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1.0 OBJECTIVE

This specification defines the performance, test, quality and reliability requirements of the slotted and vertical staking header connectors.

2.0 SCOPE

This specification covers the slotted header and the vertical stacking header connectors designed for use in low power applications requiring a printed wiring board mounted disconnect. The headers provide only the male half of the inter-connection, using a female connector to complete the connection.


The Headers shall be available in one of the following type classifications:

<u>TYPE</u>	<u>PLATING</u>
I	30u INCH GOLD
II	15 u INCH GOLD
III	GOLD FLASH
IV	150u INCH TIN
V	15u Pd. Ni.
VI	30u Pd. Ni.
VII	DUPLEX 150u INCH TIN AND 15u INCH GOLD
VIII	PRESS FIT WITH TYPE 1 THRU VII PLATING

3.0 GENERAL

The specification is composed of the following sections.

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2.0	SCOPE	1
3.0	GENERAL	1
4.0	APPLICABLE DOCUMENTS	2
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4.0 APPLICABLE DOCUMENTS

4.1 Specifications

4.2 Military Specifications

- | | |
|-------------------|--|
| 4.2.1 MIL-F-14256 | Flux, Soldering, Liquid (Rosin Base) Activated |
| 4.2.2 MIL-G-45205 | Gold Plating, Electrodeposited |
| 4.2.3 MIL-M-24519 | Molding Plastic, Polyester, Thermoplastic |
| 4.2.4 MIL-P-55110 | Printed Wiring Boards |
| 4.2.5 MIL-P-81728 | Plating, Tin-Lead (Electrodeposited) |
| 4.2.6 MIL-P-18177 | P.C. Mounting Board |
| 4.2.7 MIL-P-13949 | Plastic Sheet Laminated, Copper Clad |

4.3 Federal Specifications

- | | |
|----------------|--|
| 4.3.1 QQ-N-290 | Nickel Plating (Electrodeposited) |
| 4.3.2 QQ-W-343 | Wire, Electrical and Nonelectrical Copper (Uninsulated) |
| 4.3.3 QQ-S-571 | Solder: Lead Alloy, Tin-Lead Alloy and Tin Alloy: Flux Cored Ribbon, Wire and Solid Form |

4.4 Standards

4.5 Military Standards

- | | |
|---------------------|---|
| 4.5.1 MIL-STD-105 | Sampling Procedures and Tables for Inspection by Attributes |
| 4.5.1 MIL-STD-202 | Test Methods for Electrical and Electronic Component Parts |
| 4.5.2 MIL-STD-275 | Printed Wiring for Electronic Equipment |
| 4.5.3 MIL-STD-1130 | Connections, Electrical, Solderless Wrapped |
| 4.5.4 MIL-STD-1344 | Test Methods for Electrical Connectors |
| 4.5.5 MIL-STD-45662 | Calibration System Requirements |
| 4.5.6 MIL-STD-1495 | Plated through hole |


4.6 Industrial Specifications/Standards

- | | |
|------------------|---|
| 4.6.1 UL-94 | Test for Flammability of Plastic Material |
| 4.6.2 ASTM B-159 | Phosphor Bronze Drawn Wire |
| 4.6.3 IPC-A-600C | Acceptability of Printed Boards |

5.0 REQUIREMENTS

5.1 Qualification

Connectors furnished under this specification shall be products capable of meeting the qualification test requirements specified herein.

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5.2 Material

Material for each part shall be as specified herein, or equivalent, substitute material shall meet the performance requirements of this specification.

5.2.1 Contact. The contact shall be Phosphor Bronze Alloy UNS C51000 in accordance with ASTM B-159.

5.2.2 Insulator. The insulator shall be glass filled polyester in accordance with MIL-M-24519, Type GPT-30F, all plastic material shall be rated V-0 in accordance with UL-94.

5.3 Finish

5.3.1 The finish on the contact shall be as specified herein for the particular type (see 2.0) of connector under consideration.

5.3.2 Types 1 through III. The contact shall be plated with the specified minimum thickness (see 2.0) of gold in accordance with MIL-G-45204, Type II Grade C over 50 microinches, minimum of nickel in accordance with QQ-N-290, Class 2.

5.3.3 Type IV. The contact shall be plated with 150 microinches, minimum thickness (See 2.0) of Palladium Nickel.

5.3.4 Type V & VI. The contact shall be plated with the specified minimum thickness (see 2.0) of Palladium Nickel.


5.3.5 Type VII. The contact shall be plated on the mated end with the specified minimum thickness (see 2.0) of gold in accordance with MIL-G-45204, Type II Grade C over 50 microinches, minimum of nickel in accordance with QQ-N-290, Class 2. On the PCB side the contact shall be plated with 150 microinches, minimum, of 93/7 tin-lead in accordance with ML-P-81728.

5.3.6 Type VIII. The contact shall be complaint press fit with the specified minimum thickness of plating of Type I through VIII.

