1.0 GENERAL

Scope – This specification covers the insulation piercing Quickie Backplane Connector System designed for Backplane-to-flat cable (round conductor) interconnection in low power applications. This specification is composed of the following sections.

2.0 APPLICABLE DOCUMENTS

The following documents, of the issue in effect on the date of the latest revision of this specification, shall form a part of this specification to the extent specified herein.

Military Specifications

MIL-M-24519	Molding Plastic, Polyester thermoplastic
MIL-G-45204	Gold Plating, Electrodeposited
MIL-C-45662	Calibration System Requirements
MIL-P-55110	Printed Wiring Boards

Military Standards

MIL-STD-105	Sampling Procedures and Tables for Inspection By Attributes.
MIL-STD-202	Test Methods for Electronic and Electrical Component Parts.
MIL-STD-275	Printed Wiring Board For Electrical Equipment.
MIL-STD-1344	Test Methods For Electrical Connectors.

Federal Specifications

QQ-N-290	Nickel Plating (Electrodeposited)
QQ-B-750	Bronze, Phosphor; Bar, Plate, Rod, Sheet, Strip, Flat, Wire, and Structural and Special Shaped Sections.

Industry Specifications / Standards

UL-94	Tests for Flammability of Plastic Materials.

Company Product Specification

BUS-12-01	Round Conductor Flat Flexible Cable.

3.0 REQUIREMENTS

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

3.2 Material – The material for each part shall be as specified herein, or equivalent. Substitute material shall meet the performance required of this specification.

3.2.1 Contact – The female contact shall be full – hard phosphor bronze in accordance with QQ-B-750, Composition A.

3.2.2 Plastic – Also molded plastic parts of the female connector and shroud shall be filled polyester in accordance with MIL-M-24519. All plastic material shall be rated flame retardant 94 V-0 in accordance with UL-94.

3.3 Finish – The female contact shall be plated in the contact area with 30 micro-inches (minimum) gold per MIL-G-45204, Type II, Grade C over 50 micro-inches (minimum) nickel per QQ-N-290, Class 2.

3.4 Design and Construction – The female connector shall be of multi-piece design, consisting of: contacts having self stripping terminations and two single ended cantilever spring members for interfacing with 0.025 inch square backplane contacts; a housing to maintain the contacts in position to interface with the backplane contacts on a 0.100 inch square grid and with the terminating cable, having conductors on 0.050 inch centers; and a pre-loaded cover providing an integral slot for alignment of cable during termination. The shroud shall be of one-piece construction and, when installed over the backplane contacts, shall simulate a composite two-row male header for mating with the female connector.

3.4.1 Installation

3.4.1.1 Female Connector – The female connector shall simultaneously terminate up to 60 wires size AWG 28 (stranded) or AWG 30 (solid) on 0.050 inch centers without pre-stripping the PVC (polyvinylchloride) cable insulation. The cable shall conform to the requirements of Company Specification BUS-12-001.

3.4.1.2 Shroud – The shroud shall be capable of being assembled within an 0.100 by 0.100 field of .025 inch square backplane contacts. The shroud will utilize four rows of contacts and a number of contacts per row two greater than that of the female connector with which it will be mated; the two outside rows and eight end contacts shall not be functional as disconnects. Iterative use of the shroud in end-to-end or side-to-side locations shall be possible on a continuous basis, without the elimination of an intervening row of contacts in the former and with the elimination of one intervening row in the latter.

3.4.2 Polarization – An optional, molded-in polarizing feature shall be available to insure correct orientation of the female connector and shrouded backpanel contacts.

3.4.3 Mating – The connector system shall be capable of mating and un-mating by hand without the use of special tools within the specified temperature range.

3.4.4 Workmanship – Connectors and shrouds shall be uniform in quality and shall be free from burrs, scratches, cracks, voids, chips, blisters, pin holes, sharp edges,

and other defects that will adversely affect life or serviceability.

3.4.5 Interchangeability – Any female connector shall be capable of mating with any properly constituted shrouded backpanel assembly without degradation in performance.

3.5 Electrical Characteristics

3.5.1 Current Rating (see 5.1) – The maximum continuous current rating of the connector system shall be 1.0 Ampere DC.

3.5.2 Contact Resistance – The contact resistance shall not exceed 15 milliohms (20 milliohms after exposure to the environments described in paragraph 3.6.5 and 3.7.1 to 3.7.7) when measured in accordance with MIL-STD-1344, Method 3004. The following details shall apply:

(a) Method of Connection – Attach current and voltage leeds as shown in Figure 1.
(b) Test Current – 1.0 Ampere DC

3.5.3 Low Level Circuit Resistance – The low level circuit resistance shall not exceed 15 milliohms (20 milliohms after exposure to the environments described in paragraph 3.6.5 and 3.7.1 to 3.7.7) when measured in accordance with MIL-STD-1344, Method 3002. The following details shall apply:

(a) Method of connection – See Figure 1
(b) Test Current – 1 milliampere DC
(c) Maximum Open – Current Voltage – 20 millivolts DC

3.5.4 Insulation Resistance (See 5.2) – The insulation resistance of mated connectors shall be not less than 5000 megohms (1000) megohms after after exposure to the humidity environment described in paragraph 3.7.2) when measured in accordance with MIL-STD-1344, Method 3003. The following details shall apply:

(a) Test Potential – 500 volts DC
(b) Points of Measurement – Between adjacent contact positions
(c) Special Preparation – The female connector shall not be terminated.

