

NOTE: MIL-STD-2119 has been redesignated as a Design Criteria Standard. The cover page has been changed for Administrative reasons. There are no other changes to this Document.

INCH-POUND

MIL-STD-2119A
19 FEBRUARY 1990
SUPERSEDING
MIL-STD-2119 (NAVY)
26 APRIL 1982
(SEE 6.4)

DEPARTMENT OF DEFENSE
DESIGN CRITERIA

DESIGN REQUIREMENTS FOR
PRINTED-WIRING ELECTRICAL
BACKPLANE ESSEMBLIES



AMSC N/A

FSC 5998

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

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F O R E W O R D

1. This military standard is approved for use by all Departments and Agencies of the Department of Defense (DoD).

2. 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-5523, 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.

3. This standard was developed to specify what shall be incorporated into the design of a backplane which is defined on an assembly drawing (backplane drawing) to be approved. MIL-A-28870 was developed to procure backplanes in accordance with the approved assembly drawing (backplane drawing). This standard does not specify inspection requirements. They are found in MIL-C-28859.

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1. SCOPE

1.1 Purpose. This standard establishes design requirements governing printed-wiring electrical backplane assemblies consisting of rigid printed-wiring boards in accordance with MIL-P-55110 on which separately manufactured connector component parts qualified in accordance with MIL-C-28859 have been added. The design criteria (such as printed-wiring board thickness) contained in this standard are predicated on the requirement that end item assemblies are conformal coated or solder masked.

1.1.1 Application guidance. The rigid printed-wiring board may be used to distribute power and ground throughout the backplane and provide internal point-to-point circuit connections. Compliant components may be selected which have wrappost tails protruding beyond the lower surface of the printed-wiring electrical backplane and may also be used to provide external point to point circuit connections. It is the intent for these assemblies that no other media other than the compliant feature is required for mechanical or electrical attachment of the MIL-C-28859 components to the rigid printed wiring boards. This standard takes precedence regarding compliant features as an acceptable means of interlayer/interfacial interconnect for printed wiring board assemblies.

1.2 Classification. Printed-wiring backplane assemblies shall be of the following types:

- (a) Type 2 - Double-sided.
- (b) Type 3 - Multilayer.

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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

MILITARY

MIL-P-13949	Plastic Sheet, Laminated, Metal Clad (For Printed-Wiring Boards), General Specification for.
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-C-28859	Connector Component Parts, Electrical Backplane, Printed-Wiring, General Specification for.
MIL-C-28859/1	Connector Component Parts, Electrical Backplane, Printed Wiring Compliant Pin.
MIL-C-28859/2	Connector, Component Parts, Electrical Backplane, Printed Wiring, Housing.
MIL-C-28859/3	Connector, Component Parts, Electrical Backplane, Printed Wiring, Compliant Pin, Feed-Through.

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MIL-C-28859/4	Connector, Component Parts, Electrical Backplane, Printed Wiring, Compliant Pin, Feed-To.
MIL-C-28859/5	Connector Component Parts, Electrical Backplane, Printed Wiring, Low Insertion Force (LIF), Compliant Contact.
MIL-A-28870	Backplane Assembly, Electrical, Printed-Wiring, General Specification for.
MIL-I-43553	Ink, Marking, Epoxy Base.
MIL-I-46058	Insulating Compound, Electrical (For Coating Printed Circuit Assemblies).
MIL-P-55110	Printed-Wiring Boards, General Specification for.

STANDARDS

MILITARY

DOD-STD-100	Engineering Drawing Practices.
MIL-STD-275	Printed Wiring for Electronic Equipment.

(Unless otherwise indicated, copies of federal and military specifications and standards are available from the Naval Publications and Forms Center, (ATTN: NPODS), 5801 Tabor Ave., 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).

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AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

Y14.5 Dimensioning and Tolerancing; Errata. (DoD adopted).

Y32.16 Reference Designation for Electrical and Electronic Parts and Equipment.

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

INSTITUTE FOR INTERCONNECTING AND PACKAGING ELECTRONIC CIRCUITS (IPC)

T-50 Terms and Definitions for Interconnecting and Packaging Electronic Circuits.

SM-840 Qualification and Performance of Permanent Polymer Coating (Solder Mask) for Printed Boards.

