INCH-POUND

MIL-A-24741
19 JANUARY 1990

MILITARY SPECIFICATION

ASSEMBLIES, METAL ELECTRICAL BACKPLANE, ONE AND TWO LAYER, GENERAL SPECIFICATION FOR

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the general requirements for metal electrical backplane assemblies consisting of one and two layers on which separately manufactured component parts have been added.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 55Z3, Department of the Navy, Washington, D.C. 20362-5101, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 5998

1.2 Classification.

1.2.1 Types. Metal electrical backplane assemblies shall be of the following types:

(a) Type 1: one layer.
(b) Type 2: two layer.

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATIONS

FEDERAL

L-P-509	-	Plastic Sheet, Rod and Tube, Laminated, Thermosetting.
QQ-A-250	-	Aluminum and Aluminum Alloy Plate and Sheet, General Specification for.
QQ-A-250/8	-	Aluminum Alloy 5052, Plate and Sheet.
QQ-A-250/11	-	Aluminum Alloy 6061, Plate and Sheet.

MILITARY

MIL-C-5541	-	Chemical Conversion Coatings on Aluminum and Aluminum Alloys.
MIL-A-8625	-	Anodic Coatings, for Aluminum and Aluminum Alloys.
MIL-C-28754	-	Connectors, Electrical, Modular, and Component Parts, General Specification for.
MIL-C-28754/39-		Connectors, Electrical, Modular, Connector, Type III, Keying Pegs.
MIL-I-43553	-	Ink, Marking, Epoxy Base.
MIL-C-55330	-	Connectors, Electrical and Fiber Optic, Packaging of.

STANDARDS

MILITARY

DOD-STD-100 - Engineering Drawing Practices.
MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-129 - Marking for Shipment and Storage.
MIL-STD-202 - Test Methods for Electronic and Electrical Component Parts.
MIL-STD-1344 - Test Methods for Electrical Connectors.
MIL-STD-45662 - Calibration Systems Requirements.
MIL-STD-2198 - Design Requirements for Metal Electrical Backplane Assemblies.

(Unless otherwise indicated, copies of federal and military specifications and standards are available from the Naval Publications and Forms Center, (ATTN: NPODS), 5801 Tabor Avenue, Philadelphia, PA 19120-5099.)

2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted are those listed in the issue of the DODISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI B46.1 - Surface Texture (Surface Roughness, Waviness, and Lay).

(Application for copies should be addressed to the American National Standards Institute, 1430 Broadway, New York, NY 10018-3308.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1187.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Requirements. One layer and two layer metal electrical backplane assemblies furnished under this specification shall be products which meet the requirements of MIL-STD-2198 and the backplane assembly drawing. The one layer or two layer metal electrical backplane assembly drawings shall be in accordance with DOD-STD-100. In the event of a conflict between MIL-STD-2198 and the backplane assembly drawing, the latter shall govern.

3.2 Qualification. One layer and two layer metal electrical backplane assemblies furnished under this specification shall be products which are authorized by the qualifying activity for listing on the applicable Qualified Manufacturer's List (QML) at the time of award (see 4.6 and 6.4).

3.3 Material. The type of material shall be as specified in MIL-STD-2198 and the backplane assembly drawing. Acceptance or approval of any constituent material shall not be construed as a guarantee of the acceptance of the finished product.

3.3.1 Contact and bushing sets. The contact and bushing sets shall be as specified in MIL-C-28754.

3.3.2 Keying pegs. The keying pegs shall be as specified in MIL-C-28754/39.

3.3.3 Marking ink. Marking ink shall be an epoxy base ink conforming to MIL-I-43553.

3.4 Design and construction. One layer and two layer metal electrical backplanes shall conform to the design, construction and physical dimensions specified in MIL-STD-2198 and in the assembly drawing.

3.4.1 Wrappost tail tip position. Unless otherwise specified on the backplane assembly drawing, all wrappost tail tip positions shall be within a positional tolerance of 0.020 inch (0.508 mm) diameter to datums specified on the backplane assembly drawing.

3.4.2 Holes. The mounting holes in either the one or the two layer metal electrical backplane shall meet the following requirements.

3.4.2.1 Contact and bushing set holes. Holes for the contact and bushing sets shall be 0.0725 ±0.0015 inch (1.8415 ±0.0381 mm) diameter on a grid of 0.100 inch (2.540 mm). This requirement shall be met for a minimum of 50 percent of the backplane thickness.

3.4.2.2 Mounting and other holes. Holes for mounting and other purposes in the assembly are optional.

3.4.3 Assembly of contact and bushing sets. The assembly of the contact and bushing sets shall satisfy the workmanship standards established by figure 1 when visually inspected at a magnification of 10 power. Contacts shall be installed in the insulator bushing in such a manner that the contacts are flush or below the top surface of the bushing a maximum of 0.020 inch (0.508 mm). The bushing shall be free of damage on the top surface. Figure 1A is a preferred condition. Figures 1B and 1C are unacceptable conditions. If more than 5 percent of the contact and bushing sets display any condition depicted in figures 1D through 1I, the backplane is unacceptable.

3.5 Electrical requirements.

3.5.1 Insulation resistance. When the metal backplanes are tested in accordance with 4.9.1, the insulation resistance shall be 100,000 megohms minimum before humidity test for the one layer backplane, and 100 megohms minimum before humidity test for the two layer backplane.

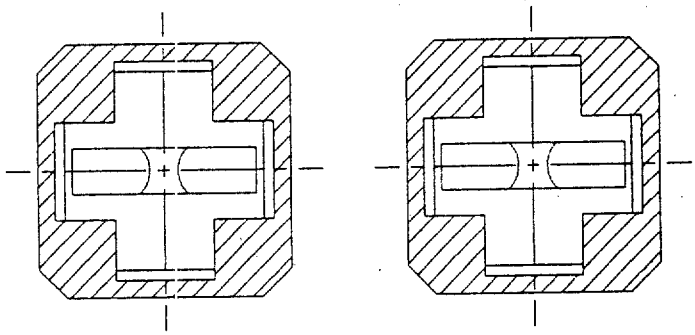


FIGURE 1A. Idealized condition.

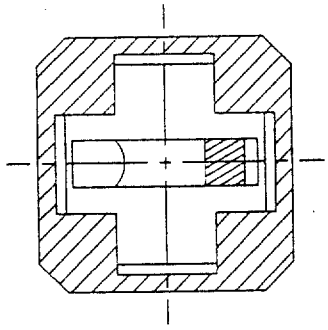


FIGURE 1B. Either tine broken.

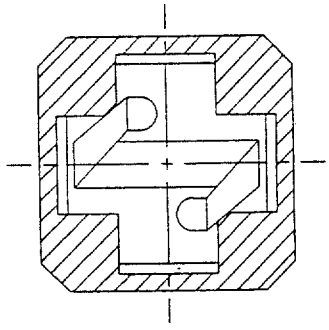


FIGURE 1C. Both contact tines twisted.

FIGURE 1. Contact and bushing set workmanship standards.

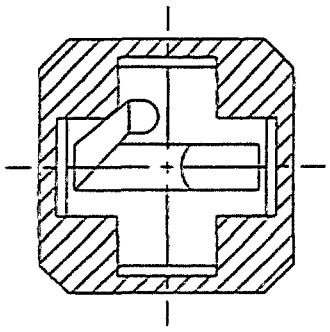


FIGURE 1D. Single contact tine twisted.

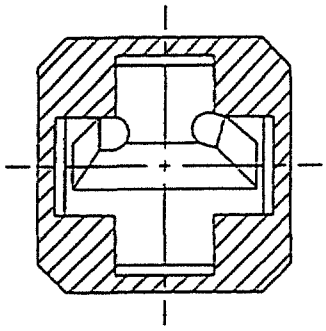


FIGURE 1E. Contact tines against bushing.

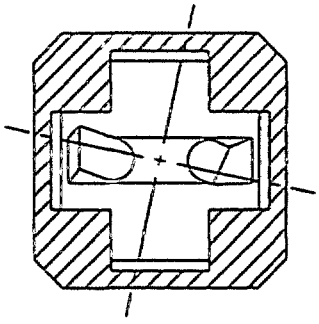


FIGURE 1F. Bushing rotated and contact tines twisted.

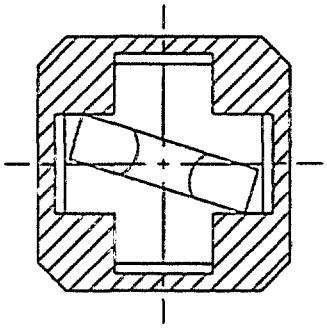


FIGURE 1G. Contact orientation not central to cruciform and contact tines bridging bushing.

FIGURE 1. Contact and bushing set workmanship standards - Continued.

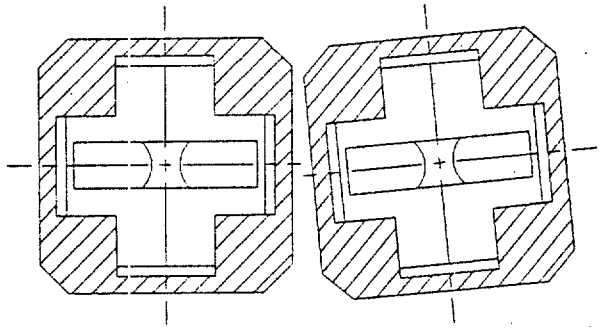


FIGURE 1H. Bushing and contacts with one set improperly oriented.

