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Plated Through Hole Fill:

Understanding the Process and Assembly Requirements

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- My Details:** Shows the attendee name and Satisfaction Rating. Attendees can change their Satisfaction Rating by clicking on the drop-down arrow.
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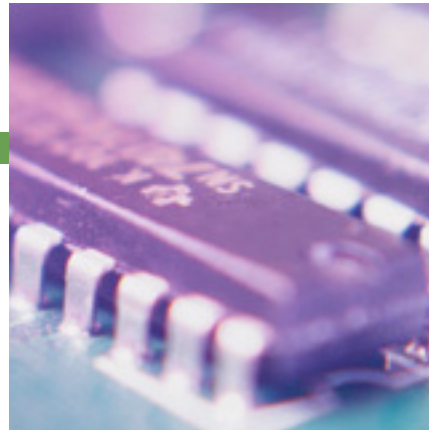


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610 Requirements for Solder Filling Plated Through Holes

Table 6-2 Plated-Through Holes with Component Leads, Minimum Acceptable Conditions ¹

Criteria	Class 1	Class 2	Class 3
A. Circumferential wetting on primary side (solder destination side) of lead and barrel	Not Specified	180°	270°
B. Vertical fill of solder ²	Not Specified	75%	75%
C. Circumferential fillet and wetting on secondary side (solder source side) of lead and barrel ³	270°	270°	330°
D. Percentage of land area covered with wetted solder on solder primary side (destination side)	0	0	0
E. Percentage of land area covered with wetted solder on secondary side (solder source side) ⁴	75%	75%	75%

Note 1. Wetted solder refers to solder applied by the solder process.

Note 2. The 25% unfilled height includes both source and destination side depressions.

Note 3. Also applies to lead and land of unsupported holes.

Note 4. Also applies to unsupported holes.

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Class 3 Requirements

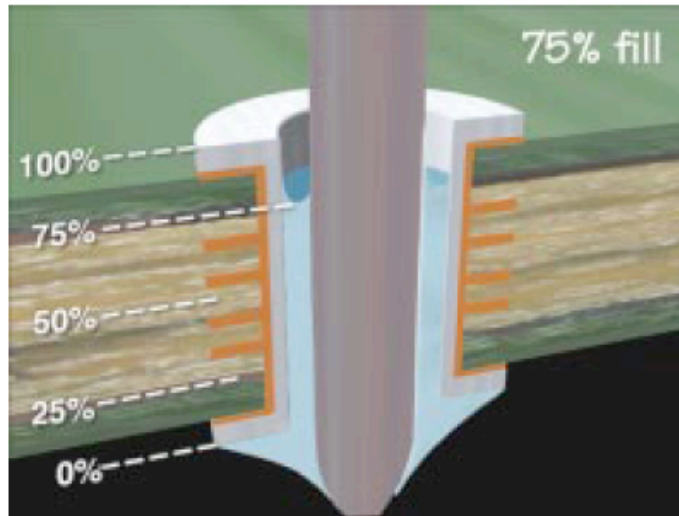


Figure 6-5

Acceptable - Class 1,2,3

- Minimum 75% fill. A total maximum of 25% depression, including both secondary and primary sides is permitted.

Defect - Class 2,3

- Vertical fill of hole is less than 75%.

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Class 2 Requirements

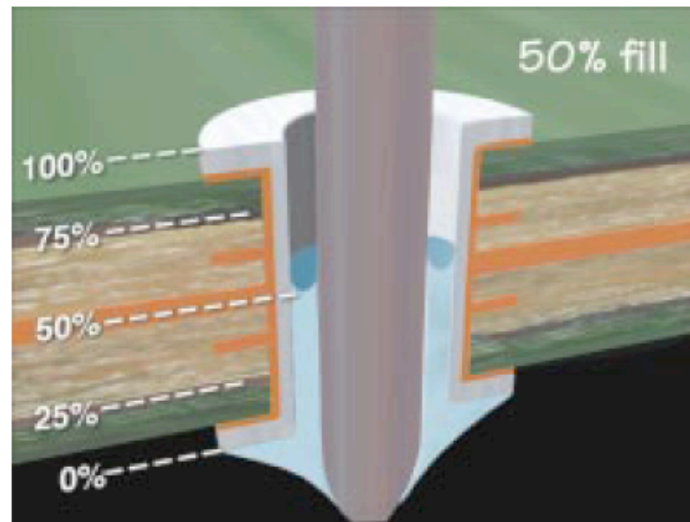


Figure 6-7

Not Specified - Class 1

Acceptable - Class 2

Defect - Class 3

- As an exception to fill requirements of Table 6-2 on PTHs with thermal planes or conductor planes that act as heat sinks, a 50% vertical fill of solder is permitted, but with solder extending 360° around the lead with 100% wetting from barrel walls to lead on the secondary side, and surrounding PTHs meet requirements of Table 6-2.

