



**AIM**

Global Solder Solutions

# Wave Soldering Troubleshooting Guide

AIM's Practical Solutions

# Excellence is more than a word... it's our passion


With roots in the world of metal stretching back over 75 years, AIM has evolved from humble beginnings into an international leader in the development, manufacture and application of electronics assembly materials.

Our mission is to offer the most innovative and reliable product solutions available to the electronics industry. At the same time, AIM is keenly focused on the need for customer support at every stage of the professional relationship. In fact, we consider our commitment to providing top-notch technical service to be just as important as our goal of producing market-leading materials.

The key to being a market leader in any industry today rests on the ability to provide customers with unmatched quality, consistency and value throughout the entire process, with products and services delivered locally, and yet still inspired by a global, environmentally-focused view.

We believe that our focus on creating excellence every step of the way is what sets AIM apart, and allows us to meet those challenges. We thank you for the confidence and trust that you have placed in us, and we look forward to continue working closely with you to help you achieve your goals.

Yours truly,



Rick Black  
President, AIM



Solder plus Support

# Types of Wave Soldering Defects



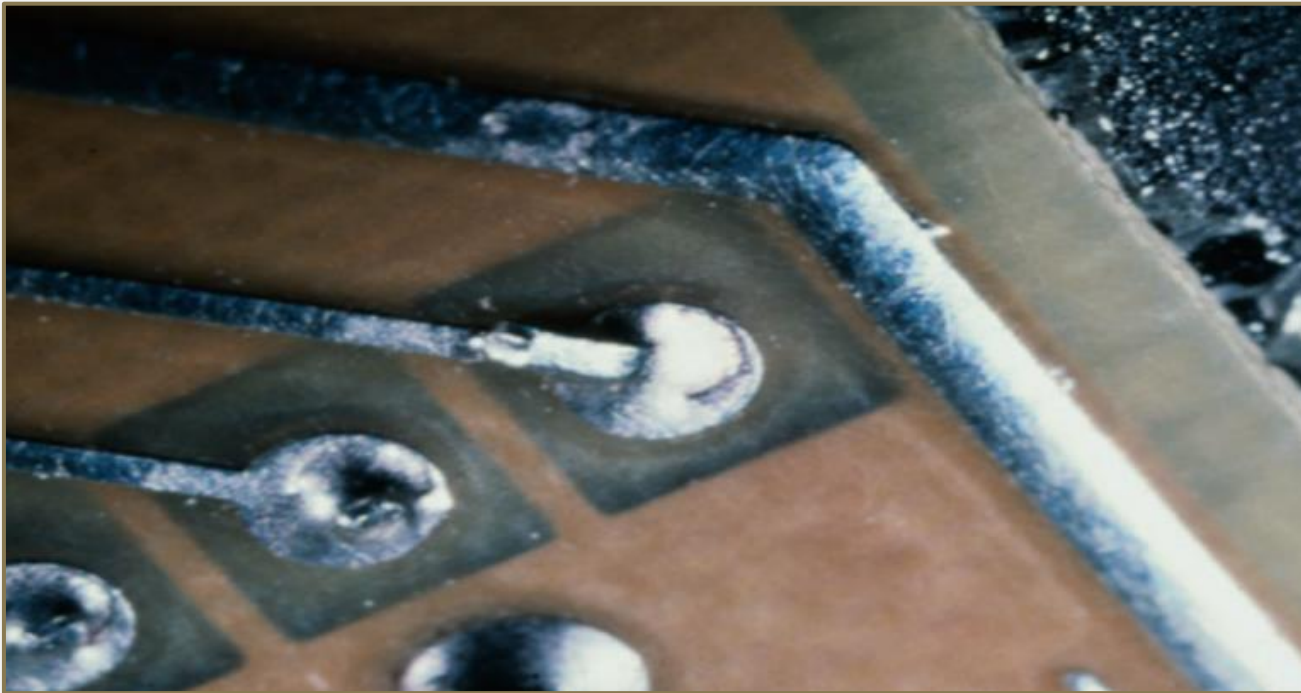
# Types of Defects

- ▶ Non-Wetting
- ▶ Dewetting
- ▶ Pin Holes
- ▶ Webbing
- ▶ White Haze
- ▶ Solder Balls
- ▶ Icycling
- ▶ Bridging
- ▶ Excess Solder
- ▶ Dull/Grainy Joints
- ▶ Cold/Disturbed Joints