5.4 Design and Construction

The connector shall be a multi-piece assembly having two rows of contacts, on a rectangular grid of .100 inch. The connector is designed with solder tail termination for installation in .040 inch diameter holes in printed wiring boards with recommended thickness of .063 inch to .125 inch. The slotted header connector is also designed for press fit terminal having (3) three levels of wrap post length .310 inch, .480 inch and .680 inch. For solderless connection in accordance with MIL-STD-1130, the recommended PCB thickness is .093 inch to .187 inch having a diameter from .038 inch to .044 inch. Both the solder tail and the press fit pin shall be available with all the plating types and thickness from paragraph 2.0 type description.

5.4.1 Wrap Post/Mating Contact. The wrap post geometry shall be in accordance with MIL-STD-1130. Both tips of the contact shall be beveled to facilitate insertion into the bit of the wire wrap tooling or into the mating female contact.

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5.4.2 Workmanship. Connectors shall be uniform in quality and shall be free from burns, scratches, cracks, voids, chips, blisters, pin holes, sharp edges, and other defects that will adversely affect life or serviceability.

5.4.3 Interchangeability. The connector shall be capable of mating with corresponding components from any source, provided those components are of the same contact population spacing, and guide post polarization.

6.0 ELECTRICAL CHARACTERISTICS

6.1 Current Rating. The maximum current rating of the connector shall be 3.0 amperes D.C. The mated maximum current rating shall be 3.0 amperes D.C. or less depending on the current rating characteristics for the mated connector.

6.2 Insulation Resistance. The insulation resistance of the unmated and unterminated connector shall not be less than 5000 Megohms after exposure to the humidity environment described in Para. 8.1 when measured in accordance with MIL-STD-1344, Method 3003. The following details shall apply:

- a. Test condition - 500 volts D.C. applied for (1) minute.
- b. Points of Measurement - Between individually paired adjacent contacts.


6.3 Dielectric Withstanding Voltage. There shall be no evidence of arc-over, insulation breakdown or excessive leakage current (> 1 milliampere) when the unmated connectors are tested in accordance with MIL-STD-1344, Method 3001. The following details shall apply:

- a. Test Potential - 750 Volts RMS 60 HZ at sea level pressure.
- b. Test duration - 60 seconds
- c. Points of measurement – between individually paired adjacent and opposing contacts.

6.4 Capacitance. The capacitance between pairs of adjacent or opposing contacts in an unmated connector shall not exceed 2.0 picofarads when measured in accordance with MIL-STD-202, Method 305, at a frequency of 100 Kilohertz.

6.5 Low-Level Circuit Resistance. The low-level circuit resistance between the compliant press-fit pins and the plated-through hole, when the connector assembly is pressed on a printed circuit board in accordance with Para. 9.9, shall not exceed 0.2 milliohms (0.5 milliohms after environmental conditioning), when measured in accordance with MIL-STD-1344, Method 3002. The following details shall apply:

- a. Test conducted on the pins at the extreme end of the insulator.
- b. Test current – 100 MA, maximum (short-circuit)
- c. Open circuit Voltage – 20 MV D.C. Maximum
- d. Method of Connection - Attach current and voltage leads as shown in Figure 1.
- e. Test Conducted on PC boards, with the maximum plated through hole tolerance. (Ref. Para. 9.5)

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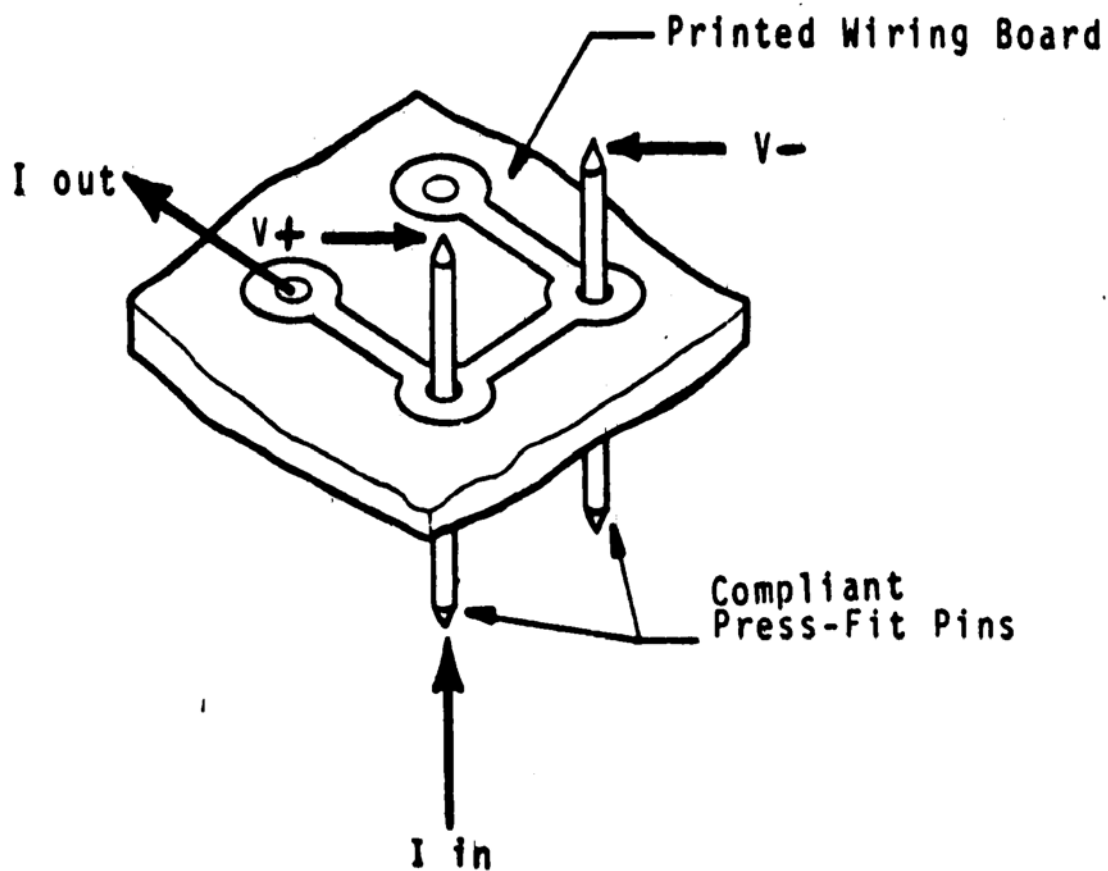



