



## Pallet Design Guidelines

### INTRODUCTION

Wave and SMT pallets are an essential and cost effective tool for the PCB assembly process. Pallets designs allow for increased through put, the securing / aligning of critical components and allow for soldering of thru-hole components affected by bottom side SMT component layout violations. Review your process using the justification section below and see how Wave and SMT pallets can improve your process.

### MATERIALS

Materials now have been designed for the wave solder and reflow PCB assembly process. Durapol, Durostone and Haysite have been adopted and are now the materials of choice. For the **lead free** wave solder and reflow process Durapol and Durostone have new formulation to withstand the higher temperature requirement and the more aggressive fluxes. All these materials are similar in their machining and durability characteristics.

### JUSTIFICATION

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.

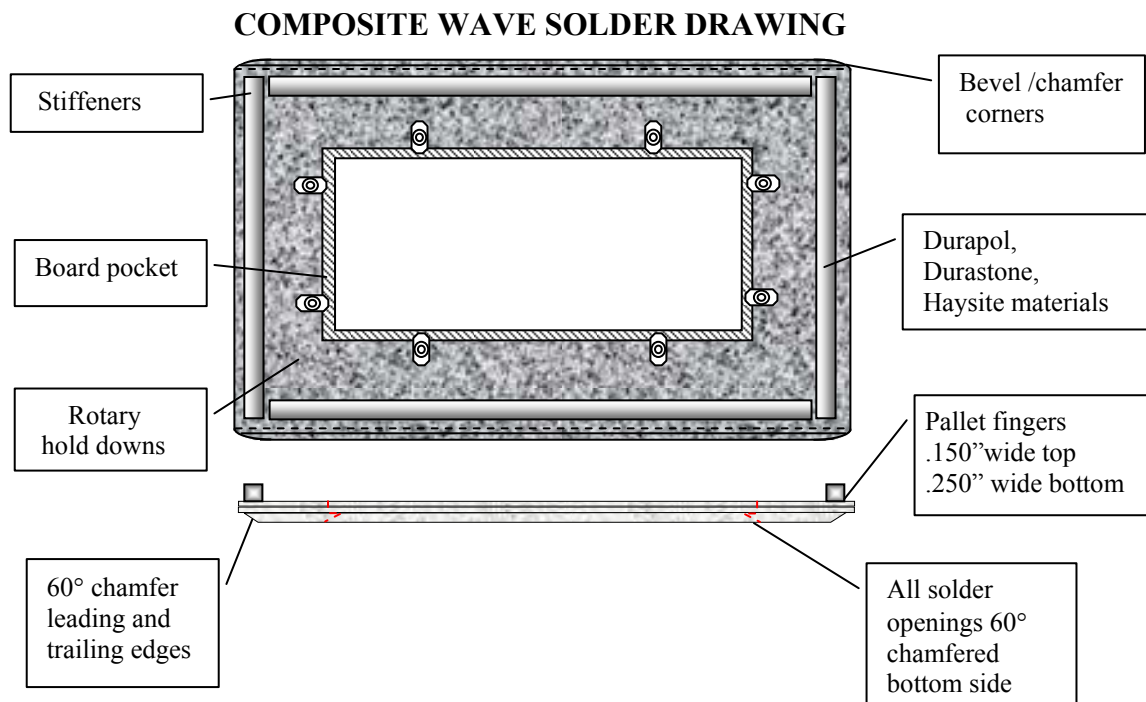
- **Elimination of SMT bottom side Glue process**
- **Reduced 2<sup>nd</sup> hand load components due to outer edge board overlap.**
  - onetime pallet cost versus recurring breakaway tab cost
  - 1<sup>st</sup> hand load labor versus 2nd hand load labor
- **Eliminate hand masking and Kapton tape processes**
  - fixture will mask areas on bottom side
- **Eliminate recurring breakaway tab cost for odd shaped PCB's**
  - one time pallet cost
- **Reduced rework / touchup cost**
  - layout violation and mis-orientation of SMT components well be masked from wave
  - additional support for assemblies with heavy component and PCBs with large width dimensions
  - Better quality than hand soldering
  - Secure and alignment of critical components with over head tooling
- **Increase PCB through put with multi-up pallet design**
  - Allows the processing of multiple PCBs at one time.
  - Eliminates the additional cost of panel up layouts.