(Application for copies should be addressed to the Institute for Interconnecting and Packaging Electronic Circuits, 7380 North Lincoln Ave., Lincolnwood IL 60646.)

(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, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

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3. DEFINITIONS

3.1 Terms and definitions. The definitions of all terms used herein shall be as specified in IPC-T-50.

3.1.1 Printed-wiring electrical backplane assembly. The printed-wiring electrical backplane is a connection device having terminals (such as wrappost for solderless wrapped connections) on one side and having connector receptacles on the other. Wiring between terminals may provide point-to-point electrical interconnection while the printed-wiring making contact with the compliant section of the terminals may provide intraconnects. The printed-wiring electrical backplane may also provide mechanical and structural support.

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4. GENERAL REQUIREMENTS

4.1 Design requirements. The design requirements of this standard are for the assembly of compliant component parts onto a rigid printed-wiring board. The compliant contact components and housings have been specifically designed to accommodate the connectors specified in MIL-C-28754 and MIL-C-28859. Figure 1 is a pictorial illustration of this assembly and incorporates the required dimensions of the assembly. Interpret all figures in accordance with ANSI-Y14.5.

4.1.1 Rigid printed-wiring board design requirements. The design requirements of the rigid printed-wiring boards shall be in accordance with MIL-STD-275 and this standard.

4.2 Backplane assembly drawing. The backplane assembly drawing shall cover rigid printed-wiring boards on which compliant separately manufactured connector component parts have been added. The printed-wiring backplane assembly drawing shall be in accordance with DOD-STD-100 and should include at least the following:

- (a) Location and identification of all connector component parts.
- (b) Type of conformal coating and masking.
- (c) Applicable ordering data.
- (d) Electrical circuitry test requirements.
- (e) Cleanliness requirements.
- (f) Master drawing for backplane printed-wiring board including the quality conformance test coupon.
- (g) Marking requirements.
- (h) Electrical performance requirements.

4.2.1 Conflict. In the event of any conflict between the assembly drawing and the requirements of this standard, a copy of the assembly drawing shall be submitted to the Government Program Manager (PM), prior to release to manufacturing or procurement, with information justifying the deviation(s) and with a request for approval of the deviation(s). If approvals for deviations from this standard have been given, the deviation shall be indicated on the assembly drawing.

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4.3 Test coupon. Two test coupons shall be provided per manufacturing layup panel or backplane, whichever is less, in accordance with figure 2. The test coupon shall be completely pinned with compliant components in accordance with MIL-C-28859/1 or MIL-C-28859/5 as applicable, and, housings in accordance with MIL-C-28859/2 shall be installed. MIL-C-28859/1 and MIL-C-28859/5 components shall not be mixed in any one footprint of the coupon. The quality conformance test coupon shall also be included on the master pattern, master drawing, and artwork of the backplane printed-wiring board.

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5. DETAILED REQUIREMENTS

5.1 Purpose. The following detailed requirements will specify to the user the requirements necessary for preparing the components and backplanes.

5.2 Assembly construction. The printed-wiring electrical backplane assembly consisting of the rigid printed-wiring board per MIL-P-55110 and components per MIL-C-28859 shall be constructed by pressing the compliant contact component into the plated-through holes in the rigid printed-wiring board and snapping the appropriate housing over the receptacle end of the compliant contact component. Other compliant connecting components per MIL-C-28859 shall also be added, as required by the master drawing. As required by the assembly drawing, keying pegs in accordance with MIL-C-28754 shall be inserted into the housings in the proper orientation and made a permanent part of the housing assembly by suitable processes which may include bonding, heat staking, and so forth.

5.2.1 Material. The type of material shall be as specified herein. Acceptance or approval of any constituent material shall not be construed as a guarantee of the acceptance of the finished product.

5.2.1.1 Compliant components. The compliant components shall be in accordance with MIL-C-28859.

5.2.1.2 Housing and keying pegs. The housing (insulator) shall be in accordance with MIL-C-28859/2 and the keying pegs shall be in accordance with MIL-C-28754/39.

5.2.1.3 Conformal coating solder mask.

5.2.1.3.1 Coverage. Printed-wiring backplane assemblies are required to be coated. Conformal coating shall be in accordance with MIL-I-46058 and solder mask, when specified on the assembly drawing, shall be in accordance with IPC-SM-840, class 3. Only MIL-I-46058, type UR conformal coating will be allowed in the plated-through hole.