Figure 1
Low-Level Circuit Resistance (Insulator not shown)

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6.6 Wrapper Resistance: The resistance between the wrap post and its terminating wire shall not exceed 2 milliohms when measured in accordance with MIL-STD-1130. The following details shall apply.

- a. Connector to be pressed on a printed circuit board in accordance with Para. 9.9.
- b. Test current – 2.0 amperes D.C.
- c. Method of Connection – attach current and voltage leads as shown in Figure 2.
- d. Test conducted on the pins at the extreme end of the insulator.

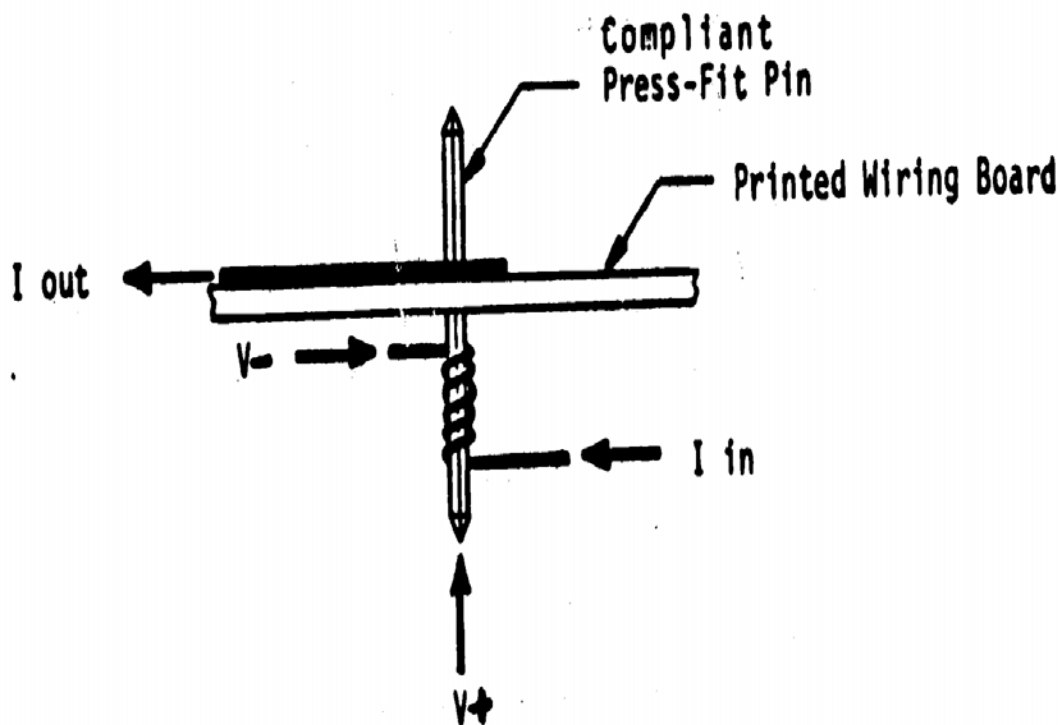




Figure 2 – Wrapper Resistance (Insulator not shown)

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7.0 **MECHANICAL CHARACTERISTICS**

- 7.1 **Contact Retention.** Individual contacts in the unmated connector shall withstand a load of 3.0 lbs. applied in either direction, along the contact axis, for 60 seconds with no movement of the contact at $+21^{\circ}\text{C} \pm 5^{\circ}$. Individual contacts in the connector assembly oppressed on a printed circuit board in accordance with Para. 4.3.6 shall withstand a load of 44, 40N (10 pounds) applied to the mated side along the axis of the pin, shall not displace the pin from its applied position in the connector @ $+21^{\circ}\text{C} \pm 5$.
- 7.2 **Wrap Post Torque.** A torque of 3.0 ounce-inches applied to the tip of the wire wrap tail contact, of the connector assembly pressed on a printed circuit board in accordance with Para. 9.9 shall not cause yielding of this member. The test shall be in accordance with MIL-STD-202, Method 211, Condition E.
- 7.3 **Solderability.** The tails of individual contacts shall be solderable over a minimum length of 0.100 inch from the tip. The test shall be similar to MIL-STD-202, Method 208. The following details shall apply:
- Aging - Suspended 2 inches above boiling distilled water for 60 minutes.
 - Acceptable Coverage - 95% minimum
 - Solder - 60/40 Tin-Lead in accordance with QQ-S-571, Type 5
 - Flux - Type A, in accordance with MIL-F-14256
 - Flux Immersion Time - Terminal dipped and allowed to set 60 seconds.
 - Solder Dwell Time - Terminal held immediately above solder for 10 seconds then immersed for 3 seconds.
 - Solder Temperature - $232 \pm 5^{\circ}\text{C}$
 - Number of Samples - 20
- 7.4 **Stripping Force.** The force to strip a wrapped connection conforming the MIL-STD-1130, when pressed on a printed circuit board in accordance with Para. 9.9, shall be not less than 8.88N (2.0 lbs.) when measured in accordance with that specification. The following details shall apply.
- Test conducted on the pins at the extreme end of the insulator.
Test conducted in accordance with Figure 3

