IPC J-STD-003C
Amendment 1
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JOINT INDUSTRY STANDARD

Solderability Tests for Printed Boards

Amendment 1

IPC

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- Minimize time to market
- Contain simple (simplified) language
- Just include spec information
- Focus on end product performance
- Include a feedback system on use and problems for future improvement

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- Keep people out
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Solderability Tests for Printed Boards

Global Replacements:

Replace "circuit board" with "printed board"
Replace "vendor" with "supplier"

Beginning with 1.3:

Replace "plated-through hole" with "PTH"
Replace "plated-through holes" with "PTHs"

Beginning with 1.3.2:

Replace "as agreed between user and supplier" with "AABUS"

1.1 Scope

Replace as follows:

1.1 Scope This standard prescribes test methods, defect definitions, and illustrations for assessing the solderability of printed wiring board surface conductors, attachment lands, and plated-through holes (PTHs). This standard is intended for use by both user and supplier.

This standard is not intended to verify the potential of successful processing at assembly or to evaluate design impact on wettability. This standard describes procedures or methods to determine the acceptable wettability of a surface finish. Wettability can be affected by handling, finish application, and environmental conditions.

1.4 Classification

Replace "specification" with "standard" in the final paragraph as follows:

This standard relies on input from the 4-14 plating process subcommittee and the 4500 series of printed board surface finish documents generated in that subcommittee to determine the durability rating potential for each specified finish. This document and the appropriate 4500 series document should be considered complimentary to one another.

1.5 Test Method Classification

Insert new first paragraph, 2nd sentence as follows:

This standard describes test methods by which the surface conductors, attachment lands, and PTHs may be evaluated for solderability. Edge Dip, Wave Solder, Surface Mount Simulation, and Wetting Balance testing can be used for both tin-lead (SnPb) and SAC 305 alloys. Other Pb-free alloys may be used for testing AABUS.

Replace within the last paragraph as follows:

The following tests are considered destructive tests. Tested printed boards should not be used in further production steps.

Table1-1 Solderability Test Method Selection

Insert new rows "Solder Float Test – 'M' coupon" and replace appropriate Table 1-1 sections and notes as follows:

Test Method	Surface Finish	Pre-Conditioning Default	Alternative Conditioning	Applies to Surface Features	Plated Through Holes
Edge dip test	Pb-Containing	Steam exposure[a]	Reflow Simulation 2X (3.4.2)[b,c]	Yes	NA
	All other	8 hours (3.4.2)[b]	Reflow Simulation 2X (3.4.2)[b,c]	Yes	NA
Wave solder	Pb-Containing	Steam exposure[a]	Reflow Simulation 2X (3.4.2)[b,c]	Yes (solder source side only)	Yes
	All other	8 hours (3.4.2)[b]	Reflow Simulation 2X (3.4.2)[b,c]	Yes (solder source side only)	Yes
Surface mount simulation	Pb-Containing	Steam exposure[a]	Reflow Simulation 2X (3.4.2)[b,c]	Yes	NA
	All other	8 hours (3.4.2)[b]	Reflow Simulation 2X (3.4.2)[b,c]	Yes	NA
Solder float test ("S" coupon or referee coupon) (compliance to IPC-6010 series only)	Pb-Containing	NA	NA	NA	Yes
	All other	NA	NA	NA	Yes
Solder float test ("M" coupon or referee coupon) (compliance to IPC-6010 series only)	Pb-Containing	Steam exposure[a]	NA	Yes	NA
	All other	8 hours (3.4.2)[b]	NA	Yes	NA
Tests with Force Measurement Criteria (refer to 1.5.2)					
Wetting balance	Pb-Containing	Steam exposure[a]	Reflow Simulation 2X (3.4.2)[b,c]	Yes	NA
	All other	8 hours (3.4.2)[b]	Reflow Simulation 2X (3.4.2)[b,c]	Yes	NA

The use of the preconditioning stressing **shall** be restricted to the following:

a. Eight hours of steam exposure precondition for Pb-bearing surface finish requirements only. The requirements should be listed in the procurement documentation.

b. PBs that are less than eight weeks older than the date code on the lot, unless AABUS. Pb-containing surface finishes are HASL and reflowed plated SnPb. All other surface finished currently include; ENIG, ENEPIG, I Ag, I Sn, OSP, Pb-Free HAL, Electroless Pd, Immersion Pd, Electrolytic NiAu, and Electroless Au.

c. "Reflow Simulation 2X" means two excursions through the reflow oven using one of the profiles defined in IPC-TM-650, 2.6.27.

