(Copies of ASTM publications may be obtained from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

2.4 Underwriters Laboratories (UL).

UL94 Tests for Flammability of Plastic Materials

(Copies of UL publications may be obtained from Underwriters Laboratories Inc., Publications Stock, 333 Pfingsten Road, Northbrook, IL 60062.)

- 2.6 National Aeronautics and Space Administration (NASA).  
SP-R-0022A Vacuum Stability Requirements of Polymeric Material for  
Spacecraft Application

(Copies of NASA documents may be obtained from National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Mail Code: JM 62, Houston, Texas 77058.)

- 2.7 Raychem Corporation.  
C-6100 System Overview and General Requirements for Integrated  
Interconnection System(12S)Components  
ES 61115 MTC100 Connector Assembly and Installation Procedures  
ES 61257 MTC50 Connector Assembly and Installation Procedures  
SOP0001 SPC Standard Operating Procedure

(Copies of Raychem documents may be obtained from Raychem Corporation, 300 Constitution Drive, Menlo Park, CA 94025.)

### 3.0 **Requirements**

- 3.1 Specification Control Drawings. The requirements for connectors under this specification shall be as specified herein and in the applicable specification control drawing. In the event of conflict between the requirements of this specification and those of the specification control drawing, 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              |
| Product Identification  | 3.7              |
| Workmanship             | 3.8              |

- 3.3 Qualification. Connectors furnished under this specification or listed on Qualified Products List C-6111-QPL shall be products which are qualified to this specification in accordance with the requirements of Specification C-6100.

- 3.4 Materials Requirements. All materials used in the manufacture of these connectors shall be of a quality and form suited for the purpose intended.

- 3.4.1 Dissimilar Metals. When dissimilar metals are used in intimate contact with each other, protection against electrolytic corrosion shall be provided as specified in MIL-STD-454, Requirement 16.
- 3.4.2 Fungus Resistance. Finishes and materials shall be fungus-inert in accordance with MIL-STD-454, Requirement 4, and encompassing the fungus species listed in MIL-STD-810, Method 508.
- 3.4.3 Hydrolytic Stability. All nonmetallic materials shall be selected to meet the hydrolytic reversion resistance requirements specified in MIL-STD-454, Requirement 47.
- 3.4.4 Vacuum Stability. Connector assemblies shall meet the vacuum stability requirements of NASA Specification SP-R-0022A.
- 3.4.5 Component Materials. Materials for specific components of the connector shall be as follows:
- 3.4.5.1 Contacts. Contact material shall be copper-based alloy per QQ-B-613, QQ-B-750, or QQ-C-530. Mating surfaces shall be gold-plated per MIL-G-45204, Type 1, Grade C, Class 1, over a suitable underplate. Silver underplate shall not be used. Solder termination areas shall be of a quality, which will ensure reliable performance in conjunction with the appropriate SolderSleeve® termination device.
- 3.4.5.2 Solder. Solder shall be Sn63, Sn96 or Sb5 per QQ-S-571 and applicable specification sheet.
- 3.4.5.3 Connector Shell. Connector shells shall be die-cast aluminum per QQ-A-591. Shell finish shall be in accordance with 3.4.5.3.1, 3.4.5.3.2 or 3.4.5.3.3.
- 3.4.5.3.1 Anodic Finish. Anodic (nonconductive) shell finish shall be black, hard and in accordance with MIL-A-8625, Type II, Class 2.
- 3.4.5.3.2 Electroless Nickel. Electroless nickel (conductive) shell conductive finish shall be in accordance with MIL-C-26074 Class 3 or 4, Grade B.
- 3.4.5.3.3 Cadmium Plating. Cadmium plating (conductive) shell finish shall be olive drab to yellow and in accordance with QQ-P-416 over a suitable underplate to withstand the 500-hour salt spray test.

- 3.4.5.4 Mounting and Mating Hardware. Mounting and mating hardware shall be corrosion resistant steel per QQ-S-763, ASTM A484 or ASTM A582. Hardware parts for use with anodic and electroless nickel shell finishes shall be passivated per QQ-P-35. Hardware parts for use with cadmium plated shells shall be cadmium plated per QQ-P-416.
- 3.4.5.5 Elastomeric Seals. Elastomeric seals shall be resilient dielectric material per the applicable specification control drawing.
- 3.4.5.6 Connector Inserts. Connector inserts shall be rigid thermoplastic dielectric material per the applicable specification control drawing.
- 3.5 Design and Construction Requirements. Connectors shall be designed and constructed to withstand handling during installation and maintenance. Complete connectors shall consist of a rectangular plug or receptacle shell; fixed or removable insert(s) with fixed pin or socket contacts; mounting/mating hardware and, where appropriate, a cable clamp.
- 3.5.1 Shells. Plug and receptacle shells shall meet the following requirements:
- 3.5.1.1 Shells for EME-Shielded Connectors. Plug shells for EME-shielded connectors shall have spring fingers which contact the receptacle shell prior to engagement of the contacts.
- 3.5.1.2 Shells for Pressure-Maintaining Connectors. Shells for pressure maintaining connectors shall have mounting flanges and elastomeric gaskets for sealing the flange to a panel.
- 3.5.1.3 Coupling. Coupling between mating connectors shall be accomplished by means of two captive jackscrews on the plug shell. Jackscrew threads shall conform to FED-STD-H28 and shall be self-locking per MIL-F-18240. Jackscrews shall provide sufficient force to effect a moisture seal between the socket contact insert and the elastomeric interfacial seal on the pin contact insert. Complete coupling shall occur when the jackscrews are torqued to 9 lbf-inch (1.0 N-m) as prescribed in Raychem ES 61115 (MTC100) or ES 61257 (MTC50).
- 3.5.1.4 Polarozation. Shell polarization shall prevent the mating of any plug and receptacle shells if the connectors are not in the correct mating position. Polarization of shells shall occur before connector keying.
- 3.5.1.5 Connector Keying. Insertable keying pins shall provide a minimum of 16 different keying combinations. Keying shall prevent the mating of any plug and receptacle not properly keyed. Connector keying shall occur before engagement of contacts or coupling hardware.

- 3.5.1.6 Insert Retention. Shells shall retain removable inserts by mechanical means. Fixed inserts shall be retained by adhesives.
- 3.5.1.7 Cable Clamps. Receptacle shells suitable for cable mounting and, all plug shells shall have provisions for attachment of cable clamps. Cable clamp screws shall have threads conforming to FED-STD-H28 and shall be self-locking per MIL-F-1 8240.
- 3.5.1.8 Mounting Hardware. Mounting hardware shall be provided with each receptacle shell. Mounting hardware screw threads shall conform to FED-STD-H28 and shall be self-locking per MIL-F-18240. Mounting hardware may also function as coupling hardware.
- 3.5.2 Inserts. Connector inserts shall be either fixed in the shell or removable. Inserts shall contain nonremovable (fixed) contacts. Removable inserts shall have polarizing keyways to ensure proper orientation within the shell. Pin contact inserts shall have an elastomeric interfacial seal bonded to the mating face.
- 3.5.2.1 Contact Arrangement. Fixed inserts shall contain one or two rows of contacts and removable inserts shall contain a single row of contacts. Contact arrangement shall be in accordance with the applicable specification control drawing, and is shown in Table I for reference only.

Table 1. Contact Arrangement

| Connector Series | Center-to-Center Contact Spacing           |                                       | Contacts per Row |                 | Contact Rows per Connector |
|------------------|--|---------------------------------------|------------------|-----------------|----------------------------|
|                  | Adjacent Contacts in Same Row<br>inch (mm) | Between Rows of Contacts<br>inch (mm) | Shell Size<br>1  | Shell Size<br>2 |                            |
| MTC50            | 0.05 (1.3)                                 | 0.1 (2.5)                             | 20               | 40              | 2                          |
| MTC100           | 0.1 (2.5)                                  | 0.1 (2.5)                             | 10               | 20              | 2                          |

- 3.5.3 Contacts. Contacts shall be designed to withstand termination and repeated mating and unmating of connectors. Mating surfaces shall be smooth and uniform and shall provide a wiping action during mating. Contacts shall not be removable from the inserts. Mating portions of the contacts shall be of blade (pin contact) and tuning fork (socket contact) design.
- 3.5.3.1 Contact Termination. Contacts for solder termination shall have solder tab terminals. The terminals shall be solder coated per 3.4.5.2 and shall be encapsulated with heat-shrinkable polymeric material to provide strain relief and sealing. Sealing shall be achieved with wires and cables specified on the applicable specification control drawing. Contacts for termination by solderless wrap connections shall have 0.025-inch (0.64-mm) square wrap post terminals.

3.5.3.2 Wire Size Compatibility. Table II shows the wire sizes compatible with each contact size and the maximum current allowable in any contact when terminated to a particular wire size.

