#### Nico Coenen

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#### **Biography:**

Nico is 43 years old with 15 years active in the electronics industry. Nico Joined Asymtek in '97 where he has been in many different positions, going from Area Manager to Global Account Manager. In these roles he has been heavily involved in the jetting technology. Four years ago He joined MYDATA a Swedish manufacturer of equipment for the SMT assembly process as Sales Director for their jet printer product

#### Title:

Jetting Solder Paste Opens Up New Possibilities in Your SMT Production

#### **Executive Summary**

Jetting of liquids is becoming the standard in our industry. MYDATA has developed a unique tool to jet solder paste. This non-contact method of applying solder paste has a large number of advantages compared to standard screen printing or dispensing. The challenges of today's production environment are not only the fact that components getting smaller but the biggest challenge is the combination of small and large components on the same board. Putting the right amount of solder paste for each component will be required to deliver the right quality. The jetting technology allows to build up the volume by single dots to achieve the right amount for each component. Special applications like pin in paste, applying paste in cavities and many more challenges of today's requirement can be easily accommodated with this technology. Practical production challenges will be covered and a suggested solution will be provided.

# Jetting solder paste opens up new possibilities in your SMT production

Chicago, August 22-23 Nico Coenen Global Sales Director Jet Printing





## Agenda :

- Differences between jetting & dispensing
- Jet Printing, how does it work
- Case study
- New Design opportunities
- Add on jetting
- Conclusion & Questions



## Dot formation when dispensing

 Pulling a needle out of a "pool" of fluid will form a column that will eventually break into two or more pieces.





## **Dot Formation**

Factors that affect dot volume:

- Needle dispense gap
- Needle size
- Dwell time
- Retract speed
- Material characteristics
- Surface tension



### Non-contact means Jetting



 The energy for breaking the fluid from the dispense tip comes from fluid momentum not from surface tension to the substrate



## What is solder jet printing?



- Depositing solder paste without stencils using inkjetting technology.
- Shooting droplets of solder paste whilst moving over the PCB
- Up to 1,800,000 dots/h



## Jet Printing solder paste





## The Three Fundamentals







Off-line station

Machine

Cassette



## The print head in details





Filter box



Cartridge



## It works ... Like a print head



- Fast changes of cartridges
- Cartridge has ID chip
- Selects machine settings
- Prevents human errors
- Enables a switch from leaded paste to leadfree or glue in seconds



## The print head

### MY500<sup>™</sup> JetPrinting Technology





## Cassette Calibration And Temperature Control



- Temperature regulation for viscosity control
  - Maintains local paste temperature at 30°C
- Cassette calibration for printing accuracy
  - Calibration station



## Software control

Setting up a new job in minutes

- Prepare new job off-line and send to machine
  - Import CAD or Gerber
  - Automated program generation
  - If required, take advantage of fine tuning capabilities
  - Generate program and send to the machine





### Software control

Optimizing solder joint quality is easy



- Each solder joint can be optimized for
  - Solder paste volume
  - Position
  - Height
  - Shape
  - Pad coverage



- Changes can be made on shapes, component or on individual pads
- Easy to use
  - "Drag and drop" functionality



## Jet Printing 3D deposits









### Jet Printing for higher quality

#### Don't spend time on rework

#### COMMON ISSUES WITH SCREEN PRINTING



SOLVED WITH JET PRINTING



### Optimise paste volume The key to good quality

#### "Each package/pad has its optimal volume requirement"

#### • Screen printer

- Depending on stencil thickness, the same package will get completely different volumes on different boards
- MY500 Jet Printer
  - Program solder paste volume / pad
  - Repeatable process

Paste volume for 0.4mm QFP when using 0.125 mm stencil

Paste volume for 0.4mm QFP when using 0.150 mm stencil Jet printed deposit for 0.4mm QFP

The volume is programmed individually and is repeatable



### **Case Study**

Benchmark test screen printer / Jet Printer at EMS

- 12 batches of 14 PCB's
- 50% with Jet Printing and 50% screen printing
- Stencil thickness : 4,8, 5 and 6 mill
- 3 different MPM screen printers used
- After paste deposition all deposits are tested through SPI
- In total > 100.000 paste deposits were tested on quality, volume, repeatability and XY accuracy