1.8 Coating Durability – SnPb Containing (HASL and Plated and Reflowed SnPb) Surface Finishes

Replace the first sentence as follows:

Shelf life criteria are applicable only to surface finishes that contain SnPb.

Table 1-2 Final Finish Conditioning/ Stress Testing for Category 3 Durability

Replace the table title and add note "a" as follows:

Table 1-2 Final Finish Conditioning/ Stress Testing for Category 3 Coating Durability[a]

a. "Reflow Simulation 2X" means two excursions through the reflow oven using one of the profiles defined in IPC-TM-650, 2.6.27.

1.9 Coating Durability – Non-SnPb Surface Finishes

Replace the 2nd paragraph as follows:

The robustness of the surface finish **shall** be defined in the appropriate IPC-4500 series document. It is noted that the 4-14 Plating Process Subcommittee usually specifies the surface finish for maximum coating durability and robustness as the default, with some exceptions. Stressing of surface finishes prior to solderability testing is used to provide a determination of robustness of the finish that may be used to evaluate the quality of a surface finish. Furthermore, stressing of the finish can help evaluate the likelihood for assembly related issues with multiple thermal excursions and/or complex assembly processes. It may also be used to compare the performance of similar surface finishes from different suppliers. Exposure to the stressing protocols is not intended to predict shelf life of a surface finish. It may be inferred that successful testing of a surface finish post stressing and stored according to the manufacturers recommendations should allow the surface finish to meet industry requirements for one year of shelf life unless otherwise stated in an appropriate IPC-4500 series document. Coating Durability A is considered the default condition.

Coating Durability B:

Add the following:

Coating Durability B: Intended for boards likely to experience multiple soldering processes and/or other process steps using SnPb or Pb-free assembly profiles when defined in the procurement documentation.

Insert Fahrenheit conversion as follows:

Following stressing in humidity and/or steam exposure as appropriate, the boards **shall** be baked for 1 hour at 105 °C [221 °F] prior to testing.

Requirement Post Stressing:

Delete letter "e":

Requirement Post Stressing:

a. ***For the Edge Dip Test A:*** Each and every feature to exhibit wetting with the minimum of 95% of each feature showing uniform smooth coverage. All holes **shall** show evidence of wetting.

b. ***For the Wave Solder Test:*** All SMT pads on the wave side of the board and holes **shall** wet and fill and meet the requirements of the test.

c. ***For the Surface Mount Simulation Test:*** Where paste is applied, there **shall** be evidence of at least 95% of each pad wetting.

d. ***For the Wetting Balance Test:*** There **shall** be evidence of positive wetting with an allowable increase in wetting time of 2X that of the non-stressed samples. The final wetting force **shall** be at least 70% that of the non-stressed samples.

3.1.3 Dissolution of Component Metallization (Leaching)

Add an "*" to the end of the title and replace the definition as follows:

3.1.3 Dissolution of Component Metallization (Leaching)* The loss or removal of a basis metal or coating during a soldering operation.

3.3.1 Pre-Conditioning Equipment

Replace the 2nd paragraph as follows:

When reflow simulation is required as a preconditioning requirement, process the test specimens per IPC-TM-650, Test Method 2.6.27, Thermal Stress, Convection Reflow Assembly Simulation.

3.4.2 Pretest Conditioning

Replace the section as follows:

All test specimens identified as requiring stressing/conditioning **shall** be subjected to one of the following prior to solderability testing. Following pretest conditioning using methods involving humidity, the samples **shall** be baked per 3.4.5. The pretest conditioning **shall** be one of the following:

a. 72 °C ± 5 °C [162 °F ± 9 °F] and 85% ± 3% Relative Humidity [RH]. The test specimens **shall** be exposed for a test duration of 8 hours ± 15 minutes. This is the **default** stressing condition.

b. Exposure to the standardized reflow temperature profiles detailed in IPC-TM-650, Test Method 2.6.27. Testing with eutectic SnPb solder **shall** be carried out using the lower peak temperature profile. Testing with SAC305 solder **shall** require the use of the higher peak temperature profile. The number of exposures to the appropriate profile **shall** be two.

c. The use of 8 hours of steam exposure at the appropriate temperature may be used for SnPb surface finishes ONLY.