Table II. Wire Size Compatibility

| Connector Series | Contact Size | Maximum Current, A | Round Wire Size, AWG | Flat Conductor Dimensions |                    |                        |
|------------------|--------------|--------------------|----------------------|---------------------------|--------------------|------------------------|
|                  |              |                    |                      | Size                      | Width<br>Inch (mm) | Thickness<br>Inch (mm) |
| MTC50            | 26           | 1.5                | -                    | 28                        | 0.25 (0.64)        | 0.005 (0.13)           |
|                  |              | 2.0                | 26                   | -                         | -                  | -                      |
|                  |              | 2.0                | 24                   | -                         | -                  | -                      |
| MTC100           | 22           | 2.0                | 26                   | -                         | -                  | -                      |
|                  |              | 3.0                | 24                   | 24                        | 0.065 (1.65)       | 0.005 (0.13)           |
|                  |              | 5.0                | 22                   | 22                        | 0.065 (1.65)       | 0.008 (0.20)           |
|                  |              | 5.0                | 20                   | -                         | -                  | -                      |

3.5.4 Interfacial Seal. The elastomeric interfacial seal shall be designed to eliminate leakage paths between adjacent contacts and between contacts and the shell when the connector is fully mated. The interfacial seal shall be permanently bonded to the mating face of the pin insert. Suitable marking shall be provided on the mating face of the interfacial seal to identify the number "1" contact on each insert.

3.5.5 Interchangeability. All components having the same part number shall be completely interchangeable with each other in regard to installation and performance.

3.5.6 Intermateability. All plug and receptacle connectors of the same series, type and shell size and containing the appropriate inserts and keying pin combinations shall mate with each other.

3.6 Performance Requirements. Connector components and assemblies shall conform to the requirements specified herein and on the applicable specification control drawings. Unless otherwise specified, room temperature shall be  $25 \pm 5^\circ\text{C}$ . Values given as "after conditioning" values refer to requirements after any of the environmental exposures of Table XI.

3.6.1 Insulation Resistance. When connector assemblies are tested as specified in 4.5.3, the insulation resistance at  $23^\circ\text{C}$  between a) any pair of adjacent contacts and b) between any contact and the shell shall be 5000 megohms minimum, unless otherwise specified. The insulation resistance at the maximum rated temperature shall be 1000 megohms minimum.

3.6.2 Dielectric Withstanding Voltage. When connector assemblies are tested as specified in 4.5.4, there shall be no evidence of breakdown or flashover. The real leakage current shall be 1.0 milliampere maximum.

3.6.3 Contact Resistance.

3.6.3.1 Contact Resistance at Specified Current. When connector assemblies are tested as specified in 4.5.5.1 or 4.5.5.2, mated contacts shall meet the requirements of Table III.

Table III. Contact Resistance At Rated Current

| Contact Size | Conductor AWG | Test Current AMPS | Voltage Drop, max mV |                    |                     |
|--------------|---------------|-------------------|----------------------|--------------------|---------------------|
|              |               |                   | At Room Temp         |                    | At Max. Rated Temp. |
|              |               |                   | Initial              | After Conditioning | After Conditioning  |
| 22           | 20            | 5.0               | 75                   | 90                 | 113                 |
|              | 22            | 5.0               | 90                   | 105                | 135                 |
|              | 24            | 3.0               | 66                   | 78                 | 99                  |
|              | 26            | 2.0               | 58                   | 70                 | 87                  |
| 26           | 24            | 2.0               | 50                   | 59                 | 70                  |
|              | 26            | 2.0               | 62                   | 74                 | 87                  |
|              | 28            | 1.5               | 65                   | 77                 | 91                  |

3.6.3.2 Low Signal Level Contact Resistance. When connector assemblies are tested as specified in 4.5.5.3, mated contacts shall meet the requirements of Table IV.

Table IV. Low Signal Level Contact Resistance

| Contact Size | Conductor AWG | Resistance, max, milliohms |                    |
|--------------|---------------|----------------------------|--------------------|
|              |               | Initial                    | After Conditioning |
| 22           | 20            | 15                         | 18                 |
|              | 22            | 18                         | 21                 |
|              | 24            | 22                         | 26                 |
|              | 26            | 29                         | 35                 |
| 26           | 24            | 25                         | 30                 |
|              | 26            | 31                         | 37                 |
|              | 28            | 43                         | 51                 |

3.6.4 Shell to Shell Conductivity (conductive finish only). When mated connectors are tested as specified in 4.5.6, the measured voltage drop shall be as shown in Table V.

Table V. Shell-To-Shell Conductivity

| Connector Class                        | Voltage Drop max, mV |                    |
|--|----------------------|--------------------|
|  | Initial              | After Conditioning |
| Environment Resistant,<br>EME-Shielded | 1.0                  | 1.5                |
| Other Classes                          | 2.5                  | 5.0                |

3.6.5 Electrical Engagement. When connector assemblies are tested as specified in 4.5.7, the electrical engagement shall be as shown in Table VI.

Table VI. Electrical Engagement

| Connector Series | Electrical Engagement, min. |        |
|------------------|-----------------------------|--------|
|                  | Inch                        | (mm)   |
| MTC50            | 0.030                       | (0.76) |
| MTC100           | 0.050                       | (1.27) |

3.6.6 Contact Engagement and Separation Forces. When socket contacts are tested as specified in 4.5.8, the largest value of the engagement force and the smallest value of the separation force measured on any contact shall be as shown in Table V11. The mean value of the engagement forces measured on the individual contacts shall be as shown in Table VII.

Table VII. Contact Engagement And Separation Forces

| Engagement Force, max.                |                               | Separation Force, min.         |  |
|---------------------------------------|-------------------------------|--------------------------------|--|
| Maximum Average Value<br>oz-force (N) | Maximum Value<br>oz-force (N) | Smallest Value<br>oz-force (N) |  |
| 9.0 (2.5)                             | 12.0 (3.3)                    | 1.0 (0.28)                     |  |

3.6.7 Durability. After conditioning as specified in 4.5.9, connector assemblies shall meet the subsequent performance requirements of Table XI and shall show no evidence of damage detrimental to performance or handling.

3.6.8 Solder Termination Tensile Strength.

3.6.8.1 Round Wire Terminations. When individual wire terminations are tested at room temperature and at the maximum rated temperature as specified in 4.5.10.1, the tensile load required to separate each wire from its terminal shall be in accordance with Table VIII.

Table VIII. Round Wire Termination Tensile Strength

| Wire Type                  | Wire Size AWG | Connector Series | Tensile Load, minimum |      |                    |      |
|----------------------------|---------------|------------------|-----------------------|------|--------------------|------|
|                            |               |                  | At Room Temp          |      | At Max. Rated Temp |      |
|                            |               |                  | lbf                   | (N)  | lbf                | (N)  |
| Annealed Copper            | 20            | MTC100           | 20.0                  | (89) | 15.0               | (67) |
|                            | 22            |                  | 12.0                  | (53) | 10.0               | (44) |
|                            | 24            |                  | 8.0                   | (36) | 6.0                | (27) |
|                            | 24            | MTC50            | 8.0                   | (36) | 6.0                | (27) |
|                            | 26            |                  | 5.0                   | (22) | 4.0                | (18) |
| High Strength Copper Alloy | 22            | MTC100           | 16.0                  | (71) | 12.0               | (53) |
|                            | 24            |                  | 16.0                  | (71) | 12.0               | (53) |
|                            | 24            | MTC50            | 10.0                  | (44) | 8.0                | (36) |
|                            | 26            |                  | 10.0                  | (44) | 8.0                | (36) |

3.6.8.2 Flat Conductor Cable Terminations. When terminated inserts are tested at room temperature and at the maximum rated temperature as specified in 4.5.10.2, the assembly shall withstand the axial load shown in Table IX without evidence of mechanical damage to the termination areas.

Table IX Flat Conductor Cable Tensile Strength

| Connector Series | Axial Load per Unit Cable Width |        |                           |        |
|------------------|---------------------------------|--------|---------------------------|--------|
|                  | At Room Temperature             |        | At Max. Rated Temperature |        |
|                  | lbf/inch                        | (kN/m) | lbf/inch                  | (kN/m) |
| MTC50            | 50                              | (8.8)  | 15                        | (2.6)  |
| MTC100           | 50                              | (8.8)  | 20                        | (3.5)  |

3.6.9 Insert Retention. When connector assemblies are tested as specified in 4.5.11, the inserts shall not be damaged or dislocated from their fully seated positions. The inserts shall retain their normal positions in the shell for at least 5 seconds at the specified load.

3.6.10 Contact Retention. When terminated inserts are tested as specified in 4.5.12, the axial displacement of contacts shall not exceed 0.012 inch (0.30 mm) while the load is applied.