# Non-Wetting

- ▶ Recognized by pull back of solder to expose the surface that was to be soldered



# Non-Wetting

## ▶ Possible Causes:

- ▶▶ Grease, oil or dirt on the pre-soldered surface
- ▶▶ Bleeding or misregistered solder mask
- ▶▶ Low temperature solder
- ▶▶ Contaminated solder
- ▶▶ Surfaces too heavily oxidized for flux being used
- ▶▶ Contaminated flux
- ▶▶ Poor application of flux

## ▶ Remedy:

- ▶▶ Investigate each possible cause and correct suspected discrepancies one at a time until solderability is restored



# Dewetting

- Recognized by metal wetting initially, then pulling back to form droplets of solder on the surface



# Dewetting

## ▶ Possible Causes:

- ▶▶ Contamination of surface by abrasives
- ▶▶ Poor plating
- ▶▶ Poor hot air solder leveling during PCB manufacturing

## ▶ Remedy:

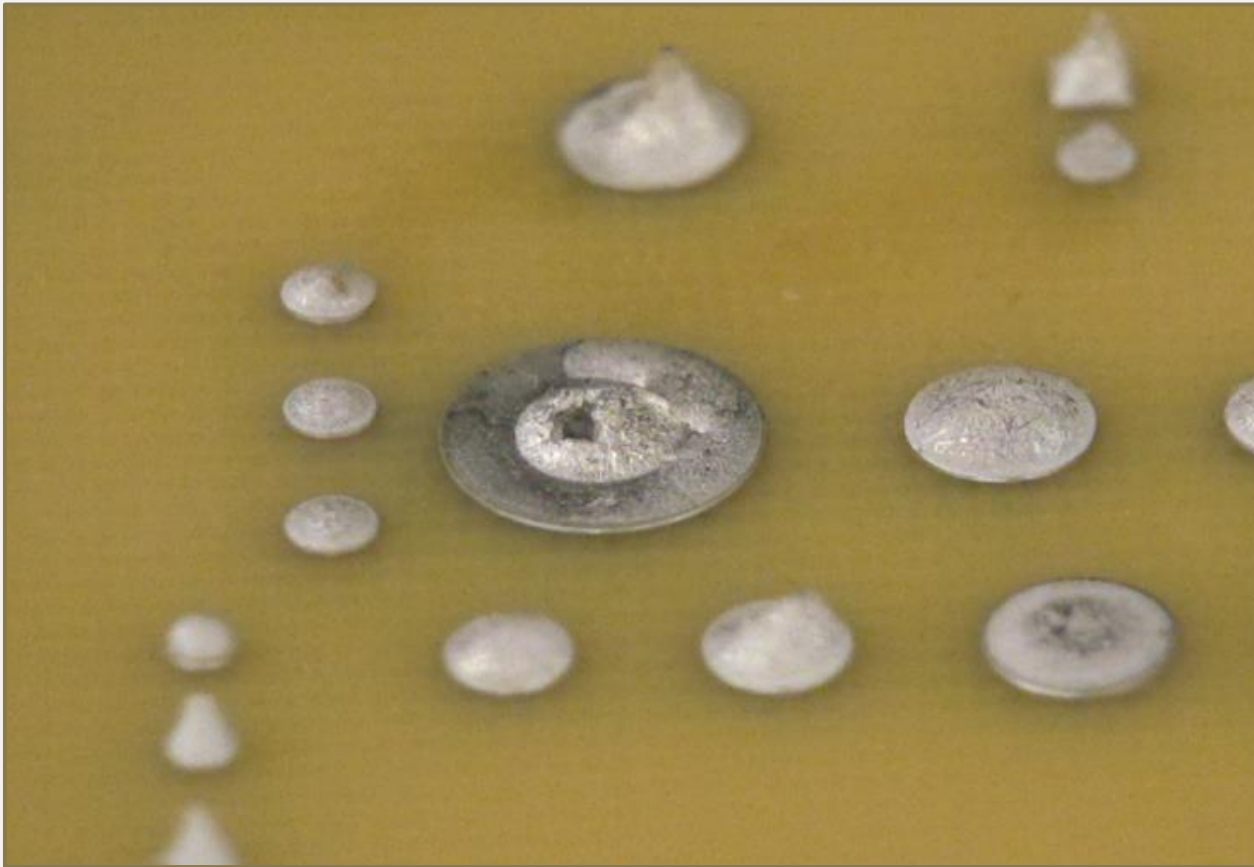
- ▶▶ Restore solderability of the surface