   1. The water to be used for steam conditioning purposes **shall** be distilled or deionized.

Table 3-2 Steam Temperature Requirements

Remove decimal values from the temperatures as follows:

Altitude	Average Local Boiling Point C [F]	Steam Temperature Limits C [F]
0-305 m [0-1000.66 ft]	100 °C [212 °F]	93±3 °C [199 ±5 °F]
305-610 m [1000.66-2001.31ft]	99 °C [210 °F]	92±3 °C [197 ±5 °F]
610-914 m [2001.31-2998.69ft]	98 °C [208 °F]	91±3 °C [195 ±5 °F]
914-1219 m [2998.69-3999.34ft]	97 °C [206 °F]	90±3 °C [194 ±5 °F]
1219-1524 m [3999.34-5000ft]	96 °C [204 °F]	89±3 °C [192 ±5 °F]
1524-1829 m [5000-6000.66ft]	95 °C [203 °F]	88±3 °C [190 ±5 °F]

3.4.4 Steam Conditioning

Replace the section as follows:

Before the application of flux and subsequent solderability testing, all specimens designated Coating Durability Rating 3 (SnPb surface finishes) **shall** be conditioned in the device (see 3.3.1) under the conditions described in Table 3-2 at a steam temperature which is 7 °C [12.6 °F] below the local boiling point.

All coupons to be tested **shall** be placed into the steam conditioning chamber such that no specimens have their pads/holes touching, and that condensation forming will drain away from the solderable surface to the coupon body. Specimens **shall not** be stacked in a manner which restricts their surface exposure to steam, nor **shall** they be placed closer than 40 mm [1.57 in] from the outer chamber walls, and **shall not** touch the inner container walls. In addition, no portion of a specimen **shall** be less than 40 mm [1.57 in] above the water level.

3.4.4.1 Post Steam Conditioning Drying

Delete entire section.

3.4.4.2 Steam Equipment Maintenance

Renumber section to 3.4.4.1 and change "should" to "shall" as follows;

3.4.4.1 Steam Equipment Maintenance Before use, the steam conditioning apparatus **shall** have been cleaned with deionized or distilled water or dilute hydrogen peroxide (commercially available 2-3% by volume) to remove any accumulated residues. This cleaning **shall** be accomplished within five working days of the conditioning period.

3.4.5 Baking

Replace section as follows:

Immediately after temperature/humidity or steam conditioning and prior to solderability testing, all boards **shall** be baked at 105 ± 5 °C [221 ± 9 °F] for 1 hour ± 5 minutes to remove surface moisture and other volatiles. Test specimens **shall** be cooled to room temperature prior to fluxing and testing. Solderability testing **shall** be performed within 72 hours of removal from the chamber.

3.5.1 Solder Temperatures

Correct Fahrenheit temperature conversion from "473" to "455" as follows:

Tin/lead solderability testing **shall** be performed at a solder temperature of 235 ± 5 °C [455 ± 9 °F]. Lead-free solderability testing **shall** be performed at a solder temperature of 255 ± 5 °C [491 ± 9 °F].

3.5.2 Solder Contamination Control

Delete "chemically or spectrographically" after "be" where indicated:

The solder in solder baths used for solderability testing **shall** be analyzed or replaced each 30 operating days. Deviations to the 30 day limit **shall** be supported by historical data. The levels of contamination and Sn content must conform to the limits shown in Table 3-3. The intervals between analyses may be lengthened if the test results indicate that the contamination limits are not being approached. The composition of the lead-free solder, including contamination levels, **shall** be maintained during testing per Table 3-3 with the silver and copper element levels adjusted for alloy requirements.

4.1 Test Procedure Limitations

Replace "specification" with "standard" as follows (in 1st and 3rd paragraph):

The test procedures of this standard are applicable to most printed board constructions typical of the industry. It is recognized that thick printed boards will not behave the same as thin printed boards due to their increased thermal mass, aspect ratio, number of ground planes, and weight of the solder column within the hole.

The test procedures of this standard **shall** be followed. If it is determined by discussions between the user and vendor that changes are necessary due to the physical characteristics of a particular test specimen and not the solderability of the test specimen surface, a new procedure **shall** be documented and used only for the applicable test specimen. Changes in test procedures and flux (see 3.2.2) **shall** take into account the wetting time and flux issues per 6.5 and 6.6.

4.1.1 Application of Flux

Add "non-adhering" in 4th sentence as follows:

Excess flux **shall** be removed by blotting the surface to be tested with a piece of clean, non-adhering, absorbent material.