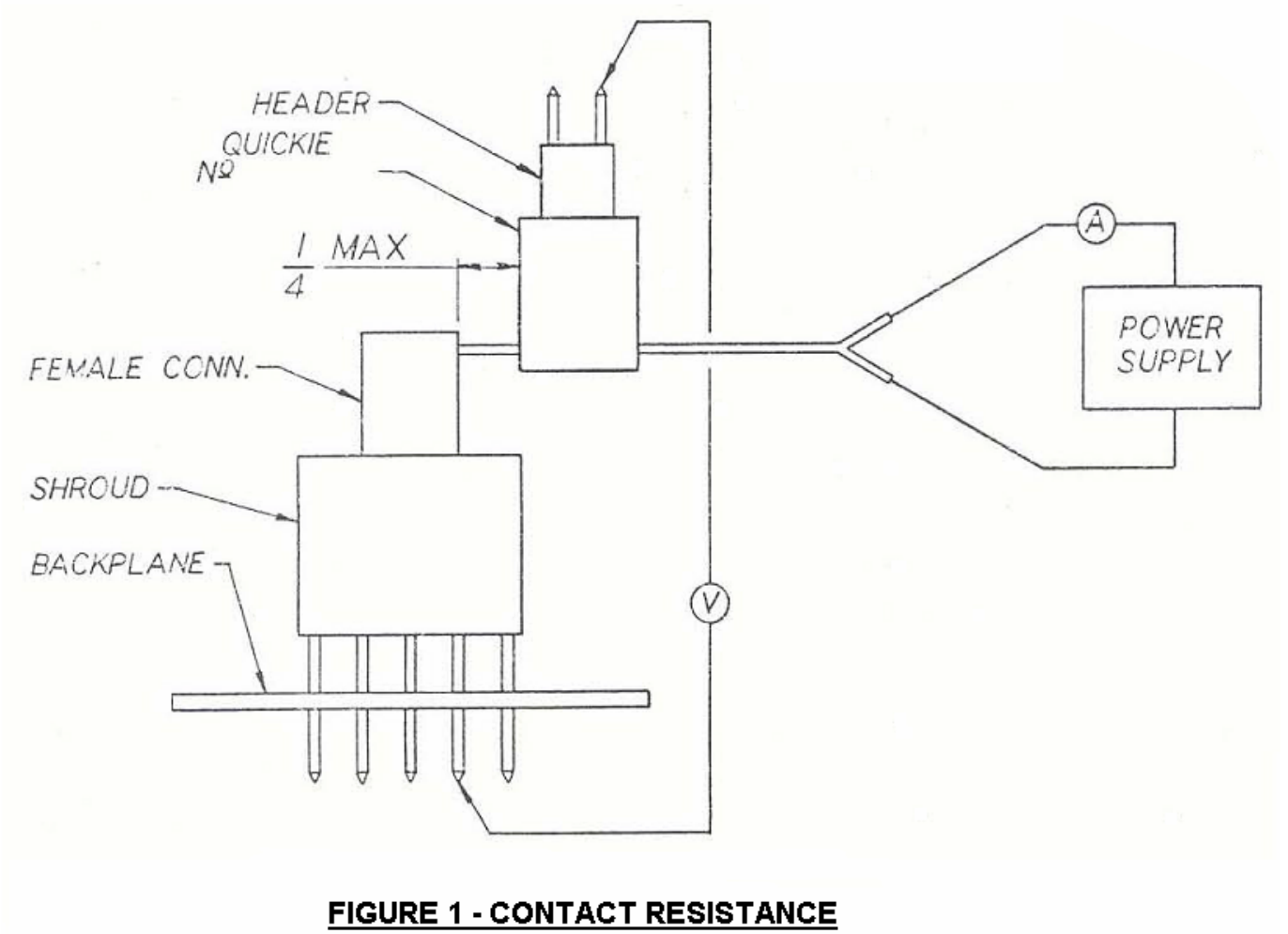


FIGURE 1 - CONTACT RESISTANCE

3.5.5 Dielectric Withstanding Voltage (see 5.2) – There shall be no evidence of arc-over, insulation breakdown, or excessive leakage current (>1milliampere) when the mated connectors are tested in accordance with MIL-STD-1344, Method 3001. The following details shall apply:

(a) Test Potential – 1000 volts RMS, 60Hz at sea-level pressure; 450 volts RMS, 60 Hz at 50,000 feet simulated altitude .
(b) Test Duration – 60 seconds
(c) Points of Measurements – Between adjacent contact positions
(d) Special Preparation – The female connector shall not be terminated.

3.6 Mechanical Characteristics

3.6.1 Cable Retention – The cable to female connector interface shall withstand the stresses imposed by twenty (20) unmatings of the female connector from the shrouded pin field when the disconnecting force is applied to the cable. The following details shall apply:

(a) Force Distribution – Evenly distributed across width of cable.
(b) Direction of Force – See Figure 2.
(c) Rate of Un-mating – 1 inch per minute.

3.6.2 Cable Flex Resistance – The cable-to-female connector interface shall withstand the stresses imposed by 100 cycles of cable flexing. The following details shall apply:

(a) Tension on Cable – 2 pounds per inch of cable width.
(b) Flex Angle - 140º as shown in Figure 3.