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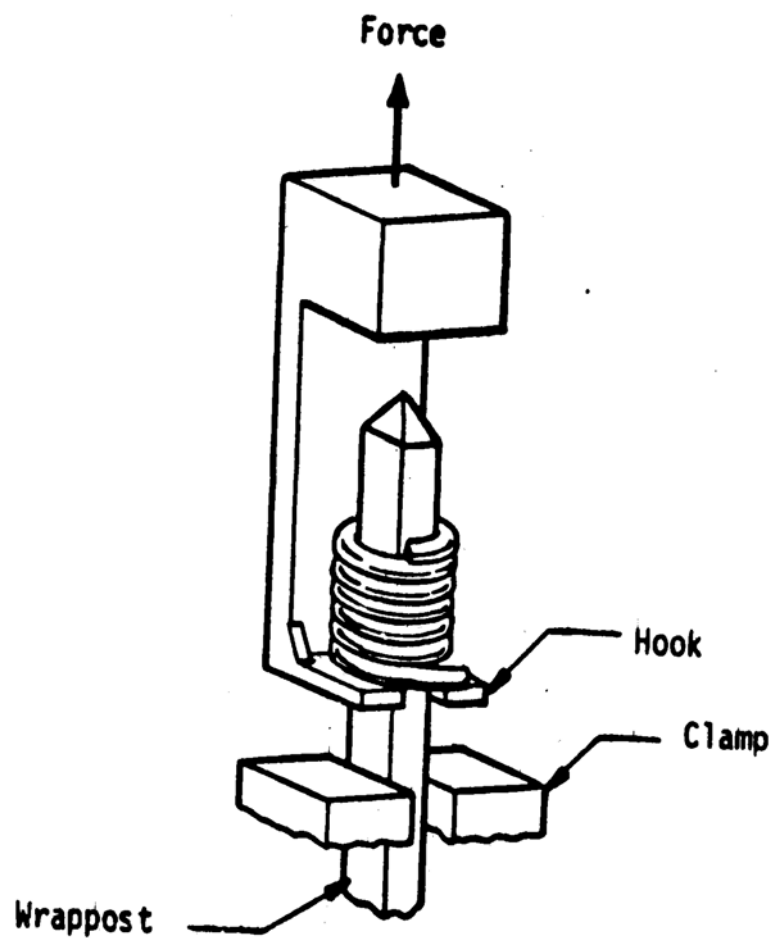



Figure 3 – Stripping Force

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7.5 Pinless Shroud Retention. The shroud when pressed onto a pin field of a PC Board shall have the retention and insertion forces in accordance with the following specifications.

	<u>Retention</u>	<u>Insertion</u>
a. 2x5 thru 2x10	6 lbs. Min	24 lbs. Min
b. 2x11 thru 2x30	12 lbs. Min	48 lbs. Min
c. 2x31 thru 2x60	18 lbs. Min	72 lbs. Min
d. 2x61 thru 2x100	24 lbs. Min	96 lbs. Min


8.0 ENVIRONMENTAL CONDITIONS

8.1 Humidity. After exposure of the connector assembly pressed on a printed circuit board in accordance with Para. 9.9 the low level circuit resistance of the compliant pin shall not exceed 0.5 milliohms (see Para. 6.5). The insulation resistance shall not be less than 5000 megohms (see Para. 6.2) the test shall be in accordance with MIL-STD-1344, Method 1002, Type 1, Condition B; the following details shall apply:


- The low level circuit resistance of the compliant pin to be conducted on the pins at the extreme end of the insulator.
- Test duration - 96 hours
- Relative humidity - 90% min
- Temperature - + 40° C
- The connector shall be pressed into a PC board having the maximum hole diameter tolerance (Ref.: Para. 9.5).