4.2.1.2 Test Specimen

Modify figure references in the 2nd sentence to "4-2, 4-3 and 4-4":

Figures 4-2, 4-3 and 4-4 are suggested test specimen styles. Test specimen preparation **shall** be in accordance with 3.4.

Figure 4-2

Modify figure title as follows:

Figure 4-2 Legacy S-Coupon Test Specimen for PTHs

Figure 4-3

New figure with the title "New S-Coupon Layout (mm[in])"

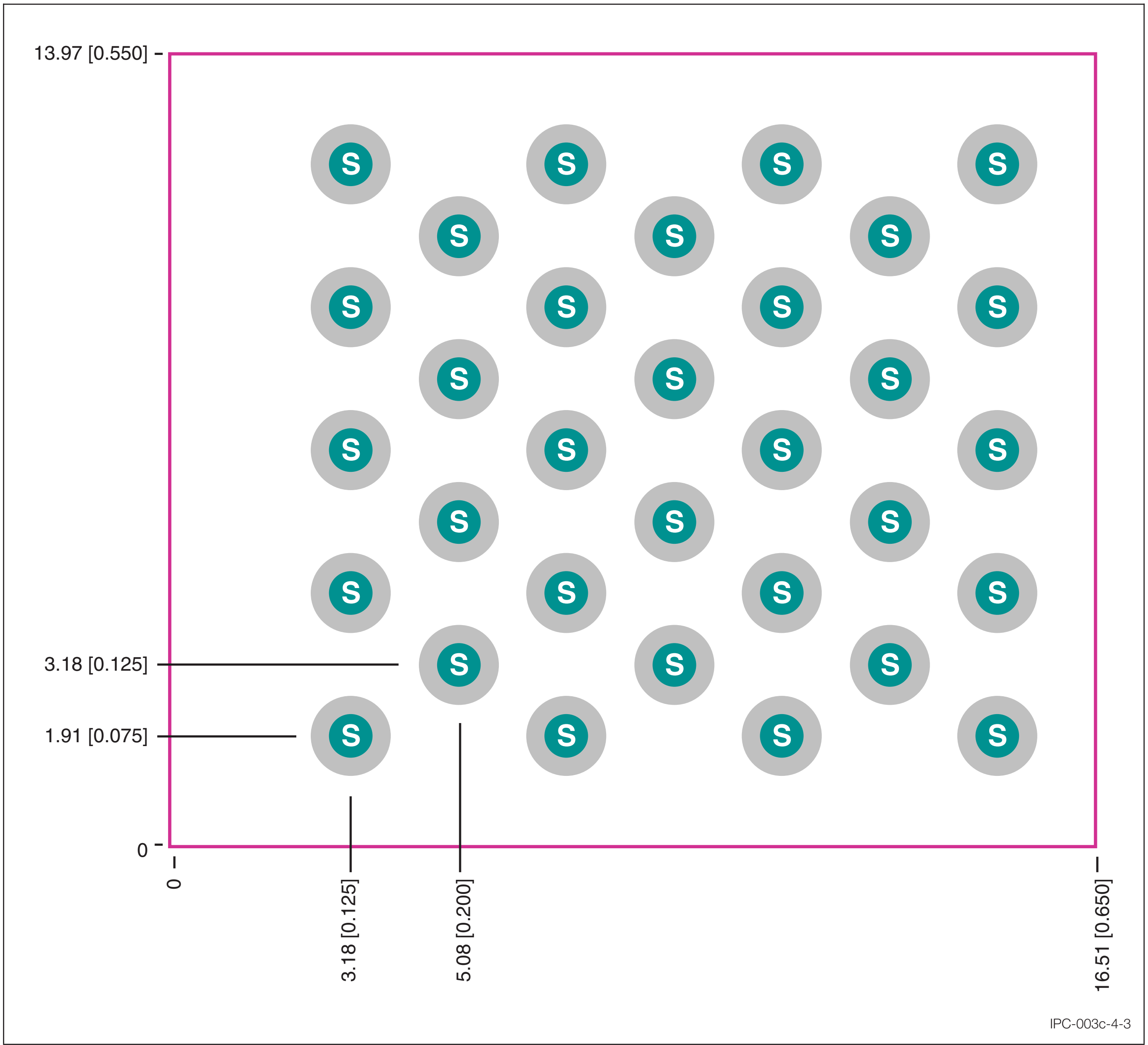

Figure 4-3 New S-Coupon Layout (mm [in])

Figure 4-3

Renumber to Figure 4-4 and delete "Note" following the figure.