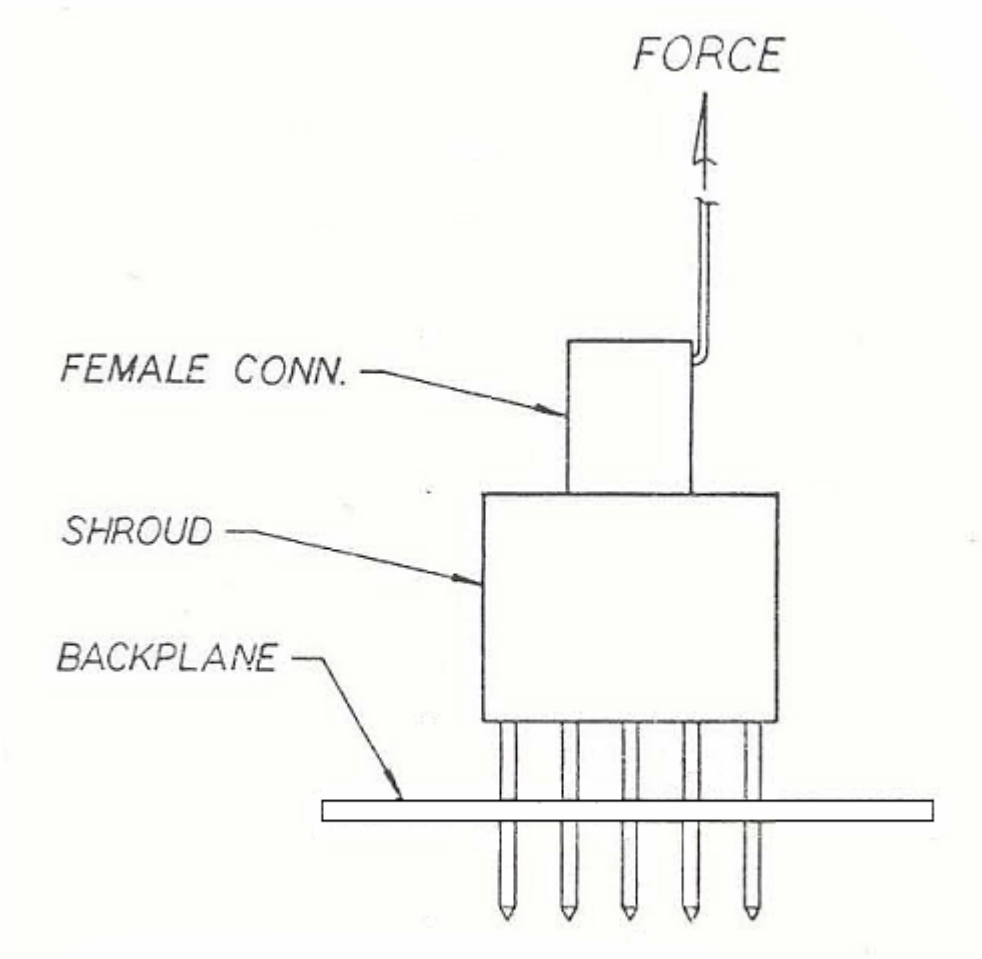
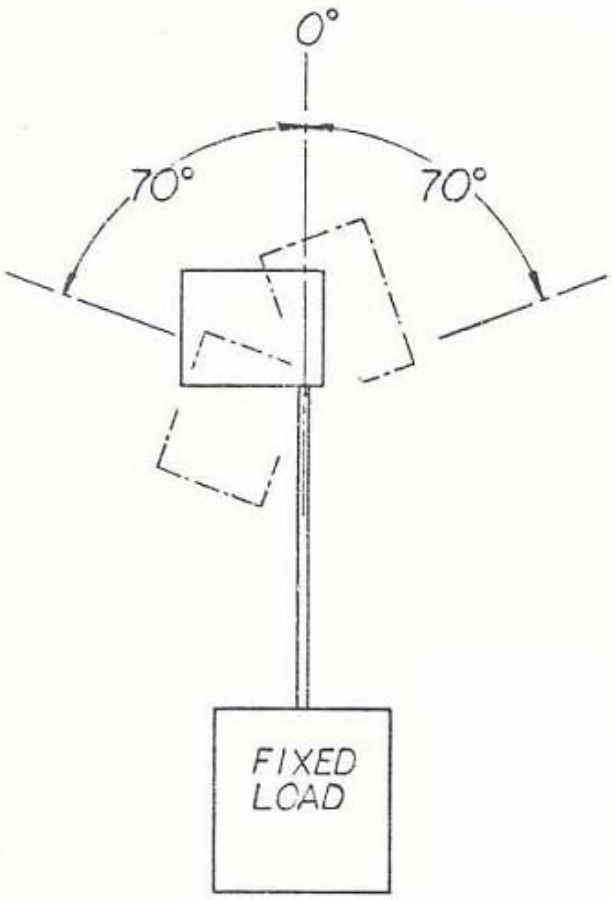


FIGURE 2 - CABLE RETENTION



ONE FLEX CYCLE CONSISTS OF CONNECTOR ROTATION FROM 0° TO +70° TO -70° AND BACK TO 0°.

FIGURE 3 - CABLE FLEX RESISTANCE

3.6.3 Total Mating Force – The total force to mate the female connector and the shrouded pin field shall not exceed the values shown in Table I. The force shall be applied at a rate not to exceed one (1) inch per minute.

TABLE I – TOTAL MATING FORCE

No. of Contacts	Force (pounds)
10	5
14	7
16	8
20	10
26	14
34	19
40	23
50	30
60	38

3.6.4 Individual Contact Separation Force – The force to withdraw the gage shown in Figure 4 from individual contact positions in the female connector shall be not less than 25 grams. The force shall be applied at a rate not to exceed one (1) inch per minute.

3.6.5 Durability – After 100 mating cycles of the female connector and the shrouded pin field, the individual contact separation force shall be not less than 25 grams (see paragraph 3.6.4) and the contact resistance shall not exceed 20 milliohms (see paragraph 3.5.2). The mating and unmating shall be performed in a manner reasonably simulating actual use.