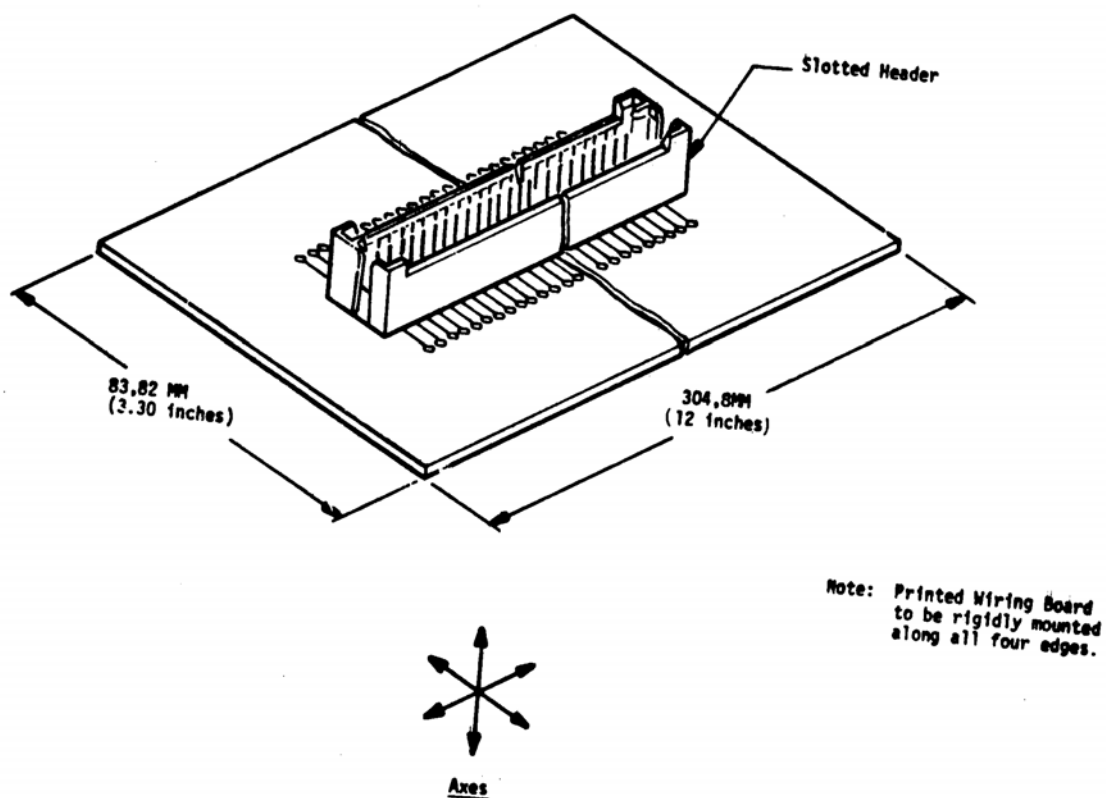
8.2 Thermal Shock. After exposure of a connector assembly pressed on printed circuit board in accordance with Para.9.9, to alternate periods of extreme high and low temperature, the contact retention shall be not less than 44, 40N (10 pounds) see Para. 7.1. There shall be not evidence of cracking or crazing of the insulator or other physical changes that would cause the connector to be out of specifications. The Dielectric Withstanding Voltage shall not be less than 750 volts RMS 60 HZ (see Para. 6.3). The test shall be in accordance with MIL-STD-202, Method 107. The following details shall apply.

- Contact retention to be conducted on the pins at the extreme end of the insulator.
- Test Conditions – B (1 hr. cycles)
- Temperature Range - 40° C to 105° C.
- The connector shall be pressed into a PC board having the max. hole diameter tolerance (Ref. Para. 9.5).


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- 8.3 High Temperature Life. After exposure of a connector assembly pressed on printed circuit board in accordance with Para. 9.9 to a high temperature environment, the low-level circuit resistance shall not exceed 0.5 milliohms (see Para. 6.5) and the contact retention shall not be less than 44,40N (10 pounds) – see Para 7.1. The insulation resistance of the connector shall be not less than 5000 megohms (see Para. 6.2). There shall be no evidence of cracking or crazing of the insulator or other physical changes that would cause the connector to be out of specifications. The test shall be in accordance with MIL-STD-202, Method 108. The following details shall apply.
- The contact retention test conducted on the pins at the extreme end of the insulator.
 - Test Chamber Temperature - 105° C
 - Test Condition (Duration)- B (250 hrs)
 - The connector shall be pressed into a PC board having the max hole dia. tolerance (Ref. Para.9.5).
- 8.4 Shock. There shall be no evidence of damage when the assembly is pressed on a printed circuit board in accordance with Para. 4.3.6. and subjected to transient accelerations, the test shall be in accordance with MIL-STD-1344, Method 2004.1, Condition A; the following details shall apply:
- Shock Pulse – 50G Peak II Millisecond, half sine
 - Number of Shocks – 3 shocks in each direction along three orthogonal axes (18 total)
 - Mounting – See Figure 5


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**Figure 5 Mounting for Shock and Vibration
(Slotted Header Shown)**

