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A Review of Some Commonly Asked Questions

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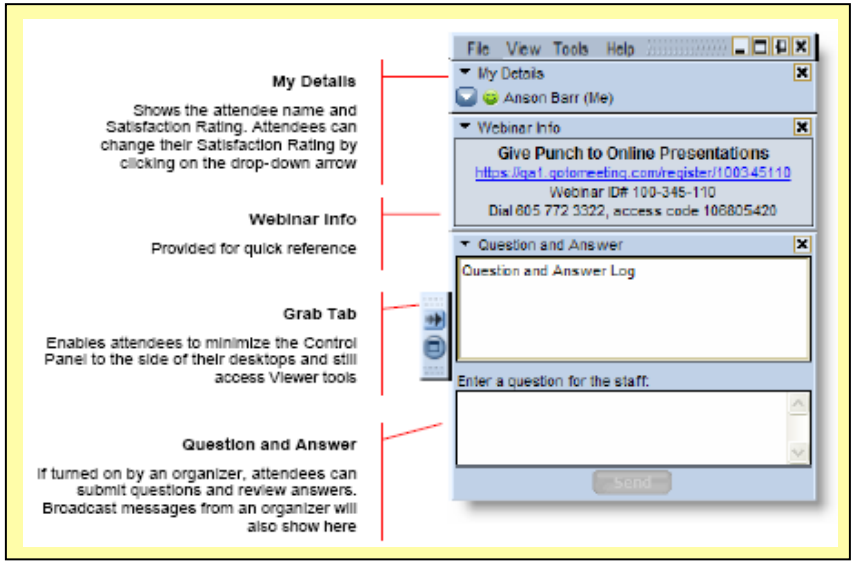

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Topics

- Poor wetting and its causes
- The impact of cutting into the solder joints while trimming leads
- Meniscus as related to the soldering requirements
- Acceptability requirements for wire wrapping to a pierced terminal

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Poor Wetting And Its Causes

- Definition:
  - Wetting = The ability of a metal to be wetted by another metal creating an intermetallic bond.
  - Wetting is the metallurgical bond of two separate metals with a third metal, i.e. solder.
    - In our case a copper-tin intermetallic compound

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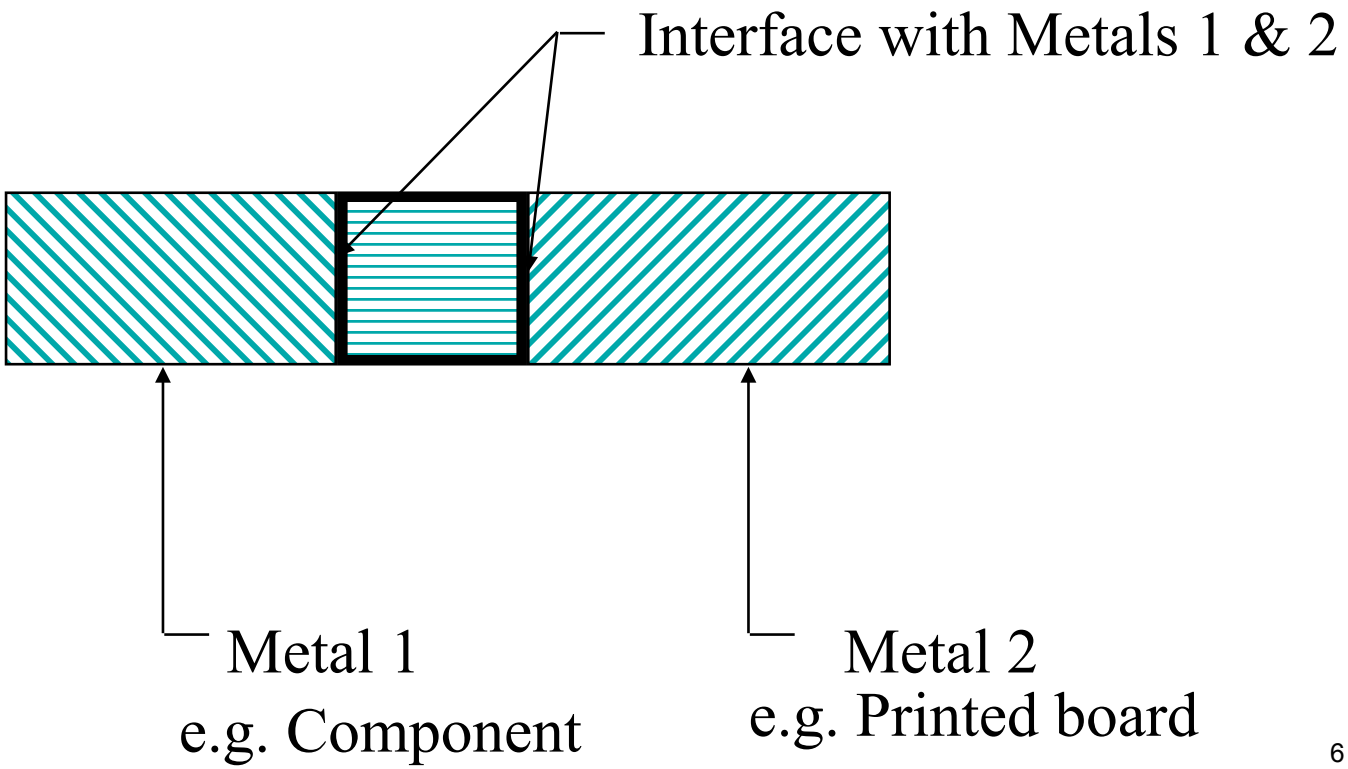
Bonding Process



