



IPC-TM-650 TEST METHODS MANUAL

1.0 Scope This test is designed to determine the peel strength of the metal cladding to the base laminate while exposed to elevated temperature by means of heated air chamber; and to evaluate the base laminate material after the peel strength test is completed for degradation due to the conditioning.

2.0 Applicable Documents

IPC-TM-650

Method 2.4.8.1, Peel Strength, Keyhole
Method 5.8.3, Peel Strength Test Pattern

3.0 Test Specimens

3.1 Size and Configuration Specimen size shall be 50.8 x 50.8 mm [2 x 2 in] by the thickness of the laminate. Cladding test strips shall be as specified (see 5.1.2).

3.2 Quantity and Sampling Unless otherwise specified, specimens shall be one lengthwise for each clad side and one crosswise for each clad side. The outside 25.4 mm [1 in] border of the parent sheet or panel shall be excluded.

4.0 Apparatus or Material

4.1 Tensile Tester A tensile strength tester equipped with a load cell, capable of measuring to the nearest 0.0045kg [0.01 lbs.] and a light load wire or chain and clamp at least 457 mm [18 in] long (its weight is included in the load cell calculation). The clamp jaws must cover the entire conductor width of each peel strip tab. Any equipment or apparatus having the described accuracy, precision, and reproducibility may be used.

4.2 Thermal Chamber An enclosure of the specimen location of the tester, capable of maintaining the test temperatures as specified, to within 3°C [5.4°F].

4.3 Specimen Hold-down A suitable hold-down clamping system equivalent in performance to that defined in IPC-TM-650, Method 2.4.8.1.

4.4 Oven Circulating air oven capable of maintaining 125 ± 2°C [257 ± 3.6°F].

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4.5 Timer Timing device capable of timing to within 1 second.

4.6 Measuring device capable of measuring from 0.0000 to 12.7 mm [0.0000 to 0.50 in] to within 0.0127 mm [0.0005 in].

4.7 Etching system capable of complete removal of metal cladding.

4.8 Etch Resist Materials or Systems

4.8.1 Printer's tape, or equivalent, of the specified width (see 5.1.4) to act as etch resist for strip formation.

4.8.2 Photo resist system (printing, developing, and striping).

5.0 Procedure

5.1 Specimen Preparation

5.1.1 Cut the specimens from the laminate sample. Specimens shall be taken no closer than 2.54 mm [1.0 in] from the edge of the laminate sheet.

5.1.2 Specimens shall be prepared with suitable etch resist material so that four strips of 3.18 mm [0.125 in] width are etched, and then cleaned and processed using standard industry practices and equipment. For qualification and referee testing, the specimens shall be photo-imaged in accordance with Method 5.8.3 of IPC-TM-650, except that tab ends are optional.

Specimens shall be etched so that the test strips on one specimen are in one direction per Figure 2. Double clad laminate shall have each side tested using separate specimens. The opposite side cladding shall be either fully removed or left fully clad. Separate samples for both the warp and fill directions are required for each side. For referee testing, the cladding on the opposite side shall not be removed.

5.1.3 Thin specimens may be provided with support by bonding them to a rigid substrate base, or may be tested with the aid of the keyhole fixture (see Figure 1). For referee testing of single sided laminates less than 0.51 mm [0.020 in], the specimens shall be bonded to a rigid substrate or laminate.

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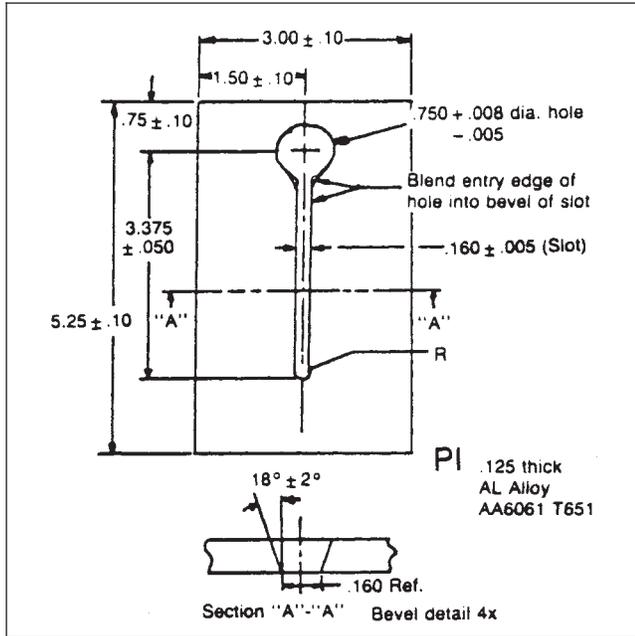


Figure 1

Note: Peel values can be affected by the adhesive used to bond the specimen to the rigid substrate. It is imperative that the best adhesive be found for the type of materials being bonded to least affect the true peel strength value.