Note: Less than 100% solder fill may not be acceptable in some applications, e.g., thermal shock. The user is responsible for identifying these situations to the manufacturer.



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Requirement Criteria

- Class 3, fill to 75%
- Class 2, fill to 75% but with exception for inner layer connections to power and ground planes
 - 50% is acceptable

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What's Needed to Fill the PTHs

- Flux
- Preheat
- Solder
- Solderable surfaces
- Correct Lead to Hole size ratios

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What Stops a PTH from Filling?

- Flux Penetration
- Low Preheat
- Heat Sinking Effect of PTH itself
- Board Solderability
- Board Thickness - Component leads not penetrating the board
- Manual soldering



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When Manually Soldering

- More than likely, there is not enough heat or thermal capacity in the solder iron to heat the entire hole up to soldering temperatures, thereby the solder solidifies going up through the hole and that's it, it doesn't fill any further.
- Keep in mind the different thermal requirements when soldering such plated through holes especially through such a thick board with internal layers drawing heat away from the joint.



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When Manually Soldering

- Once the solder solidifies in the hole the thermal requirements change drastically and more heat and energy are required to re-melt that solder than to completely fill the hole.

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Manually Soldering Recommendations

- Preheat the board as the solder joint is being made.
- Use a solder iron and tip, which has plenty of energy to continuously supply heat to the solder joint and keep the solder molten, yet not hot enough to damage the laminate material and plated through hole inner layer connections.



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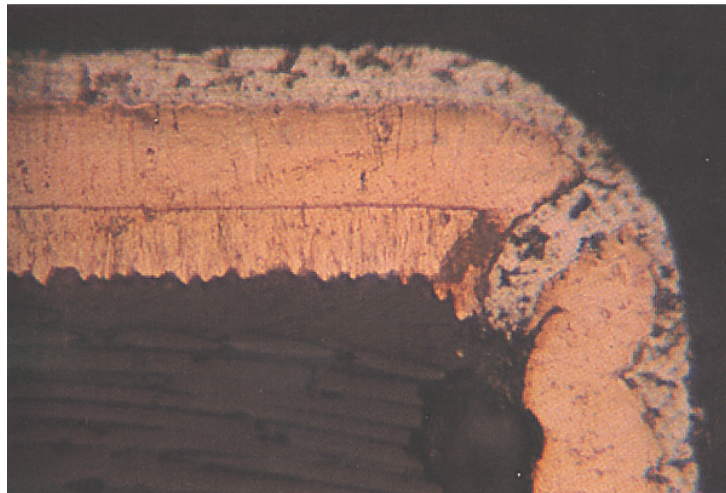


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Cracked Plating at Knee of PTH



- A defective condition for all classes of products.
- When this happens the solder will not flow to the top side



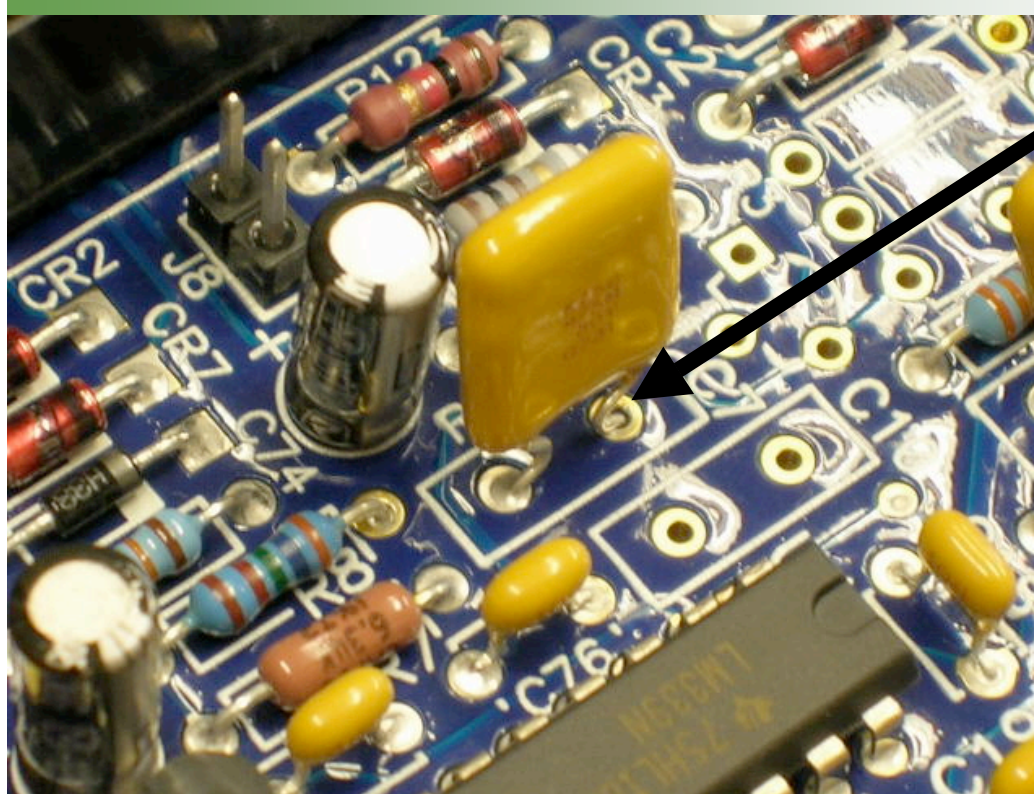
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Poor Fill in PTH