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- 8.5 Vibration. There shall be no evidence of damage when the assembly is subjected to prolonged mechanical vibration; after the test, the contact retention shall not be less than 44,40N (10 pounds) see Para. 7.1. The test shall be in accordance with MIL-STD-1344, Method 2005, Condition III. The following details shall apply:
- a. Vibration Amplitude – 1,52mm (0.06 inch) DA or $\pm 15g$
 - b. Frequency Range – 10 to 2000 HZ
 - c. Test Duration – 4 hours along each of three orthogonal axes (12 hours total)
 - d. Mounting – See Figure 5
- 8.6 Hydrogen Sulfide (H₂S) Exposure. After exposure of the connector, when pressed on a printed circuit board in accordance with Para. 9.9, to a sulfurous environment, the low-level circuit resistance shall not exceed 0.5 milliohms (See Para. 6.5). The following details shall apply:
- a. Atmosphere – 3PPM H₂S₁, in moist air.
 - b. Temperature - +40°C
 - c. Duration 96 hours
 - d. The connector shall be pressed into a PC board having the maximum hole diameter tolerance (Ref. Para. 9.5)
- 8.7 Salt Spray. After exposure of the connector when pressed on a printed circuit board in accordance with Para. 9.9 to a salt fog atmosphere, the low-level circuit resistance shall not exceed 0.5 milliohms (see Para. 6.5); the following details shall apply:
- a. Salt Solution – 5% (by weight)
 - b. Duration - 48 hours
 - c. The connector shall be pressed into a PC board having the maximum hole diameter tolerance (Ref. Para. 9.5)
- 8.8 Gas Tightness. After exposure of the connector, when pressed on a printed circuit board in accordance with Para. 9.9 expose the terminated wrap post to successively apply aqua regia and ammonium sulfide gas environments, the wrapper resistance shall not exceed 2 milliohms (see Para. 6.6), and a minimum of 75 percent of the corners in contact with uninsulated wire shall appear bright, when contrasted with the discolored pin surface. The test shall be in accordance with MIL-STD-1130.
- 8.9 Temperature Cycling. After exposure of an unmated connector to alternate periods of high and low temperature contact retention shall be in accordance with Para. 7.1 the test shall be in accordance with MIL-STD-202, Method 107. The following details shall apply:
- a. Test Condition – B (6 hr. cycles)
 - b. Temperature Range – (-40C to +70C)

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- 8.10 Resistance to Soldering Heat. There shall be no evidence of physical damage or physical changes that would cause the connector to be out of specifications, when the connector is placed on a mounting board and the board is immersed in the solder bath simulating a solder wave technique. The test shall be in accordance with MIL-STD-202E, Method 210A. The following details shall apply:
- a. Test Condition – E Procedure (2) 280C \pm 5° C 30 \pm 2 seconds
- 8.11 Resistance to Solvents. There shall be no evidence of physical damage to the insulator when the unmated connector is exposed to a typical solvent/cleaner. The test shall be similar to MIL-STD-202, Method 215; the following details shall apply:
- a. Solvent – agitated trichloroethylene
 - b. Solvent Temperature - +55 \pm 5° C
 - c. Immersion Time – 2 minutes
 - d. Number of Immersions – 2
- 8.12 Resistance to Vapor Soldering Heat. There shall be no evidence of physical damage or physical change that would cause the connector to be out of specifications when the connector is pressed on a printed circuit board in accordance with Para. 9.9, and is subjected to high heat of vapor soldering. The test shall be in accordance with the following details:
- a. Samples mounted to fiber base board in accordance – Para. 9.9 per MIL-P-18177.
 - b. Vapor Tank Temperature - 214 \pm 5° C
 - c. Cycle Time - 30 seconds \pm 2 seconds


9.0 QUALITY ASSURANCE PROVISIONS

- 9.1 Equipment Calibration. All test equipment and inspection facilities used in the performance of any test shall be maintained in a calibration system in accordance with MIL-STD-45662.
- 9.2 Inspection Conditions. Unless otherwise specified herein, all inspections shall be performed under the following ambient conditions.
- a. Temperature - 25° C \pm 5° C
 - b. Relative Humidity – 30% to 80%
 - c. Barometric Pressure – Local Ambient
- 9.3 Qualification Inspection. Qualification inspection shall be performed on sample units produced with equipment and procedures normally used in production.
- 9.4 Sample. Two (2) of the largest size, two (2) of the middle size, and two (2) of the smallest population connectors shall be subjected to the qualification inspection. The various samples will be configured as outlined in Table 1.

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9.5 Printed Wiring Board. Twelve (12) test boards conforming to the applicable requirements of MIL-P-55110 and MIL-STD-275, shall be prepared as shown in Figure 6. The laminate used in the fabrication of the printed wiring boards shall be type GE, N or P is optional, thickness of .0930 inches, A1/1A, A/1/B, in accordance with MIL-P-13949, or equivalent. The plated-through holes shall be constructed as follows:

- a. Drilled Hole Diameter – 1, 15 ± .025MM (0.0453 ± 0.001 inch)
- b. Copper Plating Thickness per side - ,025MM (0.001 inch min) ,060MM (0.0024 max)
- c. Tin-Lead (60/40) Plating Thickness per side - ,0076MM (0.0003 inches minimum)
,0178MM (0.0007 inch maximum)
- d. Finished Hole Diameter - 1,04MM ± ,076MM (0.041 ± 0.003 inch)
- e. Six (6) test boards are required to have the max. plated thru hole diameter tolerance of 1,117MM + ,000, - ,025 (.044 + .000, - .001 inch)

