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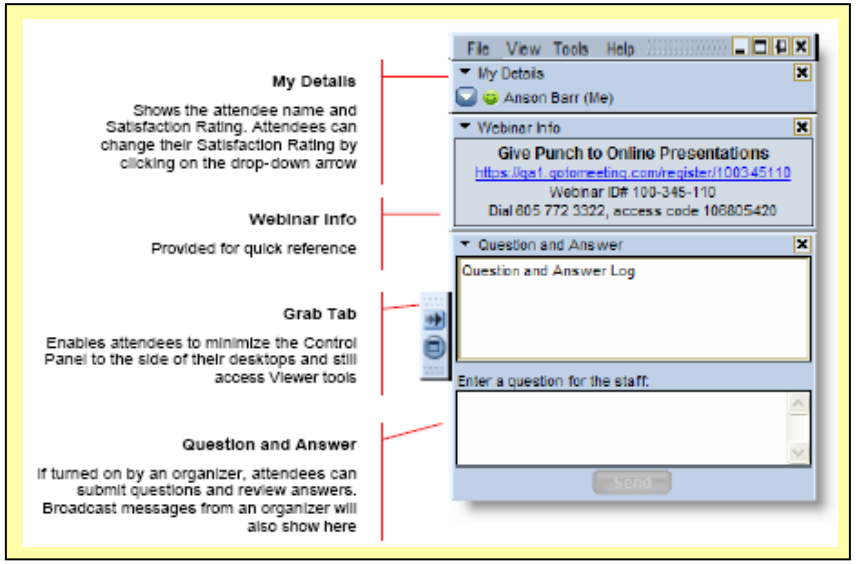

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Changes External Chapter 2

- 2.1.3 Haloing
  - Definition of minimum lateral spacing
- 2.3.1 Measles
- 2.3.3 Delamination

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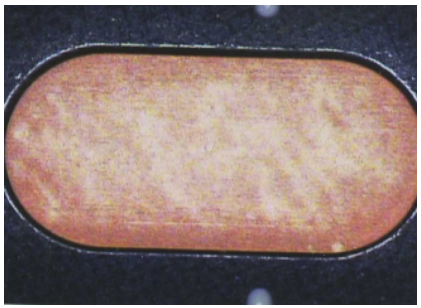
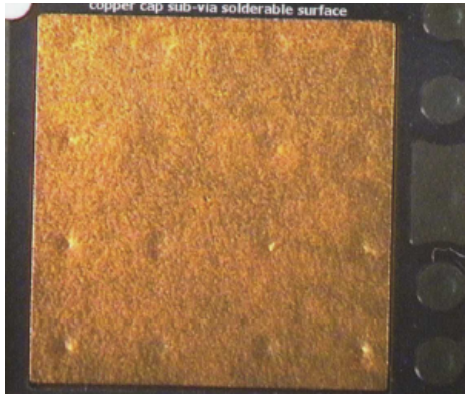
2.5.6 Cap Plating of Filled Holes





Target Condition - Class 1, 2, 3

- Copper surface is planar with no indication of cap plating.

Acceptable - Class 1, 2, 3

- When cap plating of the filled via is specified on the procurement documentation, the requirements of 2.7.1.1 and the requirements of the applicable performance specification for rectangular and round surface mount pads **shall** apply.
- No plating voids exposing the resin fill area, unless covered by solder mask.
- Visually discernable protrusions (bumps) and/or depressions (dimples) that meet the microsection requirements of the applicable performance specification.

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Annular Ring Definition

- **External Annular Ring:** The minimum annular ring on external layers is the minimum amount of copper (at the narrowest point) between the edge of the hole and the edge of the land after plating of the finished hole. This is also identified as a supported hole.

  Hole breakout refers to a condition where a hole is not completely surrounded by the land

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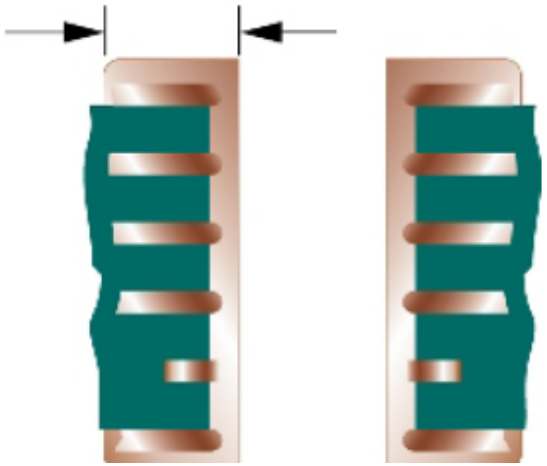
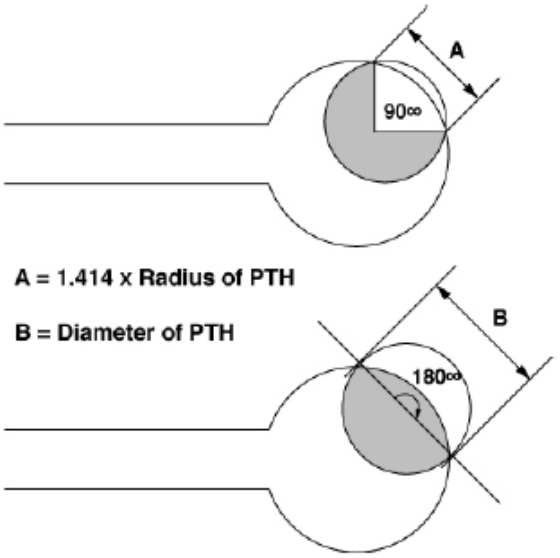
Annular Ring Examples