# Pin Holes

- Recognized by small holes or eruptions in the solder fillet



# Pin Holes

## ► Possible Causes:

- » Moisture or plating solution in the PCB laminate
- » Inadequate preheat to evaporate flux solvent
- » Flux has absorbed water
- » Physical blockage due to foreign body in hole
- » Top of plated through hole prematurely solidifying

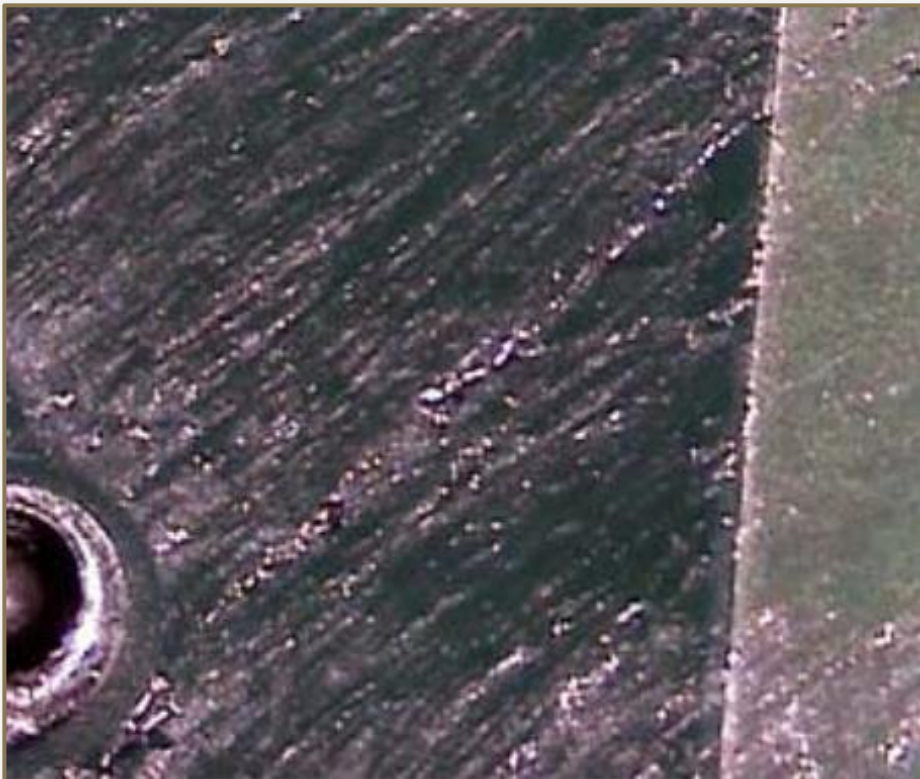
## ► Remedy:

- » Increase preheat to see if it eliminates problem
- » Put in new flux to see if it eliminates problem
- » Increase topside preheat and/or solder temperature to correct premature topside plated through hole freezing
- » If all of these fail, have the PCB's baked and cross sectioned



# Webbing

- ▶ Recognized by a spider web like extension of solder across the nonconductive portion of the PCB



# Webbing

## ► Possible Causes:

- ›› Improper curing of the laminate or solder mask
- ›› Inadequate flux (when accompanied by bridging or icycling)
- ›› Dross in the solder wave

