

MIL-STD-2119(NAVY)
26 April 1982

MILITARY STANDARD

DESIGN REQUIREMENTS FOR
PRINTED-WIRING ELECTRICAL
BACKPLANE ASSEMBLIES



FSC 5999

MIL-STD-2119(NAVY)
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DEPARTMENT OF DEFENSE

Design Requirements for Printed-Wiring Electrical Backplane Assemblies

MIL-STD-2119(NAVY)

1. This Military Standard is approved for use by The Naval Electronic Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.
2. Recommended corrections, additions or deletions should be addressed to: Commander, Naval Electronic Systems Command, ATTN: ELEX 8111, Department of the Navy, Washington, D.C. 20360.

FOREWORD

1. 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.

2. The standard was developed to specify what should be incorporated into the design of a backplane which is defined on an assembly drawing (backplane drawing) to be approved. MIL-A-28870(NAVY) was developed to procure backplanes in accordance with the approved assembly drawing (backplane drawing). The specification specifies the inspection requirements; not this Standard.

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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. 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.

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

- a. Type 2: Doubled-sided.
- b. Type 3: Multilayer.

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2. REFERENCED DOCUMENTS

2.1 Issues of documents. The following documents of the issue in effect of date of invitation for bids or request for proposal, form a part of this standard to the extent specified herein.

SPECIFICATIONS

MILITARY

| | |
|-------------|--|
| MIL-P-13949 | - Plastic Sheet, Laminated, Copper Clad |
| MIL-C-28754 | - Connectors, Electrical, Modular and Component Part, General Specification for |
| MIL-C-28859 | - Connector Component Parts, Electric Backplane, Printed-Wiring, General Specification for |
| MIL-A-28870 | - Assemblies, Electrical Backplane, Printed-Wiring, General Specification for |
| MIL-I-46058 | - Insulating Compound, Electrical (For Coating Printed Circuit Assemblies) |
| MIL-P-55110 | - Printed Wiring Boards |

STANDARDS

MILITARY

| | |
|--------------|--|
| DOD-STD-100 | - Engineering Drawing Practices |
| MIL-STD-202 | - Test Methods for Electronic and Electrical Component Parts |
| MIL-STD-275 | - Printed Wiring for Electronic Equipment. |
| MIL-STD-810 | - Environmental Test Methods. |
| MIL-STD-1344 | - Test Methods for Electrical Connectors. |

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring agency or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this standard to the extent specified herein. Unless, otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

AMERICAN NATIONAL STANDARDS INSTITUTE

ANSI-Y14.5 - Dimensioning and Tolerancing for Engineering Drawings.
ANSI-Y32.16 - Reference Designation for Electrical and Electronic Parts and Equipment.

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

INSTITUTE OF PRINTED CIRCUITS

IPC-T-50 - Terms and Definitions.
IPC-SM-840 - Qualification and Performance of Permanent Polymer Coating (Solder Mask) for Printed Boards.

(Application for copies should be addressed to the Institute of Printed Circuits, 1717 Howard Street, Evanston, IL 60202.)

3. DEFINITIONS

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

3.1.2 Printed-wiring electrical backplane. The printed-wiring electrical backplane is an interconnection device having terminals (such as wrappost for solderless wrapped connections) on one side and having connector receptacles on the other. The terminals provide point-to-point electrical interconnection capability. The point-to-point electrical intraconnections may be printed-wiring.

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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 pin 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.

4.1.1 Rigid printed-wiring board design requirement. 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.

4.2.1 Conflict. In 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 agency concerned, prior to release to manufacturing or procurement, with information justifying the deviation(s) and with a request for approval of the deviation(s). When approved the provisions of the assembly drawing shall govern. If approvals for deviations from this standard have been given the deviations shall be indicated on the assembly drawing.

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 and, housings in accordance with MIL-C-28859/2 shall be installed. The quality conformance test coupon shall also be included on the master pattern, master drawing, and art work of the backplane printed-wiring board.

