ASSOCIATION CONNECTING
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Number	
2.6.3	
Subject	
Moisture and Insulation Resistance, Printed Boards	
Date	Revision
05/04	**F**
Originating Task Group	
Rigid Printed Board Performance Task Group (D-33a)	

IPC-TM-650
TEST METHODS MANUAL

1 Scope This test method is to determine the degradation of insulating materials by examination of the visual and electrical insulation resistance properties of printed board specimens after exposure to high humidity and heat conditions. This method allows testing with (Method A) or without (Method B) Conformal Coating. When not specified, Method A is the default method.

2 Applicable Documents

IPC-CC-830 Qualification and Performance, Insulating Compounds for Printed Circuits Assemblies

3 Test Specimens

3.1 Test specimens shall be comprised of a minimum of two conductor lines per conductive layer, sufficient to allow resistance testing between adjacent conductor patterns both between layers and on the same layer. See 6.1 for examples of test specimen patterns recommended for this test method.

4 Apparatus or Material

4.1 A clean test chamber capable of programming and recording an environment of temperature ranging between 25 °C ± 2 °C [77 °F ± 4 °F) and 65 °C ± 2 °C [149 °F ± 4 °F], and 85% to 93% relative humidity.

4.2 A power supply capable of producing a standing bias potential of 100 volts DC with a tolerance of ± 10%.

4.3 A resistance meter capable of reading high resistance at the voltage described in the procurement documentation.

4.4 Solder or Flux-Cored Solder Flux shall be removable in a manner which will not adversely affect the test specimen.

4.5 Soft Bristle Brush.

4.6 Deionized or distilled water (2 megohm-cm, minimum resistivity recommended).

4.7 Isopropyl alcohol.

4.8 Drying oven(s) capable of maintaining 50 °C ± 5 °C [122 °F ± 9 °F] and 125 °C ± 5 °C [257 °F ± 9 °F].

4.9 Insulating compound (conformal coating) which conforms to IPC-CC-830.

4.10 Equipment necessary to apply and cure conformal coating.

5 Procedure

5.1 Specimen Preparation

5.1.1 Mark specimen with positive, permanent, and noncontaminating identification.

5.1.2 Visually inspect the test specimens for any obvious defects, as described in the applicable performance specification. If any test specimen is noncompliant, the test specimen should be replaced and the replacement noted.

5.1.3 Solder single stranded (to decrease the opportunity for flux contamination from the wire) insulated wire which is not affected by the test environment to each of the connection points of the test specimens. These wires will be used to connect the test patterns of the test specimens to the power supply and for insulation resistance testing.

5.1.4 Clean test lead terminals with isopropyl alcohol and scrub with a soft bristle brush for a minimum of 30 seconds. During the remainder of the test specimen preparation, handle test specimens by the edges only (see 6.2).

5.1.5 Spray rinse thoroughly with fresh isopropyl alcohol. Hold test specimen at an approximate 30° angle and spray from top to bottom.

5.1.6 Rinse cleaned area thoroughly with fresh deionized or distilled water. Hold test specimen at an approximate 30° angle and spray from top to bottom.

5.1.7 Dry test specimens in a drying oven for a minimum of three hours at an oven temperature of between 50 °C ± 5 °C [122 °F ± 9 °F) (see 6.3).

5.1.8 Specimen preparation for **METHOD B** is now completed, continue the procedure with 5.2.

5.1.9 METHOD A - Application of Conformal Coating. Continuation of Sample Preparation Apply coating to the appropriate area of the test specimen, in a manner concurrent with user's production techniques or as specified by the coating supplier.

5.1.10 After the application of coating, the test specimens are to be cured, as specified by the coating supplier.

5.1.11 After curing, stabilize to ambient temperature.

5.2 Test

5.2.1 Take the initial insulation resistance measurements at laboratory ambient temperature. Apply the voltage specified in the procurement documentation on the test specimen's test points as specified in 5.2.2 with the resistance meter, and take the reading after measurement stabilization.

5.2.2 Test points on the test specimens shall be connected in a manner that will allow adjacent conductor patterns, both between conductor layers and on the same conductor layer, to alternate between the positive (+) and negative (–) terminals of the power supply or resistance meter.