3.6.11 Coupling Torque. When terminated connector assemblies are tested as specified in 4.5.13, the connector halves shall become fully mated, shall meet the subsequent performance requirements of Table XI, and shall show no evidence of damage detrimental to performance or handling of the connectors.

3.6.12 Coupling Overtorque. When terminated connector assemblies are tested as specified in 4.5.14, there shall be no evidence of mechanical damage to shells or mating hardware.

- 3.6.13 Maintenance Aging. After conditioning as specified in 4.5.15, connector assemblies shall meet the subsequent performance requirements specified in Table XI, and shall show no evidence of damage detrimental to performance or handling.
- 3.6.14 Random Vibration. When terminated, mated connector assemblies are tested as specified in 4.5.16, there shall be no electrical discontinuities and no evidence of cracks, breaks or loosening of parts.
- 3.6.15 Mechanical Shock. When terminated, mated connector assemblies are tested as specified in 4.5.17, there shall be no electrical discontinuities and no evidence of cracks, breaks, or loosening of parts.
- 3.6.16 Thermal Shock. When terminated, mated connector assemblies are tested as specified in 4.5.18, there shall be no evidence of damage detrimental to performance or handling.
- 3.6.17 Temperature Life. When terminated, mated connector assemblies are tested as specified in 4.5.19, the insulation resistance at the maximum rated temperature shall be 1000 megohms minimum.
- 3.6.18 Humidity. When terminated, mated connector assemblies are tested as specified in 4.5.20, the insulation resistance shall be 100 megohms minimum while at high humidity and shall be 1000 megohms minimum at the final measurement. The assemblies shall meet the dielectric withstanding voltage requirements of 3.6.2. at both measurement times.
- 3.6.19 Altitude Immersion. When terminated, mated connector assemblies are tested as specified in 4.5.21, the insulation resistance shall be 1000 megohms minimum, and the mated connectors shall meet the dielectric withstanding voltage requirements of 3.6.2.
- 3.6.20 Altitude-Low Temperature. When terminated, mated connector assemblies are tested as specified in 4.5.22, the connectors shall withstand the applied potential at low pressure with no evidence of dielectric breakdown. Insulation resistance and dielectric withstanding voltage requirements at ambient conditions shall be as specified in 3.6.1 and 3.6.2.
- 3.6.21 Salt Spray. When terminated, mated connector assemblies are tested in accordance with 4.5.23.1 or 4.5.23.2, the specimens shall show no evidence of damage detrimental to performance or handling.
- 3.6.22 Ozone Exposure. When terminated, unmated connector assemblies are tested as specified in 4.5.24, the connectors shall show no evidence of damage detrimental to performance or handling.

- 3.6.23 Fluid Immersion. When terminated connector assemblies are tested as specified in 4.5.25, the connectors shall show no evidence of damage detrimental to performance or handling. Some softening and / or parting of the cable clamp elastomeric strain relief is permissible as long as functionality is not impaired.
- 3.6.24 Magnetic Permeability. When unmated connector assemblies are tested as specified in 4.5.26, the relative permeability shall be 2.0 maximum.
- 3.6.25 Solderability. (Boxmount connectors with pre-tinned PBC mount tails only). When unterminated boxmount PCB terminals are tested as specified in 4.5.27, the termination surfaces of the terminals shall be at least 95 percent covered with a continuous new solder coating.
- 3.6.26 Industrial Gas. When terminated, unmated connector assemblies are tested as specified in 4.5.28, the connectors shall meet the subsequent performance requirements of Table X1. The contacts shall show no evidence of damage detrimental to the performance or handling of the connector.
- 3.6.27 Contact Inductive Load Switching. When terminated, mated connector assemblies are tested as specified in 4.5.29, they shall meet the room- temperature, after-conditioning, contact resistance requirements of Table 111.
- 3.6.28 Overload Current and Circuit Breaker Compatibility. When terminated, mated connector assemblies are tested as specified in 4.5.30, the connectors shall meet the room-temperature, after-conditioning, contact resistance requirements of Table III.
- 3.6.29 Temperature Rise at Rated Current. When mated connector assemblies are tested as specified in 4.5.31, the temperature rise shall be 100°C maximum.
- 3.6.30 Insert Material Requirements.
- 3.6.30.1 Tensile Strength. When tested as specified in 4.5.32.1, the tensile strength shall be 13,000 psi (90 MPa) minimum.
- 3.6.30.2 Deflection Temperature. When tested as specified in 4.5.32.2, the deflection temperature shall be 185°C minimum.
- 3.6.30.3 Water Absorption. When tested as specified in 4.5.32.3, the water absorption shall be 0.5 percent maximum.
- 3.6.30.4 Flammability. When tested as specified in 4.5.32.4, the insert material shall meet the requirements for U.L. flammability rating 94 V-O.
- 3.6.30.5 Smoke Generation. When tested in accordance with 4.5.32.5, the corrected specific optical density shall be 15 maximum for each specimen tested.

- 3.6.31 Insert Impact Resistant. When unterminated pin and socket removable inserts are tested as specified in 4.5.33, the average uncompensated reversed notch impact strength for as-molded socket inserts shall be greater than 0.2 ft-lbf (0.27 J), and greater than 0.15 ft-lbf (0.20 J) for as molded pin inserts.
- 3.6.32 Insert Impact Chip Resistance. When unterminated pin and socket removable inserts are tested as specified in 4.5.34, there shall be no evidence of chipping or fracture.
- 3.6.33 Insert Flexure. When unterminated pin and socket removable inserts are tested as specified in 4.5.35, there shall be no cracking, breaking, or other mechanical deterioration. Each insert shall then be capable of being placed in a housing, together with a companion insert when required, and mated with the appropriate mating connector assembly.
- 3.6.34 Removable Insert Abuse. After conditioning as specified in 4.5.36, unmated connectors shall meet the insert retention requirements of 3.6.9, and they shall show no evidence of damage detrimental to performance or handling.
- 3.6.35 Retention System Fluid Resistance. When unmated connectors are tested as specified in 4.5.37, they shall meet the insert retention requirements of 3.6.9.
- 3.6.36 EME Shielding (EME-Shielded Class Only). When mated connector assemblies terminated to suitable shielded cable are tested in accordance with 4.5.38, the maximum surface transfer impedance ( $Z_t$  in milliohms per meter) shall be level 5 as shown in Figure 1.
- 3.6.37 Air Leakage (Pressure Maintaining Class Only). When tested in accordance with 4.5.39, connectors shall have a leakage rate of 0.5 atm cm<sup>3</sup>/s maximum.
- 3.6.38 Gas Tightness. When terminals with solderless wrap connections are tested in accordance with 4.5.40, the connections shall meet the gas tightness requirements of MIL-STD-1130.
- 3.6.39 Strip Force. When terminals with solderless wrap connections are tested in accordance with 4.5.41, the connections shall meet the strip force requirements of MIL-STD-1130.
- 3.6.40 Wrapper Resistance. When terminals with solderless wrap connections are tested in accordance with 4.5.42, the connections shall meet the wrapper resistance requirements of MIL-STD-1130.
- 3.6.41 Cold Handling. When connectors are tested as specified in 4.5.43 there shall be no visible material deterioration. Connectors shall be able to be mated and demated normally and removable inserts shall be able to be removed and installed normally.