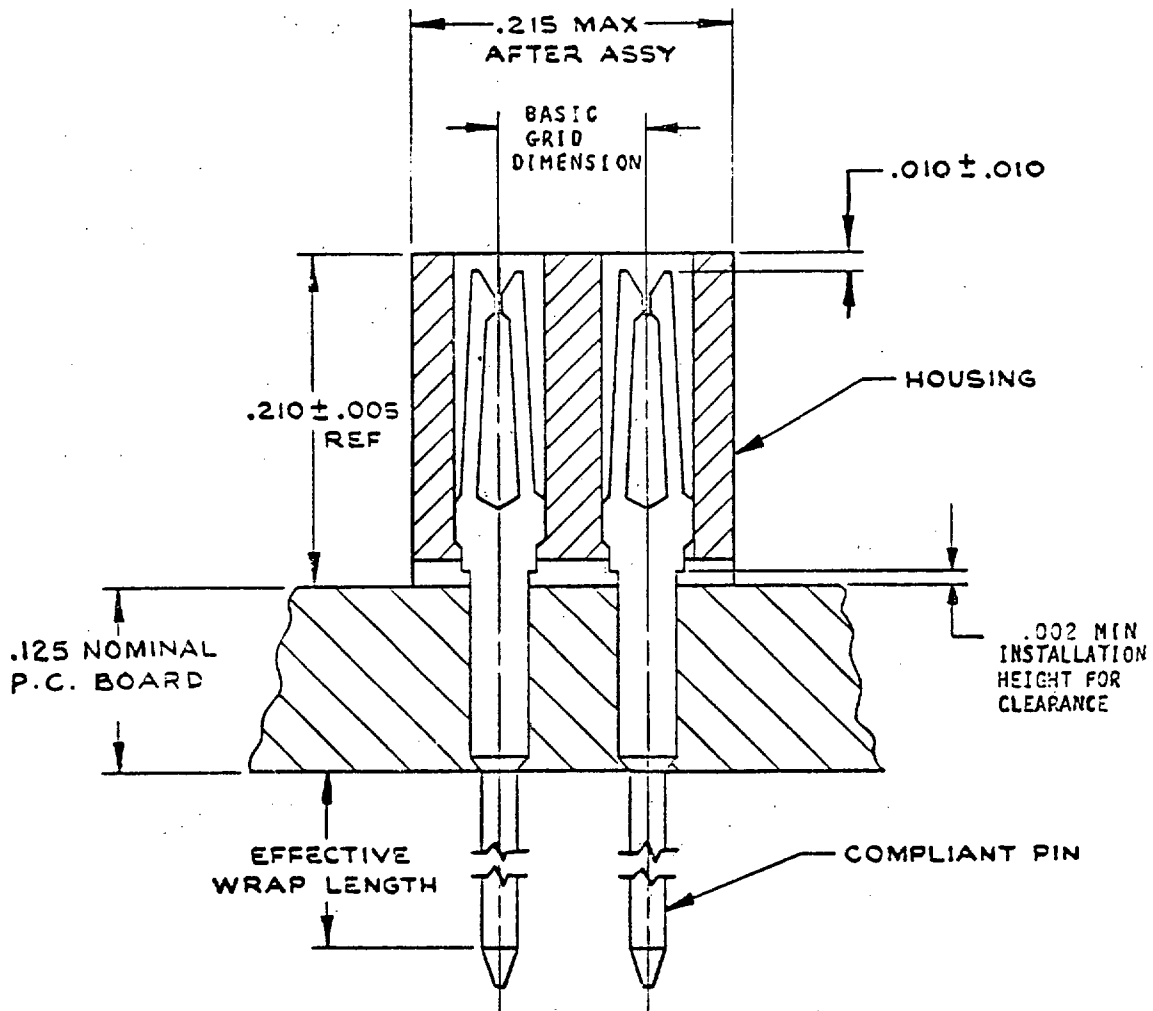


FIGURE 1. Cross-sectional view of printed-wiring electrical backplane assembly.