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

### 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 bottom side
- Board pocket lip shall be minimum .062 standard
- Board pocket shall be .030" 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

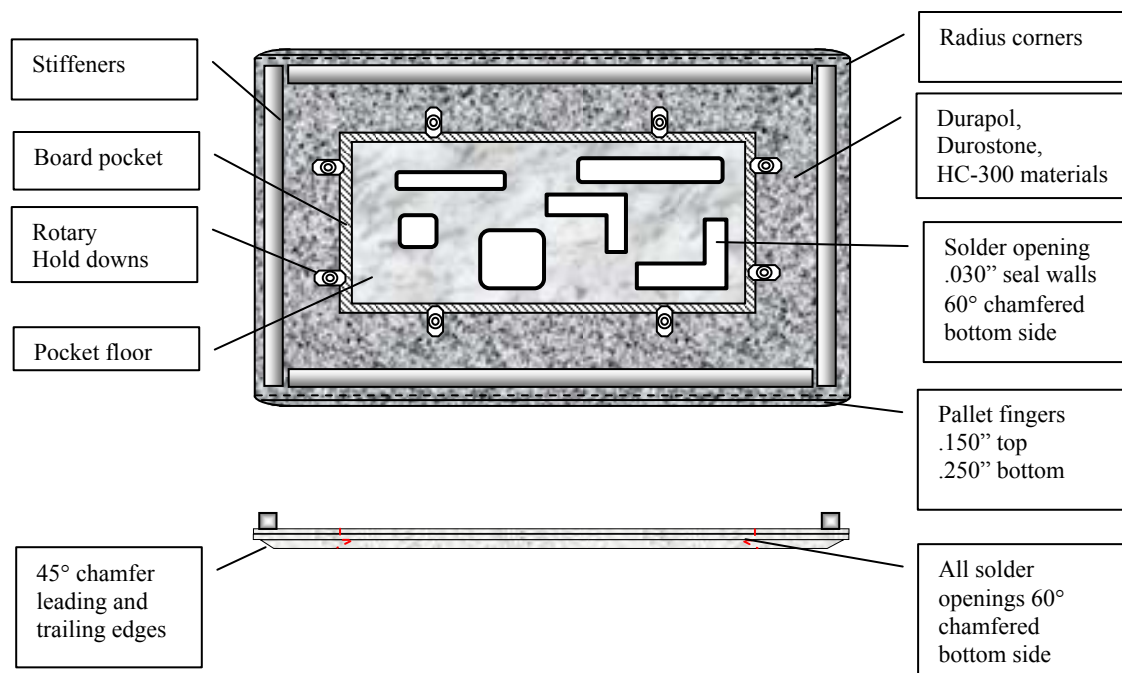




## SELECTIVE WAVE SOLDER PALLETS

- “Seal” walls can be .030” thick (min.), based upon length
- .020” clearance between the SMT components and pallet floor
- Pallet “floor” shall be .030” thick (min.), base upon size of area
- .020” min. clearance between the SMT component pad and the outside seal walls (short axis only)
- .050” (lead solder) .100” (**lead free** solder) min. clearance between annular ring of PTH and seal walls
- Board pocket shall be .030” 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 temperature 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



**AGI Corporation**

[www.AGICorp.com](http://www.AGICorp.com) - [info@AGICorp.com](mailto:info@AGICorp.com)

177 Nick Fitchard Road • Huntsville, AL 35806 • (256) 858-3300 • Fax: (256) 858-3304



## PCB LAYOUT GUIDE LINES

### PTH COMPONENT CLEARANCES FOR LEADED AND **LEAD FREE** SOLDER

Recommended minimum distance, from the outside edge of the annular ring to a SMT component pad:

