



# IPC-TM-650 TEST METHODS MANUAL

**1.0 Scope** This test method is designed to measure the Resin Flow of “no flow” prepreg used for bonding and adhesion without formation of resin bead as caused by flow of the resin.

**2.0 Applicable Documents** None

## 3.0 Test Specimens

**3.1 Size and Configuration** A specimen shall consist of multiple plies of prepreg cut approximately 102 mm [4.0 in] x 102 mm [4.0 in]. If the reinforcement is a continuous fiber woven fabric, the sides shall be cut on a bias to the fabric weave. Unless otherwise specified, the test specimen shall have three plies.

**3.2 Quantity and Sampling** Unless otherwise specified, the number of specimens tested shall be as follows: For qualification testing, 3 specimens shall be tested, with the pieces for each taken from areas of the prepreg that represents the center and both edges of the material as impregnated. For lot testing, one specimen shall be tested, with the pieces randomly taken from the prepreg. Pieces shall be taken no less than 25.4 mm [1.0 in] from the impregnated edge.

## 4.0 Apparatus or Material

**4.1 Laminating Press** Unless otherwise specified, a laminating press capable of maintaining at a temperature of 171 ± 2.8°C [340 ± 5°F] and capable of providing a pressure of 1380 ± 70 kPa [200 ± 10 psi] on the test sample, see 6.1

**4.2 Hole Punch** Hole cutting tool, such as a hole punch or die set capable of cutting a 25.4 ± 1.3 mm [1.0 ± 0.05 in] hole.

## 4.3 Materials

**4.3.1** Release material shall be Tedlar type (polyvinyl fluoride, PVF), or equivalent, of 0.05 mm [0.002 in] thickness, maximum, at least as large as the size of the caul plates.

**4.3.2** Any copper-clad laminate of thickness between 0.25 mm [0.010 in] and 0.38 mm [0.0151 in] shall be cut to approximately 152 mm x 152 mm [6.0 in x 6.0 in].

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**4.3.3** Conformal press pad material equivalent to 0.5 mm [0.020 in] cotton linter paper, and cut to approximately 152 mm x 152 mm [6.0 in x 6.0 in].

**4.4 Measuring Microscope** Bausch and Lomb, model SUB-73 stereozoom microscope with 31-16-08 micrometer disc, Carl Zeiss Stage Micrometer, or equivalent.

**4.5 Caul Plates** Caul plates shall be 3.2 mm [0.125 in] thick and 152 mm [6.0 in] square and made from type 304 steel, or equivalent.

**4.6 Desiccator** Desiccation chamber capable of maintaining an atmosphere of less than 30% RH, at 23°C [73°F].

## 5.0 Procedure

### 5.1 Specimen Preparation

**5.1.1** The prepreg shall be cut to conform with the specimen size and configuration as per 3.1.

**5.1.2** If testing is to be performed more than 10 minutes after the prepreg has been manufactured, specimens shall be desiccated for 4 ± 1/4 hrs. prior to testing.

**5.1.3 Cleaning of Copper Cladding** When applicable for referee purposes, clean the metallic cladding on the copper clad laminate by wiping the copper cladding with isopropyl alcohol. The copper clad laminate shall be immersed in suitable container containing 22-23° BAUME 20 percent by volume solution of hydrochloric acid, technical grade, maintained at 21°C ± 5.6°C [170°F ± 10°F] for a period of 15 seconds. After removal of the copper clad laminate from the hydrochloric acid, the copper cladding then shall be rinsed with a cold water spray rinse for 5 seconds and blown dry with filtered, oil free, compressed air.

### 5.2 Measurement

**5.2.1** A specimen shall be formed by stacking three plies of prepreg with the grain of the reinforcement aligned in the same direction. Only if necessary to prevent ply slippage, tack the three plies together using a standard soldering iron within one quarter inch from one or more corners so that the plies

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lay flat to one another. Using a 25.4 mm [1.0 in] diameter hole punch, cut 2 holes at least 25.4 mm [1.0 in] apart (See Figure 1) in approximately the middle of the specimen. Caution should be taken during cutting in order to prevent any loose fibers from protruding into the clearance hole. Measure the diameter of each hole in 3 places, each approximately 60° radial angle from the others and determine the average diameter of the holes.

**5.2.2** Place the stack onto and in the middle of a 152 mm x 152 mm [6.0 in x 6.0 in] copper clad laminate of thickness between 0.25 mm [0.010 in] and 0.38 mm [0.015 in] thick and cover the stack with a sheet of release film. Over the release film place 2 pieces press pad material. For referee purposes, the surface of the copper cladding shall be cleaned immediately prior to lay-up using the procedure in paragraph 5.1.3. (The cleaning is to standardize the surface against which the resin will flow.)

**5.2.3** Place the stack (specimen plus laminate, release, and padding) between the two caul plates. Load the stack into the laminating press maintained at  $171^{\circ} \pm 2.8^{\circ}\text{C}$  [ $340^{\circ} \pm 5^{\circ}\text{F}$ ] and close immediately to  $1380 \pm 70$  kPa [ $200 \pm 10$  psi]. After holding at full pressure for 20 minutes, minimum, release the pressure and remove the package.