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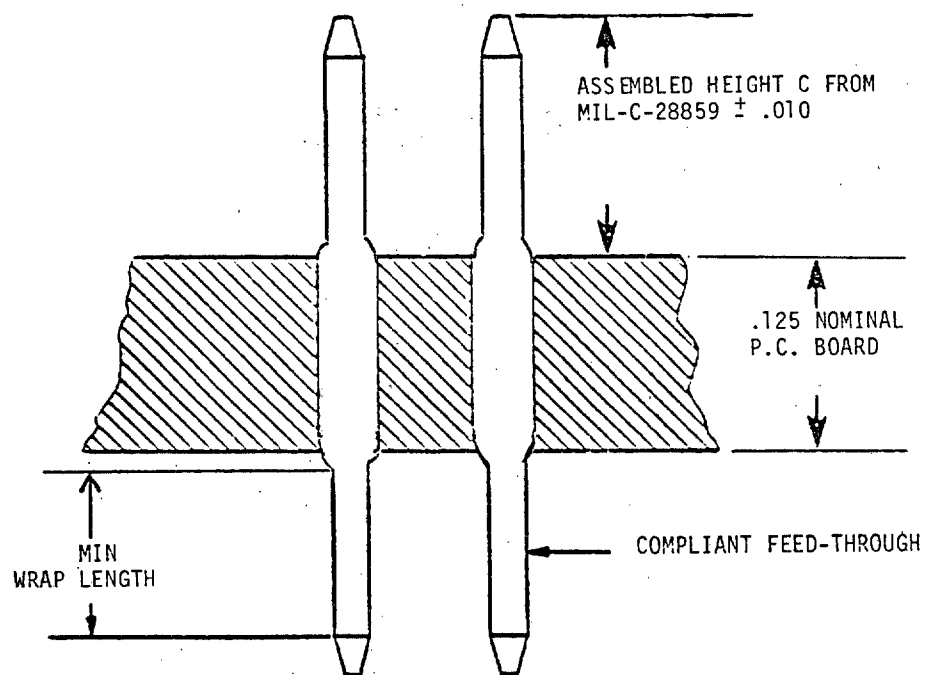


FIGURE 1. Cross-sectional view of printed-wiring electrical backplane assembly. - Continued.

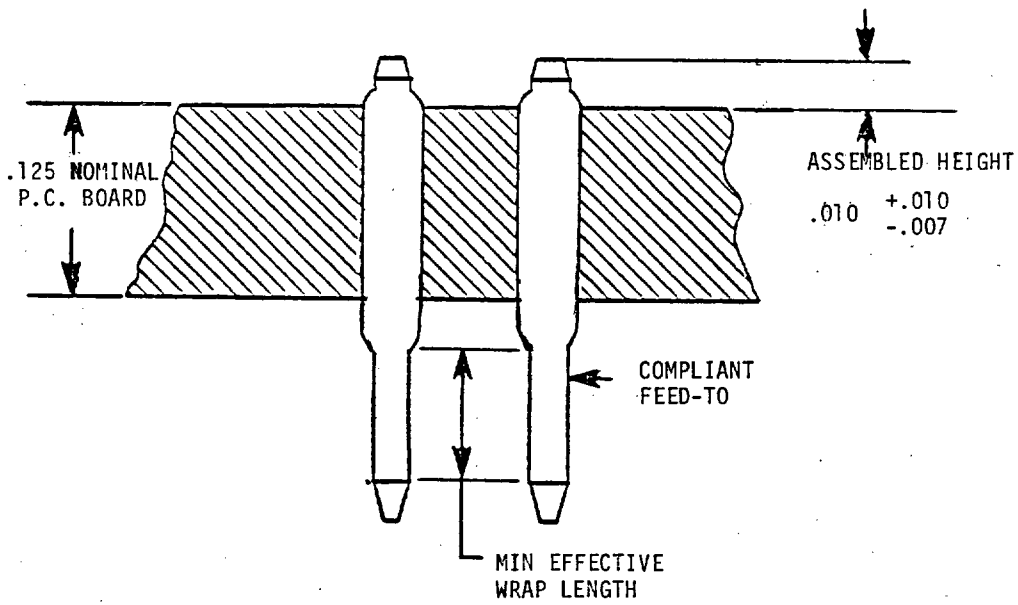


FIGURE 1. Cross-sectional view of printed-wiring electrical backplane assembly. - Continued.

