Association Connecting Electronics Industries

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Number	
2.6.3.2	
Subject	
Surface Insulation and Moisture Resistance, Copper Clad Flexible Dielectric Material	
Date	Revision
8/14/15	**C**
Originating Task Group	
D-15	

IPC-TM-650
TEST METHODS MANUAL

1 Scope This test method defines the procedures for determining the surface insulation resistance of a copper foil clad flexible dielectric material in the presence of moisture. This test method may be used for testing both metal clad dielectric as produced per IPC-4204 and bondply dielectric that must be evaluated for surface insulation resistance in a laminated format as metal clad dielectric.

The moisture resistance test is performed for the purpose of evaluating, in an accelerated manner, the resistance of materials to the deleterious effects of high humidity and heat conditions. The test method is designed to simultaneously assess leakage current caused by ionized water films and electrochemical degradation (corrosion and dendritic growth) of the test vehicle.

2 Applicable Documents

2.1 IPC

IPC-A-600 Acceptability Guidelines

3 Test Specimen The test specimen **shall** consist of an etched conductor pattern in accordance with Figure 1. Test a minimum of three test specimens per clad side. For double clad material, a separate sample unit **shall** be prepared for each side.

3.1 The test points for comb patterns 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.

4 Apparatus

4.1 Test Chamber A test chamber capable of producing and recording an environment of 65 °C ± 2 °C [149 °F ± 3.6 °F] and 85% - 93% relative humidity and which will allow the insulation resistance to be measured while the specimens are under the specified conditions. This chamber is to be used for static insulation resistance testing, involving a single temperature and relative humidity to stress the test specimen over the specified test time.

4.2 Power Supply A power supply capable of producing a bias potential of 100 volts dc with a tolerance of ± 10%.

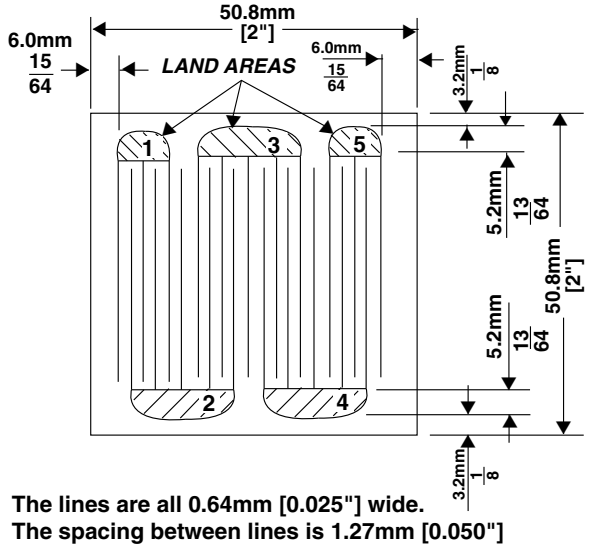

Figure 1 Insulation resistance test pattern

4.3 Resistance Meter A resistance meter capable of reading 10^{12} ohms or greater, with a measurement error not to exceed 10%, with a test voltage of 500 volts dc.

4.4 Other Equipment or Materials

4.4.1 Soft bristle brush.

4.4.2 Deionized or distilled water (2 megohm cm minimum resistivity recommended).

4.4.3 Isopropyl alcohol.

4.4.4 Single-stranded* PTFE or other fluorocarbon insulated wire. (Shielded wire recommended.) [*single-stranded minimizes flux wicking]

4.4.5 Soldering iron (25 - 40 watts).

4.4.6 Drying oven capable of maintaining at least 60 °C.

5 Procedure

5.1 Test Conditions

5.1.1 The test conditions **shall** be set at 65 °C ± 2 °C [149 °F ± 3.6 °F]; 85% – 93% RH for a minimum of 96 hours.

5.2 Specimen Preparation

5.2.1 Permanently identify each test specimen.

5.2.2 Visually inspect the test specimens for any obvious defects, as described in IPC-A-600. If there is any doubt about the overall quality of a test specimen, it should be discarded.

5.2.3 Solder single-stranded PTFE or other fluorocarbon insulated wire to each land of the test specimen. As flux residue is of great concern with this test, soldering should initially be attempted without use of any flux. If flux is required by qualitative observation, use rosin (RO), low activity flux. The solder and/or rosin must not spread beyond the land areas. These wires will be used to connect each land for polarization and for insulation resistance testing. The test pattern **shall not** exhibit any spatter of the flux or solder. It is recommended to cover or otherwise protect the test patterns during the soldering operation.

5.2.4 Spray rinse thoroughly with deionized water. Hold test specimen at an approximate 30° angle and spray from top to bottom.

5.2.5 Immerse the test specimen in deionized water and scrub with a soft bristle brush for a minimum of 30 seconds. During the remainder of the specimen preparation, handle test specimens by the edges only.

5.2.6 Immerse the test specimen in clean, virgin isopropyl alcohol and agitate for a minimum of 30 seconds. Scrub with a soft bristle brush to remove flux residue. Rinse specimen thoroughly with clean isopropyl alcohol.

5.2.7 Dry the cleaned test specimens in a drying oven for a minimum of three hours at 49 °C - 60 °C [120 °F - 140 °F].

5.3 Initial Insulation Resistance Measurement at Standard Laboratory Conditions (Ambient)

5.3.1 Condition test specimens a minimum of 24 hours at standard laboratory conditions of 23 °C ± 5 °C [73 °F ± 9 °F] and 50 % ± 10 % relative humidity. This is Test Condition A.

