ASSOCIATION CONNECTING
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Number	
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Subject	
Corrosion, Flux	
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Originating Task Group	
Flux Specifications Task Group, (5-24a)	

IPC-TM-650
TEST METHODS MANUAL

1 Scope This test method is designed to determine the corrosive properties of flux residues under extreme environmental conditions. A pellet of solder is melted in contact with the test flux on a sheet metal test piece. The solder is then exposed to prescribed conditions of humidity and the resulting corrosion, if any, is assessed visually.

2 Applicable Documents

IPC J-STD-004 Requirements for Soldering Fluxes

IPC-TM-650 Test Methods Manual

2.3.34 Solids Content, Flux for Fluxes for Soft Soldering

IEC 61189-5 Test Methods for Electrical Materials, Interconnection Structures and Assemblies - Part 5: Test Methods for Printed Board Assemblies

3 Test Specimen At least 0.035 g of flux solids, 0.3 g solder paste, 1 g wire, or 1 g preform with an equivalent amount of solids. Flux solids are defined as the residue described in IPC-TM-650, Test Method 2.3.34, Solids Content, Fluxes. All solvent must have been evaporated from the specimen in a chemical fume hood.

4 Apparatus and Reagents

4.1 Apparatus

4.1.1 Solder pot.

4.1.2 Humidity chamber capable of achieving 40 ± 3 °C [104 ± 5.4 °F] and 93 ± 5% relative humidity.

4.1.3 Air circulating drying oven.

4.1.4 Microscope having 20X minimum.

4.1.5 Analytical balance capable of weighing 0.001 g.

4.1.6 Three 50 mm x 50 mm x 0.5 mm [1.969 in x 1.969 in x 0.00197 in] 99% pure copper sheets.

4.1.7 19 mm [0.748 in] steel ball (approximate).

4.1.8 Laboratory press.

4.1.9 Tongs.

4.2 Reagents All chemicals must be reagent grade and water must be deionized (2 megohm-cm minimum resistivity recommended).

4,2,1 Ammonium persulphate.

4.2.2 Sulfuric acid, relative density 1.84.

4.2.3 Degreasing agent: acetone, or petroleum ether.

5 Procedures

5.1 Chemicals

5.1.1 Ammonium persulphate (25% m/v in 0.5% v/v sulfuric acid). Dissolve 250 g of ammonium persulphate in water and add cautiously 5 ml of 5% sulfuric acid (relative density 1.84). Mix, cool, dilute to 1 liter and mix. This solution should be freshly prepared.

5.1.2 Sulfuric acid (5% v/v). To 400 ml of water cautiously add 50 ml of sulfuric acid (relative density 1.84). Mix, cool, dilute to 1 liter and mix.

5.2 Test Panel

5.2.1 Form a 3.0 mm [0.018 in] (approximate) deep circular depression in the center of the copper test panel by forcing a 19.0 mm [0.018 in] steel ball into a 25 (approximate) mm hole to form a cup.

5.2.2 Bend one corner of the test panel up to facilitate subsequent handling with tongs.

5.3 Test Panel Pretreatment

5.3.1 Immediately before performing test, pretreat as follows using clean tongs for handling.

5.3.2 Degrease with a suitable neutral organic solvent such as acetone, or petroleum ether.

5.3.3 Immerse in 5% sulfuric acid (by volume) at 65 ± 5 °C [149 ± 9 °F] for one minute to remove the tarnish film.

5.3.4 Immerse in a solution of 25% m/v ammonium persulphate (in 0.5% v/v sulfuric acid) at 23 ± 2 °C [73.4 ± 3.6 °F] for one minute to etch the surface uniformly.

5.3.5 Wash in running tap water for five seconds. Immerse in 5% sulfuric acid (by volume) at 23 ± 2°C [73.4 ± 3.6 °F] for one minute.

5.3.6 Wash for five seconds in running tap water, then rinse thoroughly in deionized water.

5.3.7 Rinse with acetone.

5.3.8 Allow to dry in clean air.

Note: Use the test piece as soon as possible or store up to one hour in a closed container.