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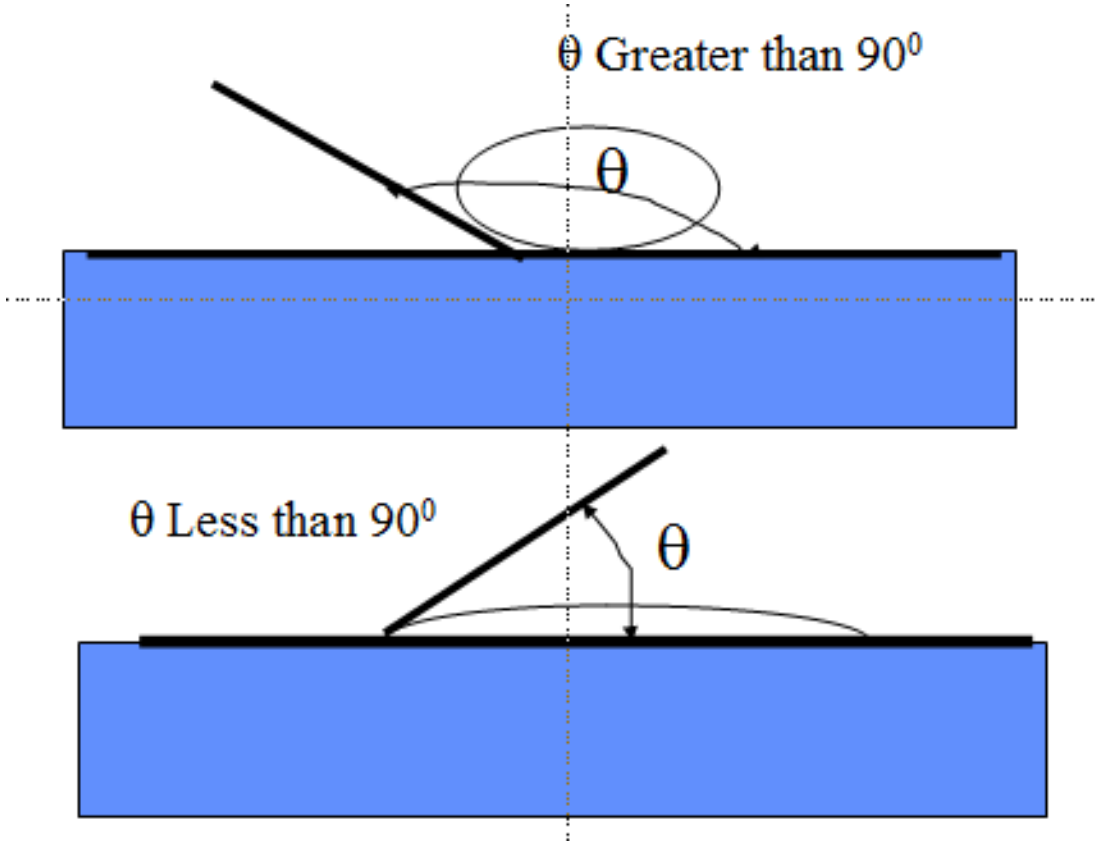
Wetting Angles