Short axis of SMT pad layout (see figure 3-1)

Long axis of SMT pad layout (see figure 3-2)

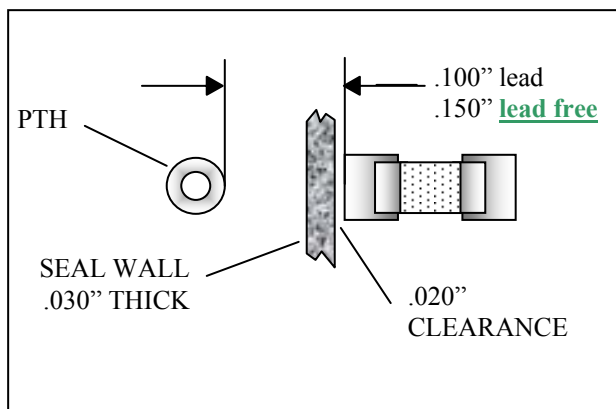


Figure 3-1

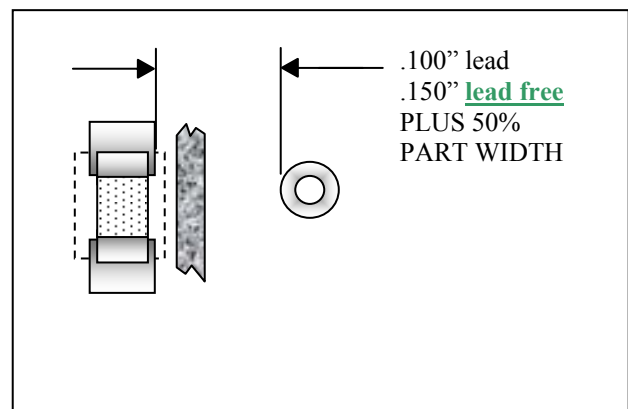


Figure 3-2

### 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).

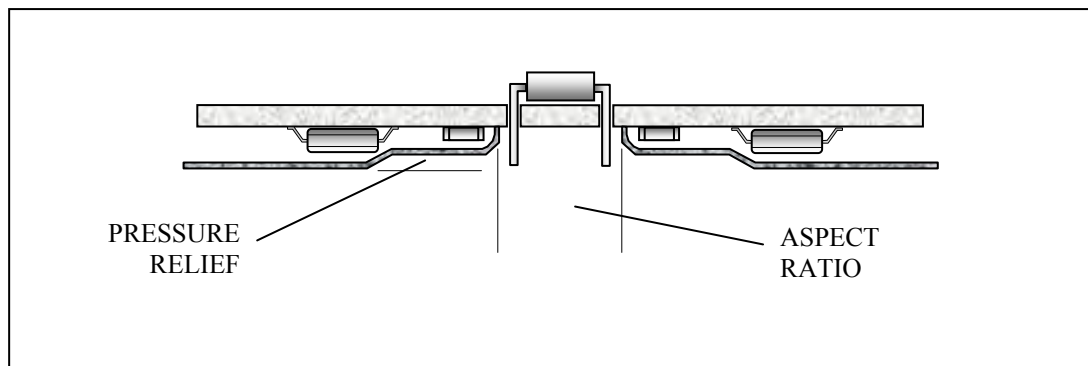


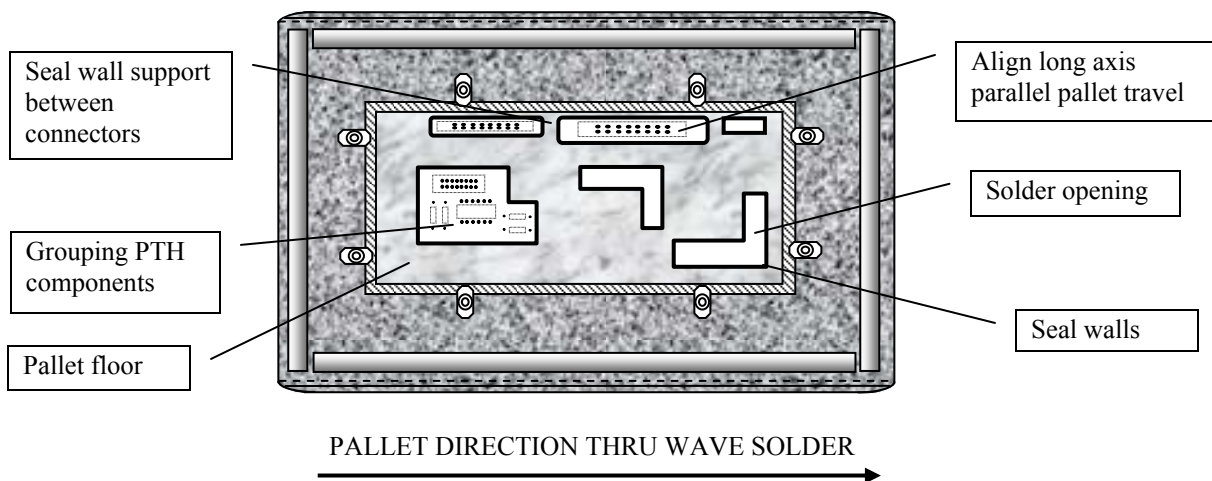
Figure 3-3



## PTH COMPONENT PCB PLACEMENTS

### PTH component layouts

- Align so the long axis is traveling 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