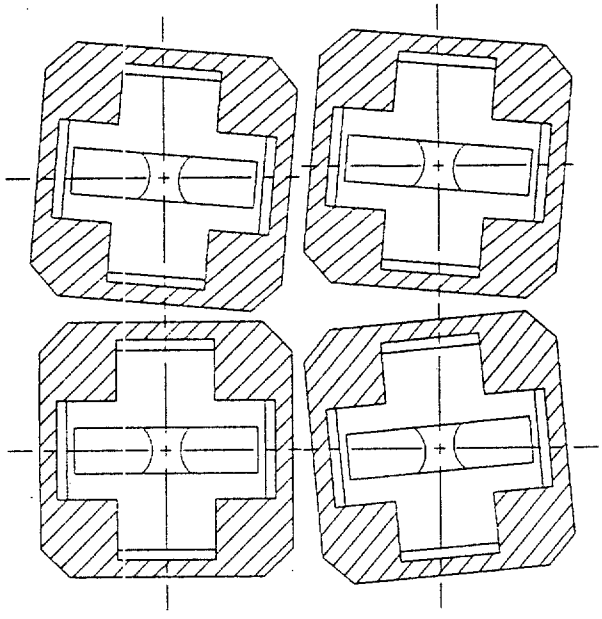


FIGURE 1I. Bushing and contacts randomly oriented in pattern.

FIGURE 1. Contact and bushing set workmanship standards - Continued.

3.5.2 Dielectric withstanding voltage. When tested in accordance with 4.9.2, there shall be no evidence of arcing, breakdown, or damage.

3.5.3 Mounting plate to contact resistance (1 and 2 layer). When the mounting plate to contact resistance is tested in accordance with 4.9.3, the voltage drop between the mounting plate and the contact in a two layer backplane shall not exceed 5.0 millivolts (mV) in the ground plane and 12.0 mV in the power plane. The voltage drop in a one layer backplane shall not exceed 20.0 mV.

3.5.4 Capacitance between the layers. When the capacitance between the layers of a two layer metal electrical backplane is tested in accordance with 4.9.4, the capacitance value between the layers shall be 30 picofarads maximum per square inch of the V_{CC} (power) plane.

3.6 Mechanical requirements.

3.6.1 Bow and twist. Unless otherwise specified on the approved assembly drawing (see 4.10.1), the maximum allowable bow and twist shall be 1.5 percent.

3.6.2 Contact and bushing retention. When the connectors are tested in accordance with 4.10.2, no contact shall have been pushed out of its bushing, nor shall any bushing have been pushed out of the base plate. There shall be no movement of the contact or bushings.

3.6.3 Contact torque. When tested in accordance with 4.10.3, the contact shall withstand a minimum torque of 3.0 ounce-inches (0.02 newton-meter). No displacement or deformation of the contact or bushing shall be visible following removal of the applied torque.

3.6.4 Keying peg retention. When tested in accordance with 4.10.4, the keying pegs installed in the housing shall withstand a removal force of 5 pounds (22 newtons) minimum.

3.6.5 Engaging and separating forces. The paragraphs below outline mechanical requirements for both standard insertion force and low insertion force contacts.

3.6.5.1 Standard insertion force. When tested in accordance with 4.10.5, the force to engage the tuning fork shall be 6.0 ounces (1.66 newtons) maximum, and the force to separate shall be 2.0 ounces (0.56 newtons) minimum.

3.6.5.2 Low Insertion Force (LIF). When tested in accordance with 4.10.5, the average force to engage shall be 2.25 ounces (0.63 newtons) maximum with random readings at 4.00 ounces (1.11 newtons) maximum. Separation force shall be 4.0 ounces (1.12 newtons) maximum.

3.6.6 LIF normal force. The average normal force shall be greater than 3.5 ounces (0.98 newtons) with random readings of no less than 3.00 ounces (0.84 newtons) allowed when tested as specified in 4.10.6.

3.7 Environmental requirements.

3.7.1 Durability. When the qualification inspection sample is tested in accordance with 4.11.1, there shall be no evidence of wear that would adversely affect the operation of the assembly. In addition, the contacts shall meet the requirements of 3.6.3 and 3.6.5.

3.7.2 Salt spray. When the qualification inspection sample is tested in accordance with 4.11.2, there shall be no visible signs of corrosion or corrosive salts on the base metal, contacts, or backplanes.

3.7.3 Shock (specified pulse). When the qualification inspection sample is tested in accordance with 4.11.3, there shall be no breakage or loosening of contacts, cracking of inserts, nor other visible or dimensional damage which could cause electrical or mechanical breakdown. There shall be no loss of electrical continuity of any of the contact circuits of more than 100 nanoseconds during test.

3.7.4 Humidity. When the qualification inspection sample is tested in accordance with 4.11.4, the backplanes shall meet the requirements of 3.5.1, 3.5.3 and 3.6.2.

3.7.5 Temperature cycling. When tested in accordance with 4.11.5, the qualification inspection sample shall show no evidence of cracking, fracturing, or other damage detrimental to the operation of the assembly.

3.7.6 Vibration. When the qualification inspection sample is tested in accordance with 4.11.6, there shall be no cracking or breaking, nor shall there be any loosening of parts, or other visible damage. There shall be no loss of electrical continuity of any of the contact circuits of more than 100 nanoseconds during the test. After testing, the assemblies shall meet the requirements of 3.5.1, 3.6.2 and 3.6.5.

3.8 Marking. The backplane assemblies shall be marked in accordance with MIL-STD-2198, using the marking ink as specified herein and on the individual assembly drawing.

3.9 Workmanship. All metal backplane assemblies shall be uniform in quality and appearance. They shall be clean and free of dirt, conductive debris, foreign matters, oil, fingerprints, corrosion, salts, burrs, sharp edges and contaminants. Workmanship qualities for two layer metal backplanes shall also include:

(a) There shall be no voids, cracks, or loose edges along the bond lines.

(b) An adhesive bead around the periphery of the joint is acceptable.

(c) All adhesive shall be fully cured.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements (examinations and tests) as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this specification where such inspections are deemed necessary to ensure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All contractors shall meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.1.2 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 contractor. The establishment and maintenance of a calibration system to control the accuracy of the measuring and test equipment shall be in accordance with MIL-STD-45662.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

(a) Materials inspection (see 4.4).

(b) Qualification inspection (see 4.6).

(c) Quality conformance inspection (see 4.7).

4.3 Suppliers certification.

4.3.1 Certification requirements. Certification shall consist of an evaluation of the supplier's equipment, facilities, records, and controls which are used to determine the repeatability of the manufacturing and testing processes.

4.3.2 Processes requiring certification. The following processes (if used in the manufacturing of backplane assemblies) shall be certified to their applicable specifications in accordance with 4.3.1 and this paragraph:

(a) Multilayer assembly process: See figure 2.

(b) Anodizing: MIL-A-8625.

4.3.3 Certification approval. Process certification shall be approved by the qualifying activity.

4.4 Materials inspection. Materials inspection shall consist of verification that the materials listed in table I, used in fabricating the one and two layer metal backplane assemblies, are in accordance with the applicable referenced specifications or requirements prior to such fabrication.

4.5 Inspection conditions. Unless otherwise specified herein, all inspections shall be performed in accordance with the test conditions specified in the general requirements of MIL-STD-202 and MIL-STD-1344.

4.6 Qualification inspection. Manufacturers who are QPL sources for MIL-C-28754 backplane component parts and who maintain QPL status are exempt from qualification inspection in accordance with this document. Upon application to the cognizant qualification organization, they will be listed as a QML source for these assemblies without further testing. For other manufacturers, qualification inspection shall be performed at a laboratory acceptable to the Government (see 6.4 and table II) on specimens produced with materials, equipment, and procedures that will be used in subsequent production.

TABLE I. Materials inspection.

Material	Requirement paragraph	Applicable specification
Aluminum	3.3	QQ-A-250 ASTM B209
Contact and bushing sets	3.3.1	MIL-C-28754
Keying pegs	3.3.2	MIL-C-28754/39
Marking ink	3.3.3	MIL-I-43553

4.6.1 Sample size. The supplier shall assemble five qualification inspection samples of each type of metal backplane for which qualification is desired. The qualification inspection sample shall conform to the requirements of figure 2 for both the single layer and the two layer metal backplane. Samples of the single layer metal backplane shall contain the qualified component parts of MIL-C-28754 and the keying pegs of MIL-C-28754/39. The single layer metal backplane shall be populated as specified in table III and view D-D of figure 2. The two layer metal backplane shall be populated according to instructions available from the qualifying activity (see 6.4). Three qualification inspection samples shall be tested at a laboratory acceptable to the Government, and two samples shall be filed and retained as reference samples by the supplier. The laboratory test report and the three tested qualification inspection samples shall be submitted to the cognizant qualification activity (see 6.4.1) for verification and approval.

4.6.2 Qualification inspection. Qualification inspections shall consist of examinations and tests specified in table II in the sequence shown.