3.6.6 Shroud Retention – After a force of ten (10) pounds is applied to either end of the installed shroud as shown in Figure 5, the shroud shall exhibit no damage or loosening with respect to the pin field in which it is installed.

3.6.7 Shroud Replacement – After the third installation of the same shroud over the same group of backpanel pins, the shroud shall exhibit no loosening with respect to the pin field.

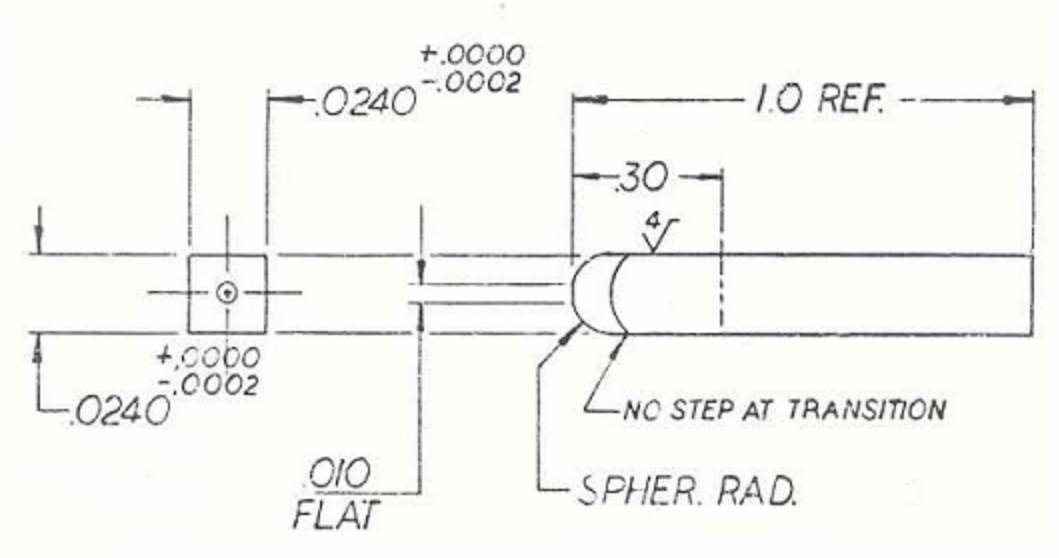


FIGURE 4 - SEPARATION FORCE GAGE

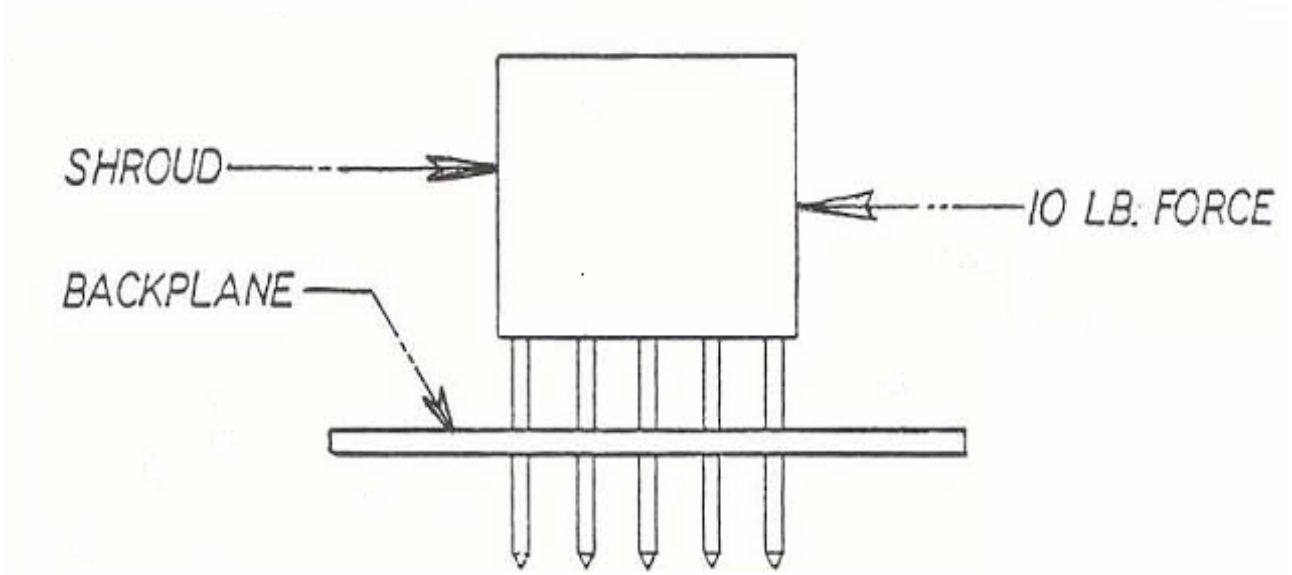


FIGURE 5 - SHROUD RETENSION

3.7 Environmental Conditions

3.7.1 Thermal Shock – After exposure of the mated connector system to alternate periods of extreme high and low temperature, there shall be no evidence of

cracking or crazing of any plastic component or other physical damage to the connector. The dielectric withstanding voltage shall be not less than 1000 volts RMS (see paragraph 3.5.5). The test shall be in accordance with MIL-STD-1344, Method 1003. The following details and exceptions shall apply:

(a) Test Condition – A
(b) Temperature Range - + 105º C to - 65º C
(c) Number of Cycles – 5 (1 cycle consisting of 30 minutes at each temperature).
(d) Transfer Time – 30 seconds, maximum

