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IPC-TM-650
TEST METHODS MANUAL

Number	
2.4.13.1	
Subject	
Thermal Stress of Laminates	
Date	Revision
12/94	
Originating Task Group	
MIL-P-13949 Test Methods Task Group (7-11b)	

1.0 Scope This test method is designed to determine the thermal integrity of unclad or metallic clad laminates using short-term solder exposure.

2.0 Applicable Documents

IPC-TM-650 Test Methods Manual

Method 2.1.1, Microsectioning

MIL-F-14256 Flux, Soldering, Liquid (Rosin Base)

3.0 Test Specimens

3.1 Size and Configuration Unless otherwise specified, specimens shall be 50.8 mm x 50.8 mm ± 0.75 mm [2.00 x 2.00 in ± 0.30 in] by the thickness of the laminate. Metallic clad laminate shall include specimens which are completely clad and fully etched.

3.2 Quantity and Sampling Unless otherwise specified, for each clad side and for each test condition, three specimens shall be used for qualification testing and two specimens for lot acceptance testing. Specimens may be cut from anywhere in the sheet of material except no specimen shall be taken closer than 25.4 mm [1.0 in] from any edge as laminated.

4.0 Apparatus or Material

4.1 Oven Air circulating oven capable of maintaining a temperature of 125 ± 2°C [257 ± 3.6°F].

4.2 Solder Bath Electrically heated solder pot; thermostatically controlled; containing at least 1.0 kilograms of solder; and capable of maintaining the specified temperature. Unless otherwise specified, the temperature shall be 288 ± 5.5°C [550 ± 10°F]. Type Sn60 or Sn63 shall be used.

4.3 Temperature Indicator Thermocouple or other device capable of measuring the solder temperature at a depth of 25.4 mm [1 in] below the surface and capable of measuring to within ± 2°C [3.6°F] at the solder temperature specified.

4.4 Desiccator A desiccation chamber capable of maintaining an atmosphere less than 30% RH at 23°C [73.4°F].

4.5 Optical Magnification

4.5.1 Microscope Range 100 to 200 X (for referee testing only).

4.5.2 Magnifier Magnifying loupe, or equivalent, capable of magnification of 4X to 10X.

4.6 Timer Stop watch, or equivalent, capable of measuring to within 0.2 seconds.

4.7 Water White Rosin Flux Type R per MIL-F-14256.

4.8 Cutting Apparatus Diamond saw, shear or other device capable of cutting to the specified size without excessive damage or stress on the material.

4.9 Etching System Etching system capable of complete removal of metallic cladding.

4.10 Flux Cleaning Solvent Isopropyl alcohol, flux thinner, or equivalent.

5.0 Procedure Specimens shall be tested in accordance with the following procedure.

5.1 Specimen Preparation

5.1.1 Etching One-half of the metallic clad laminate sampling shall be completely etched in accordance with standard industry practices.

5.1.2 Cutting The specimens shall be cut to size from the unetched and etched samples by suitable means. The edges shall be cleaned and smoothed by light sanding.

5.1.3 Conditioning For referee or qualification purposes, specimens shall be placed in an air-circulating oven maintained at 125° ± 2°C [257 ± 3.6°F] for 4 to 6 hours. After removal from the oven, place specimens in a desiccator and allow to cool to room temperature.

5.2 Measurement

5.2.1 Fluxing Immediately after removal from the desiccator, metal surfaces shall be cleaned by light abrasion, or other suitable methods. Flux with rosin flux conforming to type R, MIL- F-14256. Let drain in a vertical position.

5.2.2 Stressing Within 10 minutes of removal from desiccator, float the specimen for 10 + 1, –0 seconds on the surface of a solder bath maintained at the specified temperature, measured at a depth of 25.4 mm [1.0 in] below the surface. The specimens shall be kept in intimate contact with the solder surface and agitated by gentle downward pressure using tongs or equivalent.

Note: Very thin laminates, typically under 0.5 mm [0.020 in] thick, are prone to bowing or curling upon contact with solder. The following handling instructions apply:

a. For etched specimens, mount each specimen using staples to a piece of corrugated board (''cardboard'') approximately 75 x 75 mm [3.0 x 3.0 in].

b. For unetched single-clad specimens, mount each specimen to a 75 x 75 mm [3.0 x 3.0 in] piece of corrugated board (''cardboard'') by slipping two opposite edges into slits cut parallel and 38.1 mm [1.5 in] apart in the cardboard.

c. Unetched double-clad specimens including those of unequal cladding thicknesses, do not require mounting.

5.2.3 The specimens shall be removed from the bath and allowed to cool to room temperature. Mounted specimens may be removed from the supporting cardboard. Clean the flux from the specimens using appropriate solvent.

5.3 Evaluation

5.3.1 Etched or Unclad Specimens Examine the specimens by normal or corrected 20/20 vision, using backlighting if necessary. Record the presence of charring, surface contamination, loss of surface resin, resin softening, delamination, blistering, weave exposure, propagation of imperfections, measling, crazing, or voids.

Determine the number and dimension of any voids using 4X minimum magnification; for referee purposes, 10X magnification shall be used.

5.3.2 Clad Specimens The specimen shall be examined for any evidence of blistering, delamination or other damage. During the solder exposure, any apparent event that is evidence of damage, such as the specimen exhibiting a ''bump'' felt through the tongs, shall be recorded as a sign of possible delamination.

5.3.3 For referee purposes, the etched or unetched specimens shall then be microsectioned in accordance with IPC-TM-650, Method 2.1.1 (except there are no plated-through holes). The microsections shall be examined for degradation (see 5.6.1) at a magnification of 100X and referee inspection at 200X.

5.4 Report Any observed degradation to the unetched or etched or unclad specimens shall be reported. The number and location of voids shall be reported for each specimen. Results of referee microsection examination will take precedence over visual examination.

6.0 *Note* Automatic (gang mounting) microsectioning techniques may be used.

6.1 Desiccator Conditions The Test Methods Task Group determined that a great majority of test laboratories are unable to consistently hold the Relative Humidity in a desiccator to less than 20%. Based on data from participating company lab management, the lowest practically feasible RH for use with the affected IPC Test Methods is 30% maximum.