4.6.3 Failures. One or more failures shall be cause for refusal to grant qualification approval. Failure criteria for specimens shall be as specified in the applicable requirement paragraph.

4.6.4 Retention of qualification. To retain qualification, all suppliers, whether or not they are a MIL-C-28754 QPL manufacturer, shall forward a report at 12-month intervals to the cognizant qualification organization. The cognizant qualification organization shall establish the initial reporting date. The report shall consist of:

(a) A summary of the results of the tests performed for inspection of product for delivery (group A) indicating the number of lots that have passed and the number that have failed. The failed lots which have been reworked shall be identified and the results of testing performed on the reworked failed lots shall be reported. An accounting shall be made of all inspection lots.

(b) A summary of the results of tests for group B quality conformance inspection tests performed and completed during a 12-month interval.

(c) Failure to submit the report within 30 days after the end of each 12-month interval shall result in loss of qualification.

TABLE II. Supplier qualification inspection.

Examination or test	Requirement paragraph	Method paragraph	Number of samples to be inspected	Number of defects allowed	Measurements per sample		
					Sample 1	2	3
Subgroup I Design and construction	3.1, 3.3, 3.4, 3.8	3.9 4.8.1	3	0	1/	1/	1/
Insulation resistance	3.5.1	4.9.1			1/	1/	1/
Dielectric withstanding voltage	3.5.2	4.9.2			1/	1/	1/
Engaging and separating forces Standard LIF Assy	3.6.5.1 3.6.5.2	4.10.5 4.10.5			1/	1/	1/
Normal force LIF	3.6.6	4.10.6			1/	1/	1/
Mounting plate to contact resistance	3.5.3	4.9.3			1/	1/	1/
Contact and bushing retnn	3.6.2	4.10.2			10	10	10
Keying peg retention	3.6.4	4.10.4			2	2	2
Contact torque	3.6.3	4.10.3			5	5	5

TABLE II. Supplier qualification inspection - Continued.

Examination or test	Requirement paragraph	Method paragraph	Number of samples to be inspected	Number of defects allowed	Measurements per sample		
					Sample 1	2	3
Subgroup II							
Durability	3.7.1	4.11.1	1	0	1/		
Contact and bushing retention	3.6.2	4.10.2			10		
Insulation resistance	3.5.1	4.9.1			1/		
Dielectric withstanding voltage	3.5.2	4.9.2			1/		
Subgroup III							
Temperature cycling	3.7.5	4.11.5	1	0		1/	
Insulation resistance	3.5.1	4.9.1				1/	
Dielectric withstanding voltage	3.5.2	4.9.2				1/	

TABLE II. Supplier qualification inspection - Continued.

Examination or test	Requirement paragraph	Method paragraph	Number of samples to be inspected	Number of defects allowed	Measurements per sample		
					Sample 1	2	3
Subgroup III (Continued)							
Salt spray	3.7.2	4.11.2	1	0		1/	
Humidity	3.7.4	4.11.4				1/	
Contact and bushing retention	3.6.2	4.10.2				10	
Dielectric withstanding voltage	3.5.2	4.9.2				1/	
Insulation resistance	3.5.1	4.9.1				1/	
Subgroup IV							
Vibration	3.7.6	4.11.6					1/
Contact and bushing retention	3.6.2	4.10.2	1	0			10
Shock (specified pulse)	3.7.3	4.11.3					1/

TABLE II. Supplier qualification inspection - Continued.

Examination or test	Requirement paragraph	Method paragraph	Number of samples to be inspected	Number of defects allowed	Measurements per sample		
					Sample 1	Sample 2	Sample 3
Subgroup IV (Continued) Contact and bushing retention	3.6.2	4.10.2	1	0			10
Dielectric withstanding voltage	3.5.2	4.9.2					1/
Insulation resistance	3.5.1	4.9.1					1/

NOTES:

1/ Per test method paragraph.

TABLE III. Sample backplane preparation.

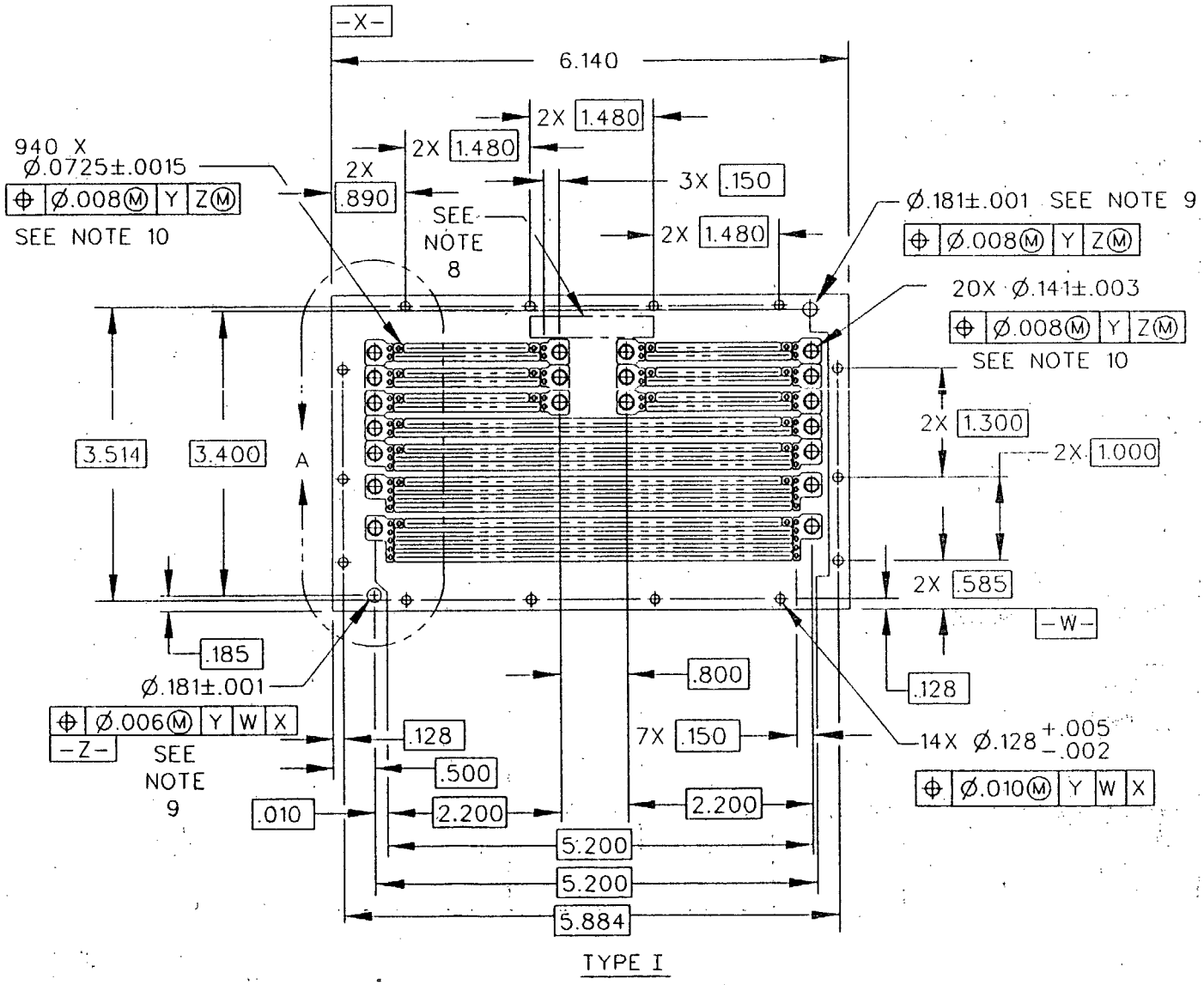
Qualified MIL-C-28754 parts	Row or position	Contains MIL-C-28754/
34 and 37	Keying positions Remaining positions	37 style "s" 34
34 and 35 or 36 or 38	A, C, E, G B, D, F	34 35 or 36 or 38
34 and 35 and 36	A, C, E, G A1, B1 A2, B2	34 35 36
34 and 35 and 38	remaining A1, B1 A2, B2	34 35 38
34 and 36 and 38	remaining A1, B1 A2, B2	34 38 36
34, 35, 36 37, 38	C, D, E, F, G and their keying positions A1 A2, B2 B1	34 37 "s" 35 36 38

NOTES:

1. A MIL-C-28754/37 part shall be at the ends of all rows containing MIL-C-28754/34 parts.

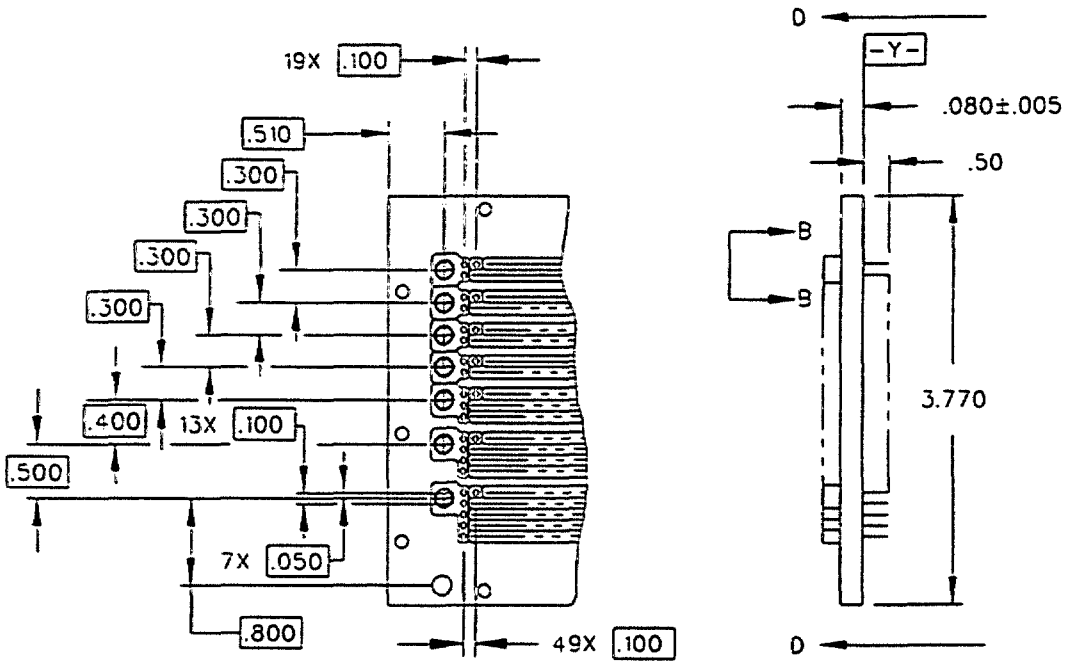
2. /34, /36, and /37 parts may be replaced by /79, /80, and /81 parts, respectively.

3. If both /79 and /34 parts are to be used on the sample, place /34 in areas A, B, C, and D only and /79 in the remaining areas.

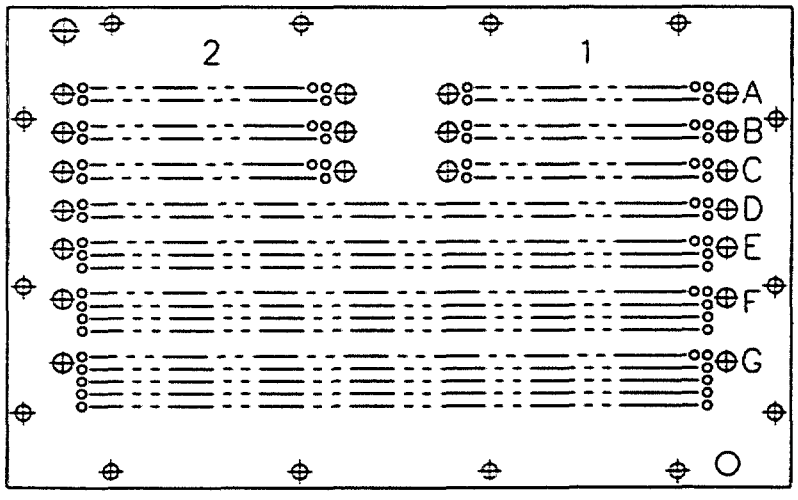


TYPE I

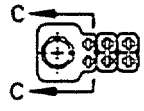
FIGURE 2. Metal backplane assembly.



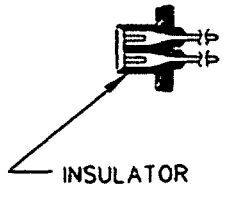
DETAIL A
APPLICABLE TO ONE LAYER
METAL BACKPLANE



VIEW D-D
WRAPPOST SIDE

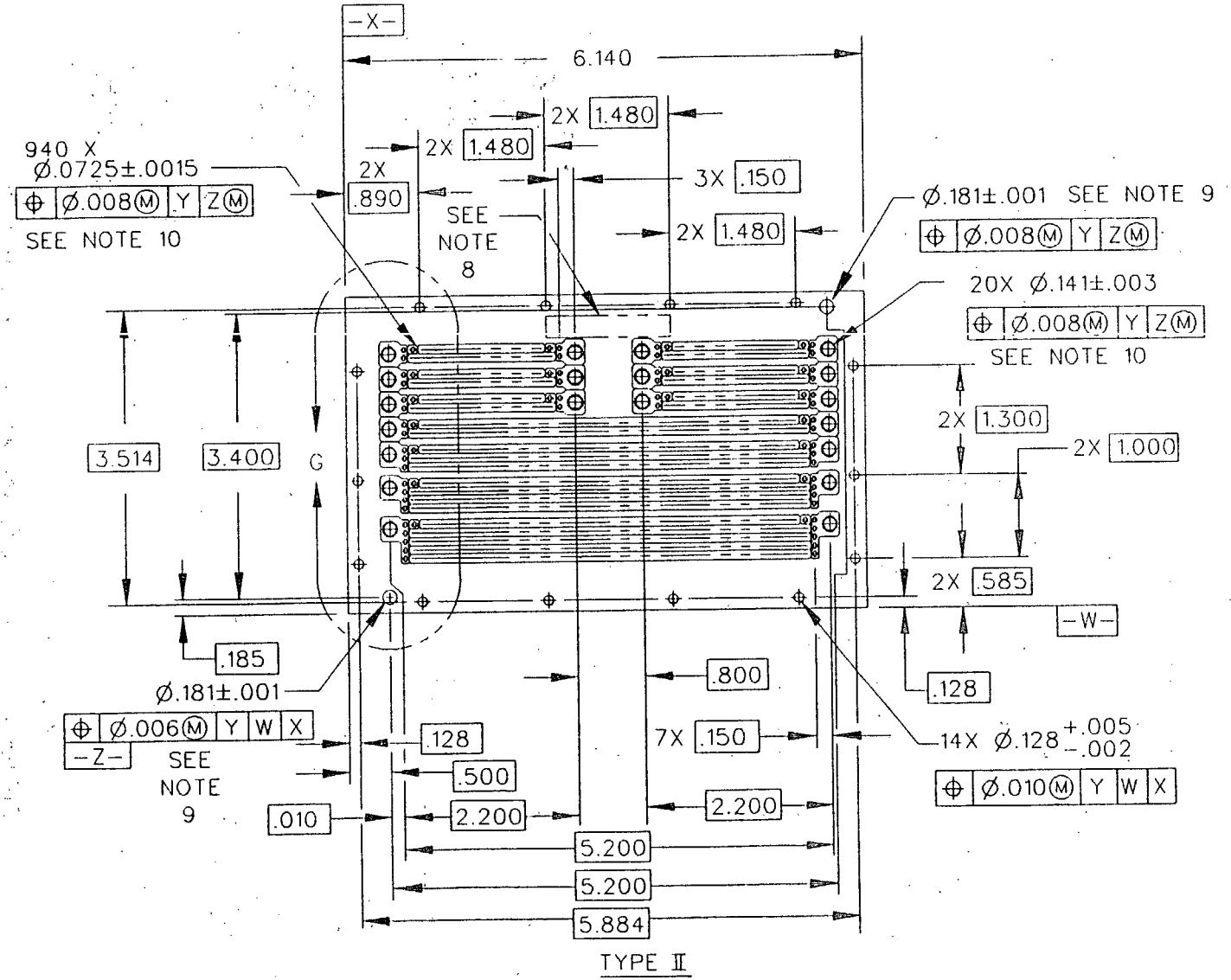


VIEW B-B
ORIENTATION
OF CONTACTS
AND INSULATORS



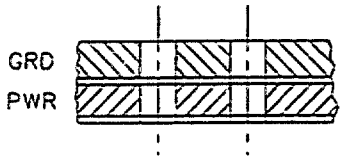
SECTION C-C
TYPICAL INSULATOR
AND CONTACT ASSEMBLY

FIGURE 2. Metal backplane assembly - Continued.

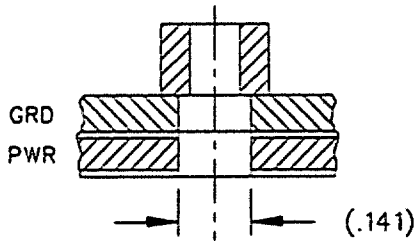


TYPE II

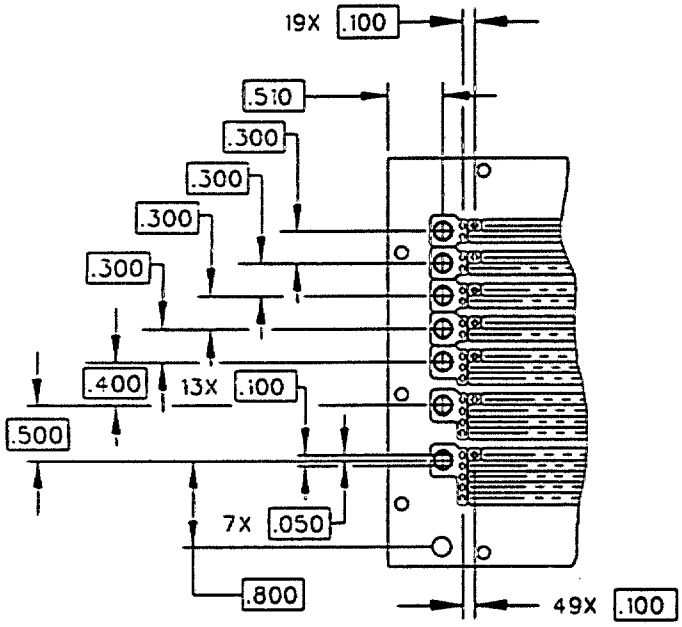
FIGURE 2. Metal backplane assembly – Continued.

