Association Connecting Electronics Industries

3000 Lakeside Drive, Suite 309S
Bannockburn, IL 60015-1249

Number **2.6.28**	
Subject **Moisture Content and/or Moisture Absorption Rate, (Bulk) Printed Board**	
Date **08/2010**	Revision
Originating Task Group **Board Storage and handling Subcommittee (D-35)**	

IPC-TM-650
TEST METHODS MANUAL

1 Scope Moisture absorption can cause delamination or other damage in printed boards subjected to soldering heat. This test is a process control tool to determine both the bulk moisture content and moisture absorption rate of a printed board. It may be used to determine whether the specimen conforms to the monitoring level of the user's performance specification, to assist in process development, or for process control. This test may not provide accurate analytical results on all specimens, depending on the thickness of the item, the presence of copper layers or other moisture barriers within the structure, or the presence of any volatile compounds other than water. The weight of the specimen is compared before and after a bake operation. The bake is intended to remove most of the water (> 90%) from the sample, and the bake time and temperature specified herein are minimums. To improve test accuracy, or to prevent heat damage, other bake parameters may be as agreed between user and supplier (AABUS).

2 Applicable Documents

IPC-QL-653 Certification of Facilities that Inspect/Test Printed Boards, Components and Materials

3 Test Specimens

This test may be applied to actual printed boards. If the item is too large to be weighed easily, a representative sample or coupon may be used. The sample may be sectioned from a larger printed board or assembly (e.g., a scrapped item), provided that the sample represents the features and construction of the whole. The sample should be sized based on the mass capacity and physical dimensions of the analytical balance. If a coupon is used, it must include features and construction similar to the item that it represents, including similar content and distribution of copper, and must have been subjected to the identical processing environments and conditions. It should be realized that the use of a representative coupon excised from a larger printed board may result in exposed laminate edges that will result in a slightly different absorption rate than the actual printed board.

4 Apparatus

4.1 Circulating air oven capable of maintaining a uniform temperature of 105 +5 °C/-0 °C (221 +9 °F/-0 °F). Nitrogen atmosphere (inert) or vacuum is not required, but will promote drying and improve accuracy of the test.

4.2 Analytical balance capable of determining the test sample/coupon weight in grams to 4 places of accuracy (X.XXXX) is required. Precautions **shall** be taken to ensure that the analytical balance test location is not compromised by vibration or air drafts. If the test samples are functional printed circuit boards with embedded active devices, ESD requirements appropriate to handling these circuit boards **shall** be followed. The analytical balance **shall** be calibrated in accordance with IPC-QL-653.

4.3 Tweezers, tongs or equivalent **shall** be used to handle the test sample/coupons to prevent handling contamination. The tweezers **shall** be cleaned prior to each test sample/coupon weighing session.

4.4 Gloves **shall** be used when handling the test samples/coupons to prevent handling contamination. The gloves **shall not** contribute any contamination material on the test samples/coupons.

5 Procedure

5.1 Initial Weighing The weight of the test sample/coupon **shall** be determined to the nearest 0.0001g and recorded.

5.2 Bake The test sample/coupon **shall** be baked for 24 hours at 105 +5 °C/-0 °C (221 + 9 °F/-0 °F), unless AABUS.

Note: The intent of this bake is to remove at least 90% of the moisture from the sample. Printed boards that are very thick, have solid copper planes, or that are especially saturated with moisture (which may be bound deep within inner layers) may require longer bake times and/or higher temperatures.

5.3 Post-Bake Weighing An extremely rigid post bake weighing regimen must be strictly followed to accurately determine the test sample/coupon absorption rate. The analytical balance measurement station **shall** be organized to prevent any interruption of the post bake weighing process.

Procedure:

1. The test sample/coupon **shall** be removed from the circulating oven and transferred immediately (within 2 minutes) to the analytical balance measurement location.
2. Each test sample/coupon **shall** be placed on the analytical balance and allowed to dwell for 15 seconds, and then

the sample/coupon weight **shall** be recorded to the nearest 0.0001 g. Note that the sample/coupon weight will not settle completely.

These measurements characterize the bulk moisture content of the test samples. If the moisture absorption rate is desired, continue with process steps 3 through 5:

3. Measure and record ambient temperature and relative humidity at the analytical balance measurement station.
4. The test sample/coupons **shall** remain at the analytical balance measurement station for 15 minutes +1/-0 minutes and procedure steps 2-3 **shall** be repeated.
5. Repeat step 4, taking measurements at 15 minute intervals, for at least 4 hours.

Note: The ambient temperature and humidity, the frequency with which ambient conditions are recorded, the measurement intervals between weighings and the number of weighings may be adjusted AABUS.

5.4 Calculations Calculate the bulk moisture content using the following equation:

$$\text{Moisture Content (\%)} = \left(\frac{\text{(Initial Weight)} - \text{(Post–Bake Weight)}}{\text{(Post–Bake Weight)}}\right) \text{X } 100$$

Calculate the moisture absorption rate by plotting the bulk moisture content versus time using the data recorded in Procedure steps 3 through 5 of 5.3.

Note: Metals do not absorb moisture, and metal content in the specimen will affect the accuracy of this determination. If copper or other metals are likely to exceed 20% of the weight of the specimen, this weight should be determined or estimated, and subtracted from both the Initial Weight and the Post-Bake Weight in the formula above. This correction factor **shall** be AABUS.

5.5 Report Report the bulk moisture content or moisture absorption rate for the sample/coupon.