The Institute for Interconnecting and Packaging Electronic Circuits
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IPC-TM-650
TEST METHODS MANUAL

Number	
2.6.3.2	
Subject	
Insulation and Moisture Resistance, Flexible Base Dielectric	
Date **5/88**	Revision **B**
Originating Task Group **N/A**	

1.0 Scope This test method defines the procedures for determining the moisture and insulation resistance of a copper foil clad flexible dielectric material.

The moisture resistance test is performed for the purpose of evaluating, in an accelerated manner, the resistance of materials to the deteriorative effects of high humidity and heat conditions, typical of tropical environments.

2.0 Applicable Documents

IPC-A-600 Acceptability Guidelines

3.0 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.

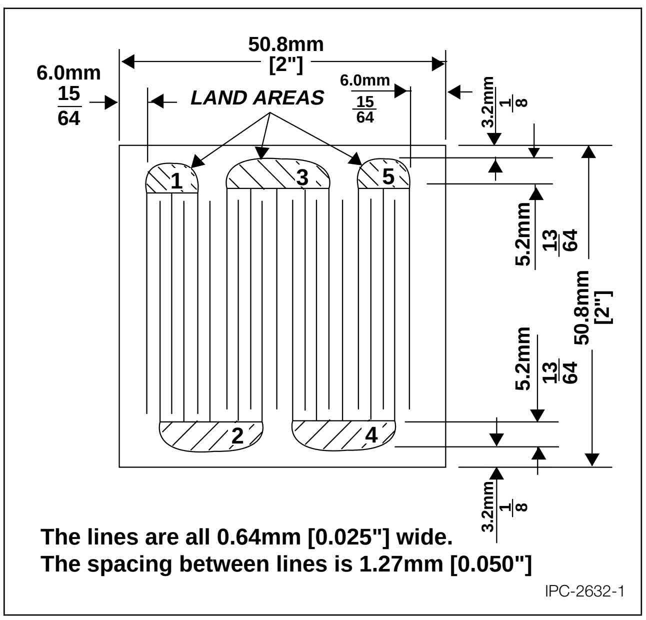


Figure 1 Insulation resistance test pattern

4.0 Apparatus

4.1 Test Chambers

4.1.1 For static test conditions (Class 1 and 2 material), a test chamber capable of producing and recording an environment of 35° +2°C [95° ±3.6°F] and 90 -0, +5 percent relative humidity and which will allow the insulation resistance to be measured while the specimens are under the specified conditions.

4.1.2 For cycling test conditions (Class 3 material), a programmable test chamber capable of producing and recording an environment of 25° +10°, -2°C [77° +18°, -3.6°F] to 65° ±2°C [149° ±3.6°F] and 90-98 percent relative humidity and which will allow the insulation resistance to be measured while the specimens are under the specified conditions.

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

4.3 A resistance meter capable of reading 10^8 to 10^{12} ohms or greater, with a measurement error not to exceed 10%, with a test voltage range of 500 volts dc or greater.

4.4 Soft bristle brush.

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

4.6 Isopropyl alcohol.

4.7 Single-stranded insulated wire. (Shielded wire recommended.)

4.8 Soldering iron (25 to 40 watt).

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

5.0 Procedure

5.1 Test Conditions

5.1.1 Class 1 and 2 material: 35° ±2°C [95° ±3.6°F], 90 -0, +5% RH, 4 days (static).

5.1.2 Class 3 material: 25° +10°, -2°C [77° +18°, -3.6°F] to 65° ±2°C [149° ±3.6°F], 90-98% RH, may drop to 80% RH minimum during temperature drop, 6-2/3 days (cycling). Number of days cycling can be decreased based on statistical sampling. (See graph 1.)

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, the test should be discarded.

5.2.3 Solder single-strand Teflon insulated wire to each land of the test specimen. The solder 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.

5.2.4 Immerse 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.

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

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

5.2.7 Rinse specimen thoroughly with clean isopropyl alcohol.

5.2.8 Dry test specimens in a drying oven for a minimum of three hours at 49° to 60°C [120° to 140°F].

5.3 Test Condition A—Initial Insulation Resistance at Standard Laboratory Conditions (Ambient).

5.3.1 Condition test specimens a minimum of 24 hours at standard laboratory conditions of 23° ±2°C [77° ±3.6°F] and 50 ± 10% relative humidity.

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 ± 50 volts dc, with the resistance meter for one minute, than take the measurement at 500 ± 50 volts dc.

5.4 Test Condition B—Insulation Resistance at Elevated Temperature and Humidity.

5.4.1 Place the test specimens from Test Condition A in the test chamber, in a vertical position, 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 Class 1 and 2 material test specimens to the static conditions of 35° ±2°C [95° ±3.6°F] and 90 -0, +5% relative humidity for four days.

