

PART 1: FLUID DISPENSING FOR **BETTER PROCESS CONTROL**

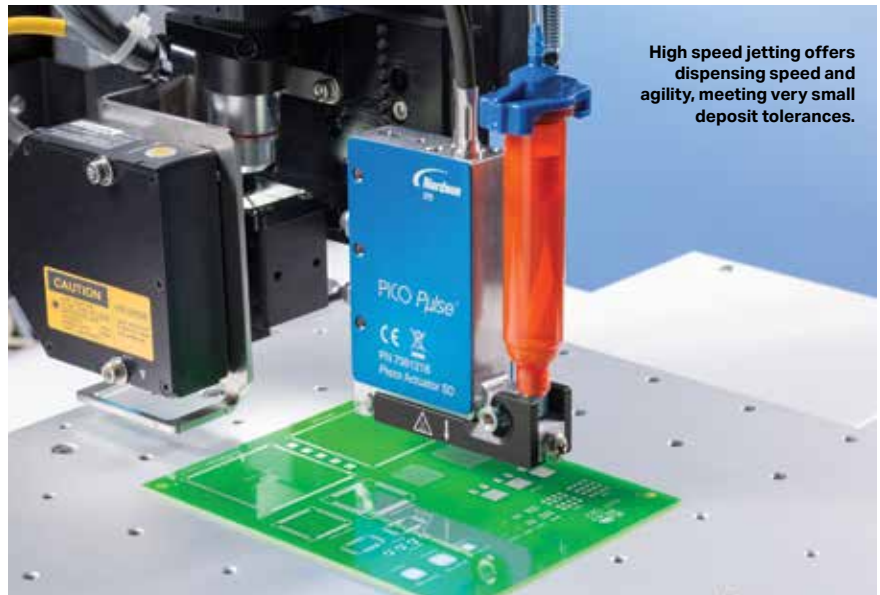
Manufacturers within the life sciences must meet stringent regulations for product manufacturing, making process control in assembly a vital issue.

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In medical device assembly, point-of-care diagnostics, near-patient testing products, and other life sciences applications, it's essential UV-cure adhesives, cyanoacrylates, silicones, and other fluids are accurately and consistently dispensed. To meet these objectives, many manufacturers have embraced automated and semi-automated fluid dispensing applications to improve process control.

Some life sciences manufacturers may have started out with manual squeeze bottles and medical syringe dispensing. Then, as production volumes increased, they needed to scale the sophistication of the fluid-dispensing processes, employing more controlled approaches with precision benchtop fluid dispensers, pneumatic valve systems, or in-line robotic dispensing systems for some or all fluid dispensing.

Part 1 offers a look at current technology in fluid dispensing and process control.



High speed jetting offers dispensing speed and agility, meeting very small deposit tolerances.

Next month, part 2 will look at the range of dispensing options – in-line automated robotic fluid dispensing, contact dispensing vs. non-contact jetting, vision-guided robotic dispensing, and benchtop fluid dispensing for medical device assembly.

Benefits of automated fluid dispensing

Regardless of the fluids being dispensed and the level of automation, the dispensing method must meet requirements for current and future throughput capacity and cost efficiency. Several factors support adopting a more efficient and controlled

dispensing method as a better processing solution for manufacturers of life sciences products:

1. Shot-to-shot repeatability, placement, deposit size, and accuracy are considerably improved as a more automated and controlled dispensing approach is employed.
2. Increased productivity comes with increased automation. For example, a worker who manually assembles 800 parts during an 8-hour shift can assemble 1,000 to 1,200 parts with the assistance of a pneumatic fluid dispenser.

3. Part quality improves when switching from manual squeeze bottle to air-powered dispensing, and further along to in-line automated dispensing. Operator-to-operator variance is significantly reduced and the ability to set time, pressure, and other dispensing parameters improves process control, ensuring the right amount of fluid is placed on each part.
4. Rework and reject rates lessen when upgrading to automated fluid dispensing solutions, improving the yield of manufacturing lines.
5. The assembly fluid used decreases significantly when using a more controlled dispensing method. Switching from manual to pneumatic dispensing can cut the amount of fluid used up to 70%.