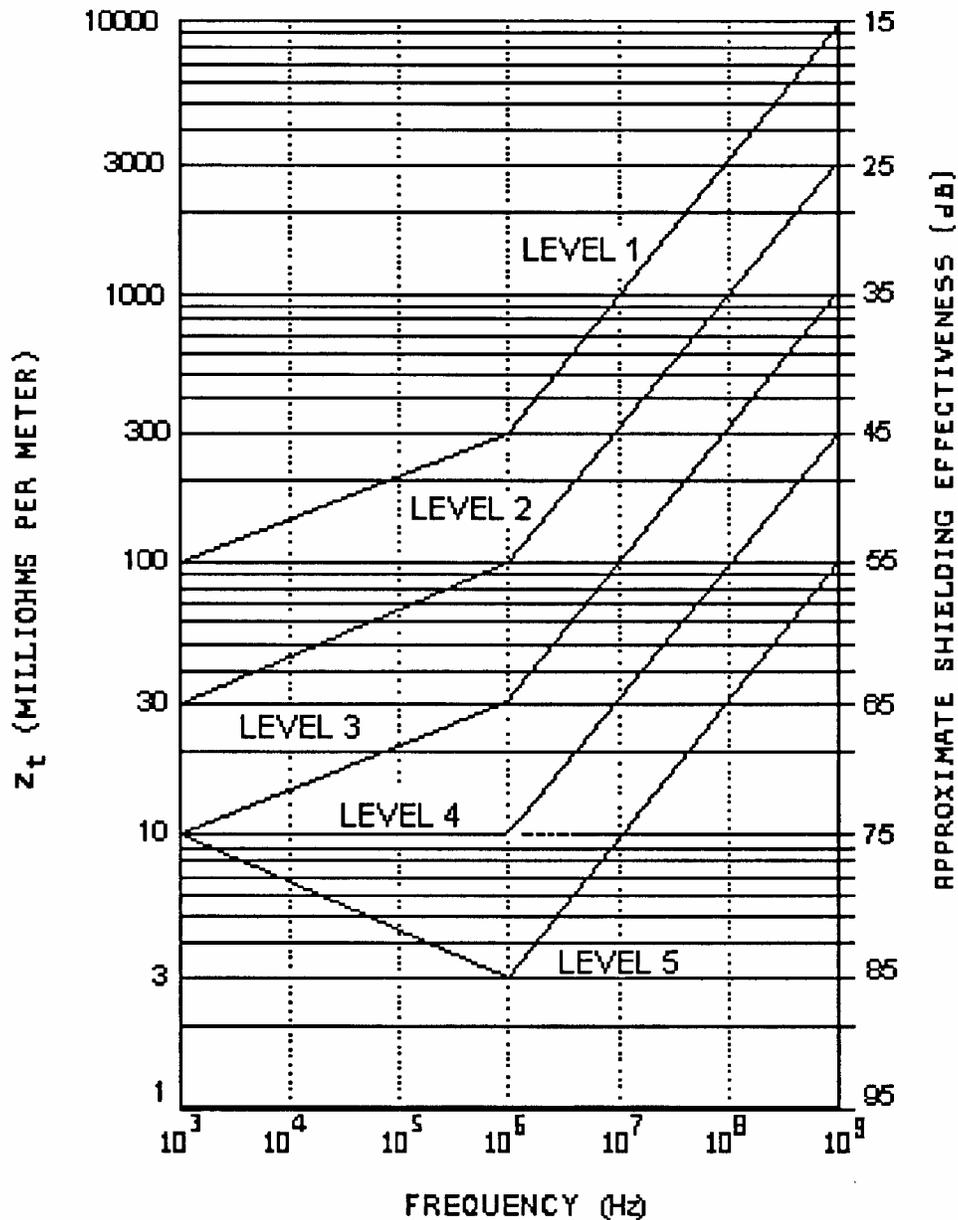


Figure 1. Surface Transfer Impedance

- 3.6.42 Post Test Examination. Connector assemblies shall be inspected as specified in 4.5.44. Any evidence of the effects described in 4.5.44 shall constitute failure.
- 3.7 Product Identification. All marking shall be in accordance with the applicable specification control drawing. The marking shall remain legible after completion of the test sequences in Groups 1, 2, 3, and 4 of Table XI.

- 3.7.1 Shell Identification. Connector shells shall be marked on an external surface with the shell part number, date code, and the name "Raychem." The top and bottom surfaces of every shell designed for removable inserts shall be permanently marked at the wire termination end to identify proper insert orientation.
- 3.7.2 Removable Insert Identification. Removable inserts shall be marked with the part number, date code, the name "Raychem," and an orientation indicator as specified in the applicable specification sheet.
- 3.7.2.1 Contact Identification. The number "1" contact shall be marked on the engaging face of each insert. The first and last contact positions shall be permanently identified on the keyed surface of each removable insert.
- 3.8 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, chips, blisters, sharp cutting edges, and other defects that would adversely affect life or serviceability.
- 4.0 Quality Assurance Provisions**
- 4.1 Responsibility for Inspection. The supplier is responsible for the performance of all inspection tests specified herein. The supplier may utilize his own or any other suitable testing facility. Inspection records of the tests shall be kept complete and available to the buyer as specified in the contract or order.
- 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-STD-45662.
- 4.2 Classification of Inspections. The examination and testing of connectors covered by this specification shall be classified as follows:
- a. Qualification inspection (See para. 4.3)
  - b. Acceptance inspection (See para. 4.4)
- 4.3 Qualification Inspection. Qualification inspection shall consist of the tests in Table XI. Qualification shall be granted upon successful completion of the inspections and tests of Table XI, conducted upon the samples of Table X, in accordance with Specification C-6100. In Table XI test groups where the tests are not sequential, separate samples shall be used for each test.

- 4.3.1 Test Samples for Qualification Inspection. Test samples, submitted for qualification inspection, shall be produced using equipment and procedures normally used in production. Test samples shall be of the types listed in Table X. Individual test samples shall be selected in compliance with the qualification requirements of Specification C-6100.

Table X. Qualification Test Samples

| <b>Test Group</b> | <b>Type of Test Sample</b>                                |
|-------------------|---|
| 1                 | Terminated mated connectors                               |
| 2                 | Terminated mated connectors                               |
| 3                 | Terminated mated connectors                               |
| 4                 | Terminated mated connectors                               |
| 5                 | Terminated mated connectors                               |
| 6                 | Terminated mated connectors (EME-shielded class only)     |
| 7                 | Terminated mated connectors (Cadmium shell plating only)  |
| 8                 | Inserts or Boxmounts w/ PCB mount tails (Solderability)   |
| 9                 | Insert Material Specimens                                 |
| 10                | Removable Inserts   |
| 11                | Terminated mated connectors                               |
| 12                | Terminated mated connectors                               |
| S-1               | Terminated mated connectors (Non-Standard Configurations) |

- 4.3.2 Failures. One or more failures of the tests listed in Table XI shall be cause for failure of qualification of the parts under test. An exception to this is visual examination, where occurrence of one major defect or two minor defects shall be cause for failure of qualification. Major and minor defects shall be as defined in MIL-STD-105. In the event of failure, procedures outlined in Raychem Specification C-6100 shall be followed.
- 4.3.3 Qualification Report. Qualification shall be documented in a report which shall be available to the buyer.

Table XI. Qualification Inspection

**Test Group 1**

| Test Sequence   | Requirement Paragraph      | Procedure Paragraph |
|---|----------------------------|---------------------|
| Visual Examination  | 3.1, 3.4, 3.5,<br>3.7, 3.8 | 4.5.2               |
| Maintenance aging   | 3.6-13                     | 4.5.15              |
| Contact engagement and separation forces  | 3.6.6                      | 4.5.8               |
| Thermal shock   | 3.6.16                     | 4.5.18              |
| Air leakage*  | 3.6.37                     | 4.5.39              |
| Coupling torque   | 3.6.11                     | 4.5.13              |
| Durability  | 3.6.7                      | 4.5.9               |
| Altitude immersion<br>Insulation resistance measurement<br>Dielectric withstanding voltage test | 3.6.19                     | 4.5.21              |
| Insert retention  | 3.6.9                      | 4.5.11              |
| Salt spray (corrosion)  | 3.6.21                     | 4.5.23.1            |
| Coupling torque   | 3.6.11                     | 4.5.13              |
| Low signal level contact resistance   | 3.6.3.2                    | 4.5.5.3             |
| Contact resistance at specified current   | 3.6.3.1                    | 4.5.5.1             |
| Electrical engagement   | 3.6.5                      | 4.5.7               |
| Contact engagement and separation forces  | 3.6.6                      | 4.5.8               |
| Coupling over torque  | 3.6.12                     | 4.5.14              |
| Post test examination   | 3.6.42                     | 4.5.44              |

\* Pressure-maintaining connectors only

**Test Group 2**

| Test Sequence                                    | Requirement Paragraph      | Procedure Paragraph |
|--|----------------------------|---------------------|
| Visual examination                               | 3.1, 3.4, 3.5,<br>3.7, 3.8 | 4.5.2               |
| Shell-to-shell conductivity                      | 3.6.4                      | 4.5.6               |
| Maintenance aging                                | 3.6.13                     | 4.5.15              |
| Contact engagement and separation forces         | 3.6.6                      | 4.5.8               |
| Contact retention                                | 3.6.10                     | 4.5.12              |
| Altitude -Low Temperature                        | 3.6.20                     | 4.5.22              |
| Insulation resistance at room temperature        | 3.6.1                      | 4.5.3               |
| Dielectric withstanding voltage at sea level     | 3.6.2                      | 4.5.4.1             |
| Thermal shock                                    | 3.6.16                     | 4.5.18              |
| Air leakage*                                     | 3.6.37                     | 4.5.39              |
| Coupling torque                                  | 3.6.11                     | 4.5.13              |
| Insulation resistance at max. rated temperature  | 3.6.1                      | 4.5.3               |
| Dielectric withstanding voltage at sea level     | 3.6.2                      | 4.5.4.1             |
| Dielectric withstanding voltage at altitude      | 3.6.2                      | 4.5.4.2             |
| Durability                                       | 3.6.7                      | 4.5.9               |
| Random vibration                                 | 3.6.14                     | 4.5.16              |
| Mechanical shock                                 | 3.6.15                     | 4.5.17              |
| Shell-to-shell conductivity                      | 3.6.4                      | 4.5.6               |
| Humidity   | 3.6.18                     | 4.5.20              |
| Insulation resistance in high humidity           |                            |                     |
| Dielectric withstanding voltage in high humidity |                            |                     |
| Insulation resistance after 24 hours             |                            |                     |
| Dielectric withstanding voltage after 24 hours   |                            |                     |
| Low signal level contact resistance              | 3.6.3.2                    | 4.5.5.3             |
| Contact resistance at specified current          | 3.6.3.1                    | 4.5.5.1             |
| Contact engagement and separation forces         | 3.6.6                      | 4.5.8               |
| Contact retention                                | 3.6.10                     | 4.5.12              |
| Coupling over torque                             | 3.6.12                     | 4.5.14              |
| Post test examination                            | 3.6.42                     | 4.5.44              |

\* Pressure-maintaining connectors only.