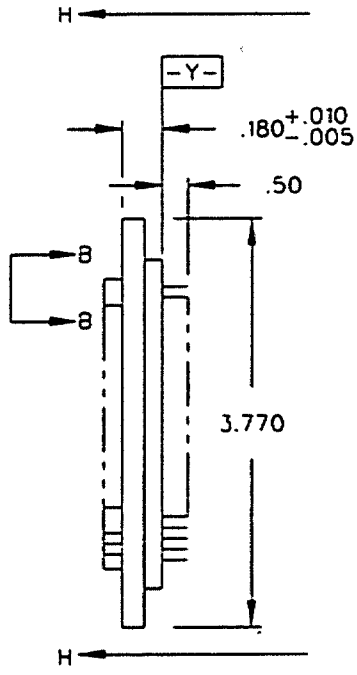


SECTION F-F
ROTATED 90° CW
PINS AND BUSHINGS NOT SHOWN



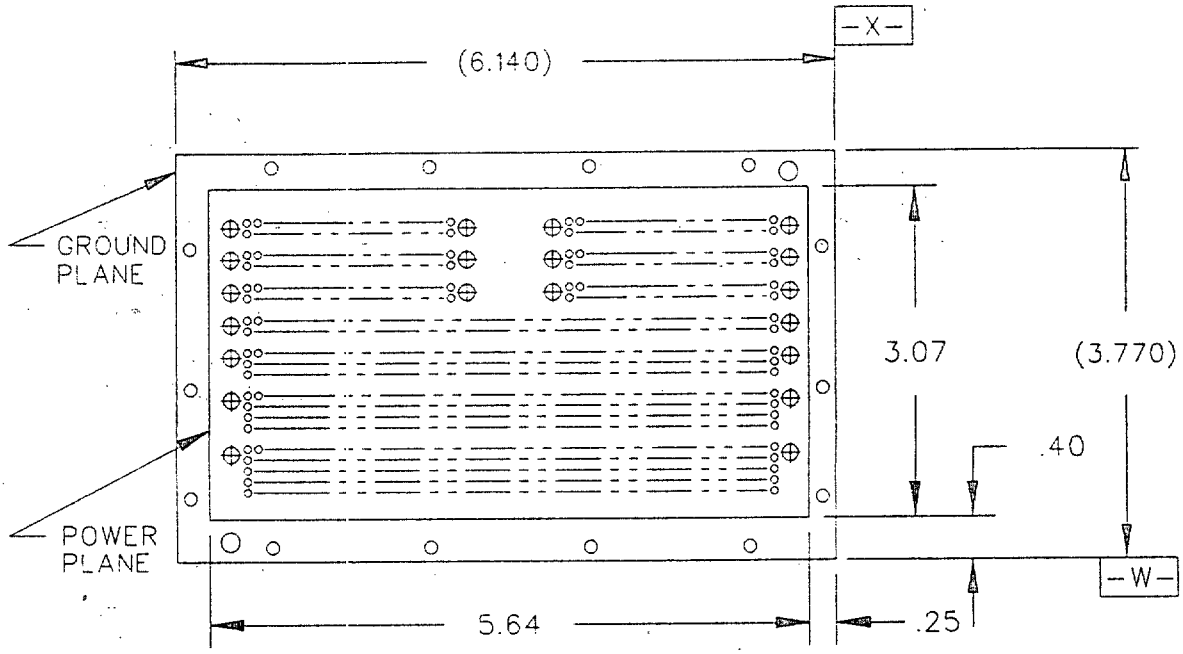
SECTION E-E
ROTATED 90° CW





DETAIL G
APPLICABLE TO TWO LAYER
METAL BACKPLANE

FIGURE 2. Metal backplane assembly - Continued.



VIEW H-H
WRAPPOST SIDE

Inches	mm	Inches	mm	Inches	mm	Inches	mm
0.001	0.025	0.128	3.251	0.400	10.160	1.480	37.592
0.0015	0.0381	0.141	3.581	0.50	12.70	2.200	55.880
0.002	0.051	0.150	3.810	0.500	12.700	3.07	77.98
0.003	0.076	0.181	4.597	0.510	12.954	3.400	86.360
0.005	0.127	0.185	4.699	0.585	14.859	3.514	89.256
0.006	0.152	0.200	5.080	0.800	20.320	3.770	95.758
0.008	0.203	0.25	6.350	0.890	22.606	5.200	132.080
0.010	0.254	0.300	7.620	1.000	25.400	5.884	149.454
0.0725	1.8415	0.40	10.16	1.300	33.020	6.140	155.956

FIGURE 2. Metal backplane assembly - Continued.

NOTES:

1. Dimensions are in inches.

2. Type 1 backplane material. Aluminum alloy sheet material in accordance with QQ-A-250/8 or QQ-A-250/11.

3. Type 1 backplane finish. Anodic MIL-A-8625, type II, black seal or chemical film per MIL-C-5541, class 3.

4. Type 2 backplane material. Aluminum alloy, ASTM B209 or 6061, QQ-A-250/11, T6.

5. Type 2 backplane finish. Ground plane, chemical film, MIL-C-5541, class 3. Power plane, anodize, MIL-A-8625, type II, class 1, non-dyed dichromate seal. External edge, combination of insulator and prepreg material. Bottom surface, plastic, L-P-509, type IV, grade G-10, 0.003 thickness minimum.

6. Backplane flatness. Bow and twist requirements shall apply.

7. All holes shall meet the dimensional requirements specified on the drawing for a minimum of 50% of the plate thickness. Delineation and dimensions of the remaining portion of holes optional as long as minimum opening is maintained.

8. The plate shall be marked on surface indicated using ink per MIL-I-43553. The manufacturer's code identification shall be marked in the area outlined. If only standard insertion force components are used, mark "STD". If only LIF components are used, mark "LIF". See table III.

9. The 0.181 inch (4.597 mm) diameter holes are tooling holes and shall be used to locate the plate in the wire wrapping machine.

10. The hole diameters apply to the fabricated holes in the base plate.

11. Tolerances except where noted are ±0.005 inches (0.127 mm) for three place decimals and ±0.01 inches (0.25 mm) for two place decimals.

FIGURE 2. Metal backplane assembly - Continued.

(d) If the summary of the test results indicates nonconformance to specification requirements, and corrective action acceptable to the procuring activity and to the cognizant qualification organization has not been taken, action shall be taken to remove qualification. In addition to the periodic submission of inspection data, the supplier shall immediately notify the cognizant qualifying agency when the inspection data indicates failure of the product to meet the requirements of this specification with corrective action acceptable to the procuring activity and to the cognizant qualification organization taken. In the event that no production occurred during the reporting interval, the supplier shall be required to requalify (see 4.6).

4.7 Quality conformance inspection. Quality conformance inspection shall consist of inspections or tests on deliverable backplanes.

4.7.1 Inspection of product for delivery. Inspection of products for delivery shall consist of groups A and B inspection.

4.7.1.1 Inspection lot. An inspection lot shall consist of all assemblies having the same part number produced under the same conditions and offered for inspection at one time.

4.7.1.2 Group A inspection. Group A inspection shall consist of the inspections specified in table IV.

4.7.1.2.1 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 IV.

4.7.1.2.2 Rejected lots. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units, and resubmit for reinspection. Resubmitted lots shall be inspected using tightened inspection, and shall not thereafter be tendered for acceptance unless the former rejection or requirement of correction is disclosed. Such lots shall be separate from new lots, and shall be clearly identified as reinspected lots.

4.7.1.2.3 Disposition of backplanes. Backplanes which have passed group A inspection may be delivered on the contract or purchase order, and need not be delayed pending the results of group B inspection.

4.7.1.3 Group B inspection. Group B inspection shall consist of the examinations and tests specified in table V, in the order shown, on the samples which have been examined in group A inspection.

4.7.1.3.1 Sampling plan. Statistical sampling and inspection shall be in accordance with MIL-STD-105. The acceptable quality levels (AQL) shall be as specified in table V. Major and minor defects shall be as defined in MIL-STD-105.

4.7.1.3.2 Rejected lots. If an inspection lot is rejected, the contractor may rework it to correct the defects, or screen out the defective units, and resubmit for reinspection. Resubmitted lots shall be inspected using tightened inspection. Such lots shall be separate from new lots, and shall clearly be identified as reinspected lots.

4.7.1.3.3 Disposition of sample units. Sample units which have been subjected to group B inspection may be delivered on the contract or purchase order, if the lot is accepted.

TABLE IV. Group A inspection.

Inspection	Requirement paragraph	Test method paragraph	AQL (percent defective)
Visual and mechanical	3.3, 3.4	4.8.1	2.5

TABLE V. Group B inspection.