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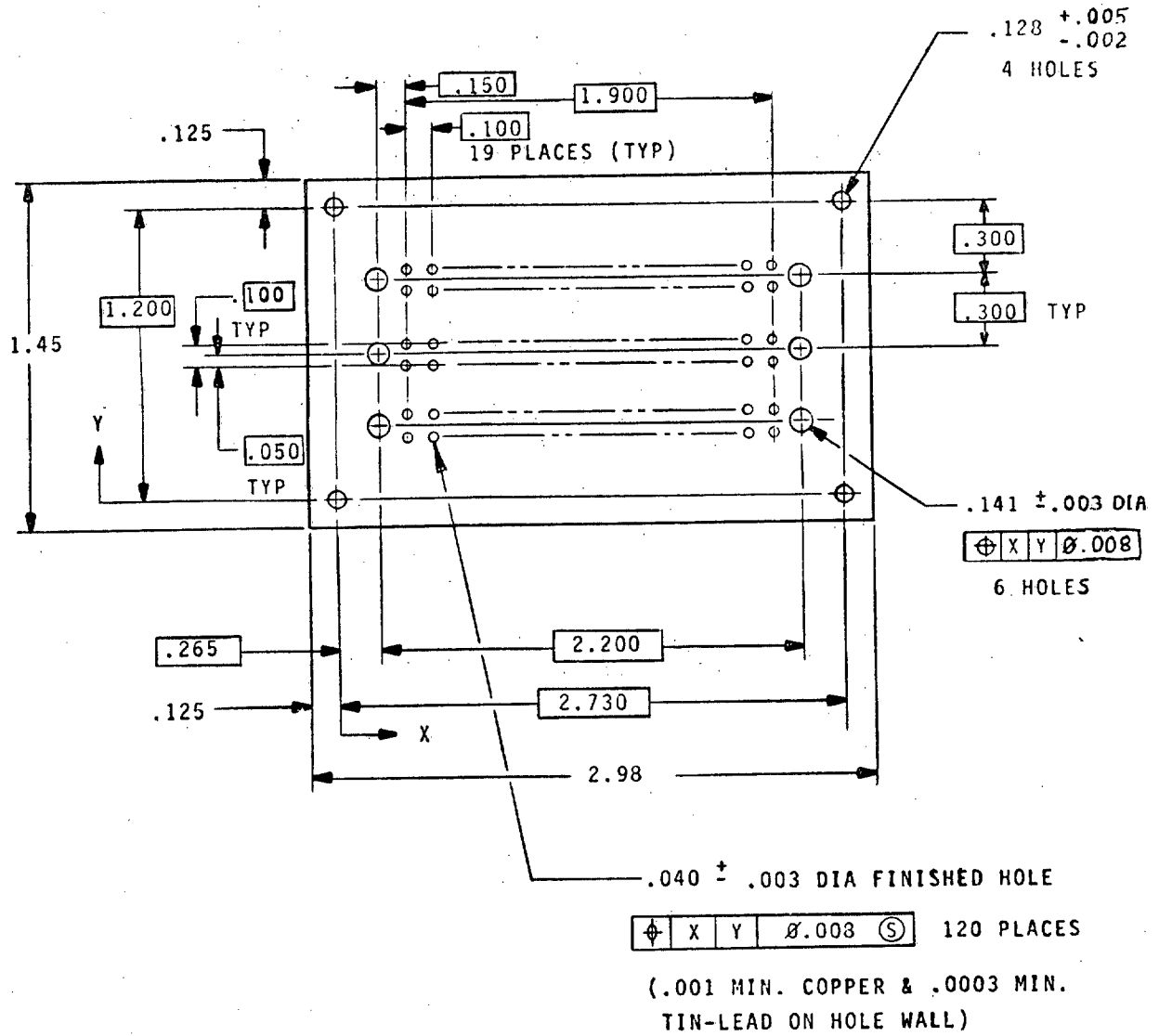


FIGURE 2. Test coupon.