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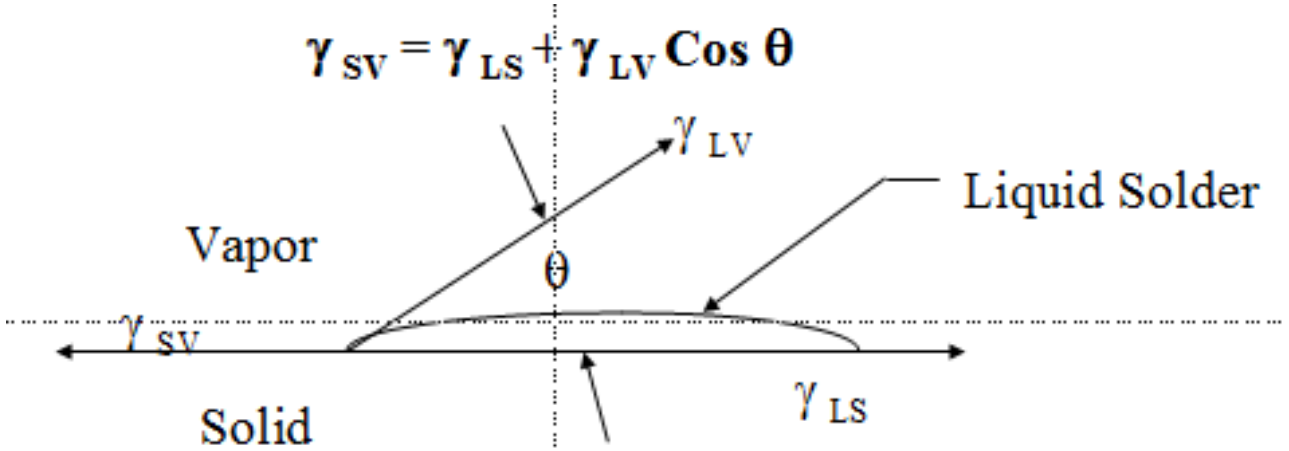
Equilibrium of Wetting

$$\gamma_{SV} = \gamma_{LS} + \gamma_{LV} \cos \theta$$



θ = Dihedral Angle
γ = Forces of the surface energies
γ_{SV} = Solid Vapor interface
γ_{LS} = Liquid Solid interface
γ_{LV} = Liquid Vapor interface

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Poor Wetting And Its Causes

- Two reasons product does not solder
  - Oxidized intermetallic coating
    - Exposed intermetallic surfaces
  - Contamination of the surfaces to be soldered

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Specification Wetting Requirements for Class 3 Products