3.7.2 Humidity – Within one (1) hour after exposure of the mated connector system to a high humidity environment, the insulation resistance shall be no less than 1000 megohms (see paragraph 3.5.4) and the low level circuit resistance shall not exceed 20 milliohms (see paragraph 3.5.3). The test shall be in accordance with MIL-STD-1344, Method 1002. The following details shall apply:

(a) Test Condition – B (96 hours)
(b) Relative Humidity - 90% minimum (Type I – Steady State).
(c) Temperature - + 40º C

3.7.3 High Temperature Life – After exposure of the mated connector system to a high temperature operating environment, the insulation resistance shall be no less than 5000 megohms (see paragraph 3.5.4) and the contact resistance shall not exceed 20 milliohms (see paragraph 3.5.2). The test shall be in accordance with MIL-STD-1344, Method 1005. The following details shall apply:

(a) Test Chamber Temperature – Adjusted to provide connector system temperature of 105º C during operating period.
(b) Test Duration – B (250 hours)
(c) Operating Conditions – 1.0 ampere DC current through all contacts of connector system; duty cycle: 45 minutes ON and 15 minutes OFF.

3.7.4 Shock – There shall be no evidence of physical or mechanical damage when the mated connector system is subjected to transient accelerations. During and after each shock, the contacts shall evidence no discontinuity greater than ONE (1) microsecond. The shroud shall not move more than 0.005 inch from its original assembled position as a result of this test. The test shall be in accordance with MIL_STD-1344, Method 2004. The following details shall apply:

(a) Test Conditions – G (100G, 6 ms Sawtooth)

(b) Number of Shocks – 3 shocks in each direction along three orthogonal axes (18 total)
(c) Mounting – See Figure 6

3.7.5 Vibrations – There shall be no evidence of physical or mechanical damage when the mated connector system is subjected to prolonged mechanical vibration. During vibration along each axis, the contacts shall evidence no discontinuity greater than one (1) microsecond. The shroud shall not move more than 0.005 inch from its original assembled position as a result of this test. At the completion of the test, the individual contact separation force shall be not less than 25 grams (see paragraph 3.6.4) and the contact resistance shall not exceed 15 milliohms (see paragraph 3.5.2). The test shall be in accordance with MIL-STD-1344, Method 2005. The following details shall apply:

(a) Test Condition – III (+15G, 10 to 2000 Hz)
(b) Duration – 4 hours along each of three orthogonal axes (12 hour total)
(c) Mounting – See Figure 6

3.7.6 Hydrogen Sulfide (H2S) Exposure – After exposure of the mated connector system to an H2S atmosphere, the low level circuit resistance shall not exceed 20 milliohms (see paragraph 3.5.3). The following details shall apply:

(a) Atmosphere – 3ppm H2S in moist air.
(b) Temperature - + 40º C
(c) Duration – 96 hours