5.2.3 Place test specimens in chamber in a vertical position and under a condensation drip shield. Connect the DC voltage source to the test specimen test points as indicated in 5.2.2. Apply a 100 ± 10 volts DC polarization voltage to all test specimens.

5.2.4 Expose test specimens to one of the following specified test conditions: (See 6.4.)

(a) Class 1 – 35 °C ± 5 °C [95 °F ± 9 °F], 85% to 93% relative humidity, for four days (static).

(b) Class 2 – 50 °C ± 5 °C [122 °F ± 9 °F], 85% to 93% relative humidity, for seven days (static).

(c) Class 3 – 20 cycles of temperature ranging from 25 °C +5/-2 °C [77 °F +9/-4 °F] to 65 °C ± 2 °C [149 °F ± 4 °F], 85% to 93% relative humidity, 160 hours total.

5.2.4.1 Temperature cycling The following constitutes one complete cycle (for the Class 3 Test Condition).

(a) Start test at 25 °C +5/-2 °C [77 °F +9/-4 °F], and raise temperature at 65 °C ± 2 °C [149 °F ± 4 °F], over a time span of 150 minutes ± 5 minutes.

(b) Maintain temperature at 65 °C ± 2 °C [149 °F ± 4 °F] over a time span of 180 minutes ± 5 minutes.

(c) Lower temperature from 65 °C ± 2 °C [149 °F ± 4 °F] to 25 °C +5/-2 °C [77 °F +9/-4 °F] over a time span of 150 minutes ± 5 minutes.

There shall be no delay between cycles. Polarizing voltage shall be maintained throughout the 20 cycle period. The humidity may drop a minimum of 80% relative humidity when going from high to low temperature. See Figure 1 for a graphical illustration of temperature cycling.

5.3 Measurement

5.3.1 Disconnect 100 volts DC polarized voltage source before taking any insulation resistance measurement. Insulation resistance shall be read as specified in 5.2.1. Voltage polarity for measurement should be identical to that of the polarizing voltage.

5.3.2 Final resistance measurements shall be made after removal of specimen from the chamber, and after one hour and before two hours stabilization at laboratory ambient temperatures.

Any reasons for deleting values, e.g., scratches, condensation, bridged conductors, etc., must be noted.

5.4 Evaluation

5.4.1 Each test specimen shall be evaluated for insulation resistance quality for its class, following and/or during the initial, wet and/or dry conditions, as applicable.

5.4.2 After completion of all electrical testing, the test specimens shall be examined for evidence of mealing, blistering, delamination, or other forms of degradation, following 24 hour stabilization at laboratory ambient temperatures.

6 *Notes*

6.1 Test Pattern Examples

6.1.1 ''Y'' Patterns There are a variety of ''Y'' test patterns (also referred to as ''E'' test coupons) in various specifications within the industry. See Figure 2 for an illustration of ''Y'' pattern test coupons.