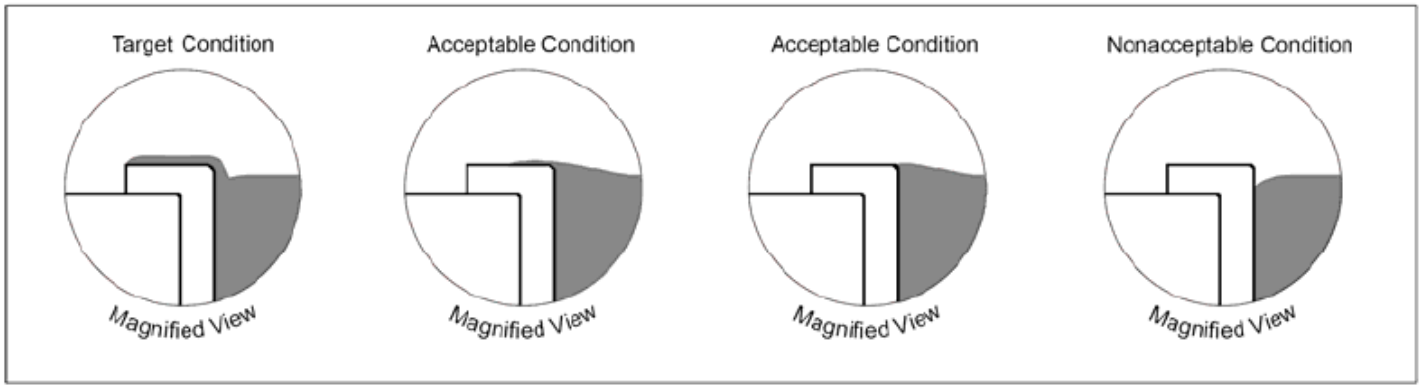

Figure 4-5 Effectiveness of Solder Wetting of Plated-Through Holes - Class 3

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Types of Solderability Defects