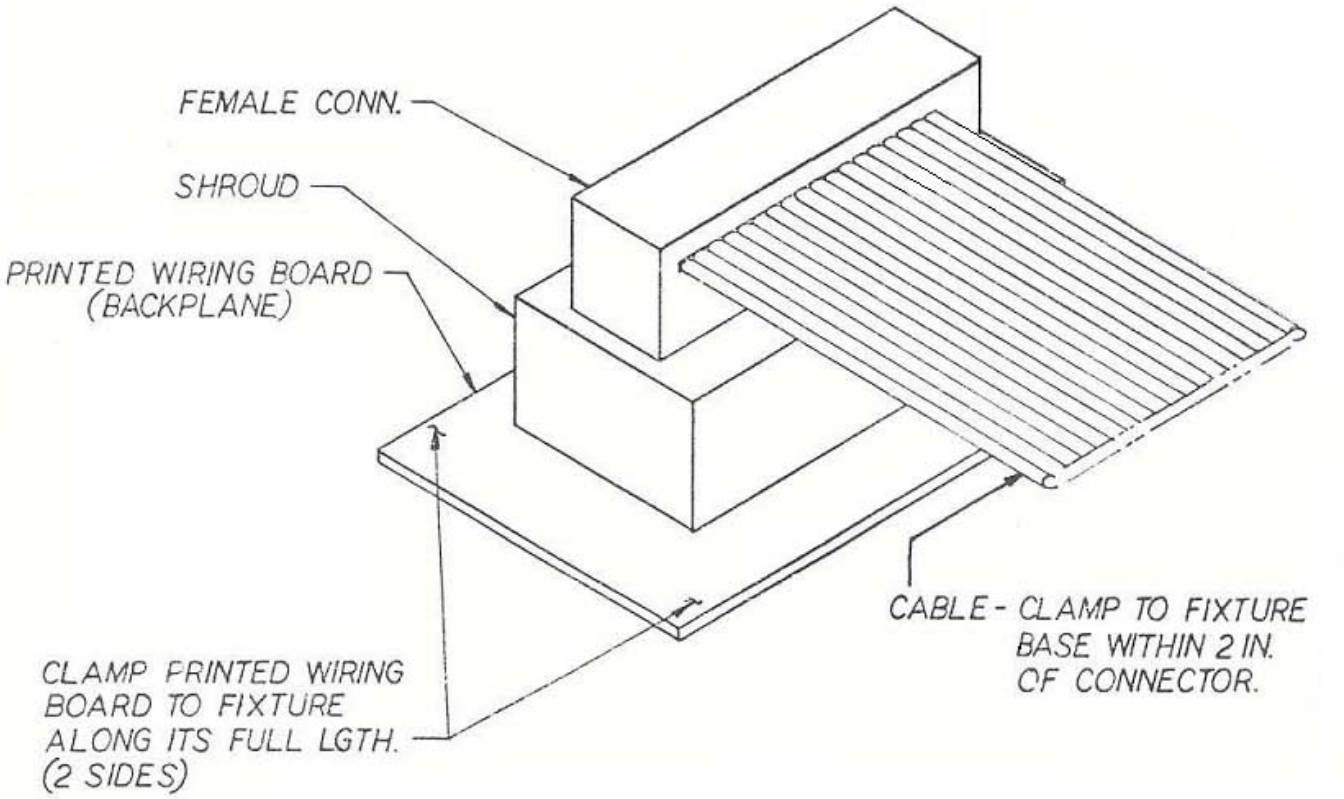


FIGURE 6 - MOUNTING FOR SHOCK & VIBRATION

3.7.7 Salt Spray – After exposure of the mated connector system to a salt fog atmosphere, the low level circuit resistance shall not exceed 20 milliohms (see

paragraph 3.5.3). The test shall be in accordance with MIL-STD-1344, Method 1001. The following details shall apply:

(a) Salt Solution - 5%
(b) Duration – B (48 hours)

3.7.8 Solvent Resistance – After immersion in solvents commonly encountered in soldered connector applications, the shroud shall exhibit no evidence of swelling, softening, cracking, crazing, dimensional change, or other defect that would affect the service life of the connector system. The test shall be in accordance with MIL-STD-202, Method 215.

4.0 Quality Assurance Provisions

4.1 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-C-45662.

4.2 Inspection Conditions – Unless otherwise specified herein, all inspections shall be performed under the following ambient conditions:
(a) Temperature - 25º C + 5º C
(b) Relative Humidity – 30% to 80%
(c) Barometric Pressure – Local Ambient

4.3 Qualification Inspection – Qualification inspection shall be performed on sample units produced with equipment and procedures normally used in production.

4.3.1 Sample – Components for six (6) of the largest and three (3) of the smallest population backplane connector systems and three (3) of the largest shrouds shall be subjected to the qualification inspection.

4.3.2 Preparation of Samples

4.3.2.1 Female Connector – The female connectors shall be configured and terminated as shown in Table II.

TABLE II - FEMALE CONNECTOR DESCRIPTION

Connector	No. of	Wire	Wire

Number	Contacts	Size	Type	Length
1-2	Largest	AWG 28	Stranded	10 inches
3	Largest	----------	Not Terminated	----------
4-5	Largest	AWG 28	Stranded	10 inches
6	Largest	AWG 30	Solid	10 inches
7-8	Smallest	AWG 28	Stranded	10 inches
9	Smallest	AWG 30	Solid	10 inches

4.3.2.2 Printed Wiring Test Boards – Eight (8) test boards conforming to the applicable requirements of MIL-P-55110 and MIL-STD-275 shall be prepared as shown in Figure 7.

4.3.2.3 Backplane Assembly – Pin contacts shall be staked and soldered into the printed wiring test boards to form simulated back-plane assemblies. The pin tip configuration and true position tolerance shall be as shown in Figure 8. Shrouds shall be installed to complete the backplane assembly.