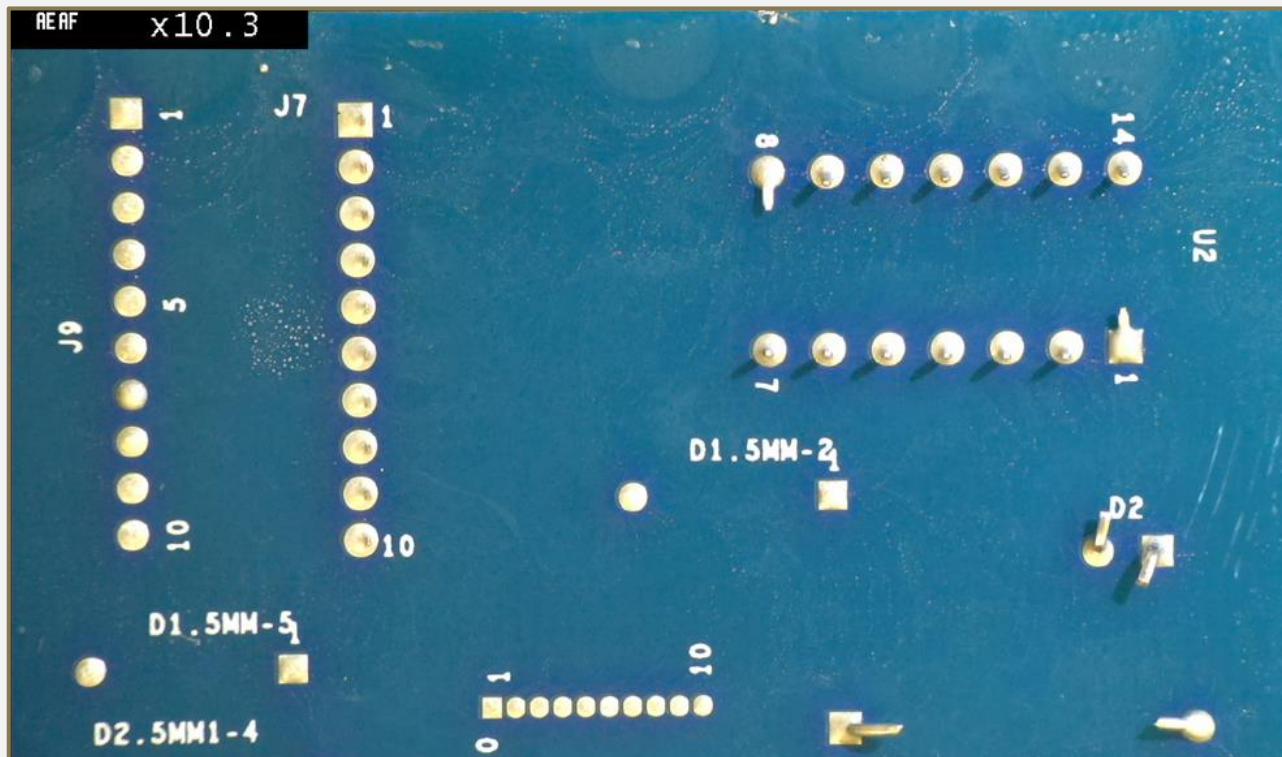
## ► Remedy:

- ›› Baking the PCB will sometimes correct the improperly cured mask or laminate condition
- ›› Substituting a more viscous flux or increasing the quantity of flux put on the PCB
- ›› Correcting the drossing problem in the wave



# White Haze on Solder Mask

- ▶ Recognized by a white haze on the nonconductive portion of the PCB that cannot be removed by washing.



# White Haze on Solder Mask

- ▶ Possible Causes:

- ▶▶ Improper curing of the laminate or solder mask

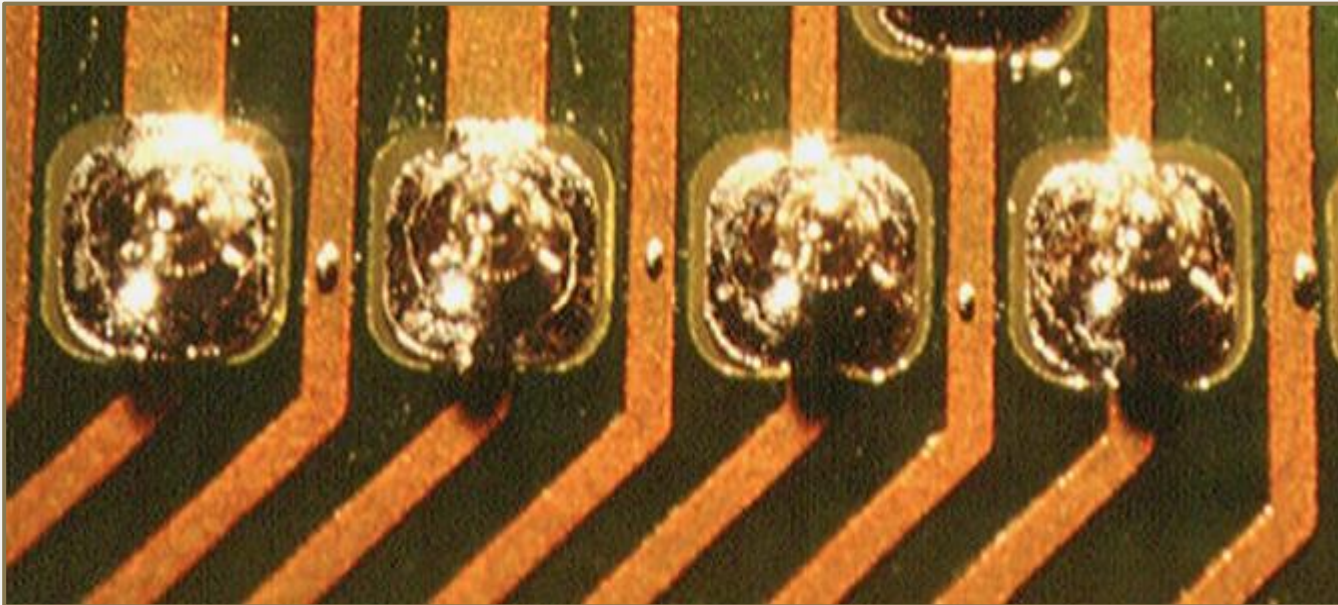
- ▶ Remedy:

- ▶▶ Baking the PCB will sometimes correct the improperly cured mask or laminate condition



# Solder Balls

- ▶ Recognized by tiny spherical shapes of solder dispersed over the surface of the PCB



# Solder Balls

## ► Possible Causes:

- » Insufficient preheat
- » Plated through hole conditions that create pin holes, resulting in Solder Balls
- » High Humidity in the manufacturing area
  - » Moisture in the flux

## ► Remedy:

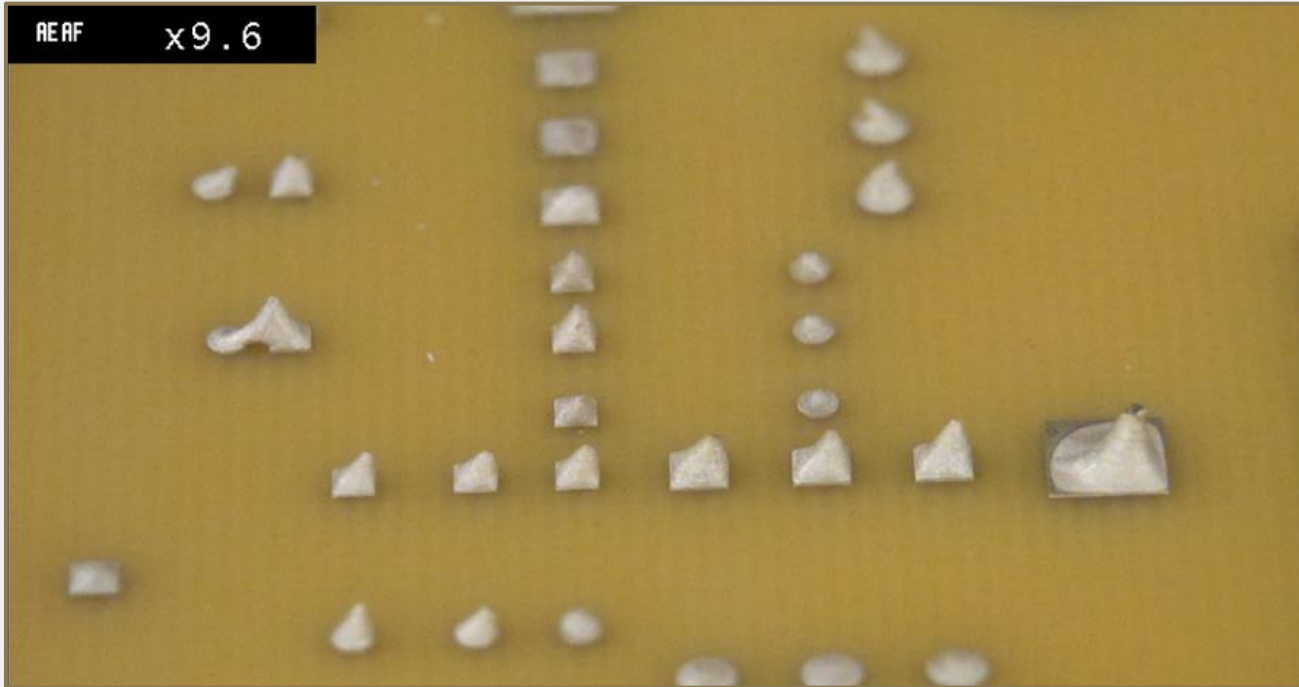
- » Investigate each possible cause and correct suspected discrepancies one at a time until problem is corrected





