



ASSOCIATION CONNECTING
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IPC-TM-650 TEST METHODS MANUAL

1 Scope This procedure is to be used for preparing a metallographic specimen of printed wiring products. The finished microsection is used for evaluating the quality of the laminate system and the plated-through holes (PTHs). The PTHs can be evaluated for characteristics of the copper foils, plating, and/or coatings to determine compliance with applicable specification requirements. The same basic procedures may be used for mounting and examination of other areas. Because manual metallographic sample preparation is regarded by many as essentially an art, this method describes those techniques that have been found to be generally acceptable. It does not attempt to be so specific as to allow no acceptable variations that can differentiate metallographers. Furthermore, the success of these techniques remains highly dependent upon the skill of the individual metallographer.

2 Applicable Documents

IPC-MS-810 Guidelines for High Volume Microsectioning

ASTM E 3 Standard Methods of Preparation of Metallographic Specimens

3 Test Specimens Cut the required specimens from a printed board or test coupon. Allow sufficient clearance to prevent damage to the area to be examined. The recommended minimum clearance is 2.54 mm [0.0984 in]. Abrasive cut off wheels can cut closer to the area of examination without causing damage. Some commonly used methods include sawing using a jewelers saw, miniature band saw, or abrasive cut-off wheel; routing using a small milling machine; or punching using a sharp, hollow die (not recommended for brittle materials, i.e., polyimide and some modified epoxy resin systems) (see IPC-MS-810). It is recommended that a minimum of one microsection containing at least three of the smallest diameter PTHs shall be made for each specimen tested. When microsectioning multilayer production printed boards designed without nonfunctional lands on all layers, care needs to be exercised in choosing the test location such that internal lands are connected to the selected PTHs. This is so that a complete quality evaluation can be made.

Number 2.1.1	
Subject Microsectioning, Manual Method	
Date 05/04	Revision E
Originating Task Group Post Separation Task Group (D-33a)	

4 Apparatus or Material

- 4.1** Sample removal method (see IPC-MS-810 for the best method to meet your needs).
- 4.2** Mount molds.
- 4.3** Smooth, flat mounting surface.
- 4.4** Release agent (optional).
- 4.5** Sample supports (optional).
- 4.6** Metallographic rotary grinding/polishing system.
- 4.7** Belt sander (optional).
- 4.8** Metallographic microscope capable of 100X to 200X magnification.
- 4.9** Vacuum pump and vacuum desiccator (optional).
- 4.10** Room temperature curing potting material (recommended maximum cure temperature 93 °C [200 °F]).
- 4.11** Abrasive paper USA CAMI Grade grit numbers 180, 240, 320, 400, and 600. See Figure 1 for conversion from American to European grit sizes.
- 4.12** Cloths for polishing wheels: a hard, low, or no nap cloth for rough and intermediate polishing and a soft, woven, or medium nap cloth for final polishing.
- 4.13** Oxide or colloidal silica polishing suspension (final polish, 0.3 µm to 0.04 µm [11.8 µin to 1.57 µin]).
- 4.14** Diamond polishing abrasive (6.0 µm to 0.1 µm [236 µin to 3.94 µin]).
- 4.15** Polishing lubricant.
- 4.16** Specimen etching solution (see 6.4).



IPC-TM-650		
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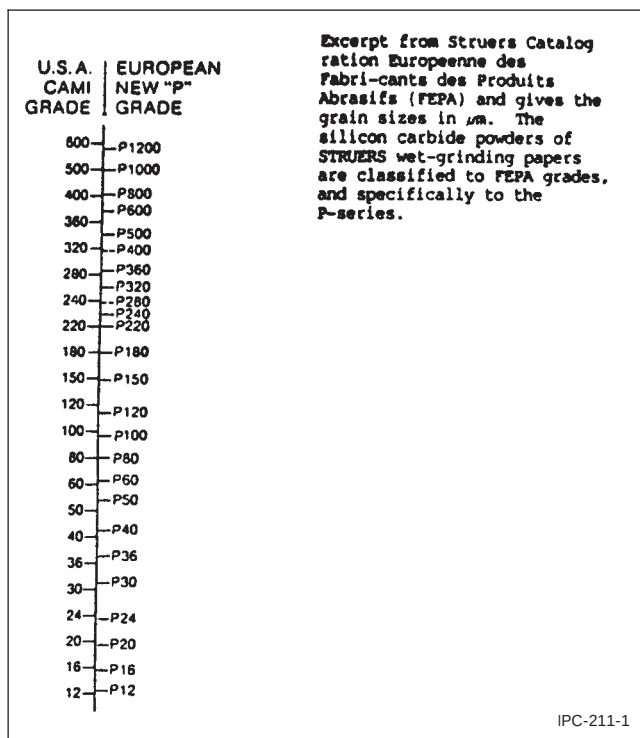


Figure 1 Abrasive paper grit size (American vs. European)

4.17 Cotton balls and swabs for cleaning and etchant application.

4.18 Isopropyl alcohol, 25% methanol aqueous solution, or other suitable solvent (check for reaction with the encapsulation media and marking system).

4.19 Specimen marking system.

4.20 Ultrasonic cleaner (optional).

5 Procedure

5.1 Preparation of Specimen Grind the sample sequentially on 180, 240, 320 grit wheel to within approximately 1.27 mm [0.05 in] of final polish depth. Deburr all edges prior to mounting.

5.2 Mounting Metallographic Sample

5.2.1 Clean mounting surface and dry thoroughly, then apply release agent to the plate and mounting rings.

5.2.2 Thoroughly clean the sample using a suitable solvent such as isopropyl or ethyl alcohol. This is especially important when microsectioning "thermally stressed" (solder floated) specimens. Residual flux may result in poor adhesion of the encapsulation media causing gaps between the specimen and the media. These gaps make proper metallographic sample preparation extremely difficult, if not impossible.

5.2.3 Stand specimen in mount ring, perpendicular to the base using sample supports, clips, or with the use of double-sided adhesive tape.

5.2.4 The surface to be examined should face the mounting surface.

5.2.5 Fill the mounting ring carefully with potting material, by pouring from one side to ensure complete PTH filling. Some potting materials may require dilution as recommended by the material manufacturer to reduce the viscosity in order to fill small diameter PTHs. Hand protection is recommended to prevent skin sensitization.

5.2.6 The sample must remain upright and the holes filled with encapsulating material.

5.2.7 Epoxy potting materials may require vacuum degassing in order to achieve complete hole filling.

5.2.8 Allow specimen to cure and remove hardened mount from ring. The minimum qualities the mount should exhibit are:

- No gaps between the potting material and the sample.
- The PTHs filled with material.
- No bubbles in the potting material.

The presence of these deficiencies will result in sample preparation difficulties, as noted in 5.2.2. Identify the specimen by a permanent method. The selected marking system should remain unaffected by solvent and lubricant exposure.

5.2.9 For finite plating thickness measurements, such as gold and nickel thickness on edge board contacts, the over-plated specimen may be placed at a 30° angle. This will provide viewing at twice the actual thickness. The measured thickness is then divided by two to arrive at the true thickness. For a more thorough discussion of the techniques of taper sectioning, refer to the references in 6.5.

5.3 Grinding And Polishing