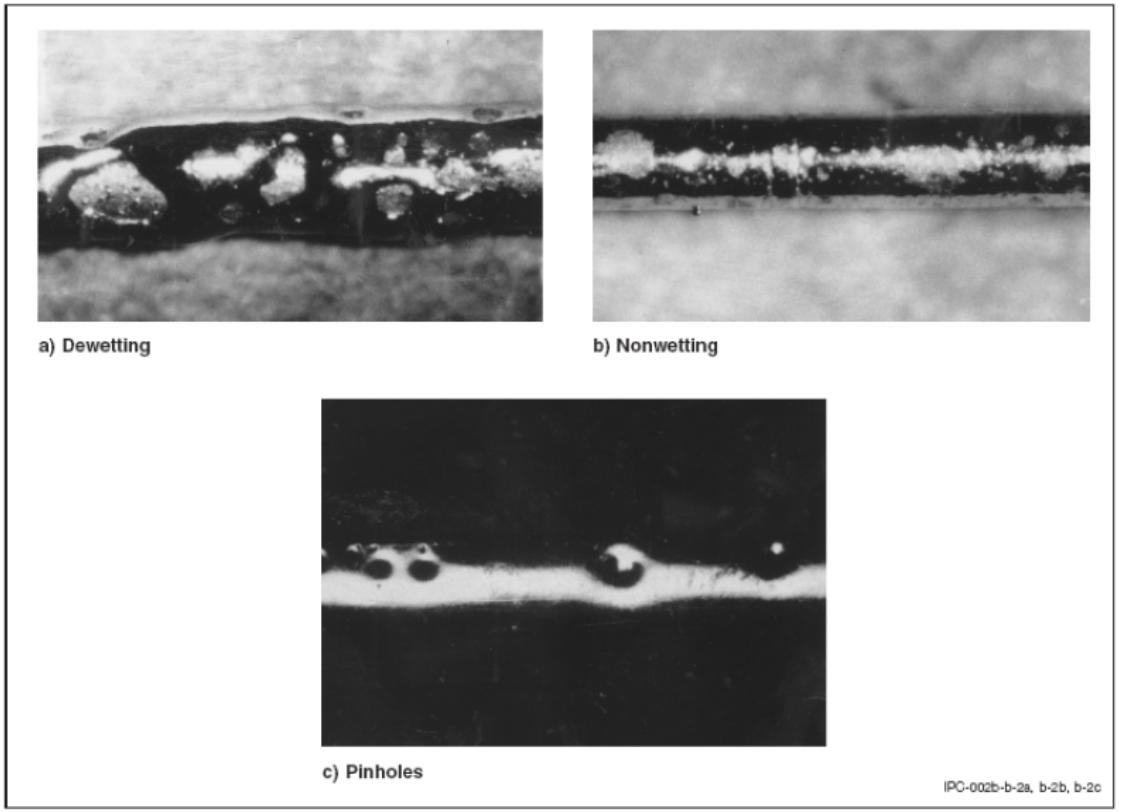

Figure B-2 Types of Solderability Defects

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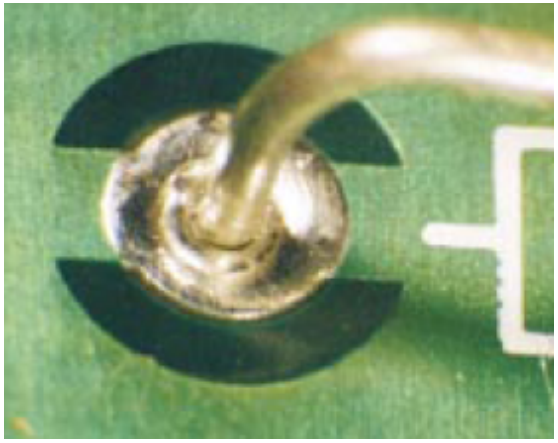
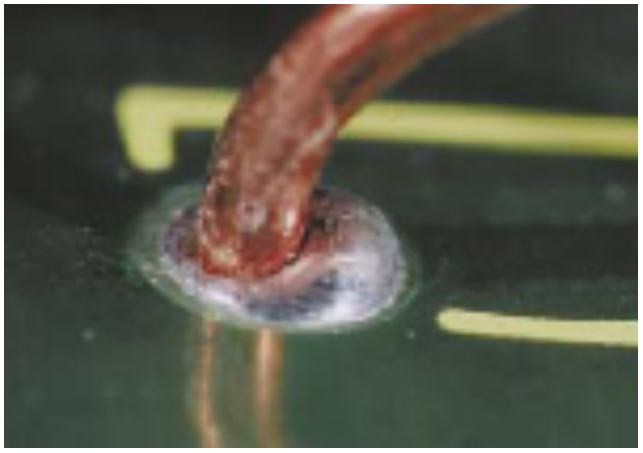
Poor Wetting And Its Causes

- Wetting implies the surfaces are clean and oxide free





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Poor Wetting And Its Causes

- Non Wetting

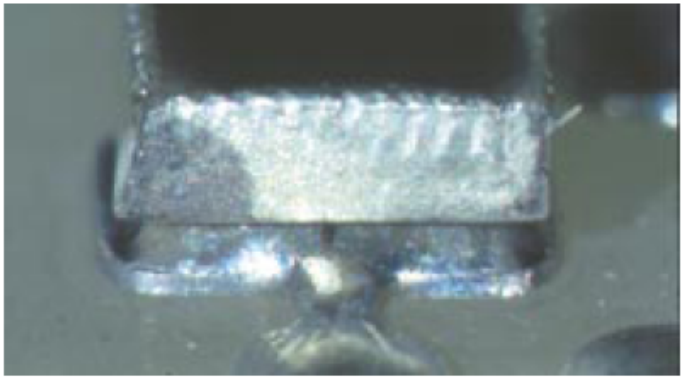

Figure 5-36

Defect - Class 1,2,3

- Solder has not wetted to the land or termination where solder is required.
- Solder coverage does not meet requirements for the termination type.

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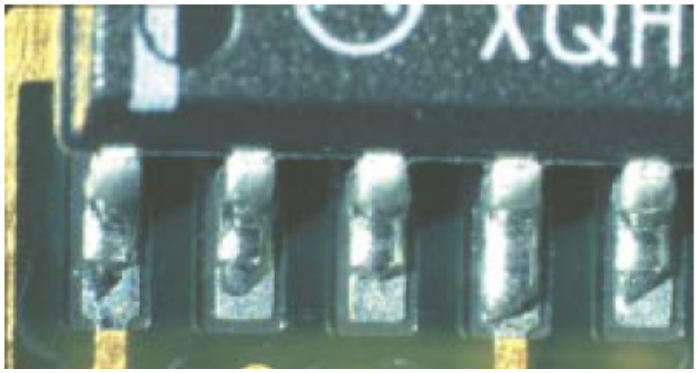
Poor Wetting And Its Causes

- Dewetting



Defect - Class 1,2,3

- Evidence of dewetting that causes the solder connection to not meet the SMT or through-hole solder fillet requirements.