Break out of 90° and 180°

Measurement of External Annular Ring





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Annular Ring Acceptance Table

Characteristic	Class 1	Class 2	Class 3
Plated-through holes	180° breakout of hole from land is allowed provided minimum lateral spacing is maintained. The land/conductor junction is not reduced more than 30% of the minimum conductor width specified on the production master nominal.	90° breakout of hole from land is allowed provided minimum lateral spacing is maintained. The land/conductor junction is not reduced more than 20% of the minimum conductor width specified on the engineering drawing or the production master nominal. The conductor junction should never be less than 0.050 mm or the minimum line width, whichever is smaller.	The minimum annular ring shall not be less than 0.050 mm. The minimum external annular ring may have 20% reduction of the minimum annular ring in isolated areas due to defects such as pits, dents, nicks, pinholes, or splay.

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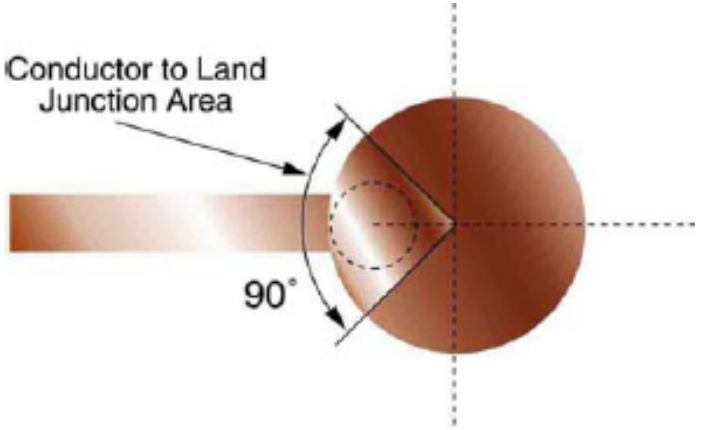
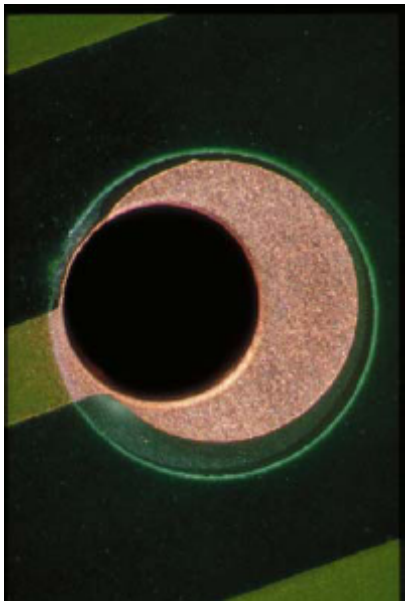
2.10.2 External Annular Ring - Measurement

Conductor to Land Junction: A 90 º area centered around the point where the conductor connects to the land and this area only applies to breakout conditions





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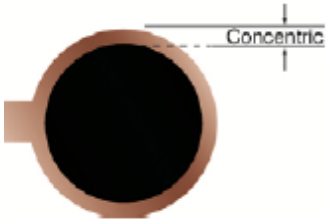
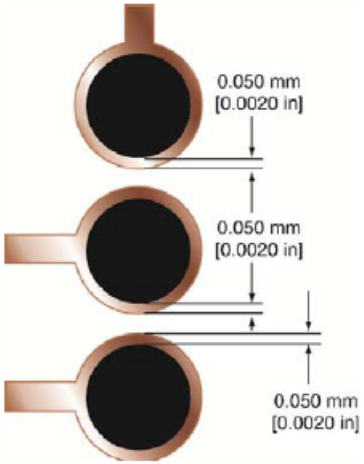
2.10.3 External Annular Ring Acceptance Criteria



Target Condition - Class 1, 2, 3
- Holes are centered in the lands.



Acceptable - Class 3
- Holes are not centered in the lands, but the annular ring measures 0.050 mm [0.0020 in] or more.

- The minimum external annular ring may have 20% reduction of the minimum annular at the measurement area due to defects such as pits, dents, nicks, pinholes, or splay.