5.1.4 Peel the test strip back approximately 12.7 mm [0.5 in] from the tab end (if present).

5.1.5 Unless otherwise specified, specimens shall be pre-conditioned by baking at 125°C [257°F] for 4 ± 0.5 hours. This preconditioning is required regardless of elevated test temperature requirements in the applicable specification.

5.2 Measurement

5.2.1 Peel Strength Determination

5.2.1.1 Preheat the test chamber to the specified temperature.

5.2.1.2 Place the specimen inside the test chamber, close the door and allow the specimen to remain in the heated chamber for 60 + 6, -0 minutes before performing the peel test at the applicable elevated temperature.

5.2.1.3 After attaching the clamp to each peel strip, allow the specimen to stabilize at the elevated temperature for 2.5

minutes for 0.5 mm [0.020 in] thick material or less, and 5 minutes for material thicker than 0.5 mm [0.020 in].

5.2.1.4 Start tester and apply force in the vertical direction at 50.8 mm [2 in] per minute until peel is completed or test strip breaks or tears (see 6.1).

5.2.1.5 Observe and record the minimum load as defined by Figure 2. Measure and record the actual width of the metal strip.

5.2.1.6 If the full width of the test strip does not peel, the result may be discarded and another strip tested.

5.2.1.7 Perform the procedure as per 5.2.2 through 5.2.4 on a minimum of 2 strips per side per specimen. Any unusual event or irregularity in the data shall be cause to void the strip's results and repeat the sequence on a different strip.

5.2.2 Determination of Degradation Examine the specimens using normal or corrected 20/20 vision. Record the presence of any base laminate degradation, including loss of surface resin, discoloration, resin softening, delamination, blistering, propagation of imperfections, measing, crazing, or voids.

5.3 Calculation and Report

5.3.1 Calculate peel strength in pounds per inch width using the formula:

$$\text{lbs/in} = \frac{L_M}{W_S}$$

where:

L_M = Minimum load

W_S = Measured width of peel strip

5.3.2 Record and report each individual peel strength value. Average the individual peel strength values for each side and each grain direction of the laminate sampling. For example, if the sampling plan called for one specimen per side and per grain direction, there will be at least two values to be averaged from four different specimens.

5.3.3 Report any presence of laminate degradation as observed in 5.2.1.3.

6.0 Notes

6.1 Test strip breaks may be caused by either superior bond

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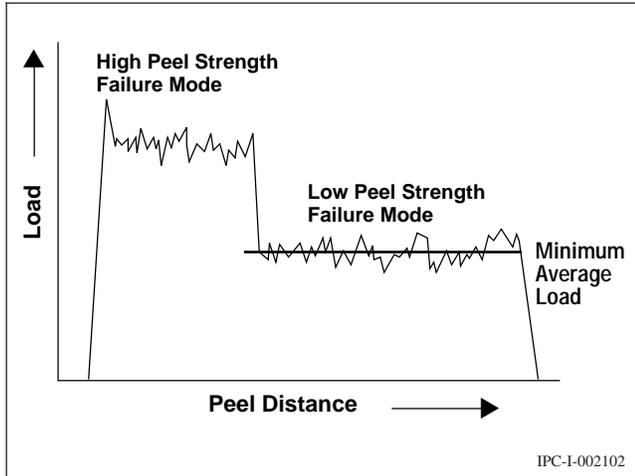


Figure 2 Multiple Failure Modes

or brittle foil. Where superior bond is shown (value at break is above specification), the value at break may be used instead of the minimum load. The reported average shall indicate that the value is greater than average.

6.2 For copper foil less than 1 oz/ft², copper plating or solder coating may be added to avoid breaks and tears.