Inspection	Requirement paragraph	Test method paragraph	AQL (percent defective)
Mounting plate to contact resistance	3.5.3	4.9.3	
Engaging and separating forces Standard LIF assy force	 3.6.5.1 3.6.5.2	 4.10.5 4.10.6	 0.65
Insulation resistance	3.5.1	4.9.1	
Contact and bushing retention	3.6.2	4.10.2	

4.7.2 Inspection of packaging. Except when commercial packaging is specified, the sampling and inspection of packaging and marking for shipment and storage shall be in accordance with the quality assurance provisions of the applicable container specification and the marking requirements of MIL-STD-129. The inspection of commercial packaging shall be as specified in the contract or purchase order (see 6.2).

4.8 Methods of examination and test.

4.8.1 Design and construction examination. Completed metal backplane assemblies shall be examined to verify that the materials, design and construction, marking, and workmanship are in accordance with the applicable requirements (see 3.1, 3.3, 3.4, 3.8 and 3.9).

4.9 Electrical testing.

4.9.1 Insulation resistance. (See 3.5.1) The single layer backplane assembly shall be tested in accordance with method 3003, MIL-STD-1344. See figure 3. The following details and exceptions apply:

(a) Test voltage: type 1 - 10,000 Mohms before humidity. 10 Mohms in chamber or within 1 hour after removing. 500 Mohms after 4 hours drying.
type 2 - 100 Mohms before humidity. 10 Mohms after 24 hours drying.
(b) Test points: Between contact and base plate.
(c) Insulation resistance: See table II.

4.9.2 Dielectric withstanding voltage. (See 3.5.2) The plate assemblies shall meet the requirements of MIL-STD-1344, method 3001. See figure 4. The following details and exceptions apply:

(a) Magnitude of test voltage and potential:
type 1 - -350 Vac rms at 60 Hz or 750 Vdc before humidity.
type 2 - 500 Vdc after humidity.
(b) Application point of test voltage: Between contact and base plate.

4.9.3 Mounting plate to contact resistance. (See 3.5.3) The test set up for the single layer backplane shall be as shown on figure 5. The test set up for the two layer backplane shall be as shown on figure 6. The test current in both cases shall be 3.0 amperes.

4.9.4 Capacitance between layers. (See 3.5.4) The capacitance between layers shall be measured on the two layer backplane assembly in accordance with MIL-STD-202, method 305, and as shown on figure 7.

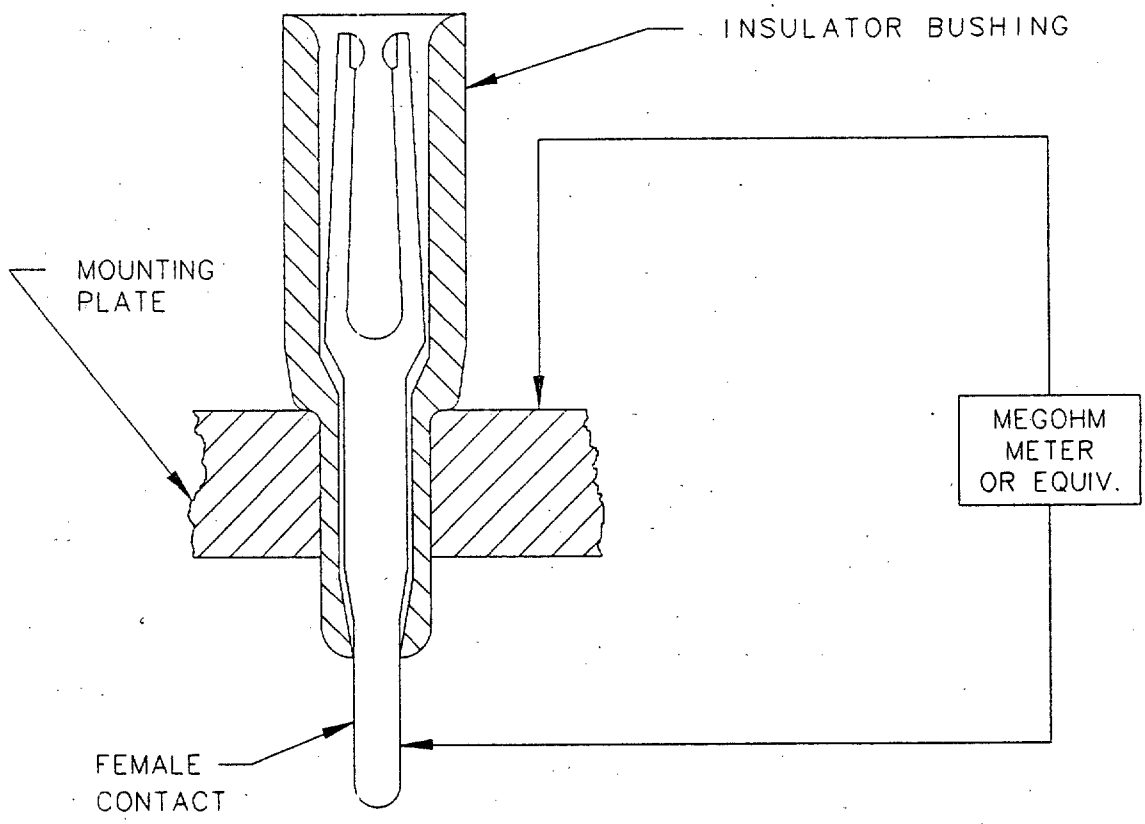


FIGURE 3. Test setup for measuring insulation resistance.

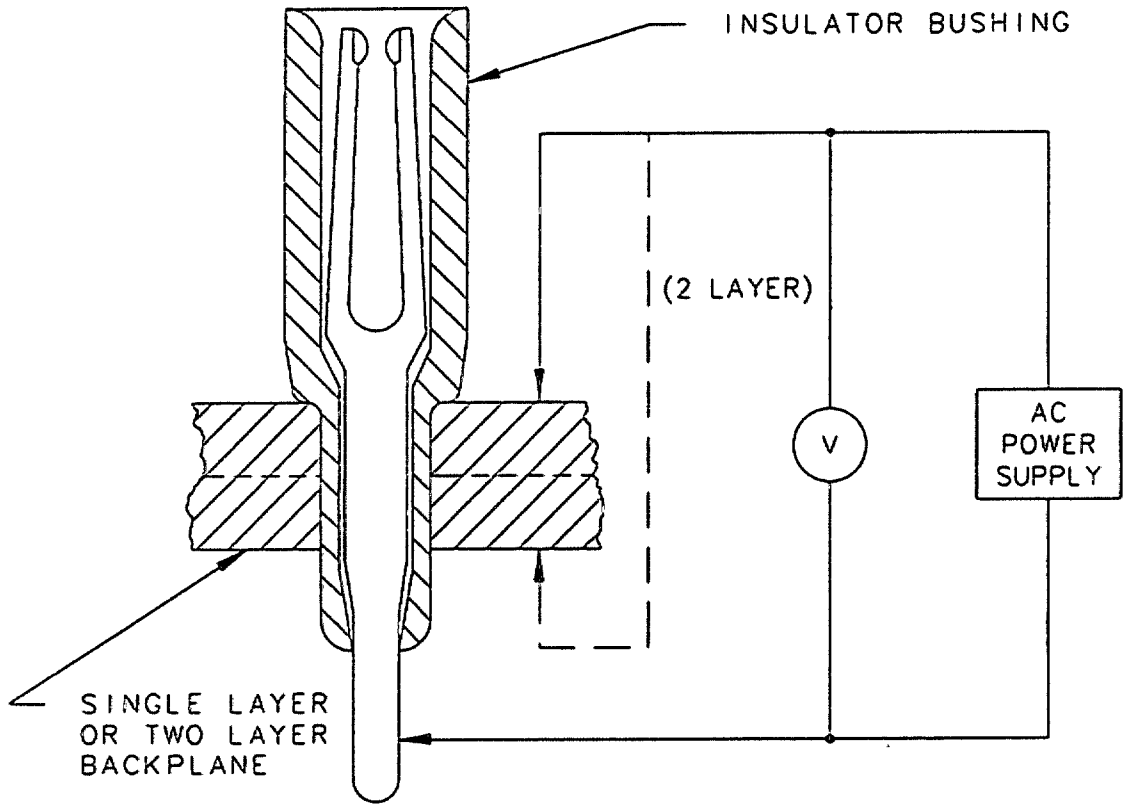


FIGURE 4. Test setup for measuring dielectric withstanding voltage.