5.3.2 Take an initial insulation resistance measurement between each pair of terminals, 1 to 2, 2 to 3, 3 to 4, and 4 to 5 at standard laboratory conditions. Before taking the measurement, apply a polarizing potential of 500 volts dc ± 50 volts dc, with the resistance meter for one minute, then take the measurement at 500 volts dc ± 50 volts dc.

5.4 Insulation Resistance Measurement at Elevated Temperature and Humidity

5.4.1 Place the test specimens from Test Condition A in the test chamber, in a vertical position parallel to airflow, and under a condensation drip shield. Apply a 100 volt dc polarization potential to each pair of terminals of the test specimens.

5.4.2 Expose the material test specimens to the conditions of 65 °C ± 2 °C [149 °F ± 3.6 °F] and 85% -93% relative humidity for a minimum of 96 hours.

5.4.3 Disconnect the 100 volt dc polarization potential.

5.4.4 Apply a reverse polarization potential of 500 ± 50 volts dc with the resistance meter for one minute, then take the measurement at 500 volts dc ± 50 volts dc between each pair of terminals, 1 to 2, 2 to 3, 3 to 4, and 4 to 5, of the test specimen.

5.4.5 Measure and record the insulation resistance at the end of the nominal 96 hour conditioning period. These tests are to be conducted without opening the test chamber.

5.5 Insulation Resistance Measurement after Recovery from Elevated Temperature and Humidity

5.5.1 Remove the test specimens from the test chamber after disconnecting the bias voltage (100 volts dc).

5.5.2 Stabilize the test specimens, at the following conditions: 23 °C ± 5 °C [73.4 °F ± 9 °F] and 50% ± 10% relative humidity, for 24 hours [+ 0.5 hours / - 0 hours].

5.5.3 Take the insulation resistance measurements and record such at laboratory ambient temperature at 23 °C ± 5 °C [73.4 °F ± 9 °F] after the above stabilization conditioning.

5.5.4 Apply a reverse polarization potential of 500 ± 50 volts dc with the resistance meter for one minute. Next, take the measurements at 500 volts dc ± 50 volts dc between each pair of terminals, 1 to 2, 2 to 3, 3 to 4, and 4 to 5, of the test specimen.

5.5.5 Note any reason(s) for deleting values, i.e., scratches, condensation, bridged conductors, etc.

5.6 Evaluation

5.6.1 The values to be reported **shall** only be the readings taken in 5.5 through 5.5.5, which are the ''After Recovery'' values. See Figure 2 for a typical IR plot.

5.6.2 After completion of all electrical testing, the test specimens **shall** be examined for measling, blisters, delamination, or other forms of degradation, following 24 hour stabilization at laboratory ambient temperatures.

6 Notes

6.1 Documented alternative cleaning procedures may be implemented if there is a concern that scrubbing will adversely affect test results.

6.2 A failure due to measling, blistering, delamination, or any other form of degradation, may be due to several factors, and not necessarily due to inferior coatings.

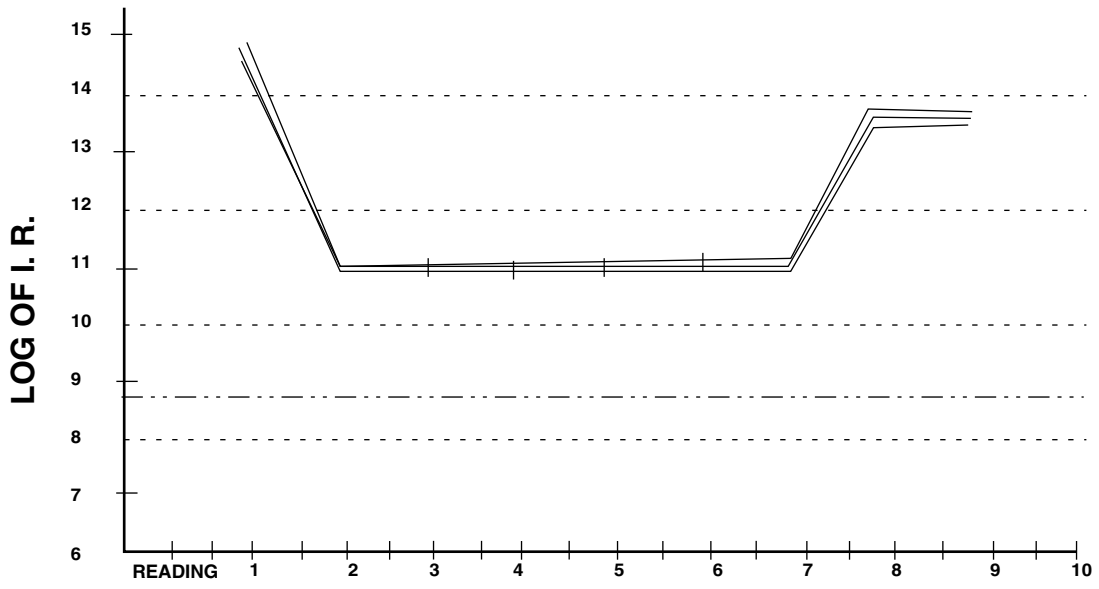

Figure 2 Typical IR and MIR plot