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IPC-TM-650
TEST METHODS MANUAL

Number **2.3.26.1**	
Subject **Ionizable Detection of Surface Contaminants (Static Method)**	
Date **11/94**	Revision
Originating Task Group **Ionic Conductivity (5-32a)**	

1.0 Scope

1.1 Purpose This test method establishes a procedure for determining the amount of surface ionic soil on a printed board or printed board assembly. The soil must be soluble in water, alcohol or some mixture of both. The determination can be made on either a quantitative or a qualitative basis.

1.2 Restrictions The equipment used does not differentiate between specific ionic specie. It determines their presence and ranks them according to their ionic mobilities. Salts with high ionic mobilities are weighted heavier than salts with lower ionic mobilities.

1.3 Application This method has application as a quality control tool and as a method for developing and evaluating cleaning process parameters. As a quality control tool, it can be used to inspect parts to determine if they conform to predetermined levels of cleanliness. In process development this procedure can be used to evaluate solvent and process efficiency and also to set levels of acceptable cleanliness.

2.0 Applicable Documents None

3.0 Test Specimen Any preproduction or production bare printed board or printed board assembly.

4.0 Test Equipment A measuring device based on extraction of ions in a static volume of solution. Solution is cleaned through ion exchange columns to a high resistivity value before initiation of a test. During a test, a recirculating loop is used consisting of the solution in the test tank being pumped to provide agitation, past the measuring probe and back into the test cell again, bypassing the ion exchange columns. Thus the term ‘‘static’’. A meter or digital display along with a recorder or printer is used to record the results. The conductivity probe is temperature compensated.

5.0 Procedure

5.1 Solvent/Systems The equipment can be used with alcohol/water mixtures of 50% alcohol/50% water to 75% alcohol/25% water plus or minus 10%.

Alcohol/water systems are used when nonpolar soils might encapsulates or otherwise mask the water soluble ionic soils. Various alcohols have been used successfully. The preferred systems use either N-propanol or isopropanol as the alcohol solvent. Because of the high dielectric constant of the alcohols, excessive alcohol in the mixture will generally degrade the sensitivity of the measurement. To obtain maximum sensitivity and to insure sufficient alcohol to readily remove all nonpolar residue, the recommended mixtures are from 50% alcohol (by volume) and 50% water to 75% alcohol (by volume) and 25% water. The recommended optimum mixture is recommended to be 75% alcohol/25% water.

5.2 Calibration Once the fluid in the system has established a high level of cleanliness (20 megohms or higher), a precise quantity of calibration solution is measured into the test solution. The system then measures resistivity, which can be calculated into a final contamination level expressed in equivalent micrograms of sodium chloride.

5.3 Testing Once the system has been calibrated in accordance with 5.2, and the solution cleaned to a high resistivity value, a test may be accomplished by immersing the test specimen in the test cell. Care must be taken not to handle the sample or any of the appliances used to insert it into the tank. Finger dirt contains highly mobile ionic soils and may give false readings.

After insertion of the sample and during the course of the measurement, the resistivity of the solution will decline. End of test is determined by a preselected time or (depending on model of equipment) automatically aborted when no further change in contamination is measured.

5.4 Evaluation Without a sample in the tank, a condition will be established in which the resistivity of the solvent, as measured by the conductivity cell, will obtain a maximum value as indicated by the meter or display readings in megohms. With the introduction of a contaminated sample into the test cell, the resistivity reading will decay. The sample remains immersed in the solvent for the predetermined time or if automatic time was preselected, until no further contamination is measured.

5.4.1 Theory of Measurement Technique The entire amount of ionic material removed from the sample can be related using a formula for mathematical calculation of contamination as the equivalent of NaCl is micrograms per sq. Where:

D = Volume of solution in test cell
B = End resistivity in megohms.
C = Sample surface area (L x W x 2)
G = Starting resistivity in megohms
A = % of alcohol in test solution
E = Empirical constant –0.008175
F = Empirical constant 0.3093028

Formula will be:

$$\frac{D}{C \times 10\ (A\,E + F)} \times \left(\frac{1}{B} - \frac{1}{G}\right) = \text{Micrograms NaCl/Sq.}$$

Calculation can also be computed without subtracting the starting contamination (1/G). This is assuming that the starting contamination is small enough so that it may be ignored.

5.4.2 Treatment of Test Data The number obtained from Section 5.3 will be the ionic contamination on the surface of the board in terms of equivalent micrograms of sodium chloride. (If the calibration solution contained a different salt than sodium chloride, the number will be in terms of equivalent micrograms of that salt). It is common practice to divide this figure by the total area on both sides of the printed board or printed board assembly and present the data in terms of equivalent micrograms of salt per unit of area.

By using a scale of measurement based on only one salt i.e., sodium chloride, the ionic contaminants are being measured in terms of their ionic mobility. The more mobile or active an ion is, the more likely it is to cause a problem. Thus, while this test method will not differentiate between specific ions, it is an effective way of quantifying the presence of many ions.

6.0 Notes

6.1 Other Uses Because the equipment measured the ionic activity of any part or solution which contains ionic material, it may be used for various other purposes. A partial list appears below:

A. Incoming inspection of reflowed tin/lead boards to determine if residues have been completely removed.
B. Measurement of purity of incoming and redistilled solvents.
C. Measurement of amount of activated rosin flux dissolved in the boiling sump of a vapor degreaser.
D. Measurement of activity level of activated rosin fluxes.

6.2 Availability The equipment specified, or its equivalent, may be procured commercially. Source is Alpha Metals Inc. (Equipment name is Omegameter^{TM}).