DOUBLED SIDED BOARD PATTERN

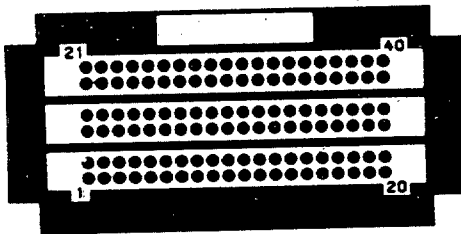


FIGURE 2. Test coupon. - continued

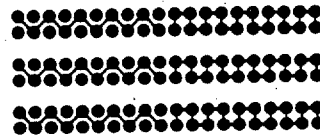
| | | |
|------------------|----------|-------------|
| SIZE A | FSCM NO. | DRAWING NO. |
| SCALE | REV | SHEET |

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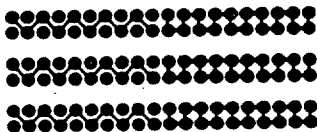
MULTILAYER BOARD PATTERN



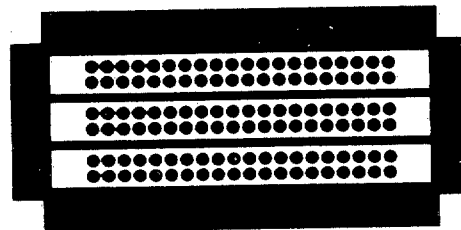
LAYER 1



LAYER 2, 4, 6, 8, ETC.



LAYER 3, 5, 7, 9, ETC.



LAST LAYER

FIGURE 2. Test coupon. - continued

| | | |
|-------|----------|-------------|
| SIZE | FSCM NO. | DRAWING NO. |
| A | | |
| SCALE | REV | SHEET |

5. DETAILED REQUIREMENTS

5.1 Assembly constructions. 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 pin component into the plated-through holes in the rigid printed-wiring board and snapping the appropriate housing over the receptacle end of the compliant pin 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.

5.1.1 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.

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

5.1.1.2 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.

5.1.1.3 Conformal coating solder mask.

5.1.1.3.1 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.

5.1.1.3.2 Thickness. The conformal coating thickness for type ER, UR, and AR shall be $.003 + .002$ inch ($.080 + .050$ mm); SR shall be $.005 + .003$ inch ($.13 + .08$ mm) and XY shall be $.005$ to $.002$ inch ($.01$ to $.05$ mm) when measured on a flat unencumbered surface.

5.1.1.4 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 |
| | GI | 204° C | X | X |

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

5.1.2 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.

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

5.1.2.2 Hole size. The drilled hole size shall be $0.453 + 0.001$ inch ($1.150 + .0254$ mm). The finished hole size shall be $0.040 + .003$ inch ($1.016 + 0.076$ mm) and shall have .0001 inch (.00254 mm) minimum of copper and .0003 inch minimum of tin-lead on the hole wall (see Figure 4).

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5.1.3 Printed wiring board thickness. The rigid printed-wiring board thickness shall be 0.125 ± 0.013 inch (3.175 ± 0.330 mm).

5.2 Assembly. The printed-wiring electrical backplane assembly shall meet the following requirements.

5.2.1 Compliant components. When assembled in the printed-wiring electrical backplane, the compliant component height above the rigid printed-wiring board shall be in accordance with figure 1. The compliant pin component shall be capable of individual removal and replacement without displacing the housing from its installed position.

5.2.1.1 Wrappost tail tip position. Unless otherwise specified on the approved backplane assembly drawing, all wrappost tail tip positions shall be within true position of 0.020 inch (.508mm) diameter to specified datums on the approved backplane assembly drawing.