5.4.3 Expose the Class 3 material test specimens to 20 cycles of temperature and humidity. The humidity (90-98% relative humidity) and polarizing potential (100 volts dc) shall be maintained throughout the entire 20 cycle period.[1] One cycle is made up of the following three steps:

A. Start test at 25° ±2°C [77° ±3.6°F] and raise temperature to 65° ±2°C [149° ±3.6°F] over a time span of 2-1/2 ±0.1 hours.

B. Maintain temperature at 65° ±2°C [149° ±3.6°F] for three hours minimum.

C. Lower temperature from 65° ±2°C [149° ±3.6°F] to 25° ±2°C [77° ±3.6°F] over a time span of 2-1/2 ±0.1 hours.

This constitutes one complete cycle. There shall be no delay between cycles. See Graph 1.

5.4.4 Disconnect the 100 volt dc polarization potential.

5.4.5 Apply a reverse polarization potential of 500 ± 50 volts dc with the resistance meter for one minute, then take the measurement at 500 ± 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.

5.4.6 For Class 3[2] material test specimens, measure and record the insulation resistance once every 24 hours, during the high temperature phase of the conditioning cycle. For Class 1 and 2 material test specimens, measure and record

1. The relative humidity may drop to 80% RH minimum during temperature drop (step C).
2. Cycles can be reduced to 10 if statistical data correlates to 20 cycle test.

the insulation resistance at the end of the four-day static conditioning period. These tests are to be conducted without opening the chamber.

5.5 Test Condition C—Insulation Resistance After Recovery from Elevated Temperature and Humidity Cycle.

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

5.5.2 Condition the test specimens, at 23°C ±2°C [73.4° ±3.6°F] and 50% ±10% relative humidity, for 2 to 24 hrs,[3] stabilization.

5.5.3 Take the insulation resistance measurements at laboratory ambient temperature (23° ± 2°C [73.4° ±3.6°F]) after the above conditioning.

5.5.4 Apply a reverse polarization potential of 500 ± 50 volts dc with the resistance meter for one minute, then take the measurement at 500 ± 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 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.

5.5.6 Any reason for deleting values, i.e., scratches, condensation, bridged conductors, etc., must be noted.

5.6 Evaluation

5.6.1 The value to be reported shall be the average of at least three readings taken as described per 5.5 through 5.5.6. See graph 2 for typical IR plot.

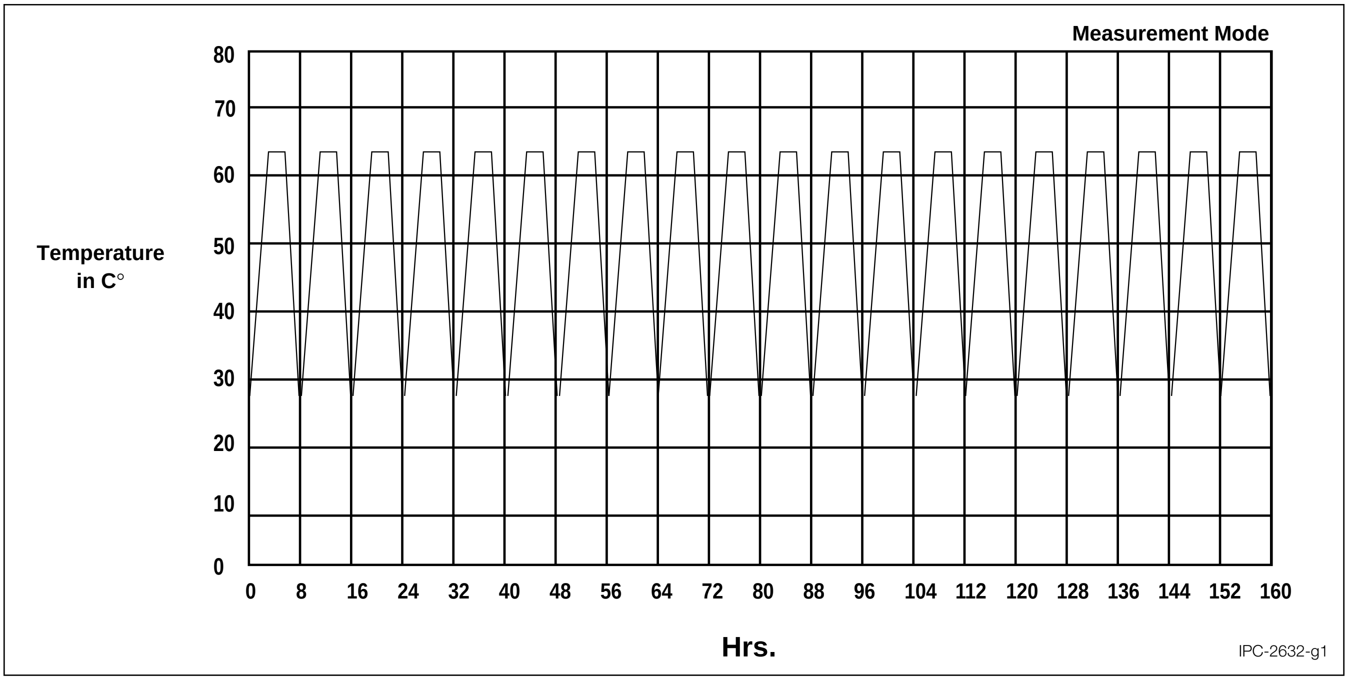
5.6.2 After completion of all electrical testing, the test specimens shall be examined for measling, blisters, delamination, or other forms of degradation, following 24 hour stabilization at laboratory ambient temperatures.