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5.2.1.3.2 Thickness. The conformal coating thickness for type ER, UR, and AR shall be 0.003 plus or minus 0.002 inch (0.076 plus or minus 0.051 mm); SR shall be 0.005 plus or minus 0.003 inch (0.127 plus or minus 0.076 mm) and XY shall be 0.0005 to 0.002 inch (0.0127 to 0.051 mm) when measured on a flat unencumbered surface.

5.2.1.4 Rigid printed-wiring boards. Type 2 and type 3 printed-wiring electrical backplane assemblies shall use rigid printed-wiring boards in accordance with MIL-P-55110. The metal clad laminates shall be in accordance with table I.

TABLE I. Backplane material.

Specification	Base material	Maximum operating ^{1/} temperature	Type	
			2	3
MIL-P-13949	GF	125°C	X	X
	GM	150°C		X
	GI	170°C	X	X

^{1/} Ambient temperature plus the temperature rise caused by current in the conductor.

5.2.2 Hole pattern. The drilled holes for the location of compliant components shall be on a 0.100 inch (2.54 mm) grid system. The number of rows and columns per hole pattern shall be in accordance with the assembly drawing.

5.2.2.1 Hole pattern accuracy. The accuracy of the hole pattern in the printed-wiring board shall be in accordance with figure 3.

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5.2.2.2 Hole size. The drilled hole size shall be 0.0453 plus or minus 0.0010 inch (1.150 plus or minus 0.0254 mm). The finished hole size shall be 0.040 plus or minus 0.003 inch (1.016 plus or minus 0.076 mm) and shall have 0.001 inch (0.0254 mm) minimum of copper and 0.0003 inch (0.00761 mm) minimum of tin-lead on the hole wall (see figure 4).

5.2.3 Printed wiring board thickness. The rigid printed-wiring board thickness shall be 0.125 plus or minus 0.013 inch (3.175 plus or minus 0.330 mm).

5.3 Assembly. The printed-wiring electrical backplane assembly as specified in MIL-A-28870 shall meet the following requirements.

5.3.1 Compliant components. When assembled in the printed-wiring electrical backplane, the compliant component height above the rigid printed-wiring board shall be as specified on figure 1. The compliant contact component shall be capable of individual removal and replacement without displacing the housing from its installed position. Only new, or "virgin", compliant components should be used when a backplane assembly is made. Upon insertion into the backplane, the compliant component shall not eject conductive debris from the plated through hole.

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

5.3.2 Housing. When assembled on the compliant contact component in the rigid printed-wiring board, the housing dimensions shall be as specified on figure 1.

5.3.2.1 Replacement. The housing, when removed, shall be replaced with an unused housing and the removed housing discarded.

5.3.3 Bow and twist. The maximum allowable bow and twist shall be 1.5 percent.

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5.4 Marking. Printed-wiring backplane assemblies shall be marked with reference designations in accordance with ANSI Y32.16 and as specified on the assembly drawing. All assemblies shall be identified for traceability to the production lot.

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

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6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. This standard specifies what should be incorporated into backplane design.

6.2 Issue of DODISS. When this standard is used in acquisition, the issue of the DODISS to be applicable to this solicitation must be cited in this solicitation (see 2.1.1 and 2.2).

6.3 Data requirements. The following Data Item Description (DID) must be listed, as applicable, on the Contract Data Requirements List (DD Form 1423) when this standard is applied on a contract, in order to obtain the data, except where DOD FAR Supplement 27.475-1 exempts the requirement for a DD Form 1423.

<u>Reference Paragraph</u>	<u>DID Number</u>	<u>DID Title</u>	<u>Suggested Tailoring</u>
4.2.1	DI-DRPR-80651	Engineering Drawings	Callout deviations from MIL-STD-2198

The above DID was cleared as of the date of this standard. The current issue of DOD 5010.12-L, Acquisition Management Systems and Data Requirements Control List (AMSDL), must be researched to ensure that only current, cleared DID's are cited on the DD Form 1423.

6.3.1 Data for program manager. If this standard is specified, it is recommended that it be followed without deviation. However, if deviations are required to meet specific system constraints, it is recommended that the program manager be aware of such deviations by following 4.2, 4.2.1 and 6.3.