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2.10.3 Annular Ring Acceptance Criteria

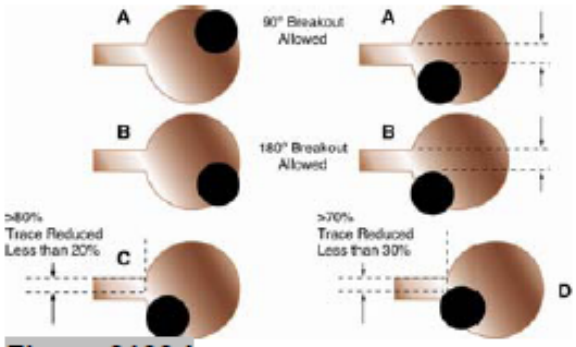

Figure 2103d

Acceptable - Class 2

- 90° breakout or less (See item A)
- If breakout occurs at the conductor to land junction area, the land/ conductor junction is not reduced by more than 20% of the minimum conductor width specified on the engineering drawing or the production master nominal. The conductor junction should never be less than 0.050 mm [0.0020 in] or the minimum line width, whichever is smaller (See item C).
- Minimum lateral spacing is maintained.

Acceptable - Class 1

- 180° breakout or less (See item B).
- If breakout occurs at the conductor to land junction area, the conductor is not reduced by more than 30% of the minimum conductor width specified on the production master nominal (See item D).
- Form, fit and function are not affected.
- Minimum lateral spacing is maintained

Nonconforming – Class 1, 2, 3

- Defects either do not meet or exceed above criteria.

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2.10.4 External Annular Ring Unsupported Holes

- Easier to distinguish due to clarity of photos.

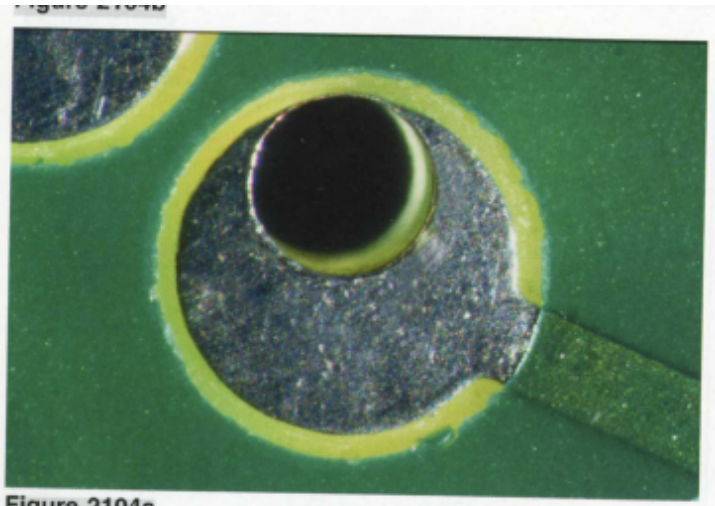

Figure 2104c

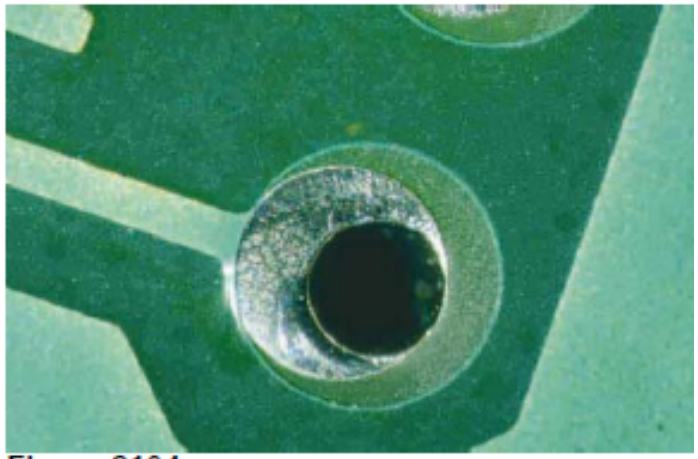

Figure 2104c

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Internal Chapter 3

Internally Observable Characteristics

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Laminate Cracks

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Definition

- If any portion of a crack that exists in Thermal Zone A cross over into Thermal Zone B, then it's entire dimension gets factored in to the minimum criteria for voids/cracks, that being 0.08 mm or less, in accordance with 3.1.1 of IPC-A-600H and 3.6.2.4 of IPC-6012C.
- We don't subtract from the laminate crack/void any portion of it that resides in Zone A. If it crosses between the two zones, it's treated in its entirety as a crack in Zone B.

