



# IPC-TM-650 TEST METHODS MANUAL

**1.0 Scope** This test method establishes a procedure for determining whether the adhesion of a polymer coating to an inorganic or ceramic substrate is above an adequate level. The substrate may or may not have an oxide layer on the surface. The test can be inverted and used for determining the adhesion of a metal coating to a polymer film.

## 2.0 Applicable Documents

**ASTM D 3330** Test Method for Peel Adhesion of Pressure-Sensitive Tape of 180° Angle

**ASTM D 3359** Standard Test Methods for Measuring Adhesion by Tape Test

**3.0 Test Specimen** The test specimen shall consist of the coated substrate. A control should also be prepared using a mutually agreed upon material whose results from this test are known, preferably a material with an adhesion classification of 5. At least 3 test specimens should be prepared for each material of interest.

## 4.0 Apparatus or Material

**4.1** 25 mm [1.0 in] wide semitransparent pressure sensitive tape with an adhesion strength of  $43 \pm 6$  g/mm [ $38 \pm 5$  oz/in]. The adhesion should not change more than 6.5% of its mean value within 12 months. 3M Scotch brand #600 tape has been found to be acceptable for this test.

**4.2** Rubber eraser on end of pencil.

**4.3** A light source is helpful in determining if the cut has been made all the way through the polymer to the substrate.

**4.4** A closed boiling water bath.

## 5.0 Procedure

**5.1** Preparation of test specimen. Refer to ASTM D 3330 and ASTM D 3359.

**5.1.1** Prepare and clean the substrate according to the manufacturer's recommended procedure.

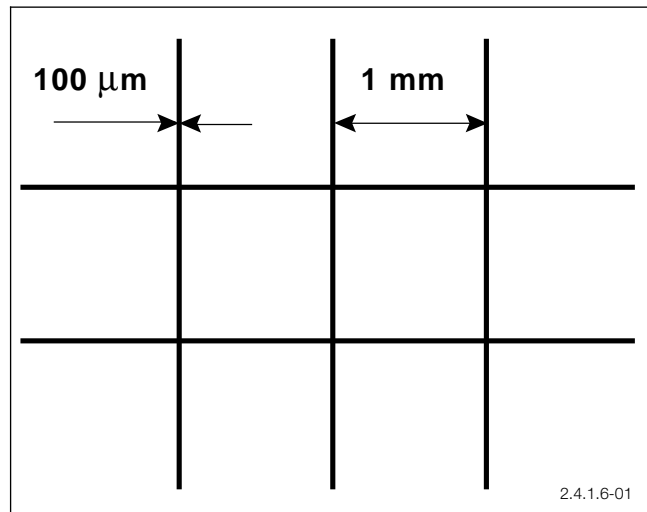
**5.1.2** Prime the surface with the manufacturer's recom-

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mended adhesion promoter, if required.

**5.1.3** Apply a 10  $\mu$ m to 25  $\mu$ m (measured after processing is complete) coating onto the surface of the substrate using the manufacturer's recommended procedure.

**5.2 Pattern Coating** The coating should be patterned according to the procedures outlined in section 4.2.5 of IPC-DD-135. The pattern consists of a 10 x 10 grid of 1 mm x 1 mm squares separated by 100  $\mu$ m wide lines or pattern features, as illustrated in Figure 1. At least two complete grids must be patterned on the specimen, one for the initial test and one for the 3 hour test.



**Figure 1**

## 5.3 Test

**5.3.1** Remove two complete laps of tape and discard. Remove an additional length at a steady (not jerked) rate and cut a piece approximately 75 mm [3.0 in] long.

**5.3.2** Place the center of the tape over one of the grid patterns and smooth into place by a finger. Rub the tape firmly with the eraser on the end of the pencil to ensure good contact between the tape and the film. The color under the tape is a good indicator of contact between the tape and the film.

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**5.3.3** Within 90 seconds of applying the tape, remove the tape with a steady motion by pulling at a 180° angle.

**5.3.4** Inspect the lattice pattern under illumination for removal of coating from the substrate. Rate the adhesion in accordance with the following scale illustrated in Figure 2:

- 5 The edges of the line patterns are completely smooth; none of the squares of the lattice are detached.
- 4 Small flakes of the coating are detached at the intersection of the lattice; less than 5% of the area is affected.
- 3 Small flakes of the coating are detached along the edges and at intersections of the lattice. The area affected is 5 to 15% of the lattice.
- 2 The coating has flaked along the edges and on parts of the squares. The area affected is 15 to 35% of the lattice.
- 1 The coating has flaked along the edges of the line patterns in long ribbons and whole squares have detached. The area affected is 35 to 65% of the lattice.
- 0 Greater than 65% of the lattice has detached.

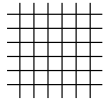
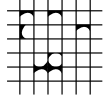
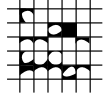
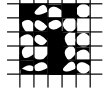
**5.3.5** Place the test specimens in a boiling water bath and stress the samples for 3 hours. The water in the boiling water bath must completely cover the test specimens for the entire 3 hours. A closed system that returns the steam as condensation is preferred.

**5.3.6** Remove the test specimens from the boiling water bath or environmental chamber and allow to cool to room temperature.

**5.3.7** Wipe sample dry. Repeat steps 5.3.1-5.3.4 on the second (unused) grid pattern.

**5.3.8** Report adhesion results for both the initial and 3 hour tests.

**6.0 Notes** None

Classification	Surface of cross-cut area from which flaking has occurred. (Example for six paralleled cuts)
<b>5</b>	<b>None</b>
<b>4</b>	
<b>3</b>	
<b>2</b>	
<b>1</b>	
<b>0</b>	<b>Greater than 65%</b>

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**Figure 2**