6.4 Supersession data. This standard supersedes the requirements of MIL-STD-2119(NAVY) dated 26 April 1982.

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6.5 Subject term (key word) listing.

Multilayer printed boards.

Solderless wrapped interconnections.

Standard Hardware Acquisition and Reliability Program, (SHARP).

Tuning fork contacts.

6.6 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodians:

Navy - SH

Army - ER

Air Force - 85

Review activities:

Navy - OS

DLA - ES

User activities:

Navy - AS, MC, CG

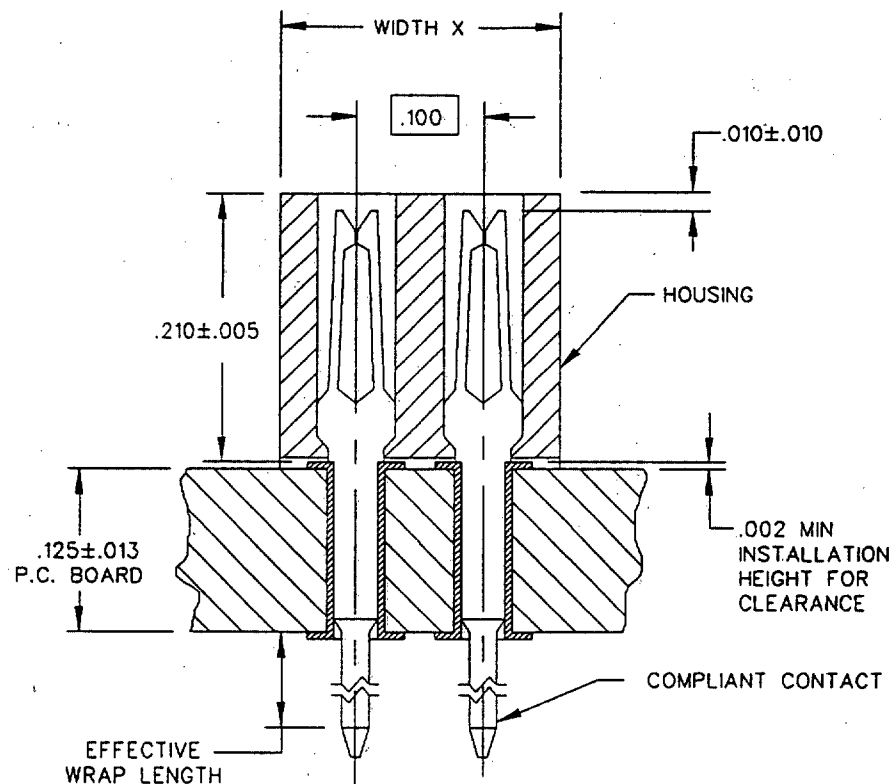
Preparing activity:

Navy - SH

Agent: NW

(Project 5998-0005)

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DIMENSIONS

CONTACT ROW	PITCH	WIDTH X
2	0.300	0.215 MAX
3	0.400	0.315 MAX
4	0.500	0.415 MAX
5	0.600	0.515 MAX

FIGURE 1. Cross-sectional view of printed-wiring electrical backplane assembly.