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Laminate Cracks

3.1.1 Laminate Voids (Outside Thermal Zone)

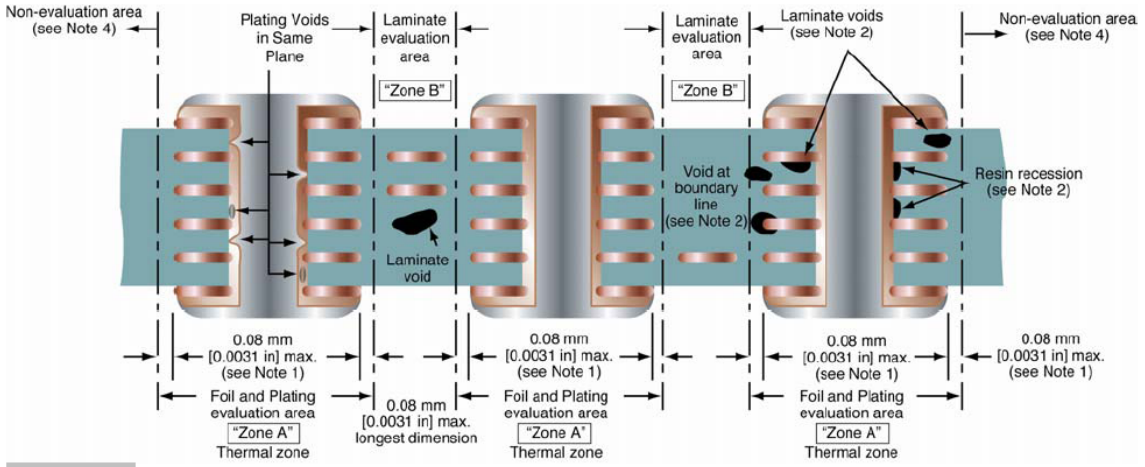

Figure 311a

Notes:

Note 1. The thermal zone extends 0.08 mm [0.0031 in] beyond the end of the land, either internal or external, extending furthest into the laminate area.

Note 2. Laminate anomalies or imperfections in the Zone A area are not evaluated on specimens which have been exposed to thermal stress or rework simulation.

Note 3. Delamination/Blistering is evaluated in both Zone A and Zone B.

Note 4. Laminate anomalies or imperfections in the non-evaluation areas are not evaluated on specimens which have been exposed to thermal stress or rework simulation.

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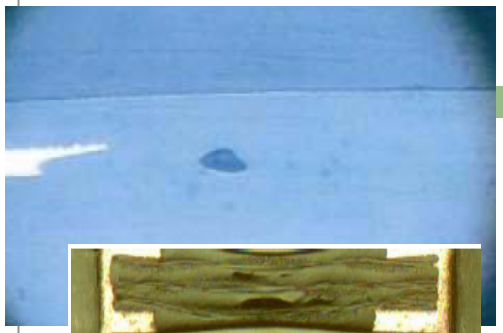
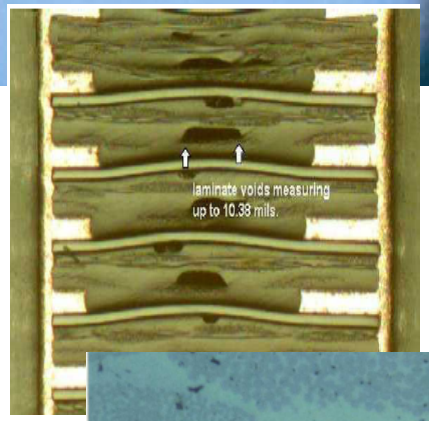
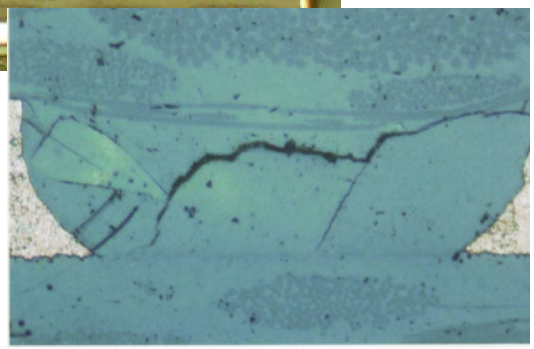
3.1.1 Laminate Voids/Cracks







Acceptable - Class 2, 3
- Void less than or equal to 0.08 mm [0.0031 in] and does not violate minimum dielectric spacing.
- Laminate anomalies or imperfections, such as voids or resin recession, in Zone A areas that have been exposed to thermal stress and rework simulation.
- Multiple voids between two adjacent plated-through holes in the same plane shall not have combined length which exceeds these limits.

Acceptable - Class 1
- Void less than or equal to 0.15 mm [0.00591 in] and does not violate minimum dielectric spacing.
- Laminate anomalies or imperfections, such as voids or resin recession, in Zone A areas that have been exposed to thermal stress and rework simulation.
- Multiple voids between two adjacent plated-through holes in the same plane shall not have combined length which exceeds these limits.

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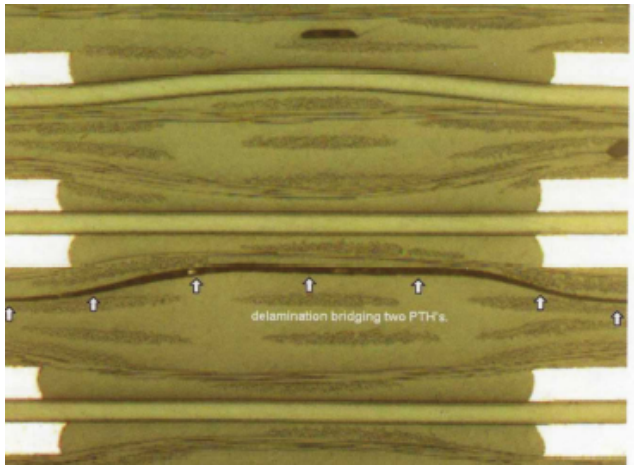
3.1.4 Delamination