		JET		STENCIL			
BOARD #	SURFACE	PCB QUANTITY	SOLDER PASTE	PCB QUANTITY	SOLDER PASTE	STN. THICKNESS (µm)	PRINTER
1	Gold-nickel	6	Senju M705-LFAC19	7	Alpha OM-338-T	120	1
2	HASL	8	Senju 2062-AC19F13	7	Alpha OM-5100	150	2
3	HASL	3	Senju 2062-AC19F13	0	n/a	n/a	n/a
4	Gold-nickel	5	Senju M705-LFAC19	0	n/a	n/a	n/a
5	HASL	7	Senju 2062-AC19F13	7	Alpha OM-5100	150	2
6	HASL	7	Senju 2062-AC19F13	7	Alpha OM-5100	150	2
7	HASL	7	Senju M705-LFAC 19	7	Alpha OM-338-T	125	2
8	HASL	7	Senju 2062-AC19F13	7	Alpha OM-5100	150	1
9	HASL	7	Senju 2062-AC19F13	7	Alpha OM-5100	150	2
10	Gold-nickel	7	Senju 2062-AC19F13	7	Alpha OM-5100	150	1
11	HASL	7	Senju 2062-AC19F13	7	Alpha OM-5100	150	3
12	HASL	7	Senju 2062-AC19F13	7	Alpha OM-5100	125	2

Breakdown of boards produced during the study. (Note, where necessary, results from the study were weighted in order to compensate for different pcb quantities within certain batches.)



PRINTER

1 = MPM Accuflex

2 = MPM Ultraprint 1500

3 = MPM Ultraprint 2000

Benchmark test screen printer / Jet Printer at EMS



- Overall Quality is OK
- Where are the differences?



#### SOLDER PASTE VOLUME (nanoliter, nl)





Repeatability - reaching the same volume every time

#### Histogram of Volume [nl]



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Repeatability - reaching the same volume every time

#### Histogram of Volume [nl]



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Batch 8- Scatterplot of OffsetY [µm] vs OffsetX [µm]





### Conclusions

- No compromises with jet printing, every time the optimum volume per pad
- Jet printing is applying **less volume** in general
- The **repeatability** for the volume remains constant for jet printing and changes with screen printing upon choice of stencil
- The XY positioning is comparable but jet printing is much less sensitive from external parameters such as PCB quality, component quality, operator skills, ...



## New design opportunities

Prepare your business for anything





- Jet Printing as add-on technology
- Repair





### Jet Printing challenging components

Jet Printing POP (package-on-package)







### Jet Printing challenging components

#### Pin-in-paste



Build "piles" of solder paste



After reflow, bottom view



### Jet Printing challenging boards

Filling a via

Easy to edit paste deposits to fill via holes adjacent pads





## Jet Printing challenging boards

Handling multi-level boards

With jet printing, you can easily handle multi-level PCB's





### Jet Printing challenging boards

Board stretch / Board warpage

#### Board stretch and alignment

•Boards are aligned and any stretch is compensated for by using board fiducials

#### Board warpage

Laser height sensor maps board surface

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•Control software ensures the the print head travels with constant jet height over the board







## Mix small and large components



#### iPhone 3G board



- Mixing small and large components is the big challenge today
- Jet printing can accommodate this easily
- No compromising of solder joint quality.



 The picture shows 0201 components next to a D-PAK.

### Jet Printing no limitation on keep out distances

#### IPC 7525 stencil guidelines

As a general design guide K1 should be 0,9mm [35,4mil] for every 0,025mm[0,98mil] of step- down thickness.



Step in	mm	K1 is distance form the step edge to the nearest aperture in step -down area
0,010	[0,397mil]	0,36mm [14,1mil]
0,020	[0,787mil]	0,72mm [28,3mil]
0,025	[0,984mil]	0,90mm [35,4mil]
0,030	[1,181mil]	1,08mm [42,5mil]
0,050	[1,969mil]	1,80mm [70,9mil]
0,080	[3,14 mil]	2,88mm [113,4mil]
0,100	[3,937mil]	3,60mm [141,7mil]



## Add on Jetting

Adding solder paste for :

- RF shieldings
- Connectors
- Any other component that needs extra solder paste





## Add on Jetting

Adding solder paste :

• In cavities







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## Conclusions

- Jet printing gives you unlimmited design opportunities
- Jet printing can be used to replace a screen printer or as an add on tool
- It solves challenging applications
- It is gaining momentum in the industry



## **Questions?**