5.4 Solder for Liquid or Paste Flux Test

5.4.1 Weigh a 1.00 ± 0.05 gram specimen of solid solder.

5.4.2 Degrease the solder specimen with a suitable neutral organic solvent such as acetone, or petroleum ether.

5.4.3 Solder may be in the form of pellets or tight spirals of solid solder wire.

5.5 Test

5.5.1 Heat solder pot so that solder bath stabilizes at 235 ± 5 °C [455 ± 9 °F].

5.5.2 Liquid or Paste Flux

5.5.2.1 Place 0.035 g of flux solids into the depression in the test panel. Add the solid solder pellets or spirals.

5.5.2.2 Using tongs, lower the test panel onto the surface of the molten solder.

5.5.2.3 Allow the test panel to remain in contact with the bath until the solder specimen in the depression of the test panel melts. Maintain this position for 5 ± 1 seconds before removing the test panel from the bath. Cool the test panel to room temperature.

5.5.3 Cored Wire or Cored Preform

5.5.3.1 Place 1 gram of flux cored wire or perform into the depression in the test panel.

5.5.3.2 Using tongs, lower the test panel onto the surface of the molten solder.

5.5.3.3 Allow the test panel to remain in contact with the bath until the solder specimen in the depression of the test panel melts. Maintain this position for 5 ± 1 seconds before removing the test panel from the bath. Cool the test panel to room temperature.

5.5.4 Solder Paste

5.5.4.1 Place 0.3 g of solder paste into the depression in the test panel.

5.5.4.2 Allow the test panels to remain in contact with the bath until the solder specimen in the depression of the test panel melts. Maintain this position for 60 ± 5 seconds before removing the test panel from the bath. Cool the test panel to room temperature.

5.5.4.3 Alternately, process the panels through a reflow soldering process using the temperature profile recommended by the vendor.

5.6 Humidity Exposure

5.6.1 Carefully examine the test specimen at 20X magnification for subsequent comparison after humidity exposure. Record observations, especially any discoloration (see 8.2).

5.6.2 Preheat test panel to 40 ± 1 °C [104 ± 1.8 °F] for 30 ± 2 minutes.

5.6.3 Humidity Soak

5.6.3.1 Place the test specimen vertically in a preset humidity chamber at 40 ± 1 °C [104 ± 1.8 °F] and 93 ± 2% relative humidity.

5.6.3.2 Alternately, the specimen may be placed in a temperature humidity chamber and heated to 40 °C [1.8 °F] and

held for 30 minutes. The humidity should then be increased to 93%RH.

5.6.3.3 Expose specimen to the above environment for 240 hours (10 days). M and H fluxes may be tested in the cleaned, as well as uncleaned, condition. Specimens shall be cleaned per the manufacturers instructions.

5.7 Evaluation

5.7.1 After the exposure period, remove test specimens from humidity chamber, examine at 20X magnification and compare with observations noted in 6.5 (see 8.2).

5.7.2 For purposes of this test method, the following definition of corrosion shall prevail: ''A chemical reaction between the copper, the solder, and the constituents of the flux residues, which occurs after soldering and during exposure to the above environmental conditions.'' Corrosion for this test is classified as follows:

5.7.2.1 Minor Corrosion Any initial change of color, which may develop when the test panel is heated during soldering, is disregarded. Discrete white or colored spots in the flux residues or a color change to green-blue without pitting of the copper or formation of excrescences is regarded as *minor* corrosion.

5.7.2.2 Major Corrosion Any initial change of color which may develop when the test panel is heated during soldering is disregarded. Subsequent development of green-blue discoloration with observation of pitting of the copper panel or excrescences at the interfaces of the flux residue and copper boundary, is regarded as *major* corrosion.

6 Notes

6.1 Questionable results may be confirmed by analyzing the suspected corrosion via Energy Dispersive X-ray Spectroscopy (EDS) for the presence of copper.

6.2 Color photos before and after the test are valuable tools in identifying and documenting corrosion.

6.3 Safety Observe all appropriate precautions on MSDS for chemicals involved in this test method.