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Shallow Solder Hole Fill



- Minimum hole fill of solder, but solder wetting can be seen on the lead and in the barrel.
- Must inspect for solder wetting to the component parts being soldered to verify goodness of solder joint.



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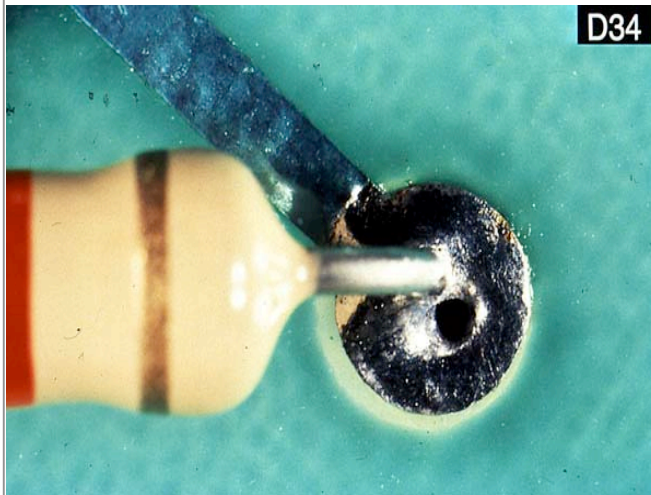


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Void in Solder Joint



- Large void in solder joint, impacts hole fill requirements, and can be caused for rejection of the solder joint.
- Could be cause for solder joint fracture due to thermal cycling during product operation.

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Did You Know?

- IPC-A-610 was developed for 0.060” board thicknesses, newer thicker boards demand new criteria

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What are we looking for?

- The ability to fill the plated through holes in thicker boards or get the criteria changed to make it easier to manufacture the product.

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IPC Spec Comment Request

- A proposal was submitted and accepted for inclusion into the next revision of IPC-A-610
- This proposal was for class 2 only.
 - Change the minimum acceptable solder condition for “vertical fill of solder” from 75% of PCB thickness to a minimum pin wetted length (regardless of PCB thickness).



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Proposed Criteria for 001 & 610

Not Specified- Class 1

Acceptable- Class 2

Defect- Class 3

- As an exception to the fill requirements of table 7-6 or 7-7, **the minimum permissible vertical fill of a PTH is 047 inch (1.19mm)** for Class 2 products provided the following conditions are met:
 - The PTH is connected to thermal or conductor **layers** that act as thermal heat sinks.



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Proposed Criteria for 001 & 610

- The component lead is discernible in the Side B solder connection.
- The solder fillet on side B has wetted 360° of the PTH barrel and 360° of the lead.
- Surrounding PTH's meet requirements of appropriate tables

NOTE: Less than 100% solder fill may not be acceptable in some applications, e.g., thermal shock, **electrical performance**. The user is responsible for identifying these situations to the manufacturer.

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Proposed criteria for IPC-A-610

Defect - Class 2, 3

- Vertical fill of hole is less than 75%.

Not Specified - Class 1

Acceptable - Class 2

Defect - Class 3

As an exception to the fill requirements of Tables 7-4 or 7-5 the minimum permissible vertical fill of a PTH is 50% or 1.19mm (0.047 inch), whichever is less, for Class 2 products provided the following conditions are met:



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Proposed criteria for IPC-A-610

- The PTH is connected to thermal or conductor planes layers that act as thermal heat sinks.
- The component lead is discernible in the Side B solder connection.
- The solder fillet on Side B has wetted 360° of the PTH barrel wall and 360° of the lead.
- Surrounding PTH's meet requirements of appropriate tables

Note: Less than 100% solder fill may not be acceptable in some applications, e.g., thermal shock, electrical performance. The user is responsible for identifying these situations to the manufacturer.

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Conclusions

- Changes have arrived for the filling of thicker boards.
- Keep track of the new documents
- If any problems develop let me know

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Thank you



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