



IPC-TM-650 TEST METHODS MANUAL

1.0 Scope This test method is designed to measure the volatile content of prepreg used as bonding plies in the manufacture of laminate and printed boards.

2.0 Applicable Documents None

3.0 Test Specimens

3.1 Specimen Size The test specimen shall be a ply of prepreg cut with its diagonal parallel to the X or Y axis of the prepreg. The specimen shall be approximately 101.6 x 101.6 mm [4 in x 4 in]. A hole approximately 3.18 mm [0.125 in] in diameter shall be punched in one corner of the specimen.

3.2 Quantity and Sampling Unless otherwise specified, for each material tested, three specimens shall be prepared; one specimen shall be cut from the center of the width and one each from each edge of the sheet of prepreg. Specimens shall be cut no closer than 25.4 mm [1 in] from the edge of the prepreg sheet.

4.0 Apparatus or Material

4.1 Analytical Balance Analytical balance capable of weighing to the nearest milligram [0.001 gram].

4.2 Oven Air circulating oven capable of maintaining $\pm 2.8^\circ\text{C}$ [$\pm 5^\circ\text{F}$] at the specified test temperature (see Table 1).

4.3 Desiccator Desiccation chamber capable of maintaining an atmosphere less than 30% R.H. at 23°C [73.4°F]. Vacuum drying systems, or equivalent, that could absorb or remove organic components shall not be used.

Table 1

Prepreg ⁽¹⁾ Material Type	Oven ⁽¹⁾ Temperature	Test ⁽¹⁾ Time
Difunctional Epoxy, Tetrafunctional Epoxy, Multifunctional Epoxy, Polyimide Blend	163°C (325°F)	15 \pm 1 minute
Polyimide	225°C (437°F)	30 \pm 1 minute
Cyanate Ester	145°C (293°F)	15 \pm 1 minute

(1) For material types that do not conform to the types listed, follow the manufacturer's instructions for temperature and time.

Number 2.3.19	
Subject Volatile Content of Prepreg	
Date 12/94	Revision C
Originating Task Group MIL-P-13949 Test Methods Task Group (7-11b)	

4.4 Hanging Device to Support Prepreg

4.4.1 Paper clip, alligator clip, or equivalent (Method A)

4.4.2 Clip jig, as shown in Figure 1. (Method B)

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 Preconditioning Unless the prepreg is tested within 10 minutes of manufacture, specimens shall be desiccated for 24 ± 2 hours before testing. Specimens tested as part of manufacturing control procedures are exempt from desiccation. For referee testing, desiccation shall be performed. (See 6.1.)

5.2 Method A

5.2.1 Apply mold release to the hanging device and allow to air dry.

5.2.2 Weigh the hanging device to the nearest milligram [0.001 gram]. Record as W_1 .

5.2.3 Weigh each specimen with a hanging device to the nearest milligram [0.001 gram]. Record as W_2 .

5.2.4 Place each specimen and hanging device in the air circulating oven at the temperature and for the time specified in Table 1 or by the governing document.

5.2.5 Remove each specimen with the hanging device and weigh within two minutes to the nearest milligram [0.001 gram]. Record as W_3 .

5.2.6 Calculate and record the volatile content as follows:

$$\text{Volatile content (\%)} = \left(\frac{W_2 - W_3}{W_2 - W_1} \right) \times 100$$

W_1 = (see 5.2.2)

W_2 = (see 5.2.3)

W_3 = (see 5.2.5)

IPC-TM-650		
Number 2.3.19	Subject Volatile Content of Prepreg	Date 12/94
Revision C		