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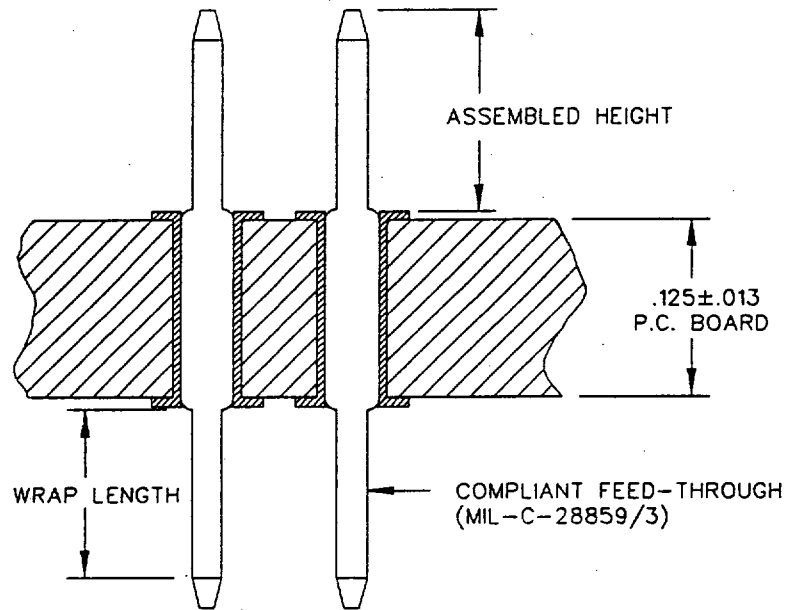
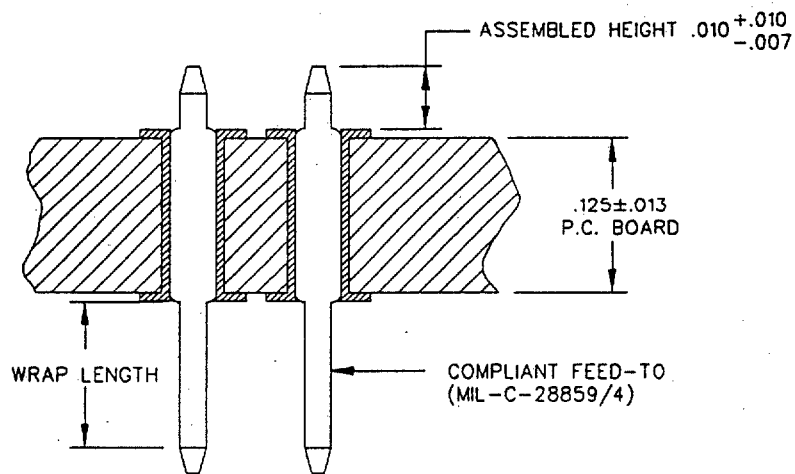


FIGURE 1. Cross-sectional view of printed-wiring electrical backplane assembly - Continued.

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Inches	MM	Inches	MM
0.002	0.051	0.315	8.001
0.007	0.248	0.400	10.160
0.010	0.254	0.415	10.541
0.10	2.54	0.500	12.700
0.215	5.461	0.515	13.081
0.300	7.620	0.600	15.240

NOTE:

1. Dimensions are in inches. Metric equivalents are given for information only.

FIGURE 1. Cross-sectional view of printed-wiring electrical backplane assembly - Continued.

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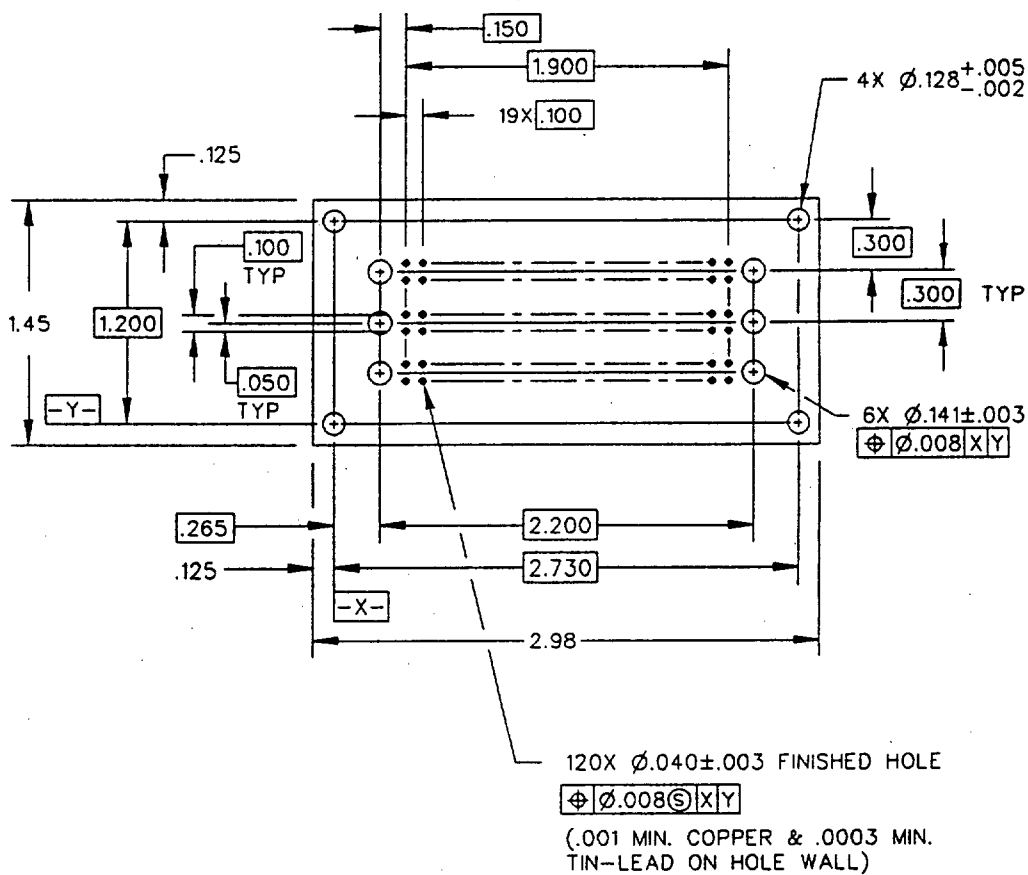