Figure 4-4 Suggested Test Specimen for Surface Mount Features

4.2.1.3 Procedure

Modify the 2nd to last sentence as follows:

After withdrawal, the solder **shall** be allowed to solidify by air cooling while the board is maintained at the same angle it was dipped.

Add to the last paragraph as follows:

For Edge Dip Testing, where a mechanical dipping device is not used and is AABUS, it is suggested to gently move the coupon side to side in the molten solder during the testing on coupons that have solder mask defined features.

4.2.1.4.1 Magnification

Add "up to" in the first sentence as follows:

Test specimens **shall** be examined at up to 10X using the equipment as specified in 3.3.3.

4.2.2.2 Test Specimen

Remove "(PB)" from the first sentence:

The suggested test specimen **shall** be in accordance with 1.7 and will typically be a ''solder sample'' from the printed board supplier.

4.2.2.3 Procedure

Change "Eutectic" to "eutectic" in the 2nd to last sentence as follows:

Solder temperature **shall** be 235 ± 5 °C [455 ± 9 °F] for eutectic SnPb and 255 ± 5 °C [491 ± 9 °F] for SAC305 unless another temperature is AABUS.

4.2.2.4.1 Magnification

Add "up to" in the first sentence as follows:

Test specimens **shall** be examined at up to 10X using equipment as specified in 3.3.3.

Figure 4-4

Renumber to Figure 4-5.

Figure 4-5 Effectiveness of Solder Wetting of Plated-Through Holes – Class 3 below 3.0 mm

4.2.2.4.4 Accept/Reject Criteria

Replace the 2nd paragraph as follows:

Accept/reject criteria for board thicknesses of <3.0 mm [<0.118 in] **shall** be in accordance with 5.2 and Figures 4-5 and 4-6. The solder must have wetted over the knee of the hole and out onto the land around the top of the hole.

Figure 4-5

Renumber to Figure 4-6.

Figure 4-6 Examples of Solder Wetting of PTHs – Class 3 below 3.0 mm

4.2.3 Surface Mount Simulation Test Tin/Lead Solder

Rename section by deleting "Tin/Lead Solder" as follows:

4.2.3 Surface Mount Simulation Test

4.2.3.2 Test Specimen

Replace "PB" in three places with "printed board" as follows:

The test specimen **shall** be in accordance with 1.7 and will normally be the ''solder sample'' from the printed board supplier. The test specimen **shall** be tested in the condition that it would normally be in at the time of assembly soldering. The test specimen surfaces to be tested **shall not** be handled in such a manner as to cause contamination, nor **shall** the surfaces being tested be wiped, cleaned, scraped or abraded. If a portion of a printed board is to be used for this test, care **shall** be taken to ensure that the cutting of the sample does not affect the solderable surfaces to be tested and that there are no rough edges that may prevent contact between the stencil and the printed board.

4.2.3.5.1 Magnification

Add "up to" in the first sentence as follows:

Test specimens **shall** be examined at up to 10X using the equipment as specified in 3.3.3.

4.3.1.1.1 Dipping Device

Modify figure references in the 3rd sentence as follows:

The test specimen dwell time is controlled to the time specified in 4.3.1.3 (see Figure 4-7 and 4-8).

Figure 4-6

Renumber to Figure 4-7.

Figure 4-7 Arrangement for the Test Apparatus (Solder Bath Wetting Balance Method) Copyright © 2006 IEC Geneva, Switzerland. www.iec.ch

4.3.1.2 Test Specimen

Insert "Note" as a new 2nd paragraph as follows:

The test specimen **shall** be in accordance with 1.7. The test specimen **shall** either be a full board, a section of a board, or a suggested test specimen as illustrated in Figure 4-9. Test specimen preparation **shall** be in accordance with 3.4.

Note: As shown in Figure 4-4, it is imperative that the metallization extends to the edge of the test specimen, in order to guarantee a repeatable and accurate test. This may be achieved by imaging the test specimen larger in the multi-test specimen panel format than as it would otherwise have been done as an individual test specimen. The singulation process (removing the individual test specimens from the multi-image panel) will have the scoring or routing path pass through the oversized copper image, thus ensuring that the copper extends to the edge of the test specimen. Due to the relative softness of the copper, the rough test specimen edge may need to be ''dressed'' using 600 grit sandpaper. An alternate method to ensure that the copper extends fully to the edge of the test coupon is to pre-route the test specimen and edge plate. This latter alternative is generally more costly and may not be available from all printed board fabricators.