**Test Group 3**

| Test Sequence                                | Requirement Paragraph      | Procedure Paragraph |
|--|----------------------------|---------------------|
| Visual examination                           | 3.1, 3.4, 3.5,<br>3.7, 3.8 | 4.5.2               |
| Magnetic permeability                        | 3.6.24                     | 4.5.26              |
| Ozone exposure                               | 3.6.22                     | 4.5.24              |
| Insulation resistance at room temperature    | 3.6.1                      | 4.5.3               |
| Dielectric withstanding voltage at sea level | 3.6.2                      | 4.5.4.1             |
| Fluid immersion                              | 3.6.23                     | 4.5.25              |
| Dielectric withstanding voltage at sea level | 3.6.2                      | 4.5.4.1             |
| Coupling torque                              | 3.6.11                     | 4.5.13              |
| Insert retention                             | 3.6.9                      | 4.5.11              |
| Post test examination                        | 3.6.42                     | 4.5.44              |

**Test Group 4**

| Test Sequence   | Requirement Paragraph      | Procedure paragraph |
|---|----------------------------|---------------------|
| Visual examination  | 3.1, 3.4, 3.5,<br>3.7, 3.8 | 4.5.2               |
| Contact engagement and separation forces                              | 3.6.6                      | 4.5.8               |
| Temperature life  | 3.6.17                     | 4.5.19              |
| Insulation resistance at maximum rated temp.                          |                            |                     |
| Humidity  | 3.6.18                     | 4.5.20              |
| Insulation resistance in high humidity                                |                            |                     |
| Dielectric withstanding voltage in high humidity                      |                            |                     |
| Insulation resistance after 24 hours                                  |                            |                     |
| Dielectric withstanding voltage after 24 hours                        |                            |                     |
| Low signal level contact resistance                                   | 3.6.3.2                    | 4.5.5.3             |
| Contact resistance at specified current                               | 3.6.3.1                    | 4.5.5.1             |
| Contact resistance at specified current and maximum rated temperature | 3.6.3.1                    | 4.5.5.2             |
| Cold handling   | 3.6.41                     | 4.5.43              |
| Insert retention  | 3.6.9                      | 4.5.11              |
| Contact engagement and separation forces                              | 3.6.6                      | 4.5.8               |
| Contact retention   | 3.6.10                     | 4.5.12              |
| Post test examination   | 3.6.42                     | 4.5.44              |
| Solder termination tensile strength                                   | 3.6.8                      | 4.5.10              |

**Test Group 5**

| Test Sequence                           | Requirement Paragraph      | Procedure Paragraph |
|---|----------------------------|---------------------|
| Visual examination                      | 3.1, 3.4, 3.5,<br>3.7, 3.8 | 4.5.2               |
| Low signal level contact resistance     | 3.6.3.2                    | 4.5.5.3             |
| Contact resistance at specified current | 3.6.3.1                    | 4.5.5.1             |
| Industrial gas exposure                 | 3.6.26                     | 4.5.28              |
| Low signal level contact resistance     | 3.6.3.2                    | 4.5.5.3             |
| Contact resistance at specified current | 3.6.3.1                    | 4.5.5.1             |
| Post test examination                   | 3.6.42                     | 4.5.44              |

**Test Group 6 (EME shielded class only)**

| Test Sequence               | Requirement Paragraph      | Procedure Paragraph |
|-----------------------------|----------------------------|---------------------|
| Visual examination          | 3.1, 3.4, 3.5,<br>3.7, 3.8 | 4.5.2               |
| Shell-to-shell conductivity | 3.6.4                      | 4.5.6               |
| Durability                  | 3.6.7                      | 4.5.9               |
| Shell-to-shell conductivity | 3.6.4                      | 4.5.6               |
| EME shielding               | 3.6.36                     | 4.5.38              |

**Test Group 7**

| Test Sequence             | Requirement Paragraph | Procedure Paragraph |
|---------------------------|-----------------------|---------------------|
| Salt spray (dynamic test) | 3.6.21                | 4.5.23.2            |

**Test Group 8**

| Test Sequence                                 | Requirement Paragraph | Procedure Paragraph |
|---|-----------------------|---------------------|
| Solderability (PCB mount tails only)          | 3.6.25                | 4.5.27              |
| Gas tightness (wrap-post terminals only)      | 3.6.38                | 4.5.40              |
| Strip force (wrap-post terminals only)        | 3.6.39                | 4.5.41              |
| Wrapper resistance (wrap-post terminals only) | 3.6.40                | 4.5.42              |

**Test Group 9**

|                         | Requirement Paragraph | Procedure Paragraph |
|-------------------------|-----------------------|---------------------|
| Insert Materials Tests: |                       |                     |
| Tensile strength        | 3.6.30.1              | 4.5.32.1            |
| Deflection temperature  | 3.6.30.2              | 4.5.32.2            |
| Water absorption        | 3.6.30.3              | 4.5.32.3            |
| Flammability            | 3.6.30.4              | 4.5.32.4            |
| Smoke generation        | 3.6.30.5              | 4.5-32.5            |

**Test Group 10 (Removable Inserts Only)**

|                               | Requirement Paragraph | Procedure Paragraph |
|-------------------------------|-----------------------|---------------------|
| Insert impact resistance      | 3.6.31                | 4.5.33              |
| Insert impact chip resistance | 3.6.32                | 4.5.34              |
| Insert flexure                | 3.6.33                | 4.5.35              |

**Test Group 11**

|   | Requirement Paragraph | Procedure Paragraph |
|---|-----------------------|---------------------|
| Contact inductive load switching                  | 3.6.27                | 4.5.29              |
| Overload current and circuit breaker compatibilit | 3.6.28                | 4.5.30              |
| Temperature rise at rated current                 | 3.6.29                | 4.5.31              |

**Test Group 12**

|                                   | Requirement Paragraph | Procedure Paragraph |
|-----------------------------------|-----------------------|---------------------|
| Removable insert abuse            | 3.6.34                | 4.5.36              |
| Retention system fluid resistance | 3.6.35                | 4.5.37              |

**Test Group S-1 (Special, Non-Standard Configurations)**

|                                      | Requirement Paragraph      | Procedure Paragraph |
|--------------------------------------|----------------------------|---------------------|
| Visual examination                   | 3.1, 3.4, 3.5,<br>3.7, 3.8 | 4.5.2               |
| Coupling over torque                 | 3.6.12                     | 4.5.14              |
| Thermal shock                        | 3.6.16                     | 4.5.18              |
| Altitude immersion                   | 3.6.19                     | 4.5.21              |
| Insulation resistance measurement    |                            |                     |
| Dielectric withstanding voltage test |                            |                     |
| Solder termination tensile strength  | 3.6.8                      | 4.5.10              |

- 4.4 Acceptance Inspection. Lot acceptance inspection shall consist of the tests listed in Table XII. Acceptance inspection shall be performed on every lot of connectors manufactured under this specification. The sample units shall be tested unterminated and shipped against orders. Inprocess examination may be used for acceptance inspection. Statistical process control (SPC) may be substituted for lot acceptance inspection per Raychem Standard Operating Procedure 0001.

Table XII. Acceptance Inspection

| Test  | Requirement Paragraph   | Procedure Paragraph | Inspection Level | AQL* |
|---|-------------------------|---------------------|------------------|------|
| Visual examination  | 3.1, 3.4, 3.5, 3.7, 3.8 | 4.5.2               | I                | 4.0  |
| Insulation resistance at room temperature (inserts only)    | 3.6.1                   | 4.5.3               | S-3              | 1.0  |
| Dielectric withstanding voltage (inserts only)              | 3.6.2                   | 4.5.4.1             | S-3              | 1.0  |
| Contact engagement and separation forces (min and max only) | 3.6.6                   | 4.5.8               | S-3              | 1.0  |

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

- 4.4.1 Sampling for Acceptance Inspection. MIL-STD-105 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 shall consist of all connectors or components of one part number, manufactured under essentially the same conditions, and offered for inspection at one time.
- 4.4.1.2 Inspection Level 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 XII.
- 4.4.2 Rejected Lots. If an inspection lot is rejected, the lot shall be replaced, or the defective units shall be reworked to correct the defect or screened out. If the lot is reworked or the defective units are screened out, the lot shall be resubmitted for inspection. Resubmitted lots shall be inspected using tightened inspection in accordance with MIL-STD-105.
- 4.4.3 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.