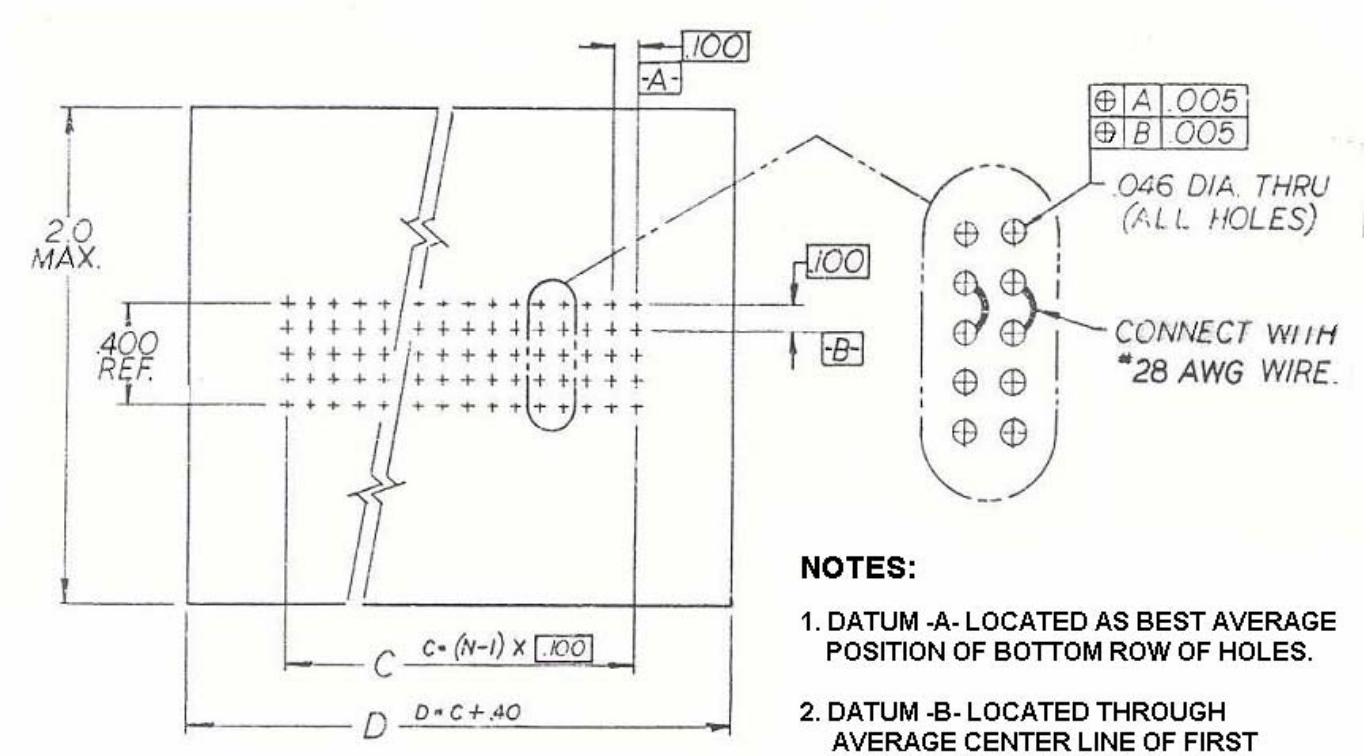
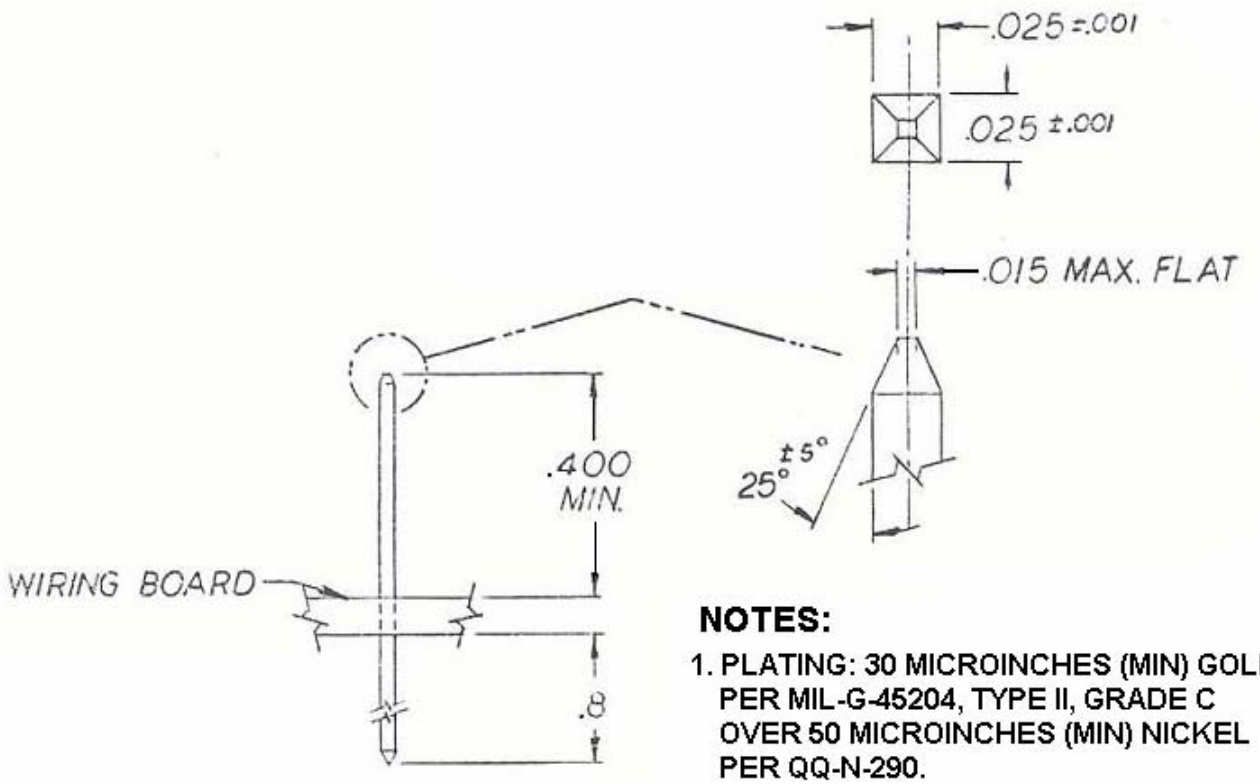


FIGURE 7 - PRINTED WIRING BOARD

NOTES:

1. DATUM -A- LOCATED AS BEST AVERAGE POSITION OF BOTTOM ROW OF HOLES.
2. DATUM -B- LOCATED THROUGH AVERAGE CENTER LINE OF FIRST HOLES.
3. BOARD TO BE 2 OZ. , SINGLE SIDED, COPPER CLAD, GLASS FILLED EPOXY .062 +/- .010 THICK.



NOTES:

1. PLATING: 30 MICROINCHES (MIN) GOLD PER MIL-G-45204, TYPE II, GRADE C OVER 50 MICROINCHES (MIN) NICKEL PER QQ-N-290.
2. TIPS OF INSTALLED PINS TO BE WITHIN .015 DIA. OF TRUE POSITION RELATIVE TO OTHER PINS IN FIELD.