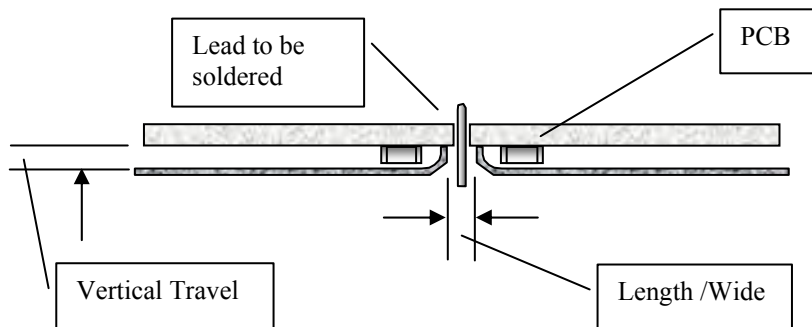
## ASPECT RATIO OF SOLDER OPENINGS

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.

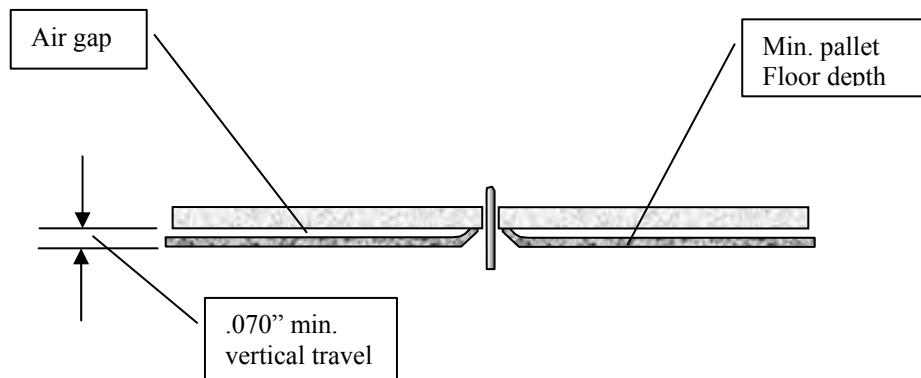
The min. ratio:1:1 (lead solder)  
Length / width dims.  $\geq .150''$  min.  
Vertical travel dims.  $\leq .150''$

The min. ratio:1.7:1 (**lead free** solder)  
Length / width dims.  $\geq .250''$  min.  
Vertical travel dims.  $\leq .150''$