4.5 Test Procedures.

4.5.1 Test Conditions. Unless otherwise specified, all tests shall be performed at ambient pressure, and relative humidity as specified in the general requirements of MIL-STD-1344 with an ambient temperature of  $25 \pm 5^{\circ}\text{C}$ . Where conditioning at the maximum rated temperature is specified, the temperature tolerances shall be minus  $0^{\circ}\text{C}$  and plus  $5^{\circ}\text{C}$ .

4.5.1.1 Connector Assembly Preparation. When terminated connectors are specified for testing, the contacts shall be terminated in accordance with the applicable specification control drawing. Wire or cable lengths shall be approximately 3 feet (1 meter). Connectors shall be assembled in accordance with the applicable Raychem engineering standard (ES). Cable clamps shall be installed, if provided for.

4.5.2 Visual Examination (see 3.1, 3.4, 3.5, 3.7.3.8). Connector components and assemblies shall be visually examined at 4X magnification.

4.5.3 Insulation Resistance (see 3.6.1). Connector assemblies shall be tested in accordance with MIL-STD-1344, Method 3003. All contacts shall be tested. Insulation resistance shall be measured a) between adjacent contacts in the insert and b) between contacts and the shell (ground). Alternate contacts may be bussed together to facilitate testing, and passing values obtained in this manner may be used to indicate compliance on a pin-to-pin basis. When insulation resistance at maximum rated temperature is specified, the connector assemblies shall be conditioned in an oven at the maximum rated temperature for 30 minutes, and the measurements shall be made while the connector assemblies are at the maximum rated temperature.

4.5.4 Dielectric Withstanding Voltage.

4.5.4.1 Dielectric Withstanding Voltage at Sea Level (see 3.6.2). Connector assemblies shall be tested in accordance with MIL-STD-1344, Method 3001. All contacts shall be tested. Test voltage shall be 60 Hz ac applied a) between adjacent contacts in the same insert and b) between contacts and the shell (ground). Alternate contacts may be bussed together to facilitate testing, and passing values obtained in this manner may be used to indicate compliance on a pin-to-pin basis. The shell and all contacts not connected to the test voltage shall be grounded. The magnitude of the test voltage shall be as specified in Table XIII.

Table XIII. Test Voltages

| Connector Series | Terminated Wire Type | Test Voltage<br>V rms |
|------------------|----------------------|-----------------------|
| MTC50            | All types            | 750                   |
| MTC100           | Round wires          | 1500                  |
|                  | Flat conductor cable | 1000                  |

4.5.4.2 Dielectric Withstanding Voltage at Altitude (see 3.6.2). Mated and unmated connector assemblies shall be tested as specified in 4.5.4.1, except that the test voltages and altitude pressure equivalents shall be as specified in Table XIV.

Table XIV. Test Voltages And Altitudes

| Altitude Pressure Equivalent                    | Test Voltage V ms |       |              |       |
|---|-------------------|-------|--------------|-------|
|   | MTC100 Series     |       | MTC50 Series |       |
|   | Unmated           | Mated | Unmated      | Mated |
| 50,000 ft – 87.5 torr<br>(15.2 km – 11.7 kPa)   | 550               | 1000  | 350          | 700   |
| 70,000 ft – 33.5 torr<br>(21.3 km – 4.47 kPa)   | 375               | 700   | 250          | 500   |
| 110,000 ft – 5.74 torr<br>(33.5 km – 0.765 kPa) | 200               | 400   | 200          | 400   |

4.5.5 Contact Resistance (see 3.6.3).

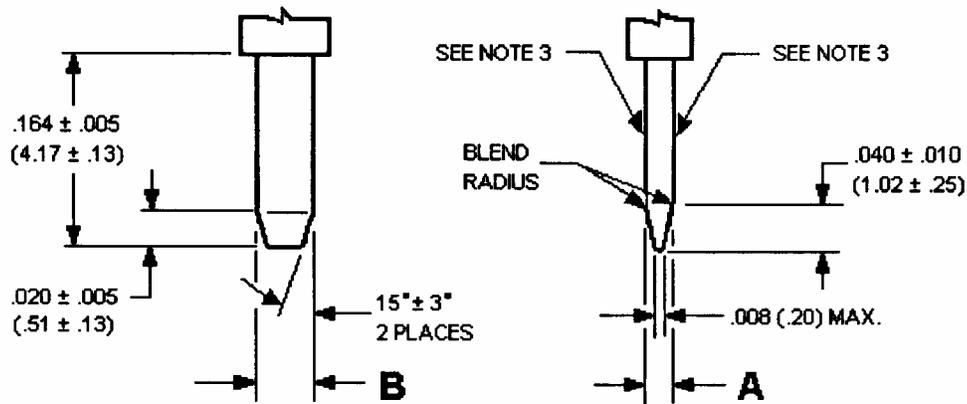
4.5.5.1 Contact Resistance at Specified Current (Room Temperature). Mated connector assemblies shall be tested in accordance with MIL-STD-1344, Method 3004. At least 20 percent of the contacts in each connector assembly shall be tested.

4.5.5.2 Contact Resistance at Specified Current (Maximum Rated Temperature). Mated connector assemblies shall be conditioned in an oven at the maximum rated temperature for 30 minutes. Measurements shall be made as detailed in 4.5.5.1, while the connector assemblies are at the maximum rated temperature.

4.5.5.3 Low Signal Level Contact Resistance. Mated connector assemblies shall be tested in accordance with MIL-STD-1344, Method 3002. At least 20 percent of the contacts in each connector assembly shall be tested.

4.5.6 Shell to Shell Conductivity (see 3.6.4). Mated connector assemblies with conductive shell finish shall be tested by applying a direct current of  $1 \pm 0.1$  ampere from the rear corner of one shell to the opposite rear corner of the other shell. Measure the voltage drop between the mated surfaces of the shells by applying the voltmeter probes on the flat surfaces at the middle of the rear edge of the shells. Probes used to make voltage measurements shall have spherical ends with 0.050 inch (1.3 mm) minimum radius and shall not puncture or damage the shell finish.

- 4.5.7 Electrical Engagement (see 3.6.5). Mated connector assemblies shall be wired to provide a series circuit through all contacts of the mated connector. A suitable power source and indicator shall be provided such that the point at which the series circuit is completed, during normal connector mating, can be established. Connector halves shall be held flat against a smooth, flat surface and mated by alternately turning each jackscrew one half turn. The mating operation shall be stopped at the first indication of a completed circuit, and the plug-to-receptacle shell spacing shall be measured along the centerline of the connectors. The mating operation shall then be continued until the connector halves are completely mated at a jackscrew torque of 9 lbf-inch (1.0 N-m), and the shell spacing shall again be measured. Electrical engagement shall be the difference between the two measurements.
- 4.5.8 Contact Engagement and Separation Forces (see 3.6.6). Contacts shall be tested in accordance with MIL-STD-1344, Method 2014, Procedure 1. Test blades shall be as shown in Figure 2. Contacts shall be conditioned by inserting and withdrawing the maximum-thickness test blade. For qualification inspection, at least 20 percent of the contacts in each connector assembly shall be tested.
- 4.5.9 Durability (see 3.6.7). Terminated connector assemblies shall be mated and unmated 500 times at a rate not to exceed 300 cycles per hour and in a manner simulating actual service. The test may be performed by hand or by mechanical means. For the MTC50 series it is permissible to shake or blow particulate debris from the threads or interface surfaces at intervals of not less than 50 cycles. If necessary, a soft bristle brush moistened with isopropyl alcohol may likewise be used at similar intervals.
- 4.5.10 Solder Termination Tensile Strength (see 3.6.8). Tensile strength testing shall be performed at room temperature and at the maximum rated temperature.
- 4.5.10.1 Round Wire Termination Tensile Strength (see 3.6.8.1). Terminated inserts shall be placed in a tensile testing device and sufficient force applied to individual wires to separate the wires from the terminals or break the wires. Wires shall be gripped  $3.0 \pm 0.5$  inches ( $76 \pm 13$  mm) from the termination area. The speed of head travel of the tensile tester shall be  $1.0 \pm 0.25$  inch ( $25 \pm 6$  mm) per minute. Conductor breakage outside the soldered termination at less than the tensile loads shown in Table VIII shall not constitute failure. At least 20 percent of the wire terminations of each insert shall be tested.



| Test Blade Type   | Dimension A, inch (mm)  | Dimension B, inch (mm)             |                                   |
|-------------------|---|------------------------------------|-----------------------------------|
|                   |   | Size 26 Contacts                   | Size 22 Contacts                  |
| Maximum Thickness | 0.0210 +0.0000<br>-0.0002<br><br>(0.533 + 0.000)<br>(-0.005)  | 0.028 ± 0.001<br><br>(0.71 ± 0.03) | 0.050 ± .001<br><br>(1.27 ± 0.03) |
| Minimum Thickness | 0.0190 + 0.0002<br>-0.0000<br><br>(0.483 + 0.005)<br>(-0.000) | 0.028 ± 0.001<br><br>(0.71 ± 0.03) | 0.50 ± .001<br><br>(1.27 ± 0.03)  |

- Notes:
1. Material: Hardened Tool Steel.
  2. Hardness: Rockwelll "C" 50-55.
  3. Surface Finish: 6 to 10 microinch (0.15 to 0.25 μm) on working surfaces
  4. Dimensions: inch (mm)

Figure 2. Test Blades for Contact Engagement and Separation Forces.