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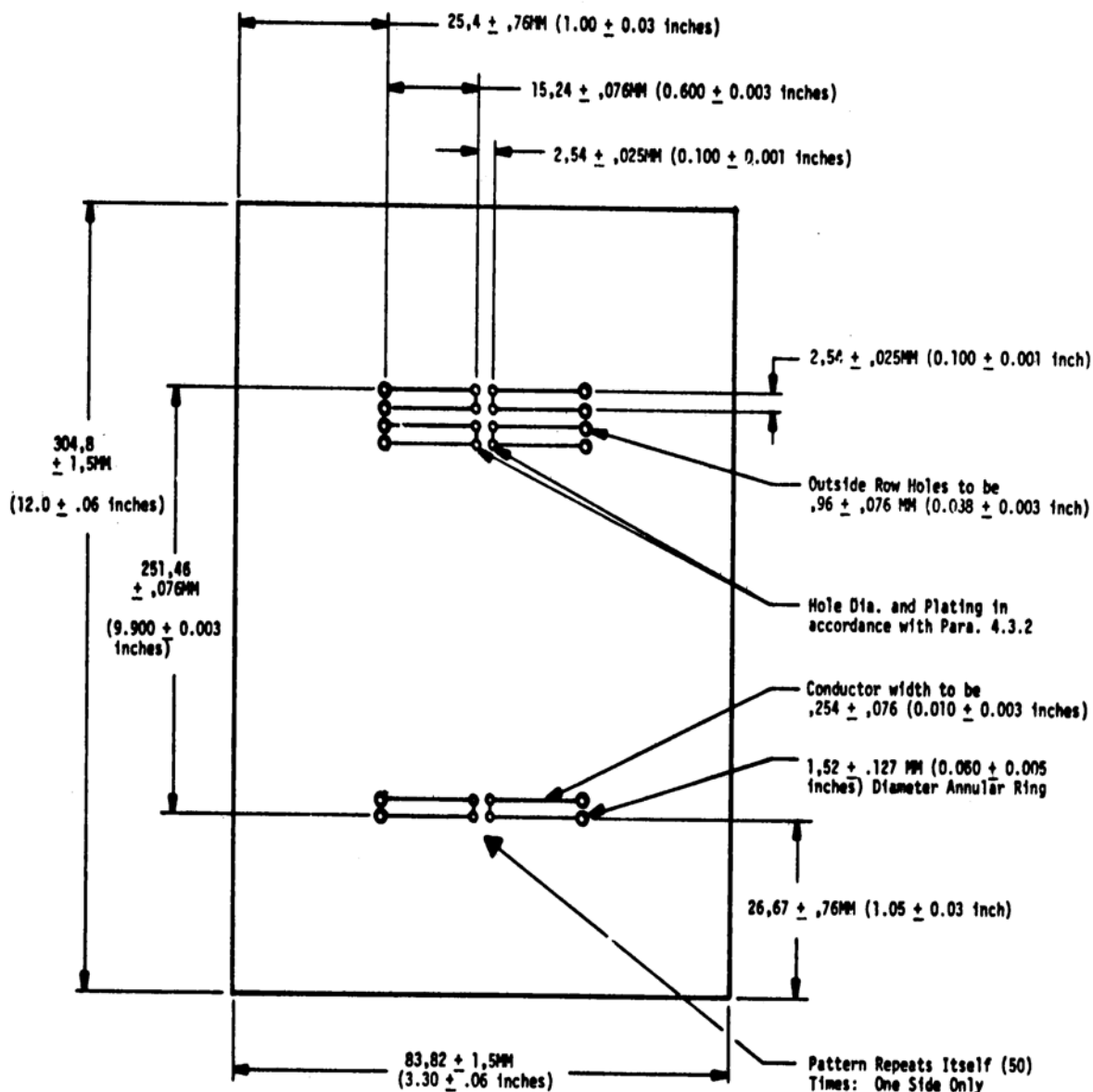


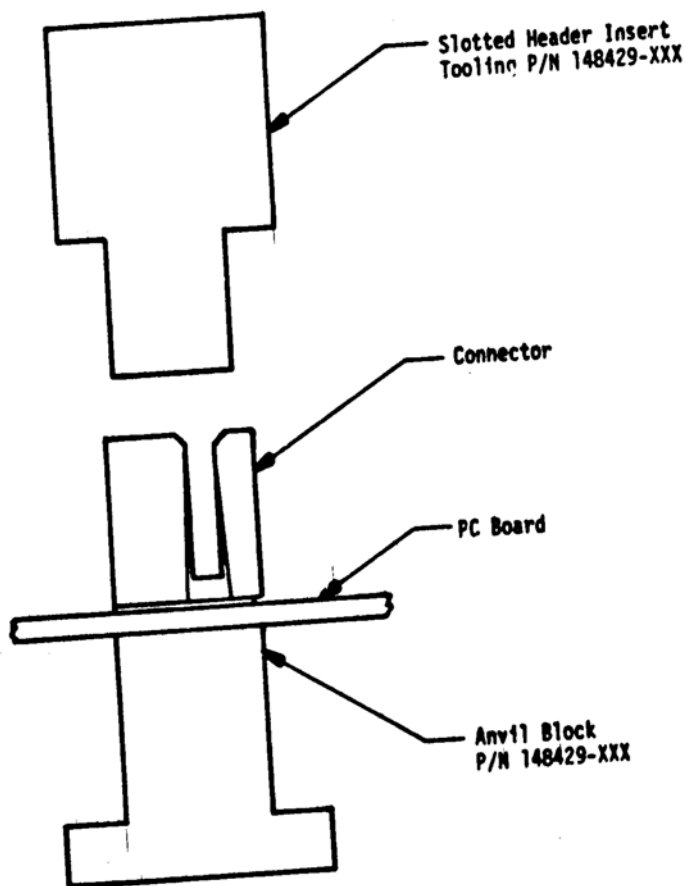


Figure 6 – Printed Wiring Board (TEST)