FIGURE 8 - BACKPLANE PINS

TABLE III - CONNECTOR SYATEM QUALIFICATION INSPECTION

Examination	Paragraph	Sample No. 1	2	3	4	5	6	7	8	9	10
Total Mating Force	3.6.2	-	-	-	X	X	X	X	X	X	-
Individual Contact Separation Force	3.6.4	-	-	-	X	X	X	-	-	-	-
Cable Retention	3.6.1	-	-	-	X	-	-	X	-	-	-
Cable Flex Resistance	3.6.2	X	-	-	X	-	-	X	-	-	-
Shroud Retention	3.6.6	X	-	-	X	-	-	-	-	-	-
Contact Resistance	3.5.2	X	X	-	X	X	X	X	X	X	-
Insulation Resistance	3.5.4	-	-	X	-	-	-	-	-	-	-
Dielectric Withstanding Voltage	3.5.5	-	-	X	-	-	-	-	-	-	-
Thermal Shock	3.7.1	X	X	X	-	-	-	-	-	-	-
Humidity	3.7.2	X	X	X	-	-	-	-	-	-	-
High Temperature Life	3.7.3	X	X	X	-	-	-	-	-	-	-
Shock	3.7.4	-	-	-	X	X	-	-	-	-	-
Vibration	3.7.5	-	-	-	X	X	-	-	-	-	-
Durability	3.6.5	-	-	-	X	-	X	X	X	X	-
Hydrogen Sulfide Exposure	3.7.6	-	-	-	X	X	X	X	X	X	-
Salt Spray	3.7.7	-	-	-	X	X	X	X	X	X	-
Solvent Resistance	3.7.8	-	-	-	-	-	-	-	-	-	X

4.3.3. Test Sequence – The sample connector systems and individual shrouds shall be subjected to the inspections specified in Table III, in the order shown.

4.4 Quality Conformance Inspection – Quality conformance inspection shall be performed on sample units produced with equipment and procedures normally used in production.

4.4.1 Sample – Components for six (6) of the largest population backplane connector system shall be selected at random from items produced every 6 to 12 months and subjected to quality conformance inspection.

4.4.2 Preparation of Samples

4.4.2.1 Female Connector – The female connectors shall be configured and terminated as shown in Table IV.

TABLE IV – FEMALE CONNECTOR DESCRIPTION

Connector No.	Wire Size	Wire Type	Length
1-2	AWG 28	Stranded	10 inch
3	--------	Not Terminated	---------
4-5	AWG 28	Stranded	10 inch
6	AWG 30	Solid	10 inch

4.4.2.2 Printed Wiring Test Boards – Five (5) test boards conforming to the applicable requirements of MIL-P-55110 and MIL-STD-275 shall be prepared as shown in Figure 7.

4.4.2.3 Backplane Assembly – Pin contacts shall be staked and soldered into the printed wiring test boards to form simulated backplane assemblies. The pin tip configuration and true position tolerance shall be as shown in Figure 8. Shrouds shall be installed to complete the backplane assembly.

4.4.3 Test Sequence – The sample connector system shall be subjected to the inspections specified in Table V, in the order shown.

TABLE V – CONNECTOR SYSTEM QUALITY CONFORMANCE INSPECTION

Examination	Paragraph	Sample No. 1	2	3	4	5	6
Total Mating Force	3.6.3	-	-	-	X	X	X
Individual Contact Separation Force	3.6.4	-	-	-	X	X	X
Cable Retention	3.6.1	-	-	-	-	X	-
Cable Flex Resistance	3.6.2	X	-	-	X	-	-
Shroud Retention	3.6.6	X	-	-	X	-	-
Shroud Replacement	3.6.7	-	X	-	-	X	-
Contact Resistance	3.5.2	X	X	-	X	X	X
Insulation Resistance	3.5.4	-	-	X	-	-	-
Dielectric Withstanding Voltage	3.5.5	-	-	X	-	-	-
Thermal Shock	3.7.1	X	X	X	-	-	-
Humidity	3.7.2	X	X	X	-	-	-
Durability	3.6.5	-	-	-	X	-	X
Hydrogen Sulfide Exposure	3.7.6	-	-	-	X	X	X
Salt Spray	3.7.7	-	-	-	X	X	X

4.4.4 Failures – If a connector system or component fails to pass the quality conformance inspection, appropriate corrective action shall be taken on the materials or processes and additional sample units shall be subjected to the quality conformance inspection to verify the effectiveness of the action.

4.4.5 Disposition of Sample Units – Sample units that have been subjected to the quality conformance inspection shall not be considered deliverable on the contract or purchase order.

4.5 Acceptance Inspection – Acceptance inspection shall consist of the examination and inspections specified in Table VI.

TABLE VI – ACCEPTANCE INSPECTION

Examination	AQL Major	AQL Minor
Visual and Mechanical	1.0%	4.0%

4.5.1 Inspection Lot – An inspection lot shall consist of all components produced under essentially the same conditions and offered for inspection at one time.

4.5.2 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 VI. Major and minor defects shall be as defined in MIL-STD-105.

4.5.3 Rejected Lots – Rejected lots shall be reworked to correct the defects or screened to remove defective units and re-submitted for inspection.

4.5.4 Disposition of Sample Units – Sample units that have been subjected to the acceptance inspection shall be considered deliverable on the contract or purchase order.

5.0 Notes and Definitions

5.1 Current Rating – The current rating of the backplane connector system is dependent on the cross-sectional area of the printed wiring board traces to which it is connected and upon the size of the flat cable conductor. The maximum continuous rating assumes the use of AWG 28 wire and a printed wiring board trace of comparable cross-section.

5.2 Insulation Resistance / Dielectric Withstanding Voltage – The specified values for these parameters assume no (or very limited) effect of the printed wiring board. If these assumptions are not met, the limits can be expected to be exceeded. The test omits the flat cable from the specification for insulation resistance due to its relatively low value and its variability with length.

Rev	Page	Revision	ECR #	Date
A	10	Section 3.6.6 changed “the middle” to “either end”.	7413	7/28/81
B	ALL	Re-typed on New Format	V06-0263	3-15-06

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