FIGURE 2. Test coupon.

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DOUBLE SIDED BOARD PATTERN

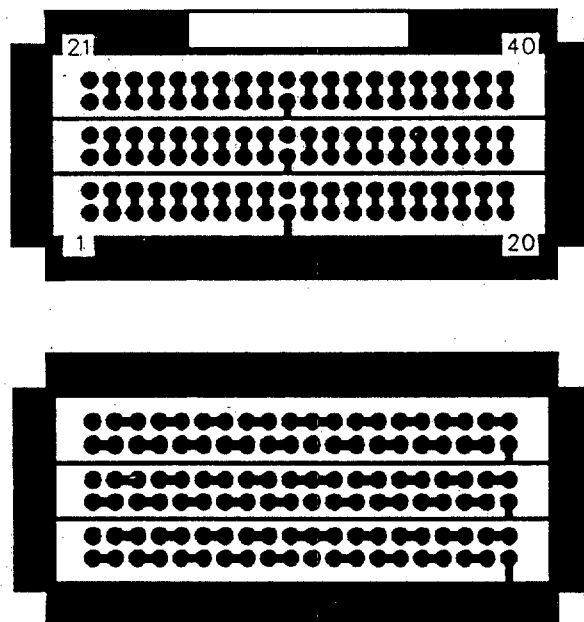
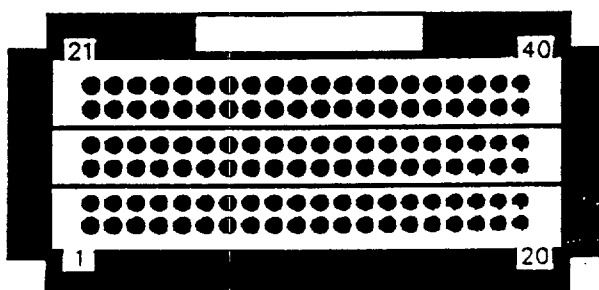


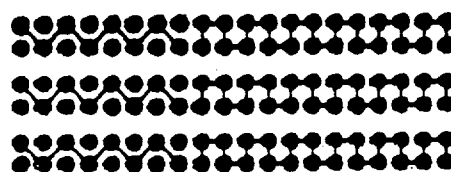
FIGURE 2. Test coupon - Continued.

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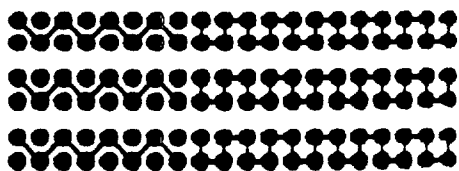
MULTILAYER BOARD PATTERN



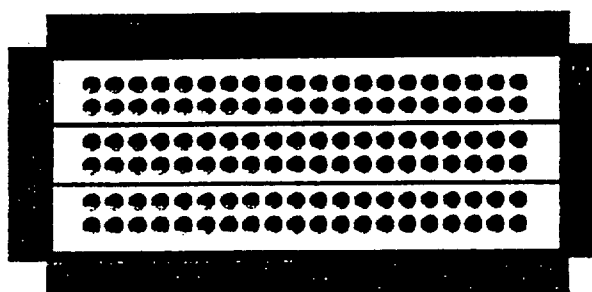
LAYER 1



LAYER 2, 4, 6, 8, ETC.