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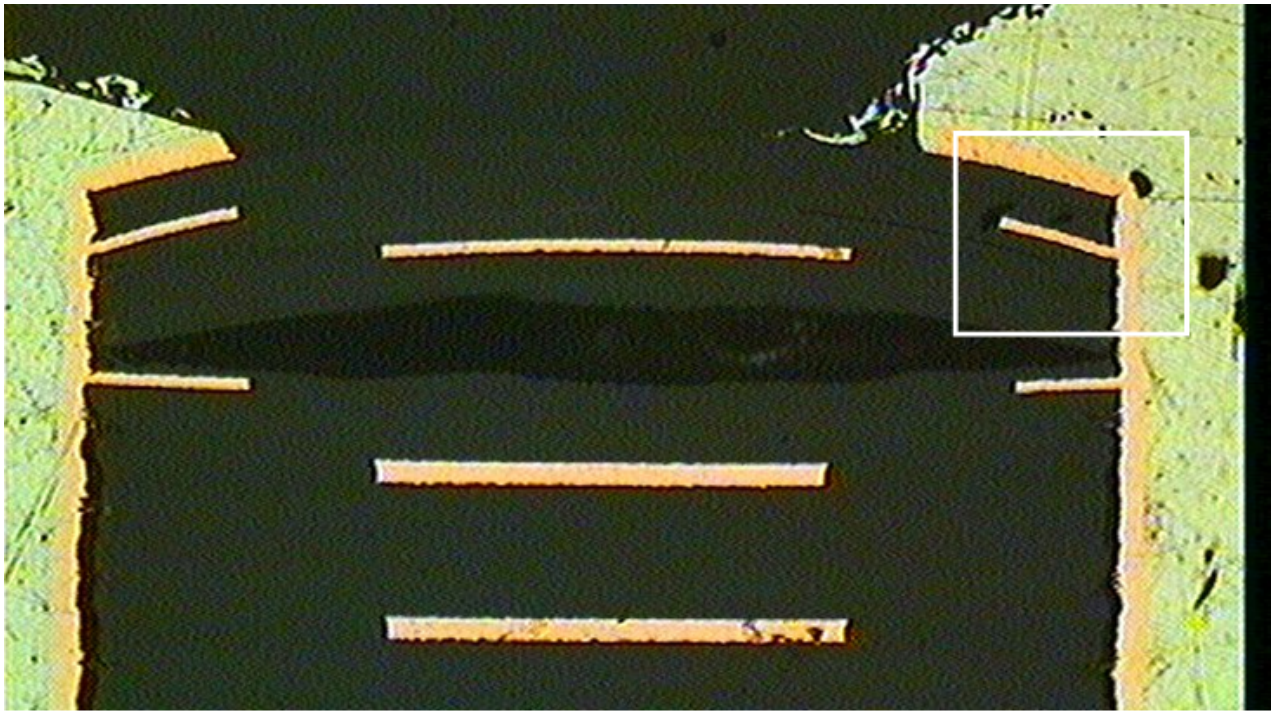
Laminate Cracks



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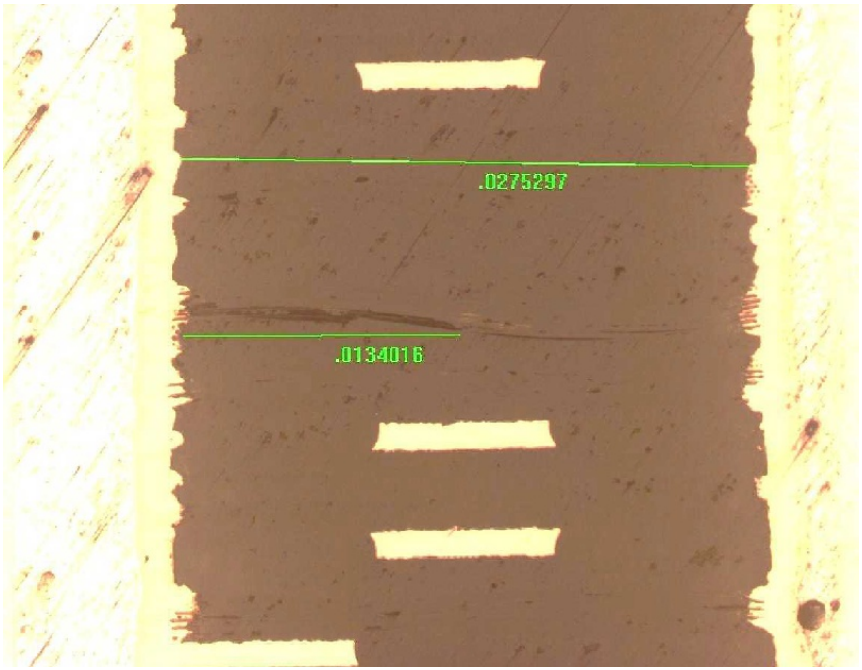