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- 9.6 Printed Wiring Board Warp or Twisted Limitations. Board warp or twist shall not exceed 25, 4MM/MM (0.010 in./in.) measurement shall be made per the requirements of IPC-A-600C.
- 9.7 Board Machining. Edges and openings shall be routed, drilled, or blanked to dimensions and tolerance shown in Figure 6. These machining operations shall not cause cracks, crazing, chipping or delaminations in excess of 1,52MM (0.06 inches) beyond the edge of any opening (hole, slot, etc.) or outside edge. Opening shall be free of foreign material.
- 9.8 Conductor Separation. The conductors on finished circuit boards shall show no evidence of lifting from the base laminate when examined without magnification. Blisters or wrinkles in the copper are evidence of separation.
- 9.9 Press Fit Connector Application. The connector shall be applied to the PC board according to the size of quantity specified in Para. 9.10 test sequence. The connector shall be applied with the proper FCI press or equivalent, using the tools as illustrated in Figure 7.

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NOTE: The Dash Numbers (XXX) used for the tooling are significant. Example: To apply a 2 X 50 Position Header use Tool # 148429-050.

Figure 7 – Application Tooling Slotted Header

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9.10 Test Sequence: The sample connectors shall be subject to the inspections specified in Table II in the order shown with samples from Table 1.

TABLE 1 - TEST SAMPLES

SAMPLE NO.	NO OF CONTACTS	CONFIGURATION
1	10 (2x5)	Solder Tail (30 u" Gold)
2	100 (2x50)	Solder Tail (30 u" Gold)
3	200 (2x100)	Solder Tail (30 u" Gold)
4	10 (2x5)	Press Fit (15 u" Gold)
5	100 (2x50)	Press Fit (15 u" Gold)
6	200 (2x100)	Press Fit (15 u" Gold)
7	100 (2x50)	Solder Tail (15 u" Pd. Ni.)
8	100 (2x50)	Solder Tail (15 u" Pd. Ni.)
9	100 (2x50)	Solder Tail (Gold Flash)
10	100 (2x50)	Press Fit (15 u" Pd Ni)
11	200 (2x100)	Press Fit (15 u" Pd Ni)
12	200 (2x100)	Press Fit (Duplex Plating)
13	Pinless Shroud	2x5 thru 2x10
14	Pinless Shroud	2x11 thru 2x30
15	Pinless Shroud	2x31 thru 2x60
16	Pinless Shroud	2x61 thru 2x100



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TABLE II – CONNECTOR QUALIFICATION INSPECTION

Examination or Test	PARA.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Insulation Resistance	6.2	x															
Dielectric Withstanding Voltage	6.3	x															
Capacitance	6.4	x															
Low-Level Circuit Resist.	6.5						x					x	x				
Wrapper Resistance	6.6						x					x	x				
Contact Retention	7.1		x				x										
Wrap Post Torque	7.2						x										
Solderability	7.3		x					x	x	x							
Stripping Force	7.4						x										
Pinless Shroud Retention	7.5													x	x	x	x
Humidity	8.1						x					x	x				
Thermal Shock	8.2						x										
High Temperature Life	8.3						x										
Shock	8.4						x										
Vibration	8.5					x											
Hydrogen Sulfide	8.6						x					x	x				
Salt Spray	8.7						x					x	x				
Gas Tightness	8.8						x					x	x				
Temperature Cycling	8.9		x														
Resistance to Soldering Heat	8.10			x													
Resistance to Solvents Heat	8.11			x													
Resistance to Vapor Soldering	8.12						x										


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- 9.11 Acceptance Inspection. Acceptance Inspection shall consist of the inspection and testing performed in Table II at a level detailed in Table III.

TABLE 111 – ACCEPTANCE INSPECTION

<u>EXAMINATION</u>	<u>AQL</u>	
	<u>Major</u>	<u>Minor</u>
Visual & Mechanical	1.0%	4.0%

- 9.12 Inspection Lot. An inspection lot shall consist of all connectors produced under essentially the same conditions and offered for inspection at one time.
- 9.13 Sampling Plan. Statistical sampling and inspection shall be in accordance with MIL-STD-105 for General Inspection, Level II. The Acceptable Quality Level (AQL) shall be as specified in Table III. Major and minor defects shall be as defined in MIL-STD-105.
- 9.14 Rejected Lot. Rejected lots shall be reworked to correct the defects or inspected to remove defective units and resubmitted for inspection.
- 9.15 Disposition of Sample Units. Sample units that have been subjected to the acceptance inspection shall be considered deliverable on the contract or purchase order.

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REVISION RECORD

<u>REVISION</u>	<u>PAGE</u>	<u>DESCRIPTION</u>	<u>EC#</u>	<u>DATE</u>
A	All	Revised all sheets	13921	4/28/87
B	All	Revised all sheets	V06-1029	10/10/06

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