New Approaches
to
Emerging SMT Printing Challenges

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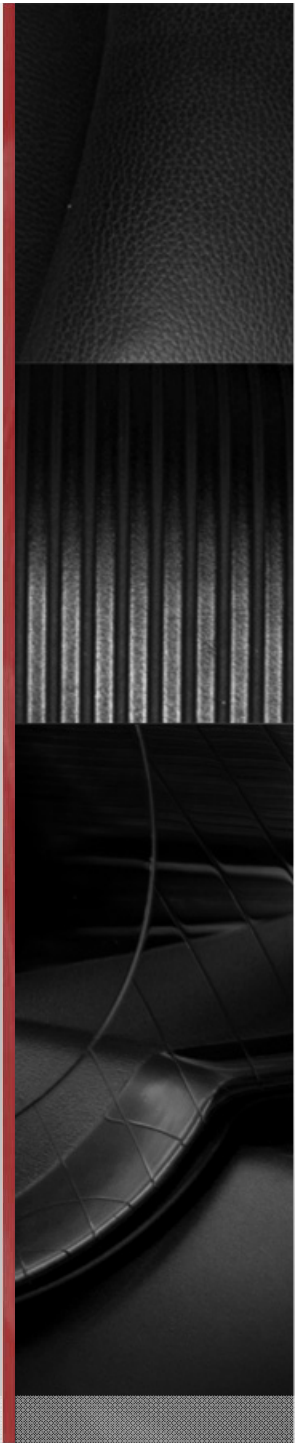
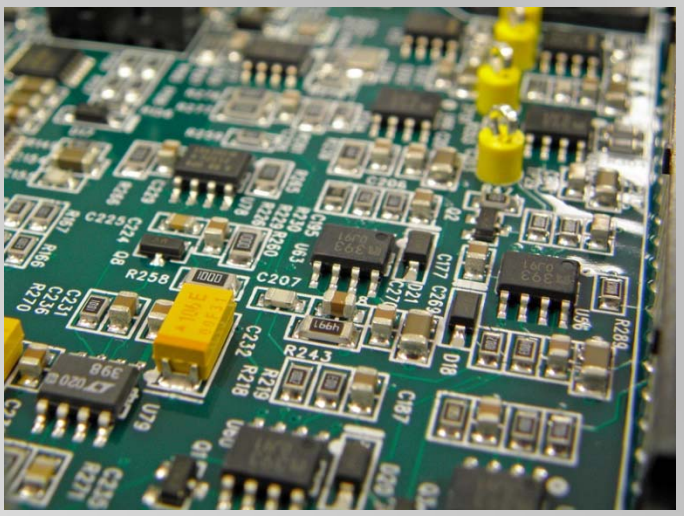


What are the Challenges?

- Need for higher throughput
- Need for higher wet print accuracy
- Larger PCBs/panelized PCBs (warpage, handling, work area)
- Shrinking PCB topographies
- Fine features and fine pitch
- Broadband printing



How are Printer Makers Responding?

- Increasing printer accuracy;
- Increasing printer throughput capability;
- Improving overall printing process efficiency;
- Increasing PCB handling size;
- Advancing existing features;
- Developing new ones.

Higher Accuracy – How?

- Defined as ‘wet print accuracy’ – the only kind that really counts;
- Software improvements and enhancements can bolster accuracy;
- Tighter tolerances in printer machining, manufacture; remember, when it comes to variations in tolerances, ‘add them together’ for cumulative total accuracy (or inaccuracy);
- Reduction in vibration through reductions in unnecessary motion of moving parts (gantries, etc.)
- Less overall motion also means less wear, longer life operating within specs.

Speed – or Throughput?

- Throughput is what matters, and is a function of TOTAL CYCLE TIME
- Speed doesn't matter because print speed/squeegee speed is controlled by the paste, the size of the board being printed, aperture size, etc.
- There is one optimum 'print speed' for every specific application
- Total cycle time is the SUM of all cycle times related to a single PCB, for example,
  - Squeegee speed
  - Board indexing, clamping, etc.
  - Vision alignment
  - Stencil wipe cycle, etc. – Add 'em UP!

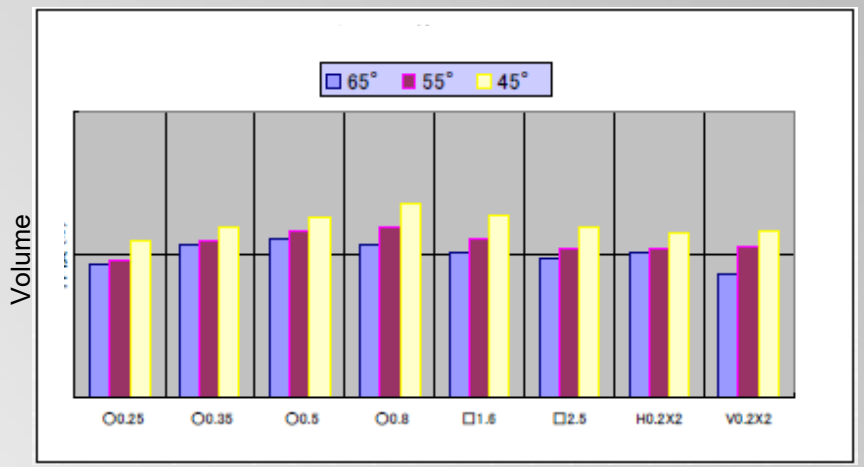
Enhancing Speed – or Throughput *per* PCB