4.3.1.3 Procedure

Modify the 2nd paragraph as follows:

The flux covered surface **shall** be immersed only once in the molten solder to an appropriate depth. The immersion depth shall not be more than 1/3 of the pad length, this is to allow for complete wetting of the pad or feature being tested. The angle of immersion **shall** be 90° (see Figure 4-10) for test vehicles (see Figure 4-9) with features on both sides. The use of an immersion angle of 20° - 40° **shall** be used for coupons removed from actual circuits and/or coupons with features present on only one side (see Figure 4-11). The immersion/emersion rate **shall** be 1 - 5 mm [0.039 - 0.20 in] per second and the dwell time **shall** be 10.0 ± 0.5 seconds or as appropriate for thick, heavy copper or otherwise thermally demanding coupons. Prior to examination, all test specimens **shall** have the flux removed using a cleaning agent in accordance with 3.2.3.

Figure 4-7

Renumber to Figure 4-8.

Figure 4-8 Arrangement for the Test Apparatus (Solder Globule Wetting Balance Method) Copyright © 2007 IEC Geneva, Switzerland. www.iec.ch

Figure 4-8

Renumber to Figure 4-9.

Figure 4-9 Suggested Wetting Balance and Soldering Immersion Test Specimens

Figure 4-9

Renumber to Figure 4-10.

Figure 4-10 Wetting Balance Test Soldering Immersion at 90° for Double Sided Finishes

Figure 4-10

Renumber to Figure 4-11 and change "PB's" to Printed Boards as follows:

Figure 4-11 Wetting Balance Test Soldering Immersion at 20 to 40° for Single Sided Coupons/Samples Removed from Printed Boards

Figure 4-11

Renumber to Figure 4-12.

Figure 4-12 Set A Wetting Curve

Figure 4-12

Renumber to Figure 4-13.

Figure 4-12 Set B Wetting Curve

Table 4-4 Pass/Fail Criteria for Specific Surface Finishes Using Eutectic SnPb

Modify Note "a" as follows:

a. These suggested criteria have been established in a two-tier evaluation format with Set A being more stringent. Components meeting Set A suggested criteria are expected to have a wider soldering process window than components meeting Set B suggested criteria. It should be recognized that components meeting Set B suggested criteria may be completely acceptable for a large process window but the user must determine which criteria set best matches their process (see Table 4-6).

4.3.1.4 Evaluation

Modify letters "b," "d" and figure references as follows:

b. The area of the test sample with fresh solder adhesion **shall** be greater than the area that was immersed in the solder bath, (i.e., the printed board **shall** exhibit positive solder wetting beyond its immersion depth).

c. The time to produce positive wetting forces **shall** be as per Table 4-6 below.

d. There **shall** be no evidence of dewetting in excess of 5%.

Figures 4-12 and 4-13 illustrate the suggested criteria contained in Tables 4-4, 4-5 and 4-6.

4.3.1.4.1 Magnification

Add "up to" in the first sentence as follows:

Test specimens **shall** be examined at up to 10X using the equipment as specified in 3.3.3.

4.3.1.4.2 Suggested Criteria

Delete

4.3.1.5 Gauge Repeatability and Reproducibility (G R&R) Protocol

Modify figure references in 2nd paragraph as follows:

Figures 4-12 and 4-13 illustrate the suggested criteria contained in Tables 4-4, 4-5 and 4-6.

Table 4-5 Pass/Fail Criteria for Specific Surface Finishes Using SAC305 Solder

Modify Note "a" as follows:

a. These suggested criteria have been established in a two-tier evaluation format with Set A being more stringent. Components meeting Set A suggested criteria are expected to have a wider soldering process window than components meeting Set B suggested criteria. It should be recognized that components meeting Set B suggested criteria may be completely acceptable for a large process window but the user must determine which criteria set best matches their process (see Table 4-6).

4.4 6010 Solder Float Test

Add NEW header "4.4 6010 Solder Float Test"

4.4.1 Solder Float Test Tin/Lead Solder

Replace the section as follows:

This test is for solder float testing of PTHs and associated annular rings for conformance requirement testing ONLY per the appropriate IPC-6010 document. This committee advises that based on the results of extensive round robin testing that this test method does not meet current G R&R requirements.

It is suggested to use the recommended edge dip and/or solder reflow simulation testing for all surface mount features.

4.4.2.3 Test Specimen

Modify figure reference in the 4th sentence as follows:

If there are not at least 30 holes in the test specimen, additional specimens **shall** be tested until at least 30 holes have been tested (see Figure 4-2).