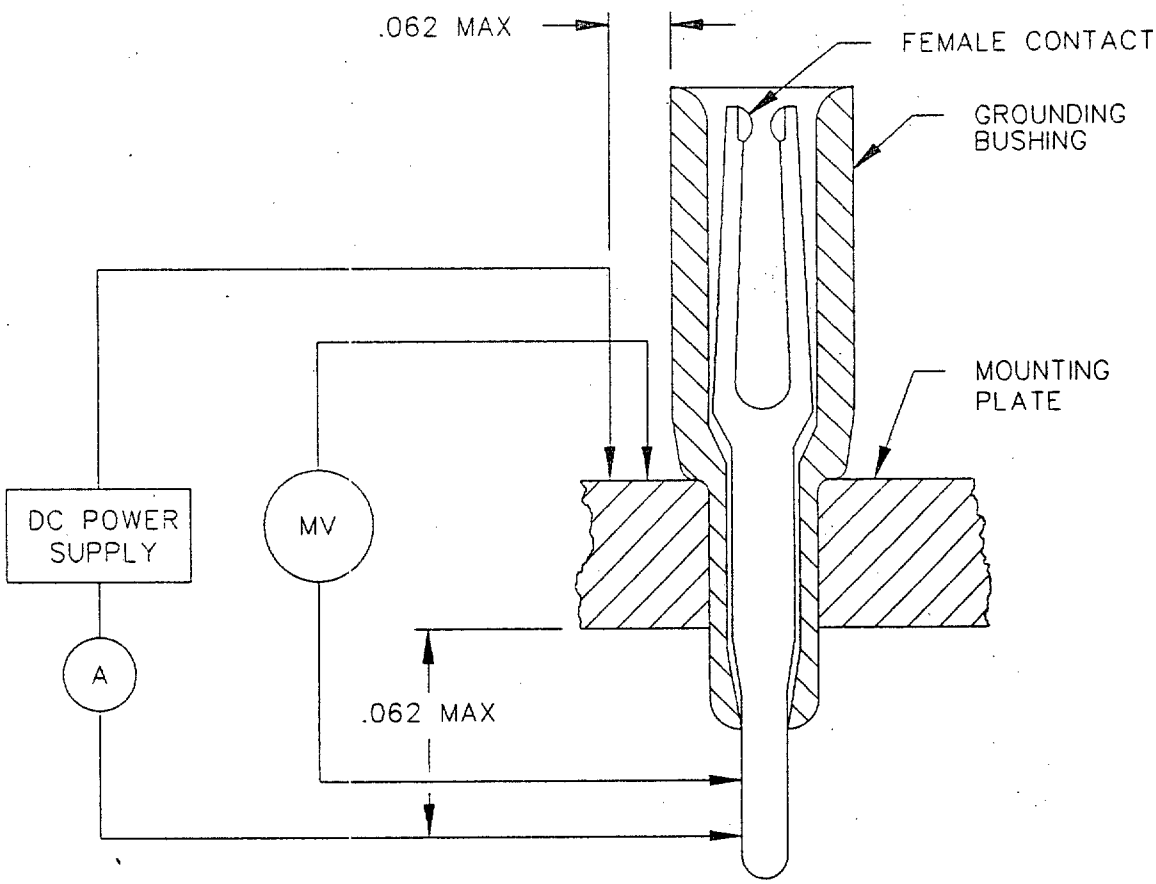


FIGURE 5. Test setup for measuring mounting plate to contact resistance on a single layer backplane.

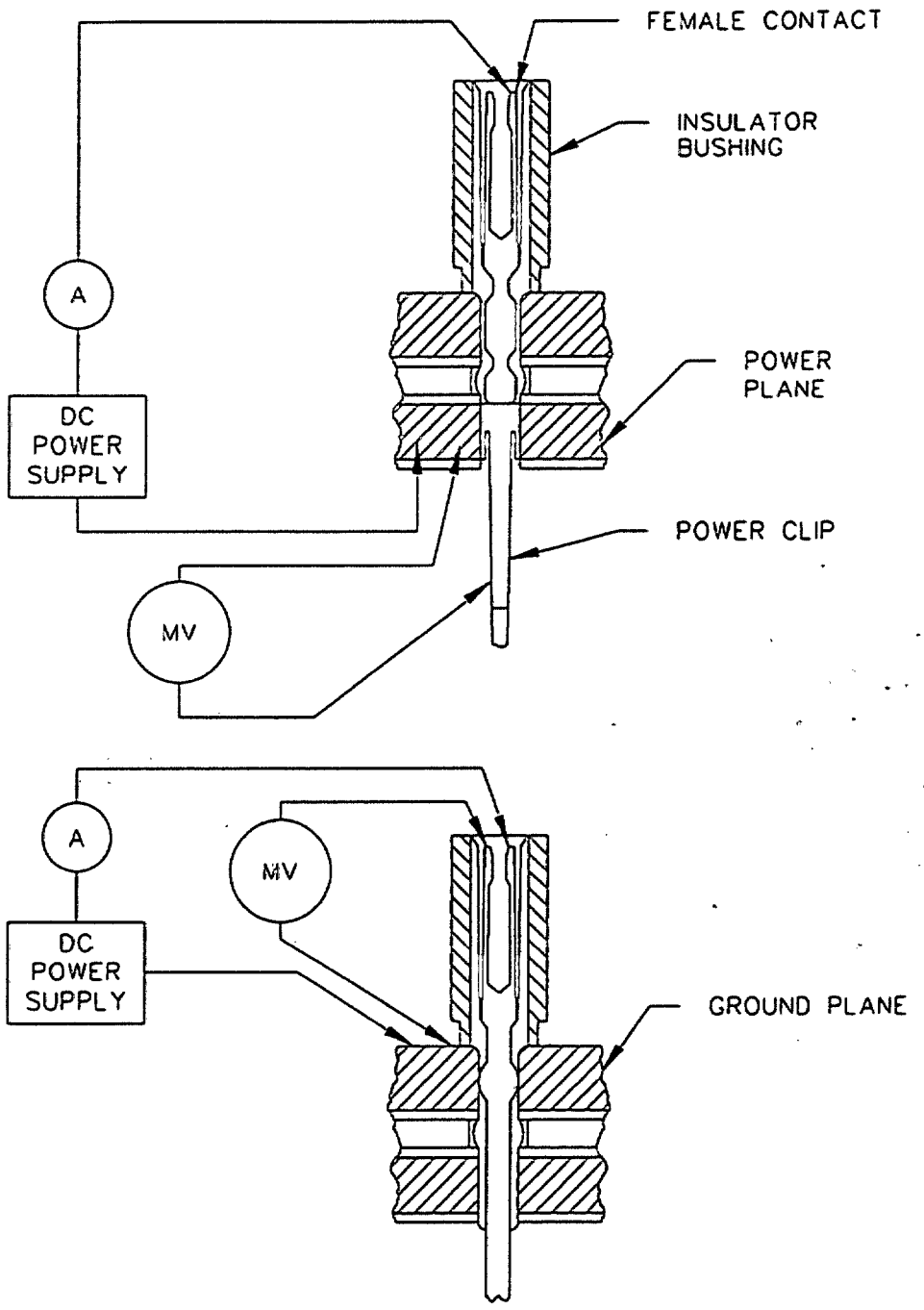


FIGURE 6. Test setup for measuring mounting plate to contact resistance for a two layer backplane.

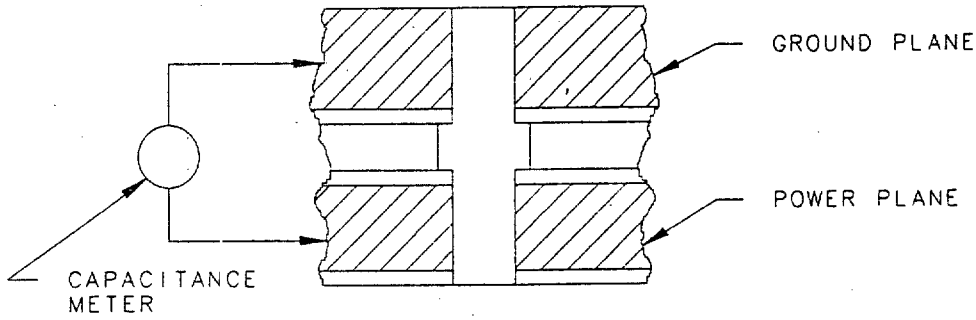


FIGURE 7. Capacitance between layers on the two layer wrappost plate.

4.10 Mechanical testing.

4.10.1 Bow and twist. (See 3.6.1) The backplane assembly shall be supported at three points that define a flat horizontal surface with the convex surface of the assembly upward. The maximum vertical displacement of the backplane (the vertical distance from the lowest point to the maximum height of the convex surface) shall then be determined. This height divided by the length of the longest side shall be considered the bow (warp). The twist of the assembly shall be determined using the same procedure described above by measuring the difference in the height between the lowest corner of the backplane and the highest corner and dividing this measurement by the length of the longest side.

4.10.2 Contact and bushing retention. (See 3.6.2) The contacts shall be tested in accordance with method 2007 of MIL-STD-1344. The following details and exceptions shall apply:

(a) Number of samples. A minimum of ten contacts per test specimen shall be tested.

(b) Applied axial load. One pound (4.5 newtons) per second until a 7 1/2 pound (33 newtons) load has been reached. Maintain load for 10 seconds. (When hookup wire is used, the wire shall be large enough to withstand the applied load.)

(c) Maximum allowable permanent contact displacement after removal of specified force - none.

(d) Axial direction - straight.

4.10.3 Contact torque. (See 3.6.3.) Contacts shall be tested in accordance with method 211 of MIL-STD-202, test condition E. There shall be no visible indication of deformation or displacement using 30X magnification.