Life sciences manufacturers can greatly benefit by looking at production requirements and embracing a more controlled, automated fluid dispensing capability. It's critical to consider the five points above, as they represent the actual cost-to-benefit factors influencing fluid dispensing processes.

Accuracy, repeatability, process control

Shot-to-shot repeatability and accuracy are critical in fluid dispensing, with particular importance in manufacturing life sciences products and devices.

Accuracy and repeatability – Depositing the right amount of fluid has a compounding consequence of keeping downstream production moving. If too much fluid is applied, it can take longer to cure, delaying production downstream. Conversely, if too little fluid is applied, the part won't properly bond, again interrupting downstream assembly or causing product failure. Precision dispensing systems apply shot-by-shot repeatable amounts of almost any manufacturing fluid, by using digital timers and precision air regulators to determine the amount of material applied.

The latest evolution of fluid dispensers can distribute nearly all assembly fluids – from thin solvents to thick silicones – with greater accuracy. They deliver exceptional throughput and process control, with consistent deposits from the beginning to the end of the fluid reservoir.

Integrity of dispensing components – The consistency and repeatability performance of precision dispensing systems goes beyond the actual dispensing equipment and is also dependent upon the quality and proper use of system components. These consumable plastic components – syringe barrels, adapter assemblies, pistons, caps, and dispense tips – are designed to meet the requirements of different types of fluids and applications, and to dispense the most precise fluid deposit possible.

To achieve the highest level of performance from these dispensing systems, several requirements need to be inherent in their manufacture and use:

1. Each consumable plastic component should be designed as part of a complete, integrated system to ensure the most accurate, repeatable fluid dispensing.
2. The dispensing components should always be used as single-use consumables, as residue from prior dispensing will degrade repeatability performance.
3. Components should be certified that no silicone mold-release agents

Barcode scanners allow the operator to change the parameters for a new application without touching process parameters on the touchscreen of this benchtop fluid dispenser.



are used in the precision molding process, or at any other time during the production of the dispensing components.

Process control – The ability to set time, pressure, and other dispensing parameters for an application improves process control and ensures the right amount of fluid is placed on each part. Fluid dispensing of dots, beads, and fills with benchtop dispensers can be achieved with dispensing equipment features such as a 1psi to 100psi air pressure regulator, timed-shots, vacuum control to keep thin fluids from dripping, digital time/pressure displays, and electric foot pedals.

Some of the latest fluid dispensers allow programmable sequencing to automatically adjust dispensing parameters, making them ideal for applications involving two-part epoxies and other fluids that thicken over time or get thinner as ambient temperatures rise.

Another feature supporting precision

robotic dispensing is automated optical inspection (AOI). When coupled with charged-coupled device (CCD) cameras and confocal lasers, vision-guided automation platforms provide optical assurance of fluid deposit volume and placement accuracy ensuring a conforming deposit. Using the robot's existing vision systems, the AOI software verifies fluid deposit widths and diameters. With the AOI confocal laser, the system measures the height of a fluid deposit in addition to the width and diameter, providing 3D deposit verification, determining if dispense requirements have been met. The confocal laser detects deposit height measurements regardless of the transparency of the fluid, which can sometimes distort quality data.

Most life sciences components have a unique barcode assigned to them as they move through the production/assembly process. Switching between stored dispensing programs using a barcode

scanner is new to fluid dispensing. The operator can change the parameters for a new application without touching process parameters on the touchscreen of this benchtop fluid dispenser. The dispenser settings automatically switch when the new program barcode is scanned.

Another unique feature is digital dispense logs, which automatically record data on dispense parameters – such as dispense time, pressure, vacuum, and date, day, and time of each dispense cycle. Downloadable manually through the dispenser's USB port, or remotely through an FTP site, the dispense log is beneficial to manufacturing processes requiring stringent, documented process control, especially in life sciences applications to meet FDA, EU Medical Device Regulation (EU MDR)), or other global medical device regulatory bodies' requirements. D&A



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