



# IPC-TM-650 TEST METHODS MANUAL

Number <b>2.2.4</b>	
Subject <b>Dimensional Stability, Flexible Dielectric Materials</b>	
Date <b>5/98</b>	Revision <b>C</b>
Originating Task Group <b>Flex Peel Strength Test Methods Task Group (D-13A)</b>	

**1 Scope** This test method is used to establish and define the procedures for determining thermal gradient dimensional changes of a plastic dielectric, metal clad or unclad.

This method may also be used to determine dimensional changes after metal removal of a clad.

**2 Applicable Documents** None

**3 Test Specimen** The test specimen shall be at least 27 cm x 29 cm of unclad or metal clad dielectric material cut and punched per Figure 1.

**4 Test Equipment**

- *Shear* — for cutting 27 cm x 29 cm test specimens.
- *Micro-Rule* — with dial indicator reading to 0.0125 mm or less or an equivalent optical system.
- *Hole Punch* — 0.889 mm minimum diameter.
- *Oven* — mechanical convection type capable of maintaining a temperature of 150°C ± 2°C.

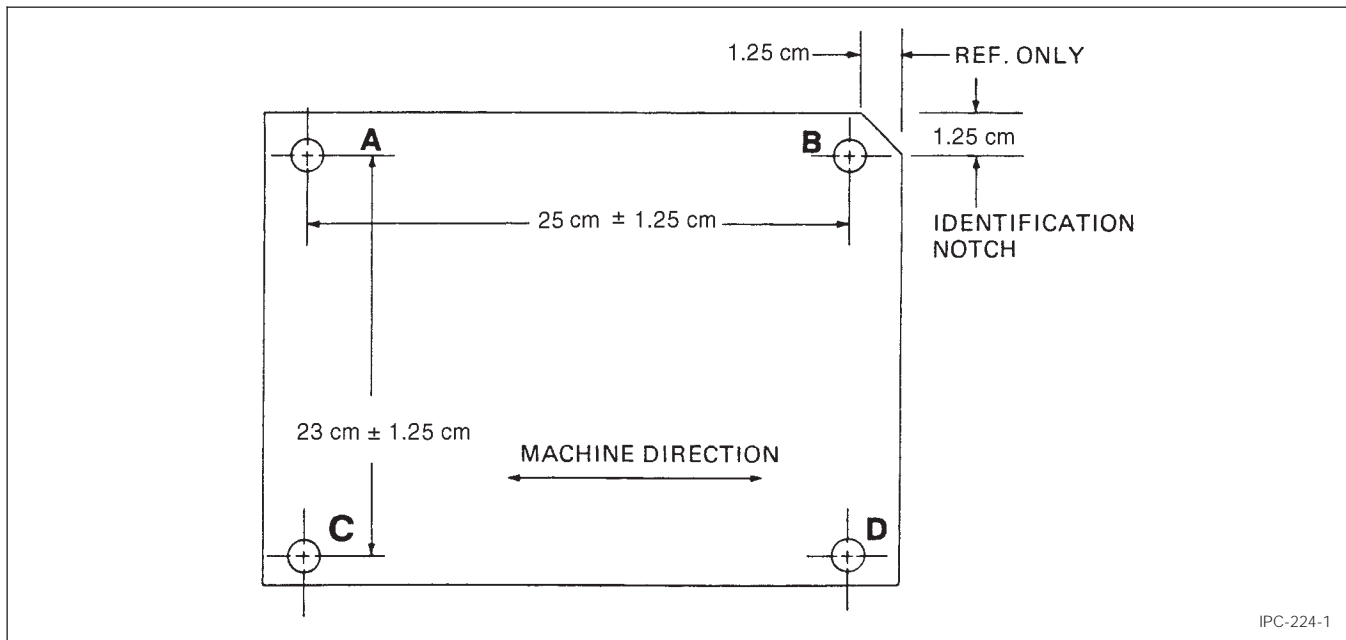
- *Etcher* — capable of maintaining test specimens a 43°C ± 5°C during the metal removal.
- *Line Scribe* — capable of producing a line 0.125 mm wide maximum.
- *Chemical Etchant* — capable of metal removal without detrimental effect to either the adhesive or dielectric.

**5 Procedure**

**5.1 Sample Preparation** Scribe 0.125 mm wide lines or punch holes at positions A through D in specimen at locations shown in Figure 1.

Allow specimen to stabilize at 23°C ± 2°C and 50% ± 5% relative humidity (RH) and measure separation of holes/lines between corresponding positions (center of hole or center of line). For example, the distance between hole centers A-B and C-D, also A-C and B-D. Record as initial measurement (1).

Stabilization times may be reduced if statistically sound evidence has been generated on the specific product line to support shorter stabilization times to reach equilibrium.



**Figure 1 Dimensional Stability Test Pattern**

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Twenty-four hour stabilization is referee method.

**5.2 Method A** Dimensional stability of unclad material due to thermal exposure—standard condition.

- (1) Place test specimen unconstrained in an oven maintained at 150°C ± 2°C for 30 ± 2 minutes.
- (2) Cool specimen to standard conditions of 23°C ± 2°C and 50% ± 5% RH for 24 hours minimum (see 5).
- (3) Remeasure separation of holes/lines and record as final measurement after thermal exposure (F<sub>1</sub>).

**5.3 Method B** Dimensional stability of metal clad dielectrics due to metal removal.

- (1) Chemically erode the metal away except for the target areas, which can have up to 13 mm x 13 mm square metal, using an etchant that has no detrimental effect on either the dielectric or adhesive. Wash and dry. The test specimen should be unconstrained during the etching, washing, and drying operation.
- (2) Stabilize test specimen for 24 hours at 23°C ± 2°C and 50% ± 5% RH (see 5.1).
- (3) Remeasure separation of holes/lines and record as final measurement after etching (F<sub>2</sub>).

**5.4 Method C** Dimensional stability of dielectric due to thermal exposure and metal removal, using specimens from Method B.

- (1) Place unconstrained etched, conditioned, and measured specimen from Method B in an oven maintained at 150°C ± 2°C for 30 ± 2 minutes.

- (2) Stabilize specimen at 23°C ± 2°C and 50% ± 5% RH for 24 hours and remeasure separation of holes (see 5.1).

- (3) Remeasure separation of holes/lines and record as final after etching and thermal exposure (F<sub>3</sub>).

**5.5** Calculate the linear dimensional changes as follows:

(Start with initial reading (I) from 5.1)

$$\text{M.D.} = \frac{\frac{(A-B)_F - (A-B)_I}{(A-B)_I} + \frac{(C-D)_F - (C-D)_I}{(C-D)_I}}{2} \times 100$$

$$\text{T.D.} = \frac{\frac{(A-C)_F - (A-C)_I}{(A-C)_I} + \frac{(B-D)_F - (B-D)_I}{(B-D)_I}}{2} \times 100$$

Where:

M.D. = % change in machine dimension.

T.D. = % change in transverse dimension.

I = Initial Reading.

F = Final Reading (Either F<sub>1</sub>, F<sub>2</sub>, or F<sub>3</sub>).

A-B = Distance Between Points A & B.

A-C = Distance Between Points A & C.

C-D = Distance Between Points C & D.

B-D = Distance Between Points B & D.

**6 Notes** The alternate method for marking clad samples allows the use of scribed lines. Caution must be used to protect scribed lines during etch operation.