Pallet Design Guidelines

INTRODUCTION
Due to the never dying, mix technology of double-sided printed circuit boards required for assembly and the ever decreasing real estate in which to place these components, there is an ever increasing demand for a reliable selective soldering process. Advances in materials, with their ability to withstand the harsh environment of wave soldering and their ease of machining, have made the Wave Soldering Pallet a cost effective assembly solution.

MATERIALS
Materials have come along way from the G10 days. Originally designed for other industries, Durapol, Delmat and ECP have been adopted and are now the predominate materials of choice. These materials are similar in their machining and durability characteristics. A new material, Technolaque, has just become available. It is designed exclusively for the wave solder process. Technolaque’s characteristics have shown significant increases in durability and strength over the predominant materials presently in use. Technolaque is constructed in layers and bonded with an adhesive that does not breakdown in the heated alcohol environment of the wave solder.

JUSTIFICATION
Solder pallets, in the past, have been a Production Supervisor’s nightmare keeping up with all the hardware and handling issues associated with adjustable wave pallets. The Process Engineer also has to justify the purchase cost. As a result of the newer materials (one-piece construction) and ease of machining (reduced fabrication cost), justification can be easily achieved. Listed below are some of the more notable cost reductions associated with solder pallets.

- Elimination of SMT bottomside Glue process
- Reduced 2nd hand load components due to outer edge board overlap.
  - onetime pallet cost versus recurring breakaway tab cost
  - 1st hand load labor versus 2nd hand load labor
- Eliminate hand masking and Kapton tape processes
  - fixture will mask areas on bottomside
- Eliminate recurring breakaway tab cost for odd shaped PCB’s
  - one time pallet cost
- Reduced rework / touchup cost
  - layout violation and misorientation of SMT components will be masked from wave
  - additional support for assemblies with heavy component and PCBs with large width dimensions
  - Better quality than hand soldering

All the above cost reduction can easily be attained with high runner assemblies. When assemblies are small runners, rework / touchup, breakaway tabs and hand masking (if applicable) can constitute justifiable paybacks.

- 1 to 3 weeks payback is common on assemblies
WAVE SOLDER PALLETS

- 45° Beveled leading and trailing edges
- Aluminum stiffeners / solder dams on all four (4) sides of pallet
- Spring loaded rotary hold down buttons, made from static dissipative, high temp. plastic
- Fabrication process insures flatness held within .010 over 6 linear inches
- Rail fingers .150” wide top, .250” wide bottom, and bottom edge flush with PCB bottomside
- Board pocket lip shall be min. .062 standard
- Board pocket shall be .024” larger than PCB in each axes
- Pallet machined for solder openings, with 60° bottom side chamfers
- Pallet design optimized to travel with the short axis leading/trailing (unless PTH components layout dictates other)
- PCB pocket depth will match pallet’s conveyor rails
- All fasteners mounted metal to metal with 316 ss hardware on solder side

COMPOSITE WAVE SOLDER DRAWING

- Stiffeners
- Board pocket
- Rotary hold downs
- 60° chamfer leading and trailing edges
- Bevel /chamfer corners
- Delmat, Durapol, Durostone materials
- Pallet fingers .150” wide top .250” wide bottom
- All solder openings 60° chamfered bottom side
SELECTIVE WAVE SOLDER PALLET

- “Seal” walls can be .030” thick (min.), base upon length
- .020” clearance between the SMT components and pallet floor
- Pallet “floor” shall be .050” thick (min.), base upon size of area
- .030” (min.) clearance between the SMT component pad and the outside seal walls (short axis only)
- .050” (min.) clearance between outer annular ring of PTH and seal walls
- Board pocket shall be .024 larger than PCB in both axes
- Pressure relieving pallet solder side, shall be applied to meet aspect ratio requirements
- Aluminum stiffeners / solder dams on all four (4) sides of pallet
- Pallet conveyor edges shall be .150” wide top and .250” wide bottom, .090 min. thickness
- Pallet design optimized to travel with the short axis leading/trailing (unless PTH components layout dictates other)
- PCB pocket depth will match pallet’s conveyor rails
- Spring loaded rotary hold-downs buttons, made from static dissipative, high temp. plastic
- 45° beveled leading and trailing edges
- Fabrication process insures flatness held to within .010” over six (6) linear inches

COMPOSITE SELECTIVE WAVE SOLDER DRAWINGS
PCB LAYOUT GUIDE LINES

PTH COMPONENT CLEARANCES

Recommended minimum distance, from the outside edge of the annual ring to a SMT component pad:
- short axis of SMT pad layout: .100” (see figure 3-1)
- long axis of SMT pad layout: .100” (plus half of the component body width) (see figure 3-2)

SMT COMPONENT HEIGHT CLEARANCES

Offset tall SMT components as much as possible to insure the maximum aspect ratio and pressure relieving (see figure 3-3).
PTH COMPONENT PCB PLACEMENTS

PTH component layouts

Align so the long axis is travelling perpendicular to the solder wave. Long axis of the PCB travels parallel to wave solder conveyor.

If PTH connector placement is required along outside edges of PCB, leave sufficient spacing for seal wall support between components.

Group PTH components to allow for larger solder openings. This will allow better bottom side preheat penetration to insure:

- Good topside solder fillets
- Reduced occurrences of upward PCB bowing due to insufficient bottom side preheating (if topside preheat is used)

Do not place passive SMD components within PTH component land patterns
ASPECT RATIO OF SOLDER OPENINGS

This aspect ratio relates to the solder openings length / width versus the vertical travel required for the solder to reach the bottom of the PCB.

The min. ratio:  1:1
  Length / width dims.  .150”min.
  Vertical travel dims.  ≤ .150”

Vertical travel may increase as long as the soldering opening increases proportionally.

Min. vertical travel  = (no bottom side component, + .020 air gap + .050 pallet floor): = .070”
Max. vertical travel = (bottom side component height + .020 air gap + .050 pallet floor) = .320”

Solder openings of .150” are the minimum in the Y axis. The openings in the X axis must be larger with an aspect ratio of 1:3 width (Y) to length (X). This will allow for the solder to recover and reach the bottom of the PCB.

When the short (Y) axis solder opening is ≥ .300” a 1:1 aspect ratio can be used for the X & Y dims.

The long axis of the solder opening should travel perpendicular to the solder wave.
CONCLUSIONS

Wave solder pallets are a proven solution to improving all mixed technology PCB assembly processes. Evaluate the assemblies you are considering per the guidelines and draw your own conclusions. AGI will be glad to help you with your evaluation and design. Let AGI be your assembly solution partner.

Challenge Us!