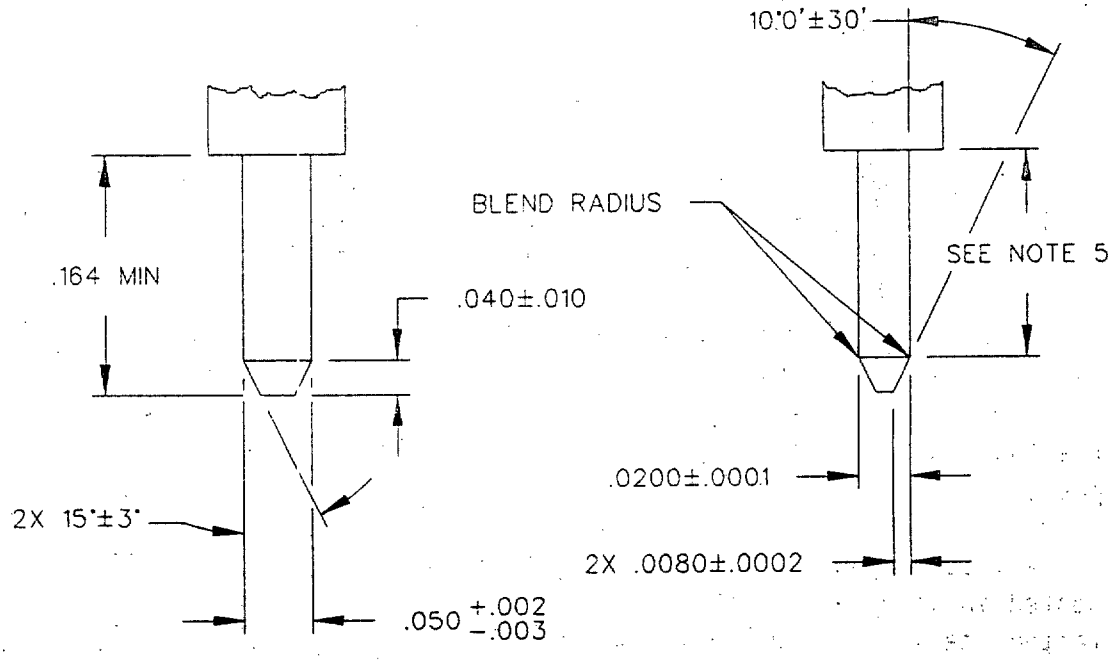
4.10.4 Keying peg retention. (See 3.6.4.) Keying peg retention shall be established by applying a load of 5 pounds (22 newtons) for 10 seconds to the surface of the keying peg opposite to that in which it was inserted into the housing. The keying peg shall not have moved from its original installed position.

4.10.5 Engaging and separating force. (See 3.6.5.) Contacts shall be tested in accordance with method 2014 of MIL-STD-1344. The number of samples tested shall be 5% per test specimen. The engaging and separating forces shall be determined using the test blade shown in figure 8.

4.10.6 LIF normal force. Fifty different contacts shall be removed from the assembled backplane. The normal force measurements shall be performed on contact sets which were tested under 4.10.5. Normal force shall be measured using equipment which directly indicated the force exerted by each tine or the average force exerted by both tines when the gap between the contact points is 0.020 plus or minus 0.0002 inch. Any equipment used for this test must be capable of direct correlation with normal force measurements using conventional force versus deflection techniques. The forces shall meet the requirements of 3.6.6.

4.11 Environments.

4.11.1 Durability. Backplane assemblies shall be tested in accordance with method 2016 of MIL-STD-1344. The contacts shall be subjected to 500 cycles of mating and unmating. Testing of contacts shall not exceed 500 cycles per hour. After durability cycles, contacts shall be tested in accordance with 4.10.3 and 4.10.5. Following this test the contacts shall meet the requirements of 3.7.1.



NOTES:

1. Dimensions are in inches.
2. Material: Hardened tool steel (Hardness: Knoop 542-598).
3. Alternate material: Tungsten carbide (Hardness: Rockwell "A" 89.5-93.0).
4. Surface finish: 4-8 microinch on working surfaces in accordance with ANSI B46.1.
5. Grinding to be in the direction of blade movement during test.

FIGURE 8. Contact engaging and separating, test blade.

4.11.2 Salt spray (corrosion). Backplane assemblies shall be tested in accordance with method 1001 of MIL-STD-1344. The following details and exceptions shall apply:

(a) Applicable salt solution - 5 percent.

(b) Test condition letter - B.

(c) Conditioning after exposure. All exposed surfaces of the backplanes shall be thoroughly washed and dried in a circulating air oven at a temperature of 38 ±3°C.

(d) Measurements after exposure. The backplanes shall be tested in accordance with 4.10.2. The backplanes shall meet the tests of 4.9.2 and 4.9.3 and the requirements of 3.7.2.

(e) Examination after exposure. The metal electrical backplanes shall be examined under a 10X magnification for evidence of corrosion. Pitting or reduction of area of parts shall be cause for failure.

4.11.3 Shock (specified pulse). (See 3.7.3) Metal backplane assemblies shall be tested in accordance with method 2004 of MIL-STD-1344. The following details and exceptions shall apply:

(a) A sample shall be mated to a suitable module assembly and supporting structure. Continuity shall be monitored during testing (100 nanoseconds discontinuity maximum).

(b) Test condition: G.

(c) Following testing, assemblies shall meet the requirements of 3.6.2, 3.5.3 and 3.7.3.

4.11.4 Humidity. The backplane assemblies shall be humidity tested in accordance with MIL-STD-1344, method 1002, type III. Following the test, the backplane shall be tested in accordance with 4.9.1, 4.9.2, 4.10.2 and meet the requirements of 3.7.4.

4.11.5 Temperature cycling. The metal backplane assemblies shall be tested in accordance with method 1003 of MIL-STD-1344. The following details and exceptions apply:

(a) Test condition A-3, except maximum temperature shall be 125°C.

(b) Measurements before and after cycling - not applicable.

4.11.6 Vibration testing. Metal backplane assemblies shall be tested in accordance with method 2005 of MIL-STD-1344. The following details and exceptions will apply:

(a) Measurements during and after the test - The mated connector assemblies shall be monitored and automatic recordings made of any electrical discontinuity (100 nanoseconds discontinuity maximum).

(b) Test conditions III and VE.

(c) Duration of the random vibration test (VE) shall be 15 minutes per axis.

(d) Following testing, assemblies shall meet the requirements of 3.6.2, 3.5.2 and 3.7.6.

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-C-55330. Also see 6.3.

6. NOTES

6.1 Intended use. The one layer and two layer metal backplane assemblies covered by this specification are intended for use in ground support, airborne, and shipboard electronic equipment.

6.2 Acquisition requirements. Acquisition documents must specify the following:

(a) Title, number, and date of this specification.

(b) Issue of DoDISS to be cited in the solicitation and if required, the specific issue of individual documents referenced (see 2.1.1).

(c) Title, revision letter, and drawing number of the applicable assembly drawing for the one layer or two layer metal backplane.

(d) Tools (as required).

(e) Marking, levels of preservation, and packaging and packing required (see 5.1).

6.3 Plastic bags. Where plastic bags are used for packaging metal backplane assemblies, they shall be clean and free from ionic contaminants.

6.4 Qualification. With respect to manufacturers requiring qualification, awards will be made only to manufacturers which are, at the time of award of contract, qualified for inclusion in the Qualified Manufacturers List QML No. 24741 whether or not such manufacturers have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification (see 4.6) in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. The activity responsible for Qualified Manufacturers List is the Naval Sea Systems Command, SEA-55Z3, Department of the Navy, Washington, D.C. 20362-5101. However, information pertaining to qualification of manufacturers may be obtained from the Naval Avionics Center, Code 814, 6000 East 21st Street, Indianapolis, IN 46219-2189.

6.5 Terms and definitions. For definition of terms defined herein, see MIL-STD-2198 and MIL-C-28754.

6.5.1 Metal electrical backplane assembly. The backplane assembly is an interconnection wiring panel into which functional circuit modules or cable connectors, built in accordance with MIL-C-28754, are plugged and secured. The assembly has tuning fork connector receptacles on one side and contact post ends (solderless wrapped connections) on the other side. The component parts are described in MIL-C-28754. The solderless wrapped wires provide paths for electrical interconnections external to the backplane. The two layer metal electrical backplane assemblies may also distribute voltages or grounds in each layer.

6.6 Subject term (key word) listing.

Connectors, solderless wrap
Standard Electronic Module multilayer metal backpanels

Custodians:
Army - ER
Navy - SH
Air Force - 85

Reviewing activity:
DLA - ES

Preparing activity:
Navy - SH

Agent: NW
(Project 5998-0006)

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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions – Reverse Side)

1. DOCUMENT NUMBER	2. DOCUMENT TITLE
MIL-A-24741	Assemblies, Metal Electrical Backplane, One and Two Layer, General Specification for

3a. NAME OF SUBMITTING ORGANIZATION	4. TYPE OF ORGANIZATION *(Mark one)*
	☐ VENDOR
	☐ USER
b. ADDRESS *(Street, City, State, ZIP Code)*	☐ MANUFACTURER
	☐ OTHER *(Specify)*:

5. PROBLEM AREAS

a. Paragraph Number and Wording:

b. Recommended Wording:

c. Reason/Rationale for Recommendation:

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional	b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional
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