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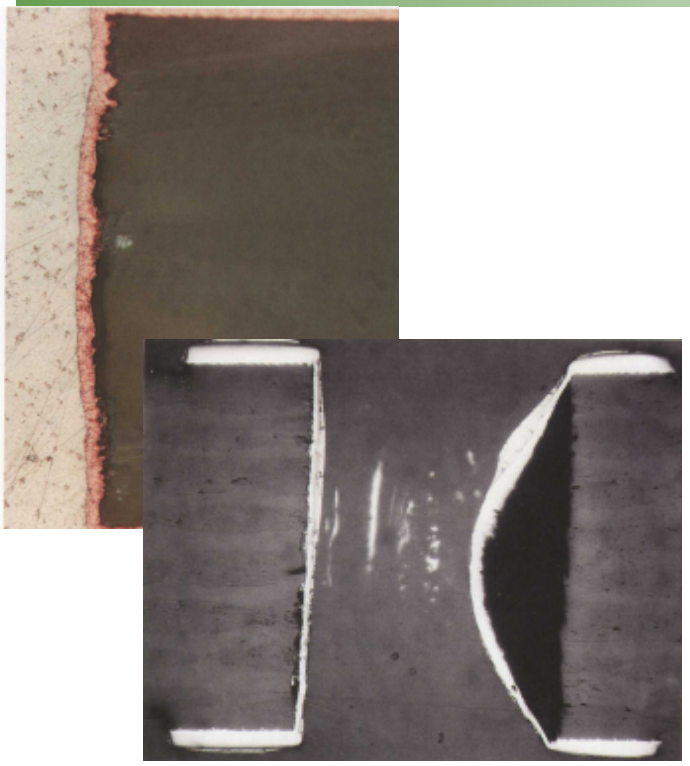
3.1.10 Hole Wall dielectric/Plated Barrel Separation (Hole Wall Pullaway)



- Dimension and plating requirements of IPC-6010 series are met.

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Changes External Chapter 3

- 3.2.3 Surface Conductor Thickness Table 3-1
- 3.3.1 Annular Ring – Internal Layers
- 3.3.8 Copper Plating Thickness

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Changes External Chapter 3
3.3.9 Copper Plating Wrap

Copper wrap plating minimum as specified in the IPC-6010 series **shall** be continuous from the filled plated hole onto the external surface of any plated structure and extend by a minimum of 25 µm [984 µin] where an annular ring is required as shown in Figure 339a.

Reduction of surface wrap copper plating by processing (sanding, etching, planarization, etc.) resulting in insufficient wrap plating is not allowed as shown in Figure 339b.

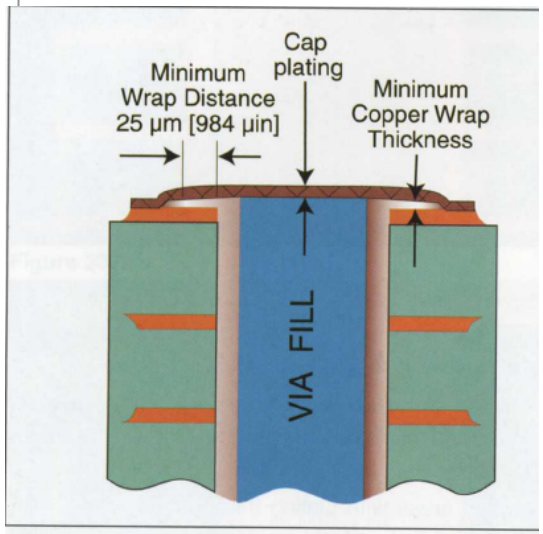

Figure 339a Surface Copper Wrap Measurement (Applicable to all filled PTHs)

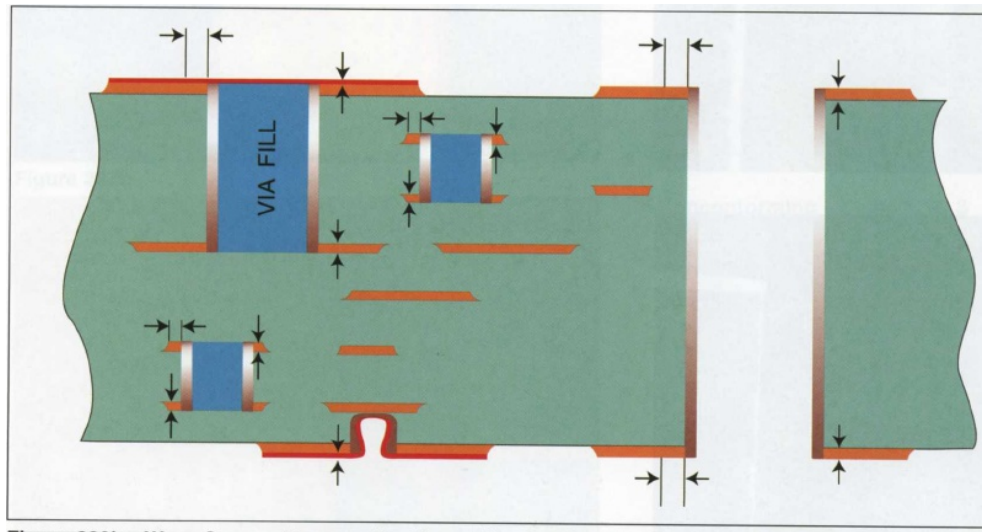

Figure 339b Wrap Copper Removed by Excessive Sanding/Planarization (Not Acceptable)
Note: Dimension lines and arrows indicate where wrap copper has been removed.