- 4.5.10.2 Flat Conductor Cable Termination Tensile Strength (see 3.6.8.2). Terminated inserts shall be placed in a tensile testing device, and an axial load as specified in Table IX shall be applied for 10 seconds uniformly across the width of the cable. Cable shall be gripped  $3.0 \pm 0.5$  inch ( $76 \pm 13$  mm) from the termination area. The speed of head travel of the tensile tester shall be  $1.0 \pm 0.25$  inch ( $25 \pm 6$  mm) per minute.
- 4.5.11 Insert Retention (see 3.6.9). Terminated connector assemblies shall be tested in accordance with MIL-STD-1344, Method 2010, except that the load shall be applied only against the insert mating surface. The load shall be 200 psi (1.4 MPa), applied evenly over the entire mating surface. If a tensile tester is used to apply the load, the speed of head travel shall be 0.02 inch (0.5 mm) per minute.
- 4.5.12 Contact Retention (see 3.6.10). Terminated inserts shall be tested in accordance with MIL-STD-1344, Method 2007. Axial load shall be 10 lbf (44 N) for size 22 contacts and 5 lbf (22 N) for size 26 contacts, applied to mating ends of contacts.
- 4.5.13 Coupling Torque (see 3.6.11). Terminated plug and receptacle assemblies shall be mated by alternately turning jackscrews; one-half turn at each side of the connector to a torque of 9 lbf inch (1.0 N-m). The mated assembly shall then be visually inspected.
- 4.5.14 Coupling Overtorque (see 3.6.12). Terminated connector assemblies shall be mated to a torque of 9 lbf-inch (1.0 N-m). The jack-screws shall then be torqued to 15 lbf-inch (1.7 N-m), and the shells and mating hardware visually examined.
- 4.5.15 Maintenance Aging (see 3.6.13). Terminated connector assemblies shall be fully mated and unmated three times. Using the tool specified in the applicable specification sheet, removable inserts shall then be removed from the shells and installed in the shells ten times. Connector assemblies shall then be fully mated and unmated three additional times.
- 4.5.16 Random Vibration (see 3.6.14). Terminated, mated connector assemblies shall be tested in accordance with MIL-STD-1344, Method 2005, Test Condition V1, Letter J. Connectors shall be panel mounted by normal means, with at least 8 inches (200 mm) of wire unsupported behind each connector. Specimens shall be subjected to vibration for 8 hours in each major axis for a total of 24 hours. The discontinuity detector shall be capable of detecting discontinuities of 100 nanoseconds and greater.
- 4.5.17 Mechanical Shock (see 3.6.15). Terminated, mated connectors shall be tested in accordance with MIL-STD-1344, Method 2004, Test Condition D. The connectors shall be panel mounted by normal means, with at least 8 inches (200 mm) of wire unsupported behind each connector. The discontinuity detector shall be capable of detecting discontinuities of 100 nanoseconds and greater.

- 4.5.18 Thermal Shock (see 3.6.15). Mated connector assemblies shall be tested in accordance with MIL-STD-202, Method 107, Test Condition F, except that the high temperature extreme shall be the maximum rated temperature.
- 4.5.19 Temperature Life (see 3.6.17). Terminated, mated connector assemblies shall be tested in accordance with MIL-STD-1344, Method 1005, for 1000 hours at the maximum rated temperature, using an air-circulating oven. Contacts shall not be wired in series or connected to an electrical load. Leads shall be brought out through a suitable port so that electrical measurements can be taken. After 1000 hours and while connectors are still at the maximum rated temperature and mated, the insulation resistance shall be measured in accordance with 4.5.3.
- 4.5.20 Humidity (see 3.6.18). Terminated, mated connector assemblies shall be tested in accordance with MIL-STD-1344, Method 1002, Type 11. Polarization voltage is not required. At least 3 hours after the start of step 7 during the final cycle, and while the connectors are still subjected to high humidity, insulation resistance shall be measured in accordance with 4.5.3 and dielectric withstanding voltage shall be tested in accordance with 4.5.4.1. Final measurements after high humidity shall be performed after the mated connectors have remained outside the chamber in ambient conditions for 24 hours.
- 4.5.21 Altitude Immersion (see 3.6.19). Terminated, mated connectors shall be tested in accordance with Method 1004 of MIL-STD-1344.
- 4.5.22 Altitude--Low Temperature (see 3.6.20). Terminated, mated connector assemblies shall be tested in accordance with MIL-STD-1344, Method 1011. While at low pressure, MTC50 series connector assemblies shall be tested at 375 Vrms, and MTC100 series connector assemblies shall be tested at 625 Vrms. After stabilizing at ambient conditions, the insulation resistance measurement shall be made in accordance with 4.5.3, with the connectors mated, and the dielectric withstanding voltage test shall be performed as specified in 4.5.4.1, with the connectors mated.
- 4.5.23 Salt Spray (see 3.6.21).
- 4.5.23.1 Salt Spray (Corrosion). Terminated unmated connector assemblies shall be tested in accordance with MIL-STD-1344, Method 1001, Test Condition B. Suitable measures shall be taken to preclude migration of condensation along the conductors.

- 4.5.23.2 Salt Spray (Dynamec Test). Terminated plugs and receptacles shall be mated and unmated 50 cycles at a rate not to exceed 300 cycles per hour. The plug and receptacle shall be completely separated during the demate portion of the cycle. The connectors shall then be mated and exposed to salt fog for 452 hours in accordance with MIL-STD-1344, Method 1001. The connectors shall then be unmated and exposed to the salt fog for 48 hours. Suitable measures shall be taken to preclude migration of condensation along the conductors. Following the salt fog exposure, 450 mate and unmate cycles shall be performed.
- 4.5.24 Ozone Exposure (see 3.6.22). Terminated, unmated connector assemblies shall be tested in accordance with MIL-STD-1344, Method 1007.
- 4.5.25 Fluid Immersion (see 3.6.23). Terminated connector assemblies shall be tested in accordance with MIL-STD-1344, Method 1016, except that measurement of initial mating and unmating forces is not required. The following exceptions and additional fluids shall be incorporated into the procedure:
- a. One sample shall be tested in hydraulic fluid per MIL-H-83282, using the same procedure as for MIL-H-5606 hydraulic fluid.
  - b. One sample shall be tested in MIL-T-5624, Grade JP-4, using the same procedure as for MIL-T-5624, Grade JP-5.
  - c. Conditioning in coolant-dielectric fluid (Coolanol) shall be at the maximum rated temperature.
  - d. One sample shall be tested in mineral-based lubricating oil per MIL-L-6082, using the same procedure as for MIL-L-7808 lubricating oil.
  - e. Samples shall be tested in each of the following fluids, using the same procedure as for MIL-H-5606 hydraulic fluid, except that the connectors shall be immersed mated: Monsanto Skydrol 500 B-4, Monsanto Skydrol LD4, Chevron Hyjet IV
  - f. One sample shall be tested in uncracked, unleaded gasoline ("white gas"), using the same procedure as for MIL-G-3056 gasoline.
- 4.5.26 Magnetic Permeability (see 3.6.24). Terminated, unmated connector assemblies shall be tested in accordance with MIL-STD-1344, Method 3006.
- 4.5.27 Solderability (see 3.6.25). Terminals shall be tested in accordance with MIL-STD-202, Method 208.

- 4.5.28 Industrial Gas (see 3.6.26). Terminated, unmated connector assemblies shall be placed on a noncorrosive rack in a closed plastic or glass chamber with a maximum volume of 2 cubic feet (56 cubic decimeters) containing a 10- percent solution of sulfurated potash NF in distilled water. Samples shall not be immersed in the solution but shall be exposed to the sulfide vapor for a minimum of 100 hours.
- 4.5.29 Contact Inductive Load Switching (3.6.27). Each of five contacts shall be demated ten times while supplying current to an inductive load. The circuit parameters shall be 5.0 amperes for size 22 contacts, 2.0 amperes for size 26 contacts, 115 volts, 400 Hz and  $0.70 \pm 0.05$  lagging power factor.
- 4.5.30 Overload Current and Circuit Breaker Compatibility (see 3.6.28). Contacts in a mated connector assembly shall be subjected to overload currents and times specified in Table XV. The rated current shall be the maximum current as specified in Table 11. Each overload condition shall be tested five times using a different contact each time.