Add "need to" to the 7th sentence as follows:

Dwell times on the solder surface may need to be in excess of thirty seconds, depending on the design.

4.4.2.4 Procedure

Add "the test sample" to the end of the 1st sentence as follows:

Dross and burned/residual flux **shall** be completely removed from the surface of the molten solder immediately prior to floating the test sample.

Split the second sentence into 2 sentences as follows:

After fluxing and draining per 4.1, ensure that none of the holes in the coupons are "plugged" with flux prior to testing. Gently tap the coupon on the absorbent material to ensure an open hole condition.

4.4.3.1 Magnification

Add "up to" in the first sentence as follows:

Test specimens **shall** be examined at up to 10X using the equipment as specified in 3.3.3.

4.4.3.2 Surface Evaluation – Accept/Reject Criteria

Modify the 3rd sentence as follows:

A minimum of 95% of each of the surfaces (i.e., each pad or annular rings) being tested **shall** exhibit good wetting.

4.4.3.3 PTH Evaluation

Replace the section as follows:

All holes on the coupons which are floated **shall** be evaluated. PTHs that bisect the perimeter of the coupon **shall not** be evaluated.

4.4.3.4 Accept/Reject Criteria

Modify figure references in the first sentence of the first paragraph:

Accept/reject criterion for board thicknesses of <3.0 mm [<0.118 in] **shall** be in accordance with 5.2 and Figures 4-5 and 4-6.

5.2 Evaluation Aids – For Class 3 PTHs

Modify the figure references as follows:

Profile views of acceptable conditions are presented in Figure 4-5 for aid in visualizing all the common conditions. The following are also acceptable conditions for specific cases:

b. Depressed fillets in holes are acceptable under the following condition: the solder in partially filled holes must exhibit a contact angle less than 90° relative to the hole wall (see Figures 4-4 and 4-5).

c. All holes less than 1.5 mm [0.0591 in] diameter **shall** retain a solder plug after solidification. Holes greater than 1.5 mm [0.0591 in] **shall not** be rejected for failure to retain a full solder plug provided that the entire barrel of the hole and the surface of the top land have been wetted with solder (see Figures 4-4 and 4-5).

6.1 Correction for Buoyancy

Modify the formula as follows:

$F_b = \rho\ gV$

Where:

F_b = Buoyancy force (N [lbf])
ρ = Density of solder at 235 °C (8.12 g/cm^3) for Sn60/Pb40 Alloy
ρ = Density of solder at 255 °C (7.41 g/cm^3) for SAC305 Alloy

g = Acceleration of gravity (981 cm/sec^2)
V = Immersed volume of the test specimen (cm^3)
= width x thickness x immersion depth

Delete the last sentence of the last paragraph as follows:

When the buoyancy force is calculated, it should be used to correct the zero axis. This correction is required to obtain both the proper measurement of wetting times, as well as wetting forces. All measurements of wetting times and wetting forces must be made from the corrected zero axis.

6.3 Prebaking

Modify "non dicyanodiamide" to add hyphen:

The introduction of the IPC-1601 printed board handling and storage guideline has resulted in an increase in the occurrence of baking prior to assembly to minimize outgassing, which may result in blowholes, measling, blisters, or delamination especially with non-dicyanodiamide (DICY) cured materials.

APPENDIX A

Modify the "P" value explanation as follows:

Where:

P = the perimeter of the test specimen in millimeters, i.e., the length in millimeters of the solder to coupon pad (or hole) to environment interfaces as measured at maximum depth of immersion.

Modify the middle paragraph as follows:

Periphery and volumes: Perimeter and volumes are to be calculated using the nominal values provided by the test board supplier and the angles and depths of immersion as described in this standard. The TOTAL perimeter (the length in millimeters of all of the solder to coupon pad (or hole) to environment interfaces on the test coupon being immersed (e.g., if there are five pads being immersed, then the sum of the widths of the five pads parallel to the solder surface) is to be used. For the immersion volume, use the volume of the portion of the test coupon pushed below the surface of the solder and NOT the entire volume of the whole test.

Modify the sentence as follows:

Finally, for a 10 mm perimeter, ideal wetting force per millimeter of perimeter for the sample is 0.394 mN/mm. From Table 4-4 (or 4-5) the force measured on a test specimen in the ''preferred'' class must be close to 0.394 mN/mm.

Note: This calculated value will not be greater than the theoretical maximum value of 0.394 mN/mm.)