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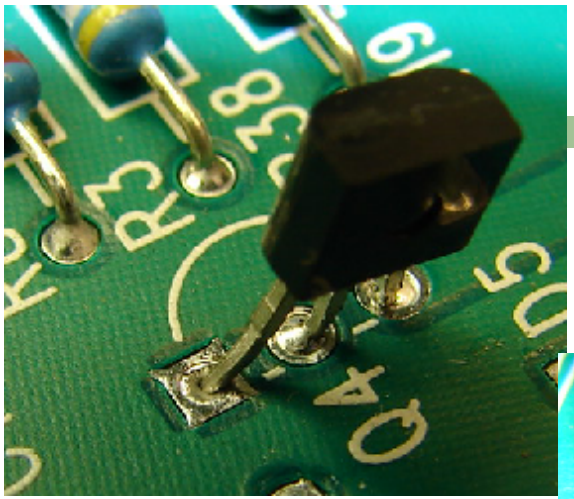
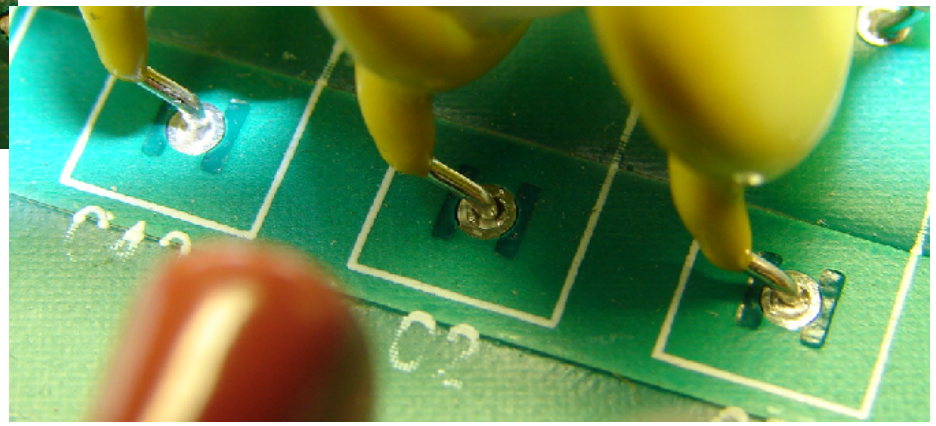
Poor wetting and its causes





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Check the Specs

- J-STD-002 - *Solderability Tests for Component Leads, Terminations, Lugs, Terminals and Wires*
- J-STD-003 – *Solderability Test for Printed Boards*

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Cutting Into the Solder Joint

- This is a new requirement for Class 3 products, where the solder joint must be reflowed when cutting the lead through the solder joint.
  - J-STD-001 Para 6.1.4 Lead Trimming
  - IPC-A-610 Section 7.3.5.9 Lead Cutting After Soldering

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Cutting into Solder Joints

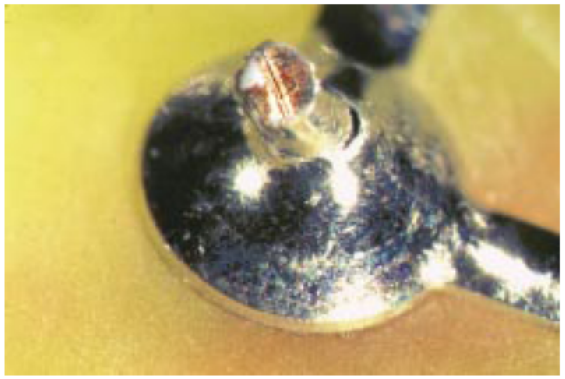

Figure 7-130

Defect - Class 1,2,3

- Evidence of fracture between lead and solder fillet.

Defect - Class 3

- Lead trimming that cuts into the solder fillet and is not reflowed.

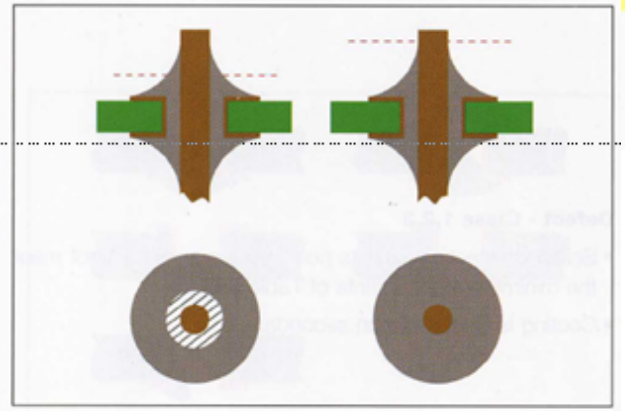

Figure 7-112

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Meniscus in Solder IPC-A-610 Rev E