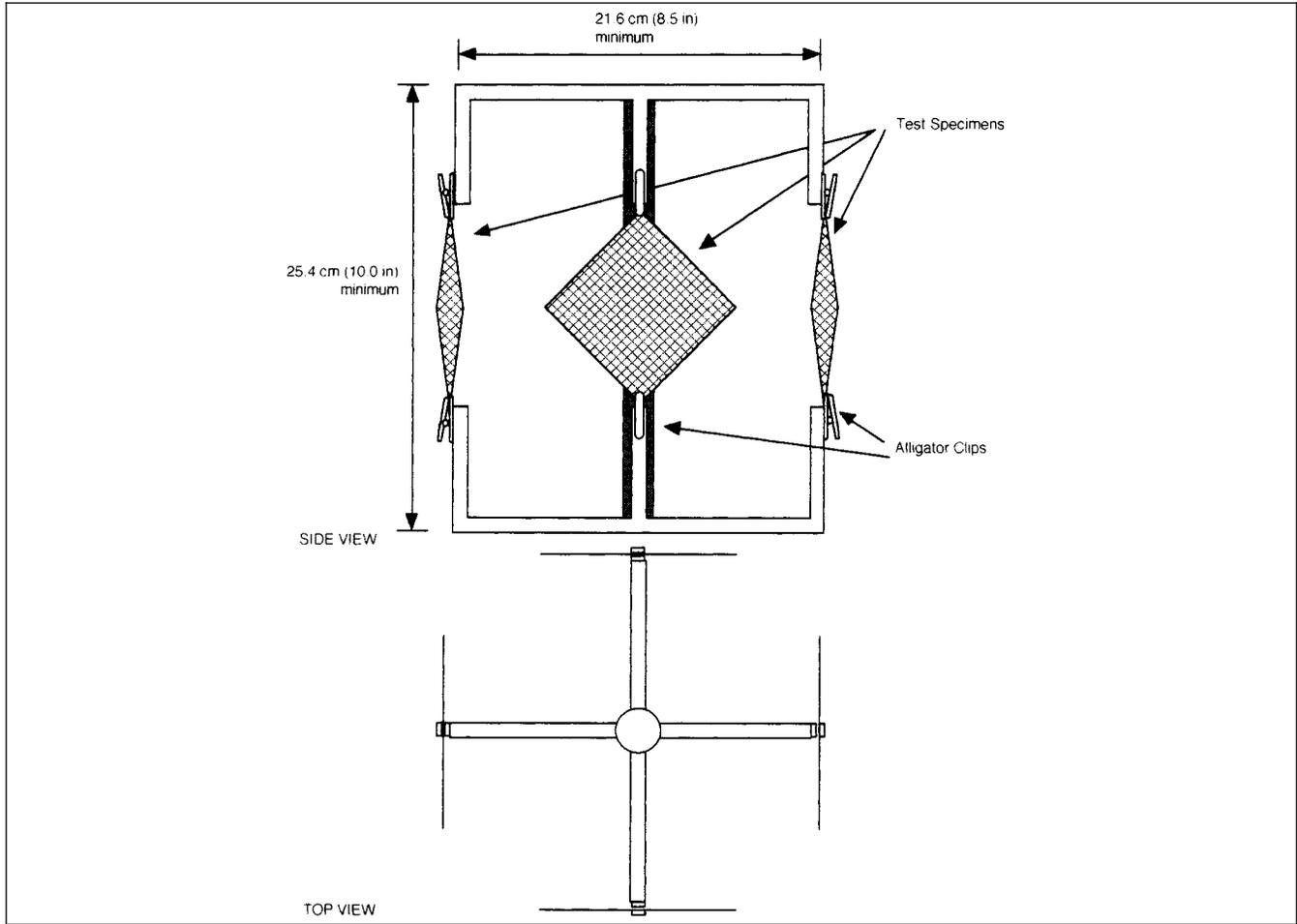


Figure 1 Method of holding device

5.3 Method B

5.3.1 Apply mold release to the alligator clips on the apparatus shown in Figure 1 and allow to air dry.

5.3.2 Weigh each specimen to the nearest milligram [0.001 gram]. Record as W1.

5.3.3 Secure each specimen at diagonally opposite corners from the metal hanging apparatus as shown in Figure 1.

5.3.4 Place the apparatus with specimens in the air circulating oven at the temperature and for the time specified in Table 1 or by the governing document.

5.3.5 Remove the specimens from the oven and from the

holding apparatus and weigh each specimen within two minutes to the nearest milligram [0.001 gram]. Record as W2.

5.4 Calculation Calculate and record the volatile content as follows:

$$\text{Volatile Content (\%)} = \left(\frac{W_1 - W_2}{W_1} \right) \times 100$$

5.5 Report The results should be reported and shall contain the following:

- (1) Identification of prepreg material type tested.
- (2) Percent volatile content for each specimen tested and the average.
- (3) Test temperature and time in oven.

IPC-TM-650		
Number 2.3.19	Subject Volatile Content of Prepreg	Date 12/94
Revision C		

6.0 Notes

6.1 Moisture Content

6.1.1 Exclusion of Moisture Content Desiccation of the specimens is performed for the following reasons.

6.1.1.1 This test method is based on the understanding that "Volatile Content" refers to organic solvents and other ingredients of the prepreg that may remain in the material after curing. Water or moisture content is not considered as a "Volatile" for purposes of this test, and therefore desiccation is a fundamental step to exclude H₂O from the data. It is not possible to remove all H₂O from material that is hygroscopic, but the most significant content is removed.

6.1.1.2 This method has a high intrinsic variability potential, and since moisture content is extremely variable and dependent on the storage environment, meaningful data is best achieved by removing the moisture.

6.1.2 Moisture Content Determination This method can be performed in an alternative manner, in which the specimen is weighed before it is desiccated. The difference between the "As Is Weight" and the "Weight After Desiccation" (but before oven drying) is the moisture content.

6.2 Alternate Specimen Holder Method B has been designed to minimize the problem of specimens flopping around in the air circulating oven.

6.3 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.