5.2.2 Housing. When assembled on the compliant pin component in the rigid printed-wiring board, the housing dimensions shall be in accordance with figure 1.

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

5.2.3 Bow and twist. The maximum allowable bow and twist shall be 1.5 percent, unless otherwise specified on the approved assembly drawing.

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

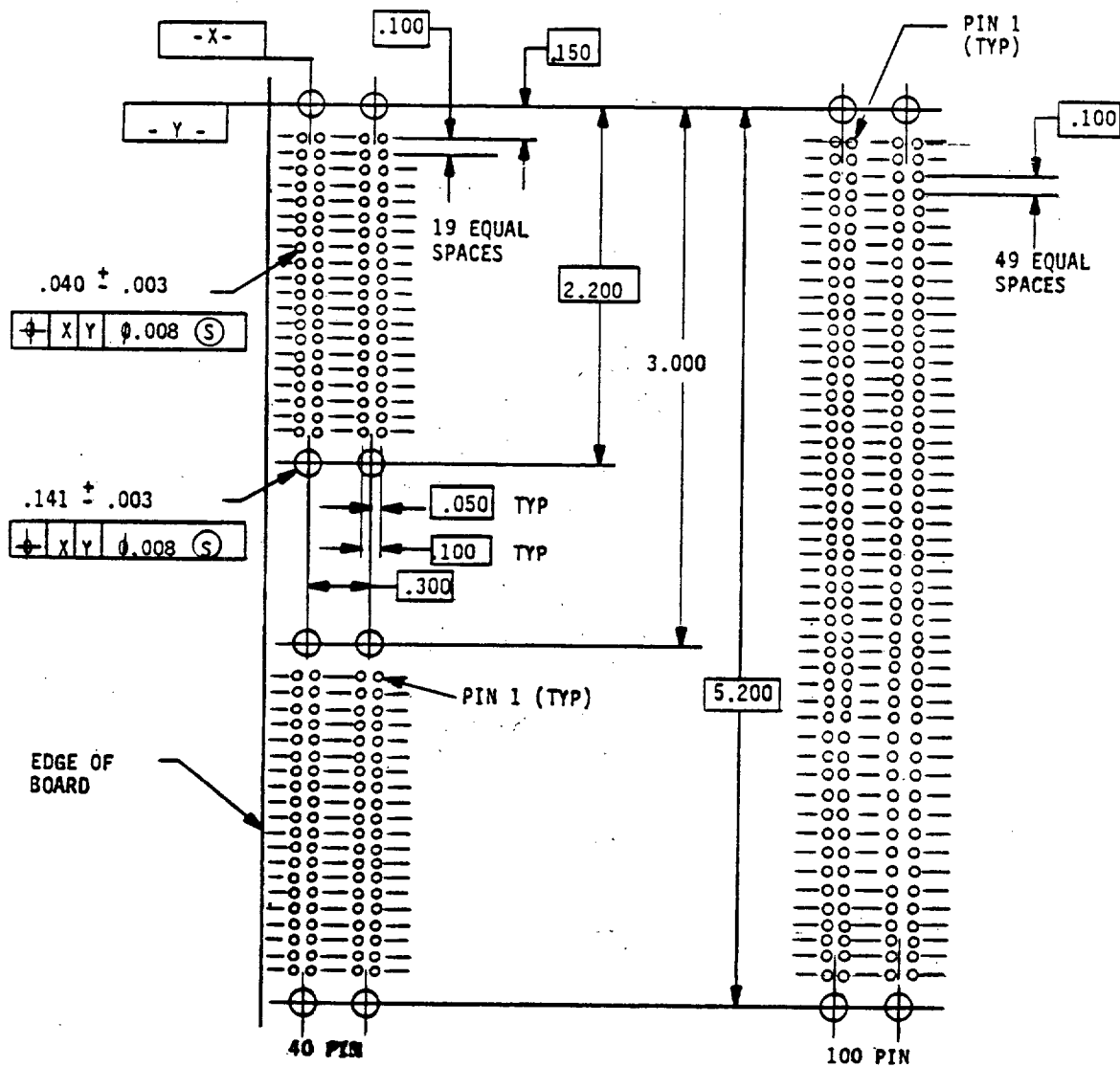
5.3.1 Marking ink. Marking ink shall be an epoxy base ink conforming to MIL-I-43553.