# Icycling

- ▶ Recognized by conical or flag shaped extension of the solder fillet



# Icycling

## ► Possible Causes:

» Any condition that causes the solder to solidify while in the process of draining, such as:

- » Inadequate flux to promote quick drainage
- » Pot temperature too low
- » Soldering surface unusually heat absorbent
- » Leads picking up dross in the wave
- » Wrong plated through hole to wire ratio

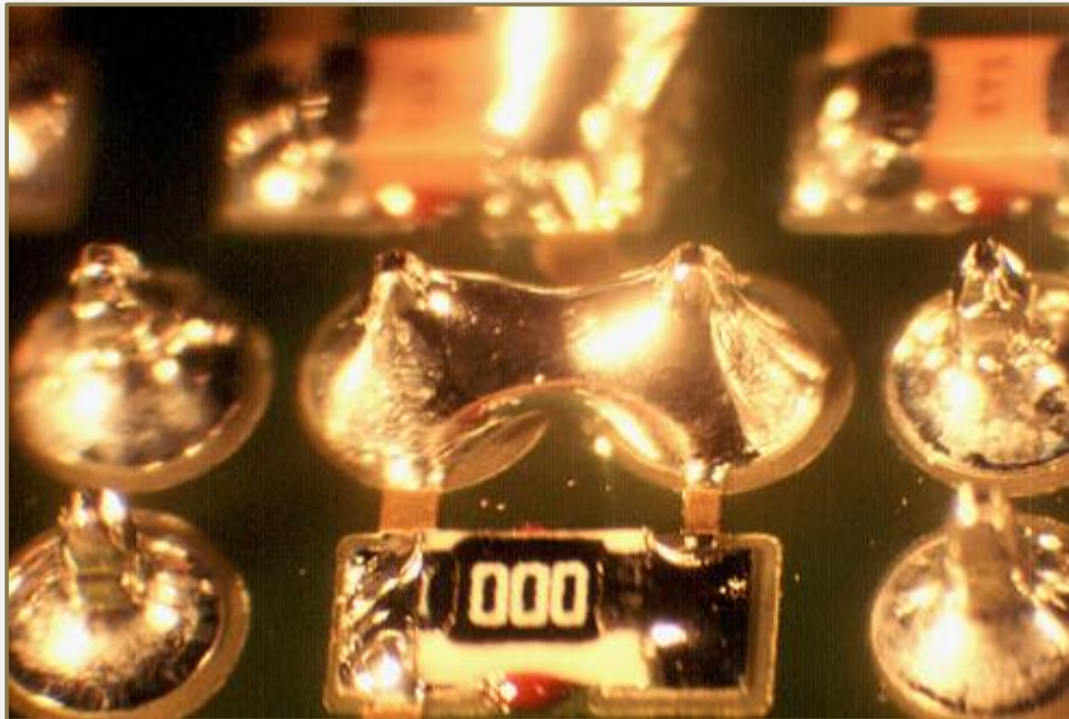
## ► Remedy:

» Investigate each possible cause and correct suspected discrepancies one at a time until problem is corrected



# Bridging

- ▶ Recognized by solder extending from one lead to an adjacent lead, causing a short circuit