6.0 *Notes*

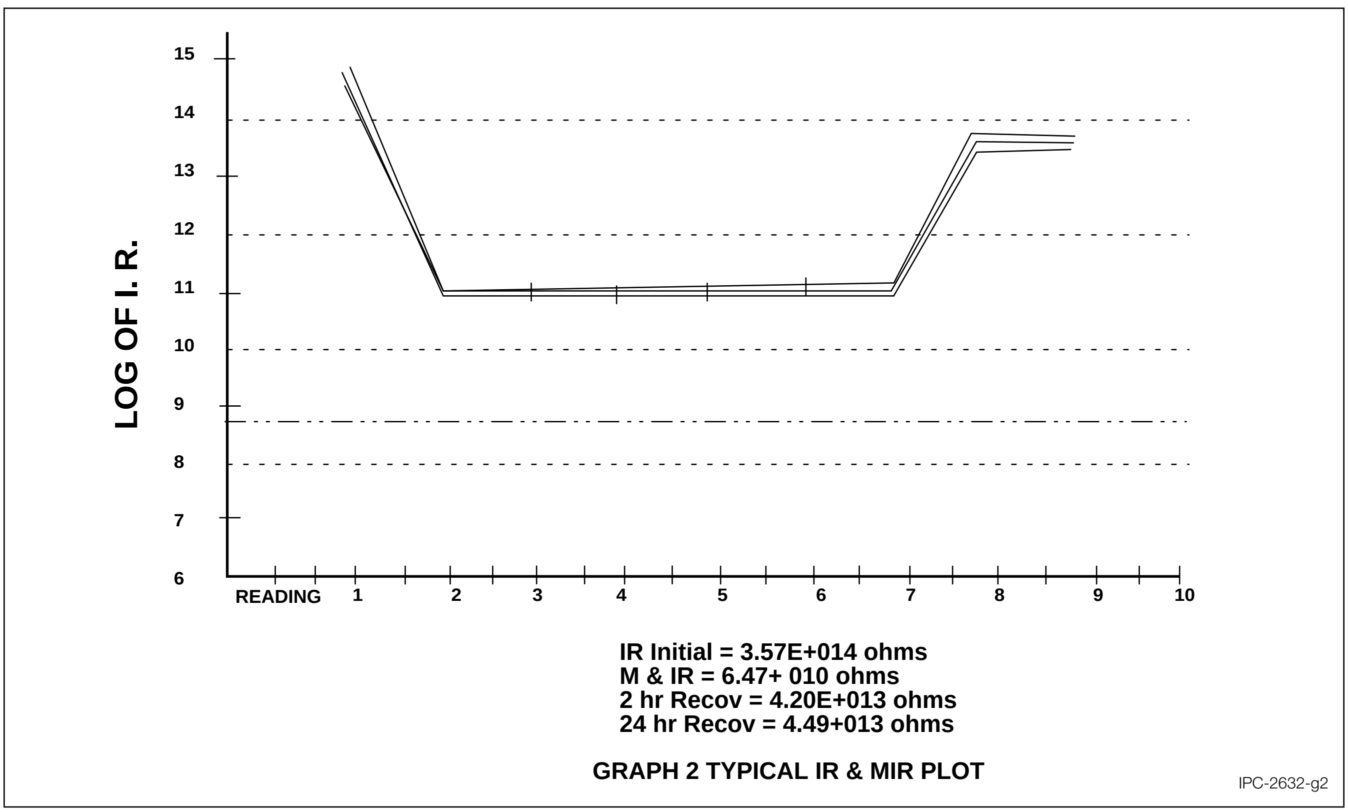
6.1 Documented alternative cleaning procedures may be implemented if there is a concern that scrubbing will adversely affect test results, i.e., when the test specimens have very fine spacing and/or are plated with soft metals (tin/lead, gold, etc.).

6.2 A failure due to measling, blistering, delamination, or any other form of degradation, may be due to several factors, and not necessarily inferior coatings. Such a system failure (solder mask and/or conformal coating on a substrate) should not be grounds for coating rejection. In such cases, a retest of the entire system is mandatory.

3. Conditioning can be reduced to 2 hours if statistical data correlates to 24 hours conditioning.



Graph 1 Moisture/Insulation resistance test



Graph 2 Typical IR and MIR plot