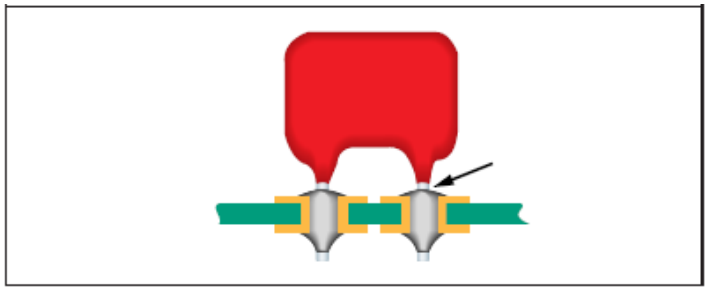
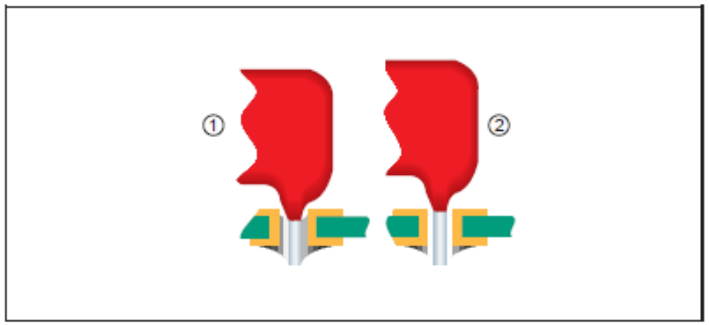


Figure 7-126



Acceptable - Class 1

- Components with a coating meniscus can be mounted with the meniscus into the solder provided:
  - 360° wetting on the secondary side.
  - Lead coating meniscus is not discernible within the connection on the secondary side.

Acceptable - Class 2,3

- Coating meniscus is not in the plated-through hole and there is discernible clearance between the meniscus and the solder fillet.

Process Indicator - Class 2

- Coating meniscus is in the plated-through hole but solder joint meets the requirements of Table 7-4.

Defect - Class 3

- Coating meniscus is in the plated-through hole.
- Coating meniscus is embedded in the solder connection.

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Meniscus in Solder
J-STD-001 Rev D & E

001 Rev D and Rev E States:

6.1.6 Coating Meniscus In Solder For Class 1 and 2 as an exception to Tables 6-4 or 6-5, as appropriate for supported or unsupported holes, on the solder destination side the meniscus may be covered by solder but on the solder source side there **shall**[4] be 360° visible solder wetting and no visible coating meniscus in the solder connection. Solder connections **shall**[5] meet the requirements of Tables 6-4 or 6-5, as appropriate.

(4) Class 1-Defect
Class 2-Defect
Class 3-Defect

(5) Class 1-Not Est
Class 2-Not Est
Class 3-Defect

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Acceptability for Wire Wrap

Figure 6-51

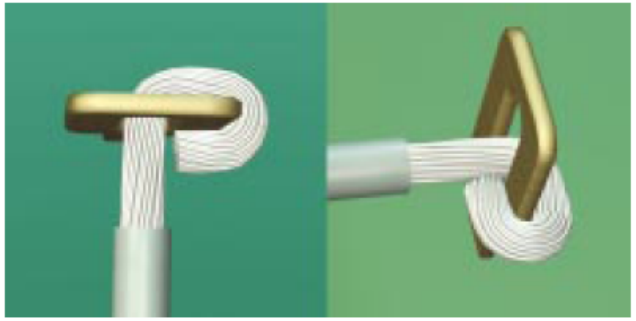

Figure 6-52

- TARGET:
  - The main requirement is that the wire passes through the eye of the terminal and contacts at least two nonadjacent sides of the terminal
- Acceptable 2, 3
  - Wire wrap equal to or greater than 90° or wire contacts both sides of the terminal.