**5.3 Evaluation** After the package has cooled to room temp, measure the diameter of the punched holes at the point of maximum and minimum diameter as formed by the resin flow. Subtract the average diameter of holes obtained in 5.2.1 from the maximum and minimum diameters.

**5.4 Report** The results shall be reported including the following:

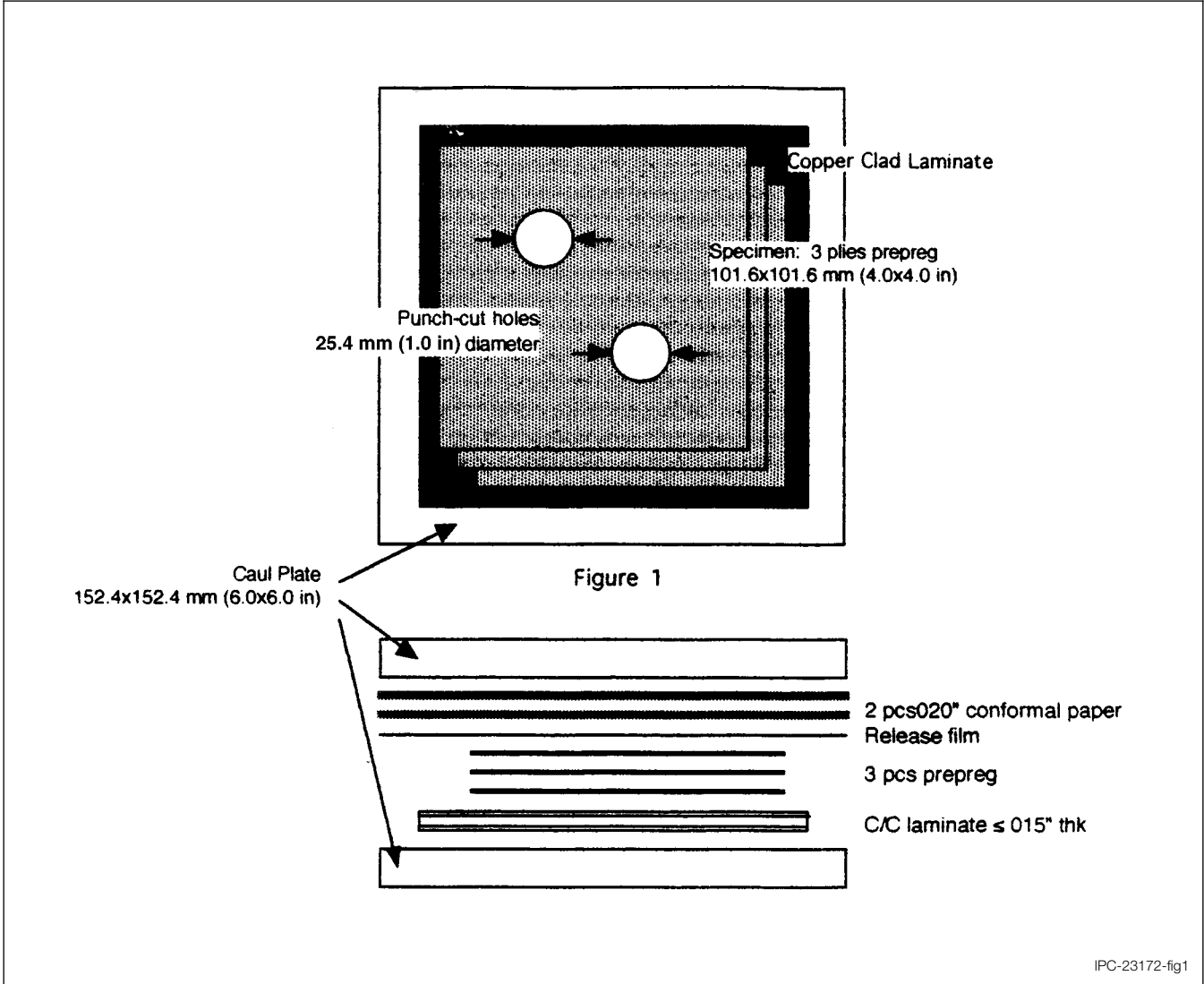
1. Identification of specimens tested.
2. Resin flow, for each specimen tested in terms of the maximum flow and minimum flow in millimeters (thousands of an inch) for both die-cut holes.

#### 6.0 Notes

**6.1** Agreement between supplier and user other than that specified in 4.1 may be necessary for specific resin chemistries.

**6.2 Desiccator Conditions** The Test Methods Task Group determined that a great majority of test laboratories are unable to consistently hold the Relative Humidity in a desiccator to less than 20%. Based on data from participating company lab management, the lowest practically feasible RH for use with the affected IPC Test Methods is 30% maximum.

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IPC-23172-fig1

Figure 1