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



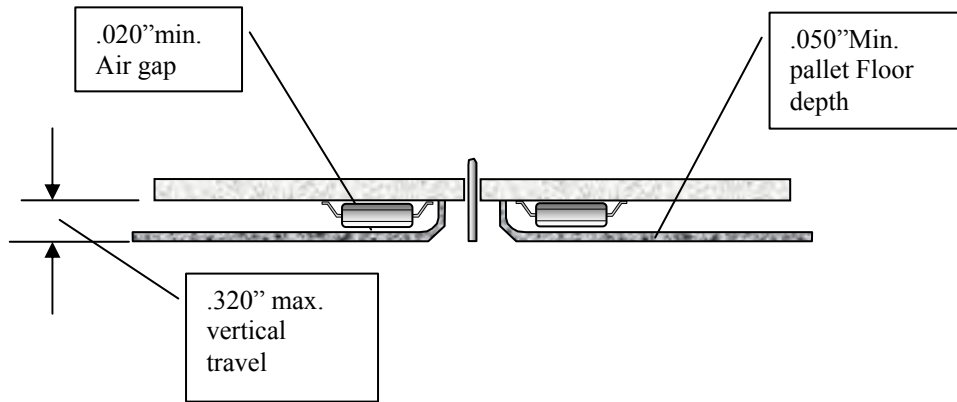
Min. vertical travel = (no bottom side component, + .020 air gap + .050 pallet floor) = **.070''**







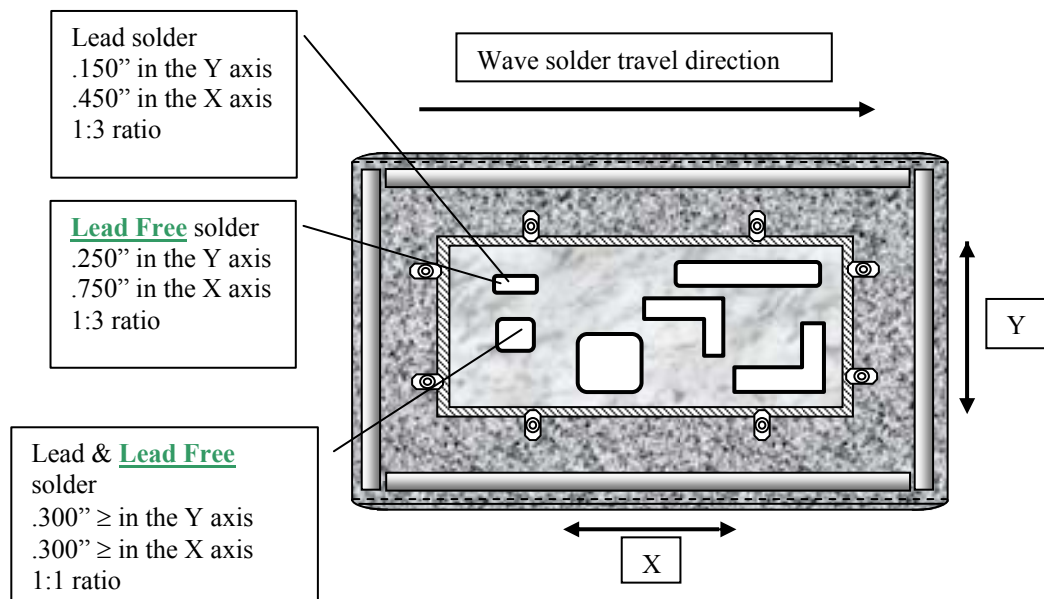
Max. vertical travel = (bottom side component height + .020 air gap + .050 pallet floor) = **.320"**



Solder openings of .150" (lead solder) and .250" (**lead free** solder) 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  $\geq .300"$  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.





## CONCLUSION

Wave solder pallets are a proven solution for 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!**

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[www.AGICorp.com](http://www.AGICorp.com) - [info@AGICorp.com](mailto:info@AGICorp.com)

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