Table XV. Overload Conditions

| Time<br>(Seconds) | Overload Current<br>(% of Rated Current) |
|-------------------|--|
| 0.35              | 2000                                     |
| 1.0               | 1000                                     |
| 300.0             | 200                                      |

- 4.5.31 Temperature Rise at Rated Current (see 3.6.29). Contacts shall be terminated to round wires: size 26 contacts to 26 AWG wire, size 22 contacts to 22 AWG wire. Except for two wires for connection to the current source, the wires shall extend 2 inches (50 mm) beyond the ends of the terminals, and all the contacts shall be series wired. The connectors shall be assembled with a thermocouple positioned against the interfacial seal at the midpoint of the insert. The connector assembly shall be suspended on edge in still air, at least 12 inches (30 cm) from the nearest surface, using twine or cord. The ambient temperature shall be maintained within  $\pm 1^\circ$  during the test. The initial temperature at the thermocouple shall be recorded, and then a direct current of 2.0 amperes for size 26 contacts or 5.0 amperes for size 22 contacts shall be applied to the series wired connector contacts. The final temperature at the thermocouple shall be recorded after steady-state conditions are reached.
- 4.5.32 Insert Materials.
- 4.5.32.1 Tensile Strength (see 3.6.30.1). Tensile strength shall be determined according to ASTM D 638 on Type IV molded tensile bars, utilizing a crosshead speed of 2.0 inches (50 mm) per minute.

- 4.5.32.2 Deflection Temperature (see 3.6.30.2). The deflection temperature at 66 psi (455 kPa) maximum fiber stress shall be determined in accordance with ASTM D 648. Specimen width shall be 0.125 inch (3 mm). (The required load is 0.34 lbf or 1.54 N.)
- 4.5.32.3 Water Absorption (3.6.30.3). Water absorption shall be measured in accordance with ASTM D 570 using 2.0 x 0.5 x 0.125 inch (51 x 13 x 3 mm) molded specimens. The test specimens shall be preconditioned for 24 hours at 100°C before immersion. Immersion time shall be 24 hours.
- 4.5.32.4 Flammability (see 3.6.3). Flammability shall be tested in accordance with UL 94V (para. 3.6.3.15) using 5.0 x 0.5 x 0.125 inch (127 x 13 x 3 mm) molded specimens.
- 4.5.32.5 Smoke Generation (see 3.6.30.5). Smoke generation shall be determined in accordance with ASTM F 814. Specimens shall be 3.0 x 3.0 x 0.125 inch (76 x 76 x 3 mm) molded wafer material. Three specimens shall be tested under flaming exposure and three under nonflaming exposure.
- 4.5.33 Insert Impact Resistance (see 3.6.31). The impact resistance of unterminated, as molded pin and socket removable inserts shall be determined in accordance with ASTM D 256, Method E. The insert shall be unnotched and shall be inserted into the vise with the smooth side of the insert toward the fixed vise jaw. A groove shall be made in the metal support to accommodate the insert keyway. The 2.0 ft.lb. hammer shall strike the insert not less than 0.05 inch (1.0 mm) from the upper edge of the insert, and at least 0.65 inch (16.5 mm) from the vise jaws.
- 4.5.34 Insert Impact Chip Resistance (see 3.6.32). Unterminated pin and socket removable inserts shall be tested in accordance with ASTM D 256, Method E, using 0.5 ft-lbf (0.7 J) energy level. The insert shall be unnotched. It shall be supported over its full height and width by a 0.25inch (6-mm) thick steel plate with a groove for the insert keyway and shall be inserted into the vise with the smooth side of the insert supported by the metal plate. The impacting tool shall be spheroid in shape, with a radius of 0.50 inch (12.7 mm), and shall strike the insert 0.25 inch (6 mm) from the end of the insert and centered between the two edges. After impact, the insert shall be examined with the unaided eye for evidence of chipping or other fracture.

- 4.5.35 Insert Flexure (see 3.6.33). Unterminated pin and socket removable inserts shall be tested in accordance with ASTM D 790, Method 1, Procedure A. The radius of the nose shall be 0.125 inch (3 mm), and a groove shall be machined in the nose to accommodate the keyway on the insert. The radius of the supports shall be 0.125 inch (3 mm), and the span between the supports shall be 1.5 inch (38 mm) for 2-inch inserts and 0.75 inch (19 mm) for 1-inch inserts. The force shall be applied to the keying side of the insert at the rate specified for the nominal specimen depth, until a strain of 5 percent is attained for MTC100 inserts, or 2.5 percent for MTC50 inserts. After deflection, the insert shall be examined under 10X magnification for evidence of cracking or breaking.
- 4.5.36 Removable Insert Abuse (see 3.6.34). Connectors with removable inserts shall be subjected to the tests listed below. A different specimen shall be used for each test. Should a removal tool become damaged during testing, it shall be replaced. Failure of a tool shall not constitute a test failure.
- 4.5.36.1 Removal Tool Rotation. Inserts of each polarization and contact type shall be tested. Inserts shall be removed while torque is applied to the removal tool. The insert shall then be reinserted. These steps shall be repeated ten times on each insert.
- 4.5.36.2 Removal Tool Thrust. Inserts of each polarization and contact type shall be tested. The applicable insert removal tool shall be inserted as if to remove the insert, and an axial load of 10 lbf (44 N) shall be applied to the tool. The tool shall then be removed along with the insert.
- 4.5.37 Retention System Fluid Resistance (see 3.6.35). Unmated connectors shall be immersed for 20 hours at room temperature in the fluids specified below, using a different connector for each fluid. Connectors shall be removed from fluids and allowed to drain for 4 hours. Insert retention shall then be tested as specified in 4.5.11. Test fluids:
- a. Monsanto low density aviation hydraulic test fluid.
  - b. MIL-H-5606 hydraulic fluid.
  - c. MIL-L-23699 lubricating oil.
  - d. Methyl ethyl ketone per TT-M-261.
  - e. Alkaline detergent, pH 10.0 to 0.5.
  - f. Aviation turbine fuel, type Jet A.
  - g. MIL-T-5624 fuel, type JP-4.
  - h. One part by volume of isopropyl alcohol per TT-1-735, Grade A or B, mixed with three parts mineral spirits per TT-T-291, Grade 1 or P-D-680, Type 2.
  - i. Anti-icing fluid, composition by weight: 66.0% ethylene glycol per MIL-E-9500, Grade A; 22.0% propylene glycol per MIL-P-83800, industrial grade; 10.0% water; 0.90% dibasic potassium phosphate; 0.65% sodium di-(2-ethylhexyl) sulfosuccinate (100% active); 0.45% benzotriazole.

- 4.5.38 EME Shielding (see 3.6.36). EME-shielded connectors shall be terminated to suitable shielded cable, and the surface transfer impedance ( $Z_t$ ) of the test specimen shall be measured in accordance with MIL-C-85485.
- 4.5.39 Air Leakage (see 3.6.37). Terminated, pressure maintaining connector assemblies shall be tested in accordance with the environmental seal test method of MIL-STD-1344, Method 1008. The wired receptacle shall be mounted on the divider and mated to the wired plug. The wires from the plug shall remain within the test chamber. The test shall be conducted at room temperature with a pressure differential of 1 atmosphere (101 kPa) maintained for 30 minutes.
- 4.5.40 Gas Tightness (see 3.6.38). Solderless wrapped connections shall be tested for gas tightness in accordance with MIL-STD-1130.
- 4.5.41 Strip Force (see 3.6.39). Solderless wrapped connections shall be tested for strip force in accordance with MIL-STD-1130.
- 4.5.42 Wrapper Resistance (see 3.6.40). Solderless wrapped connections shall be tested for wrapper resistance in accordance with MIL-STD-1130.
- 4.5.43 Cold Handling (see 3.6.41). Mated connector assemblies shall be conditioned for 2 hours minimum at minus  $25 \pm 2^\circ\text{C}$ . Connectors shall then be mated and demated and removable inserts removed and installed while at the specified temperature. Connectors shall then be inspected for material deterioration.
- 4.5.44 Post Test Examination (see 3.6.42). The tested connectors shall be examined for evidence of cracking, loosening of parts, carbon tracking, excess wear, or missing parts.
- 5.0 Preparation For Delivery**
- 5.1 Packaging and Packing. Unless otherwise specified in the procurement document, packaging and packing shall be in accordance with commercial practice.
- 5.2 Marking. Unless otherwise specified in the procurement document, marking shall be in accordance with commercial practice.