- Reduce unnecessary motion of cameras, gantries, parking…motion takes time!
- Make cycles more efficient and shorter in duration, e.g., solvent-based stencil wiping in fewer strokes;
- With a more optimized print process, frequency of stencil wipes can be lessened, boosting ‘overall’ throughput; one wipe in 10 prints is better than one wipe every 3 prints;

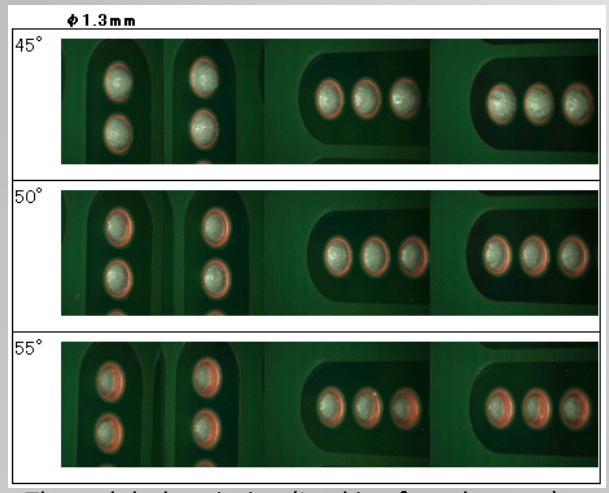
Add Enhanced Features for a Better Process

- Enhanced features support higher throughput with fewer defects;
- 3S (Single Swing Squeegee) Head, with
- **Servo-driven Squeegee Attack Angle**
  - 45 – 65 degrees / 1 degree increments
  - Angle can be programmed to dynamically adjust for different events after dispense, wipe or pause in process.
  - Since paste is always on the same side of the blade, the effect of solder paste sticking to the blades is reduced:
    - ✓ Minimizes print variation between F-R and R-F strokes.
    - ✓ Eliminates dry paste from accumulating on the top of the blade

Better Print Quality *via* Angle Adjustment

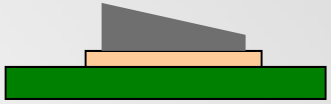


Aperture shape and size



Through hole printing (Looking from bottom)

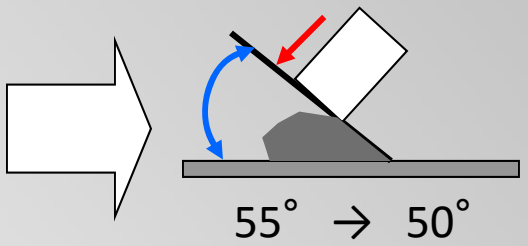
Printing Issue

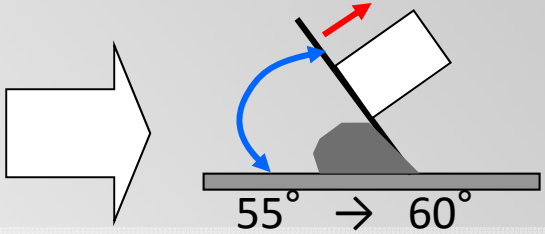


Less paste transferred on first print after wipe

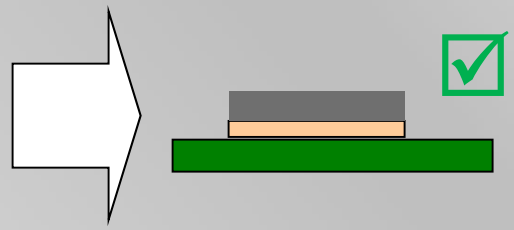
Bridging occurs due to drop in Paste viscosity