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Changes External Chapter 3 3.3.9 Copper Plating Wrap

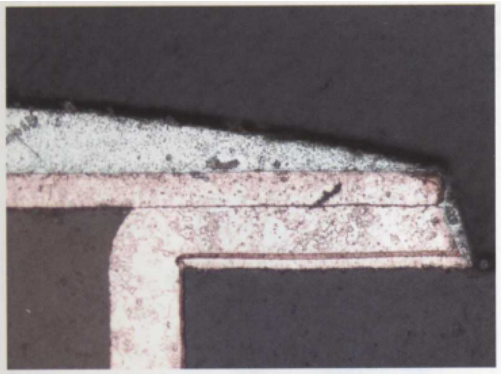

Figure 339c

Target Condition - Class 1, 2, 3

Acceptable - Class 3

- Wrap plating is continuous from the filled plated hole onto the external surface and extends by a minimum of 25 µm [984 µin] where an annular ring is required.
- Wrap thickness is not less than 12 µm [472 µin] for through, blind and buried vias ≥ two layers..
- Wrap thickness is not less than 6 µm [236 µin] for blind and buried microvias.
- Wrap thickness is not less than 7 µm [276 µin] for buried via cores (two layers).
- Reduction of surface wrap copper plating by processing (sanding, etching, planarization, etc.) does not result in insufficient wrap plating.

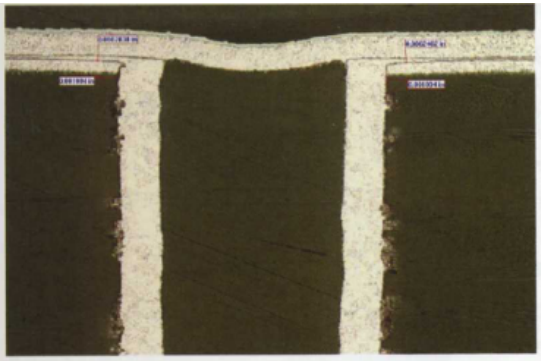

Figure 339d

Acceptable - Class 1, 2

- Wrap plating is continuous from the filled plated hole onto the external surface.
- Wrap thickness is not less than 5 µm [197 µin] for all through-hole and via structures.
- Reduction of surface wrap copper plating by processing (sanding, etching, planarization, etc.) does not result in insufficient wrap plating.

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Changes External Chapter 3 3.3.9 Copper Plating Wrap

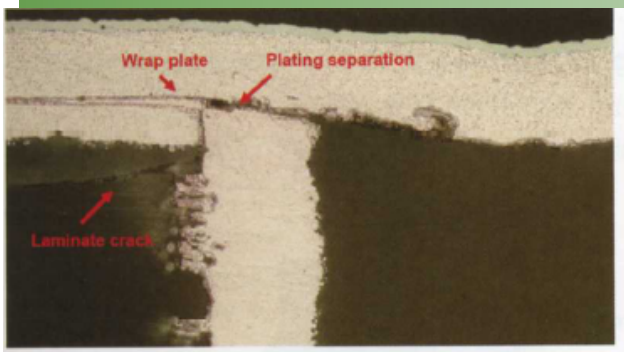

Figure 339e

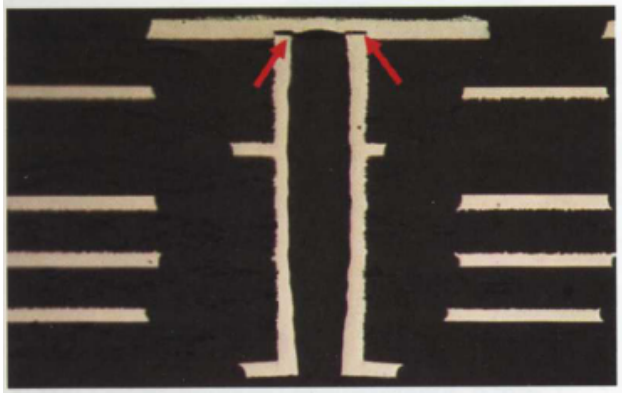

Figure 339f

Nonconforming - Class 1, 2, 3

- Defects either do not meet or exceed above criteria

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Changes External Chapter 3
3.3.16 Material Fill of Blind and Buried Vias

Blind via holes should be filled or plugged with a polymer or solder mask to prevent solder from entering them as solder in the small holes tends to decrease reliability. Incomplete via fill may result in printed board delamination due to the rapid expansion of entrapped air pockets or flux contaminants during solder reflow processes. Requirements for buried via fill are listed below.