Review activities:
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DLA - ES

Preparing activity:
Navy - EC

User activities:
Navy - AS, MC, CG

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WRAPPOST SIDE OF BACKPLANE

FIGURE 3. Typical hole pattern.

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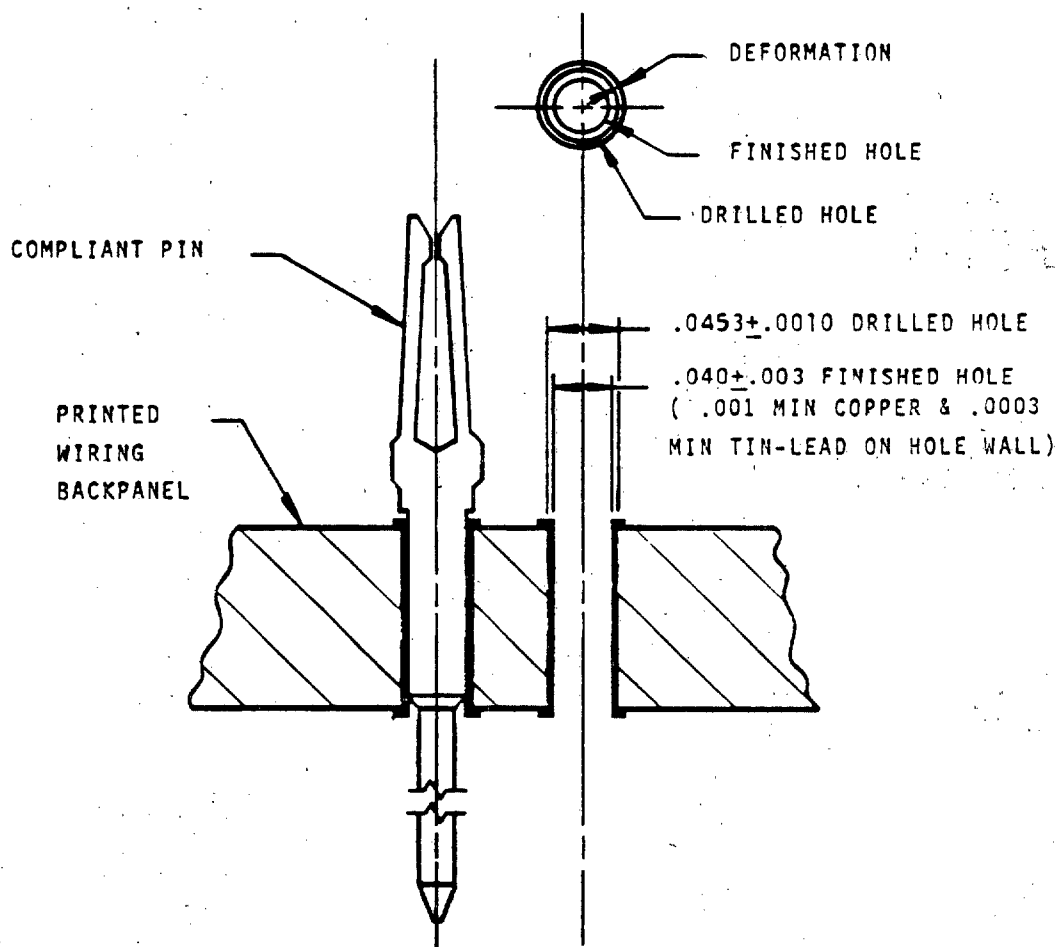


FIGURE 4. Plated - through hole
deformation radius.

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