LAYER 3, 5, 7, 9, ETC.



LAST LAYER

FIGURE 2. Test coupon - Continued.

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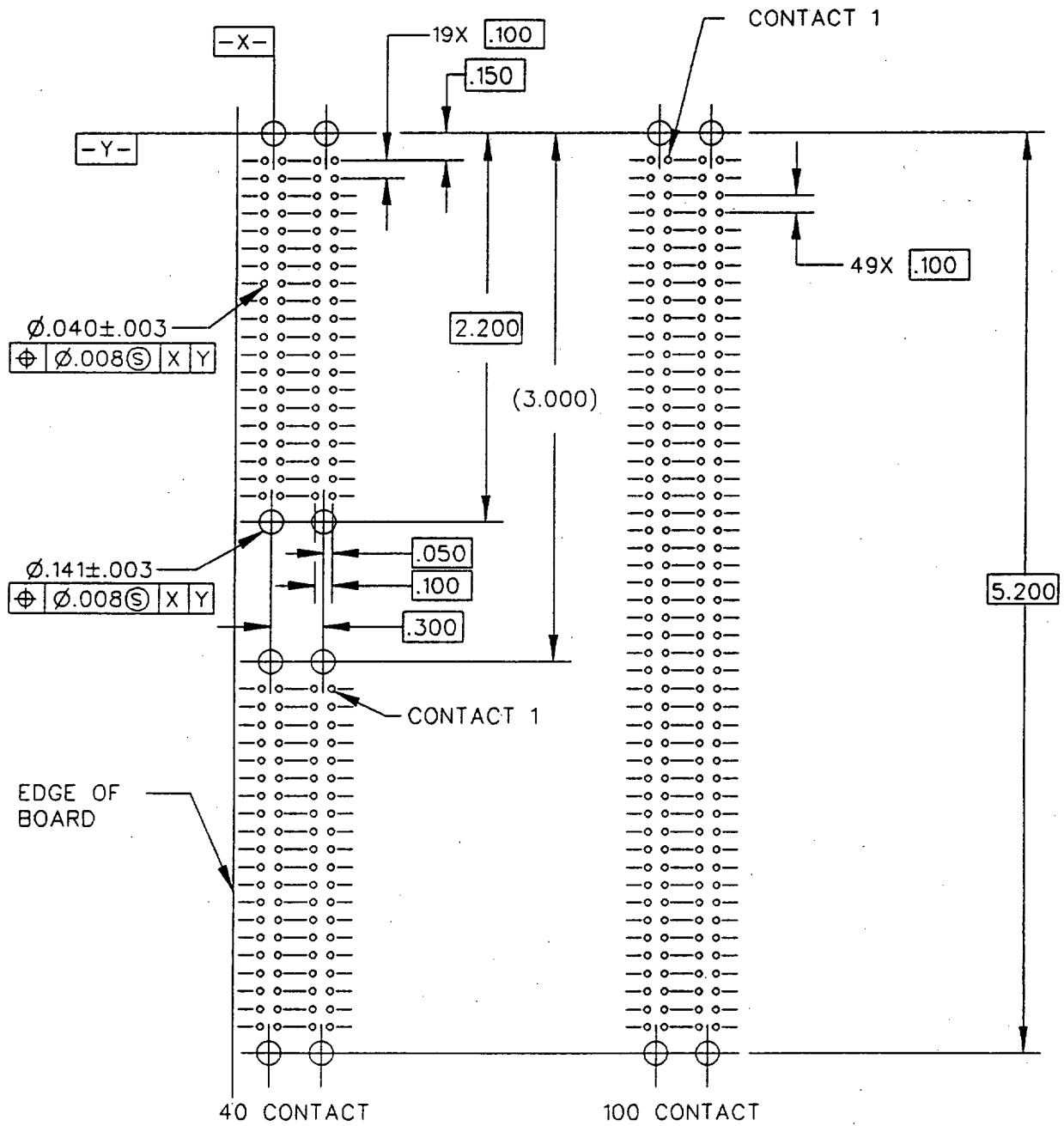
Inches	MM	Inches	MM	Inches	MM
0.0003	0.0076	0.050	1.270	1.200	30.480
0.001	0.025	0.100	2.540	1.45	36.83
0.002	0.051	0.125	3.175	1.900	48.260
0.003	0.076	0.141	3.581	2.200	55.880
0.005	0.127	0.150	3.810	2.730	69.342
0.008	0.203	0.265	6.731	2.98	75.69
0.040	1.016	0.300	7.620		

NOTE:

1. Dimensions are in inches. Metric equivalents are given for information only.

FIGURE 2. Test coupon - Continued.