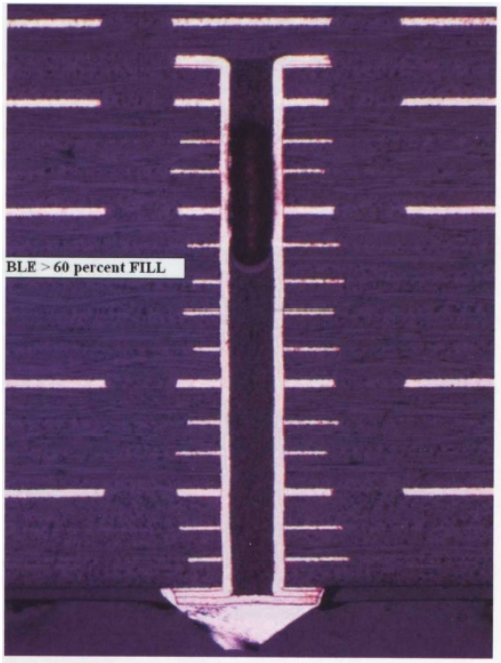

Figure 3316b

Acceptable - Class 1, 2, 3

- At least 60% buried via fill with laminating resin or similar fill material.

Acceptable - Class 2, 3

- At least 60% fill for blind vias with an aspect ratio greater than 1:1 or as specified in the procurement documentation.

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Changes External Chapter 3
3.3.17 Cap Plating of Filled Holes

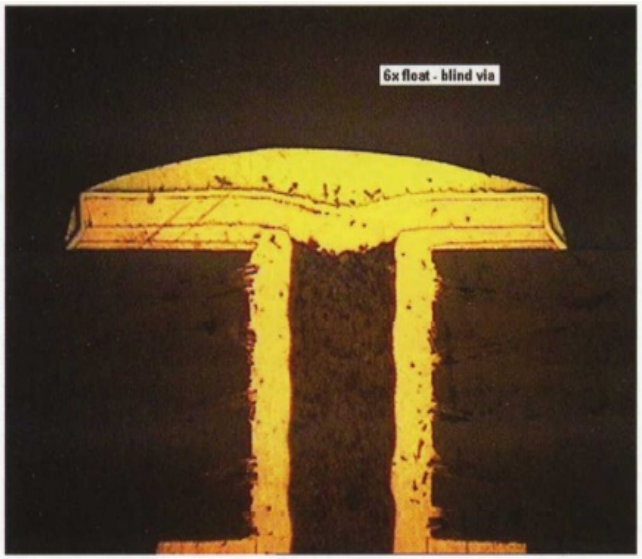

Figure 3317b

Acceptable - Class 1, 2, 3

- Separation of copper cap to fill material.
- No separation of the cap plating to underlying plating.
- Cap protrusion (bump) and/or depression (dimple) meets the dimensional requirements in IPC-6012.
- Fill material within the blind via **shall** be planar with the surface within ± 0.076 mm [0.003 in] unless otherwise specified.
- When cap plating is specified, fill material within the blind via **shall** meet the dimple/bump requirements of IPC-6012.
- No voids in the cap plating over the resin fill.

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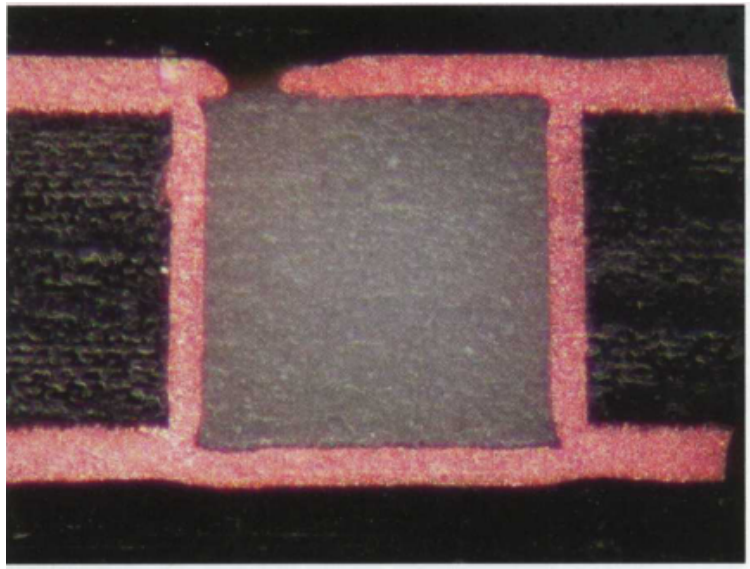
Changes External Chapter 3
3.3.17 Cap Plating of Filled Holes



Nonconforming - Class 1, 2, 3

- Defects either do not meet or exceed above criteria.

3.6.2.11.2

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Changes External Chapter 4

- 4.1.2.1 Adhesive Squeeze Out – Land Area
- 4.1.5 Stiffener Bonding
- 4.1.7 Solder Wicking/Plating Penetration Under Coverlayer

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Overall Document Changes

- The new program will emphasize the need to reference:
  - IPC-6012 - *Qualification and Performance Specification for Rigid Printed Boards*
  - IPC-6013 - *Qualification and Performance Specification for Flexible Printed Boards*

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Further Information

For questions regarding this webinar, please contact me, Leo Lambert at leo@eptac.com

For information on any of EPTAC's or IPC's Certification Courses, please visit us at our website http://www.eptac.com