Countermeasure: Adjust the angle of attack





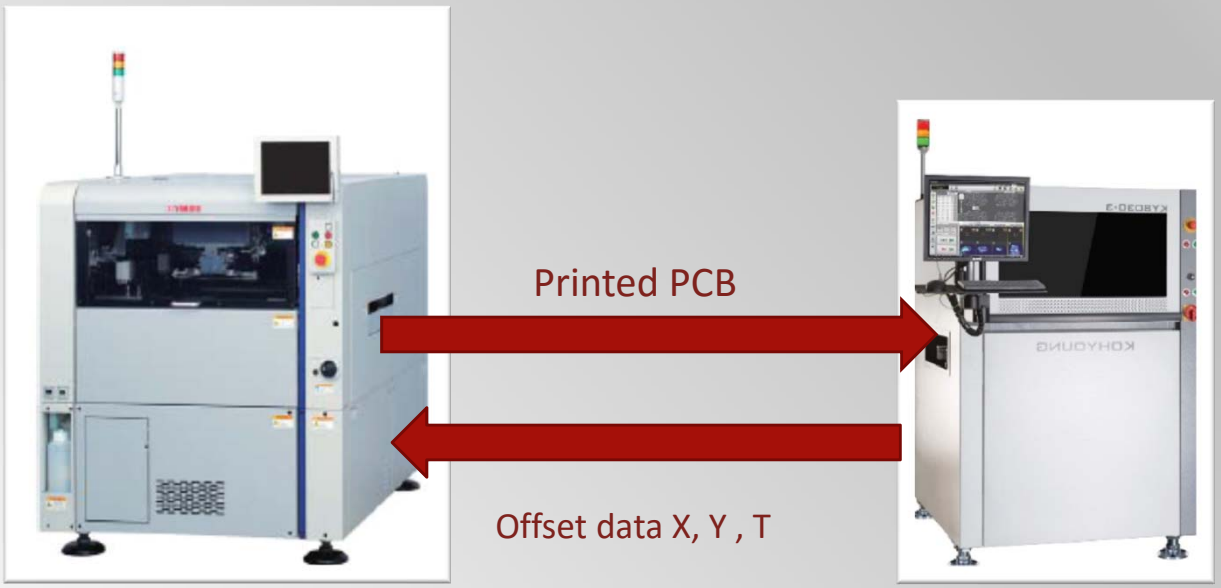
Increase in angle improves hole fill



Decrease in angle reduces pressure

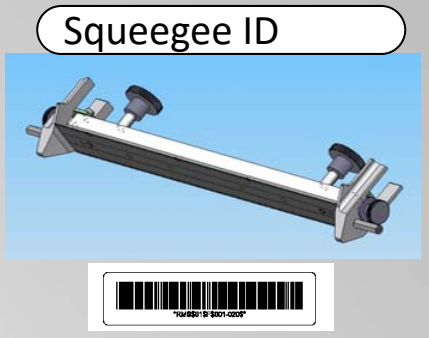
Closed – Loop SPI/Printer Communication

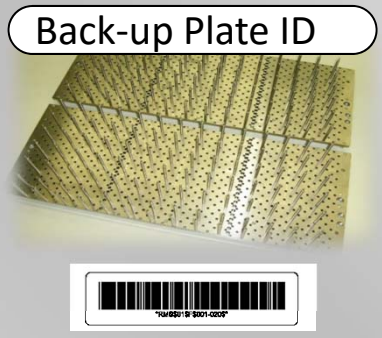
- Closed-loop communication between the printer and the downstream SPI
- Allows controlled feedback of the offset data from the SPI to be applied to the printer
- Eliminates need to change offsets due to material changes



Traceability and Process Verification

- Comprehensive product traceability and process verification is key to maintaining product quality, consistency, and process control;
- A requirement of many hi-reliability end users including Automotive, Smart Device, Industrial, DoD, etc.



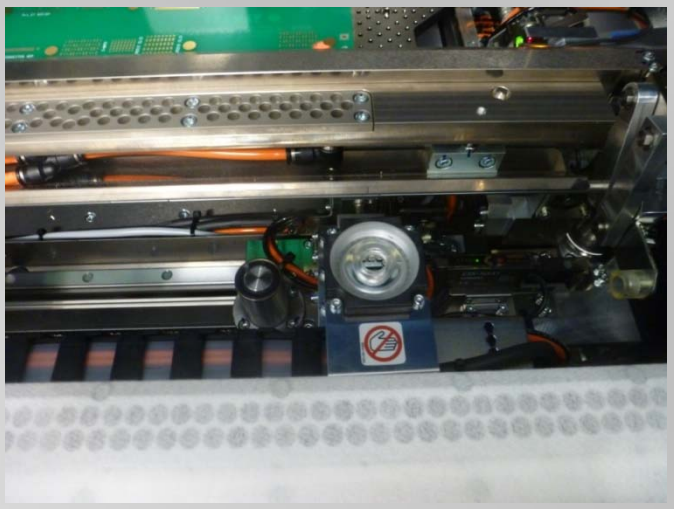


Stencil Cleaning

- The stencil cleaning/wiping system is the place to achieve the most dramatic reductions in cycle time;
- Coupled with an optimized process and lower wipe frequency, average throughput cycle times can be greatly accelerated.

Vision Alignment

- Easy teach routine
- Variable lighting to adapt to any application
- Independent Stencil and Board Camera
  - Camera does not travel between board and stencil…
  - …reducing the board to stencil distance;
  - *The shortened Z-axis movement improves accuracy and print definition!*



Conclusion

- When we speak of printer ‘Accuracy’, it is only ‘wet print accuracy’ (the net result) that really counts;
- Printer ‘Speed’ is irrelevant, since every application has an optimum print speed; what’s more important is ‘throughput’
- An overall ‘throughput speed’ of 12 seconds, for example, is the sum of all individual cycle times, i.e., board indexing, stencil wiping, vision alignment, vision inspection, etc.
- Innovations in printer features, systems, and operation can enhance throughput by lowering overall cycle time, and enhancing performance and wet print accuracy.