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Acceptability for Wire Wrap

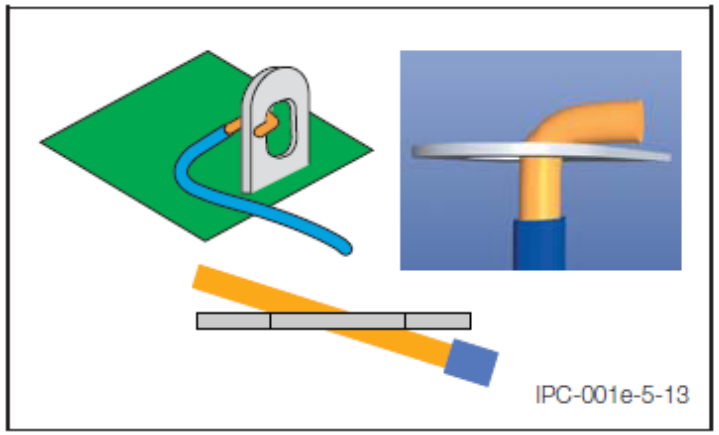

Figure 5-13 Pierced or Perforated Terminal Wire Wrap

Table 5-9 Pierced/Perforated Wire Placement

Criteria	Class 1	Class 2	Class 3
<90° wrap	Accept	Defect	
≥90° wrap	Accept		
>360° and wire end overlaps itself[1]	Accept	Defect	
Wire does not pass through the eye and contact two sides of the terminal	Accept	Defect	
Wire end violated minimum electrical clearance	Defect		

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Acceptability for Wire Wrap

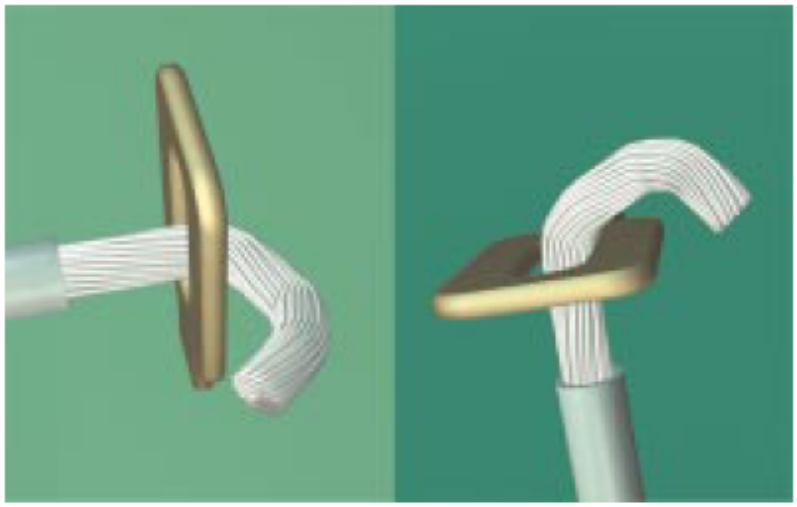

Figure 6-53

Acceptable Class 1,

Defect Class 2, 3

- Wire wrap is less than 90° or wire does not contact both sides of the terminal

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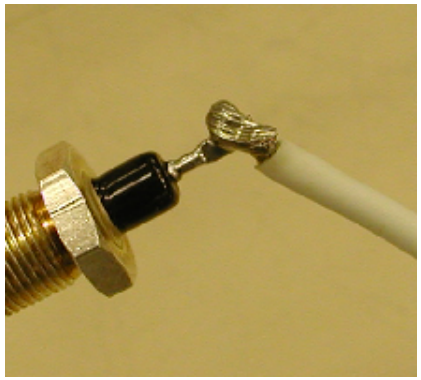
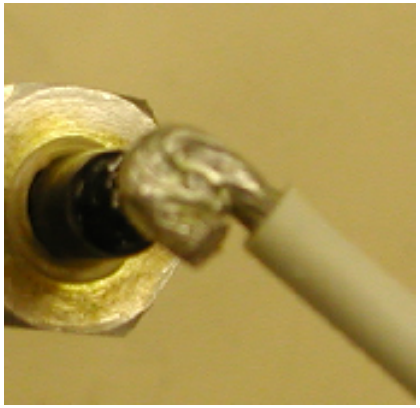
Customer request, Good or Bad?





- In this case the wire completely wraps over the terminal.
- Hole in terminal is too small for wire to be installed through the hole so the terminal was treated as a turret terminal.
- Wire is wrapped 180 around the terminal post like a turret terminal.

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Conclusion

Just keeping you informed regarding information which I think may be useful to all of you

Thank You

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