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WRAPPOST SIDE OF BACKPLANE

FIGURE 3. Typical hole pattern.

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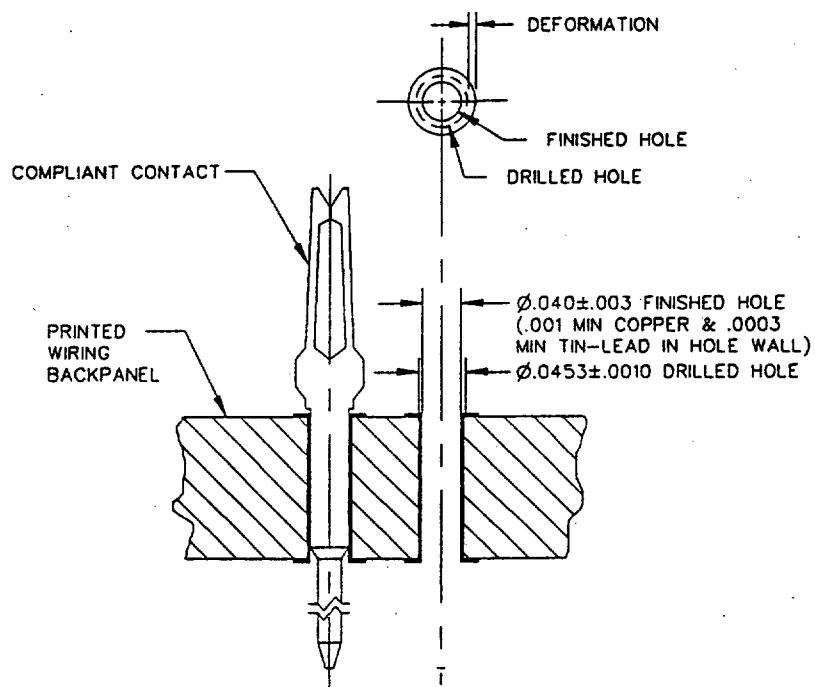
Inches	MM	Inches	MM	Inches	MM
0.002	0.051	0.100	2.540	3.000	76.200
0.003	0.076	0.141	3.581	5.200	132.080
0.008	0.203	0.150	3.870		
0.040	1.016	0.300	7.620		
0.050	1.270	2.200	55.880		

NOTE:

1. Dimensions are in inches. Metric equivalents are given for information only.

FIGURE 3. Typical hole pattern - Continued.

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Inches	MM
0.0010	0.0254
0.001	0.025
0.002	0.051
0.040	1.061
0.0453	1.143

NOTE:

1. Dimensions are in inches. Metric equivalents are given for information only.

FIGURE 4. Plated-through hole deformation.

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER MIL-STD-2119A	2. DOCUMENT TITLE Design Requirements for Printed-Wiring Electrical Backplane Assemblies		
3a. NAME OF SUBMITTING ORGANIZATION		4. TYPE OF ORGANIZATION <i>(Mark one)</i> <input type="checkbox"/> VENDOR <input type="checkbox"/> USER <input type="checkbox"/> MANUFACTURER <input type="checkbox"/> OTHER <i>(Specify)</i> : _____	
b. ADDRESS <i>(Street, City, State, ZIP Code)</i>			
5. PROBLEM AREAS			
a. Paragraph Number and Wording:			
b. Recommended Wording:			
c. Reason/Rationale for Recommendation:			
6. REMARKS			
7a. NAME OF SUBMITTER <i>(Last, First, MI)</i> - Optional		b. WORK TELEPHONE NUMBER <i>(Include Area Code)</i> - Optional	
c. MAILING ADDRESS <i>(Street, City, State, ZIP Code)</i> - Optional		8. DATE OF SUBMISSION <i>(YYMMDD)</i>	

(TO DETACH THIS FORM, CUT ALONG THIS LINE.)