Delete "again" from the last sentence:

Therefore, for a 10 mm perimeter, ideal wetting force per millimeter of perimeter for the sample is 0.397 mN/mm, slightly higher than in the previous example because the buoyancy correction is only half the size.

APPENDIX B

Delete figure reference:

Calculation of Area under the Wetting Curve

The area is calculated using the maximum theoretical force.

APPENDIX C

C.1.1 Edge Dip Solderability Test Apparatus

Alphabetize the listings as follows:

GEN3 Systems Limited (Formerly Concoat Systems) Unit B2, Armstrong Mall, Southwood Business Park, Farnborough, Hampshire GU14 0NR England. + 44 12 5252 1500 www.gen3systems.com

HMP Soldermatics, P.O. Box 948, Canon City, CO 81212, +1 (719) 275-1531

Malcom Co, Ltd Honmachi 4-15-10,Shibuya, Tokyo, Japan Tel +81 (3) 3320-5611 www.malcom.co.jp

Malcomtech International 26230 Industrial Blvd, Hayward, CA 94545 Tel +1 (510) 293-0580 www.malcomtech.com

Robotic Process Systems, 23301 E. Mission Ave., Liberty Lake, WA 99019, +1 (509) 891-1680

Solderability Testing and Solutions Inc., 108 Rosedale Ave., Richmond KY 40475, +1 (859)353-5914 www.standsgroup.com

C.1.2 Wetting Balance Test Apparatus

Alphabetize the listings as follows:

GEN3 Systems Limited (Formerly Concoat Systems) Unit B2, Armstrong Mall, Southwood Business Park, Farnborough, Hampshire GU14 0NR England. + 44 12 5252 1500 www.gen3systems.com

Malcom Co, Ltd Honmachi 4-15-10,Shibuya, Tokyo, Japan Tel +81 (3) 3320-5611 www.malcom.co.jp

Malcomtech International 26230 Industrial Blvd, Hayward, CA 94545 Tel +1 (510) 293-0580 www.malcomtech.com

Metronelec, 54, Route de Sartrouville - Le Montreal 78232 Le PECO Cedax, France (USA Distributor/Solderability Testing and Solutions Inc. Blair Park, 108 Rosedale Ave., Richmond, KY 40475, +1 (859) 353-5914) www.standsgroup.com

Robotic Process Systems, 23301 E. Mission Ave., Liberty Lake, WA 99019, +1 (509) 891-1680

Solderability Testing and Solutions Inc., 108 Rosedale Ave., Richmond KY 40475, +1 (859)353-5914 www.standsgroup.com

APPENDIX D

Modify letter "f. 1." as follows:

f. Test parameters **shall** be:

   1. Solder temperature **shall** be the value recommended for the alloy (found in the product data sheet) or the standard being used, i.e., for SnPb and ANSI-J-STD-003 it **shall** be 235 °C [455 °F], for J-STD-002 it **shall** be 245 °C [472 °F]. For SAC 305 it **shall** be 255 °C [491 °F].

Modify letter "g. 1." as follows:

g. Sample preparation for the ''known good coupon'' **shall** be as follows:

   1. Use tweezers to immerse a foil sample into a beaker of acetone and gently agitate for 20 seconds.

Modify letter "m" from "3.5 micron" to "35 micron" as follows:

m. For ease of data manipulation, it is recommended to convert the wetting forces obtained into mN/mm of wettable length. For example, for the 10 mm length of 35 micron thick copper coupon for example, the wettable length is 2 times 10 mm, plus 2 times 0.035 mm for a total length of 20.07 mm.

APPENDIX E

Replace "specification" with "standard" in the 2nd paragraph as follows:

The current J-STD-002/J-STD-003 standard includes a departure in the test flux methodology from that used in past solderability testing. The table in 3.2.2 Flux is repeated in Table E-1.

Modify number "4," replace "specification" with "standard" as follows:

4. ***Standardization of Solderability Test Flux Composition on a Global Scale*** A second major goal of the J-STD-002/003 solderability committees is to develop test methods and standards which promote global standardization for the electronics industry. The standard activated flux composition selected and tested by the committees has been utilized in the International Electrotechnical Commission (IEC) 60068-2-20 Soldering Specification. The IEC specification is successfully utilized for solderability testing. Having compatibility of flux composition requirements between the J-STD-002/003 standard and the IEC specifications is a win-win situation for electronics assemblers and component/printed wiring board fabricators.