# Bridging

## ► Possible Causes:

- » Component leads that are bent or too closely spaced
- » Excess solder
- » Inadequate flux remains to promote drainage
- » Board immersed too deep in the wave
- » Leads picking up dross in the wave
- » Contaminated solder
- » Poor component solderability

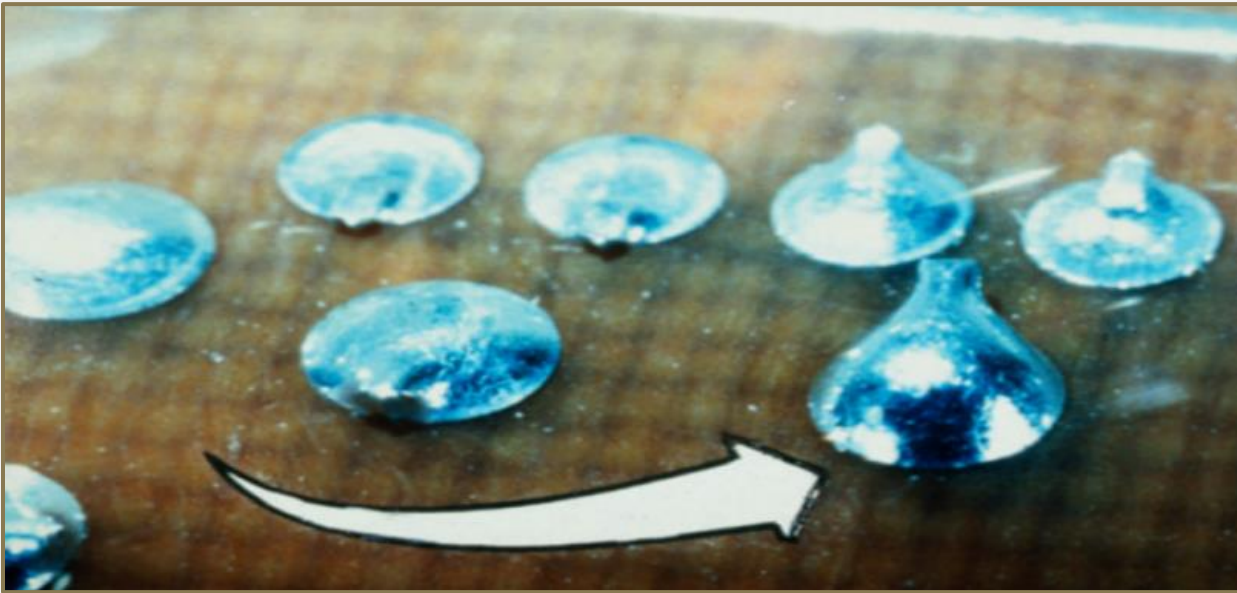
## ► Remedy:

- » Investigate each possible cause and correct suspected discrepancies one at a time until problem is corrected



# Excess Solder

- ▶ Recognized by:
  - ▶▶ Bulbous appearance of fillet
  - ▶▶ Unable to see contours of lead and land



# Excess Solder

## ► Possible Causes:

- » Any condition that contributes to poor drainage of the solder
- » Low temperature of solder or preheat
- » Contamination of solder
- » Insufficient flux to promote drainage
- » Incorrect wave exit angle or speed

## ► Remedy:

- » Investigate each possible cause and correct suspected discrepancies one at a time until problem is corrected



# Dull or Grainy Joints

- ▶ Recognized by dark, non reflective, rough surfaces from an alloy that is normally bright and shiny



# Dull or Grainy Joints

## ► Remedies:

- ›› Determine if the alloy typically has a shiny surface finish
- ›› Examine a recent pot analysis or have one completed
- ›› Conduct electrical and mechanical evaluation to see if rework is necessary
- ›› If solder meets J-STD-006 purity standards and joints are mechanically sound, there is no reason for rejection or touch up
- ›› If solder does not meet standard, it is a *cold joint* and should be replaced





# Cold or Disturbed Joints

- ▶ Recognized by rough and dull finish on the fillets in conjunction with unacceptable mechanical strength of the joint



# Cold or Disturbed Joints

## ► Possible Causes:

»» Movement while joint is still molten caused by:

»» Conveyor mechanism erratic

»» Solder temperature too high

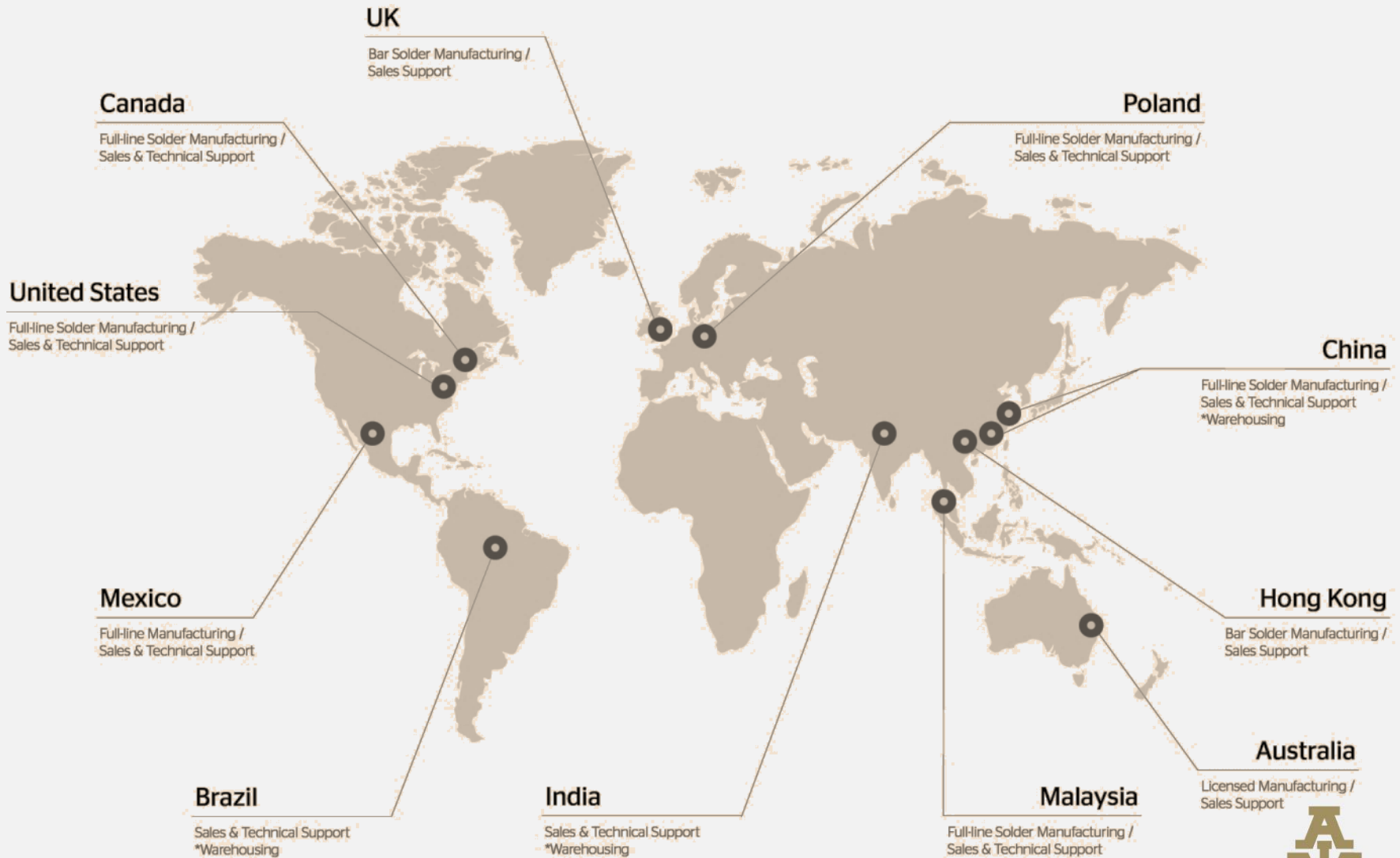
## ► Remedy:

»» Look for causes of vibration being transmitted to the PCB and correct them

»» Ensure that solder reaches solidus temperature immediately after joint is completed



# AIM Global Locations



Solder plus Support

# Thank You



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