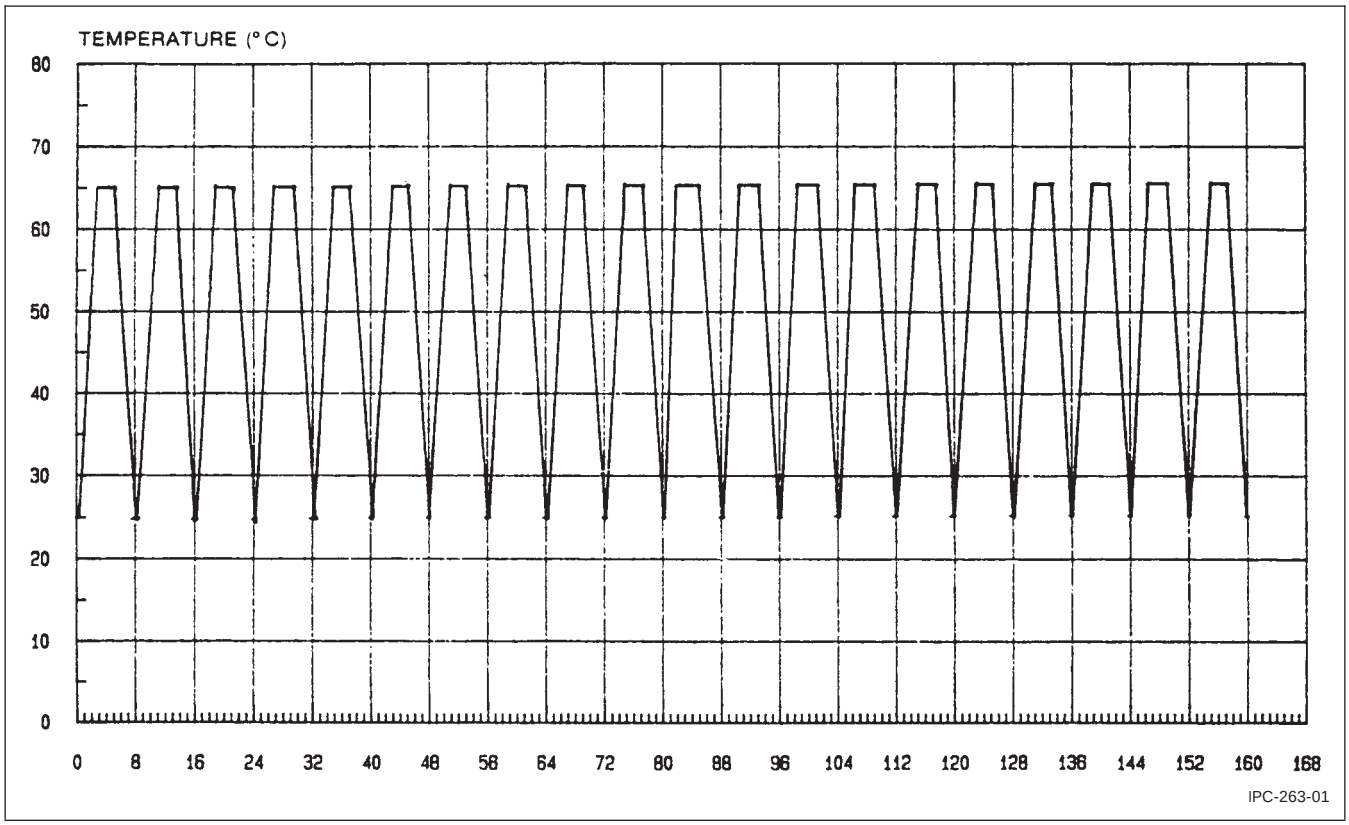

Figure 1 Moisture and Insulation Resistance Test Graph

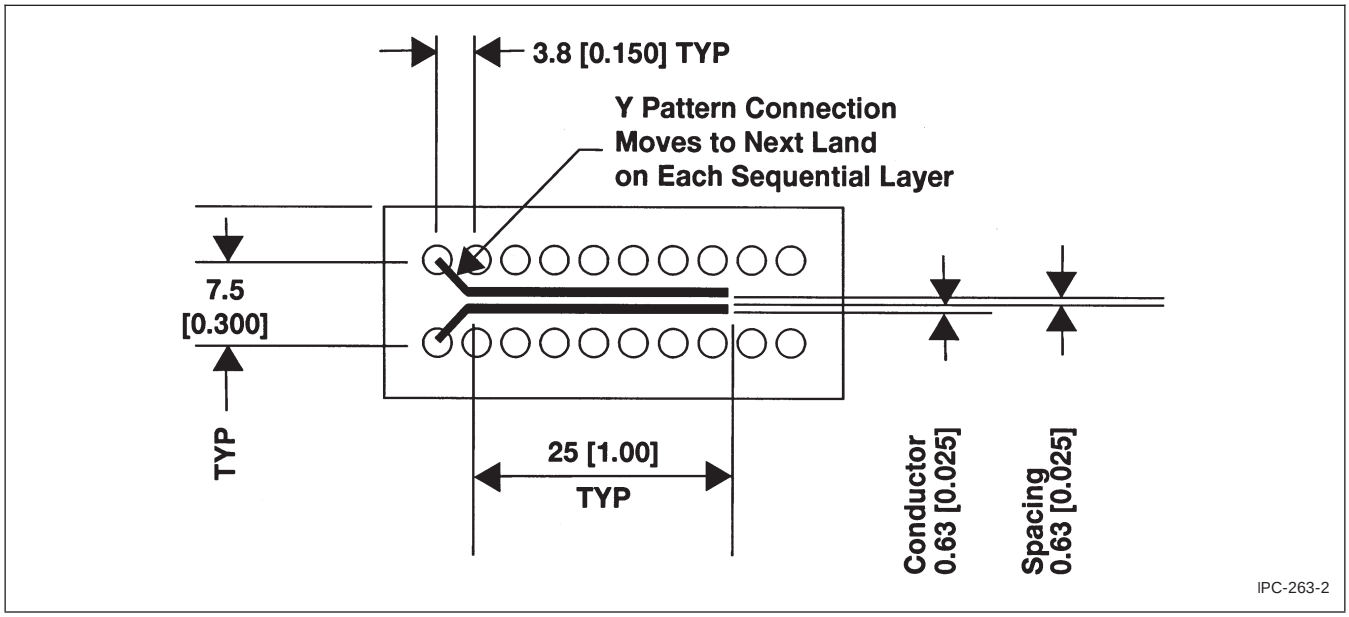

Figure 2 Insulation Resistance Coupon E (See Table 7-3), mm [in]

6.1.2 Comb Patterns Various ''comb patterns'' can be properly tested following the procedures in this document. The test points for comb patterns such as in Figure 3 are 1 to 2, 2 to 3, 3 to 4, and 4 to 5. Test points 1-3-5 are connected to the positive (+) terminal, and test points 2-4 are connected to the negative (–) terminals of the resistance meter.

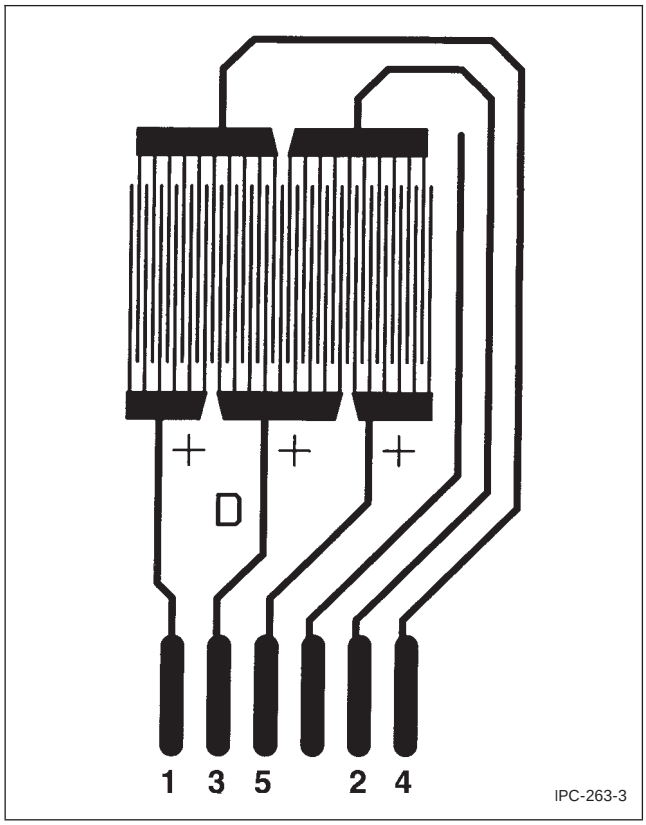

Figure 3 Typical "Comb Pattern" (from IPC-B-25A)

6.1.3 Production Board Testing Occasionally, production boards must be tested in lieu of test patterns. When this is required, one must use good judgment and select adjacent conductors for wiring terminal lands for testing, because conductor spacing and placement can affect test results.

6.2 Documented alternative cleaning procedures may be implemented. As an example, if there is a concern that scrubbing will adversely affect test results, e.g., when the test specimens have very fine spacing and/or are plated with soft metals (tin/lead, gold, etc.).

6.3 If printed boards are to be stored before coating, place the boards in a dry noncontaminating environment.

6.4 Performance specifications should specify the method of test specimen preparation, test condition class, and any deviations to this test method.

6.5 The test chamber should be constructed out of materials that will not corrode or add ionic contamination to the test environment.