LVLP

Improving Medical Device Coating Processes with Low Volume Low Pressure (LVLP) Technology

Thank you for your interest in EFD's LVLP coating technology.

For a confidential discussion of how LVLP technology can help you improve your medical device coating process, we invite you to contact our experienced Fluid Application Specialists at 800-556-3484 or lifesciences@efd-inc.com

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Introduction

If you find it difficult to achieve consistent results in your medical device coating process, need to increase yields, or find ways to reduce your production costs, Low Volume Low Pressure (LVLP) spray technology may provide the solution you are looking for.

This paper addresses:

- Common coating-related production issues
- How LVLP coating technology works
- How LVLP technology can resolve many coating-related issues

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Coating-related Production Issues

Medical devices, or specific portions of them, are often coated with primers, lubricants, drugs or other fluids.

As devices become ever smaller and more complex, it becomes increasingly difficult for manufacturers to meet stringent tolerances and cosmetic requirements. And as drug coating technologies continue to advance and win regulatory approval, the need for accurate, reliable coating systems capable of consistently dispensing precise amounts of these materials is increasing.

Common coating methods include dipping, manual application with swabs or brushes, dripping with mechanical valves, or spraying with tools like airbrushes and standard spray valves. While these methods will produce acceptable results in some applications, many device manufacturers often encounter one or more of the following problems.

Poor Process Control

Proper coating placement, coverage, and thickness are critical. Manual tools and spray systems that allow only coarse adjustment may not provide the controlled, consistent coverage needed to achieve predictable process results and reliable device performance.

Slow Production Speeds

When prototypes or small production runs are made in a laboratory or R&D setting, extra time can be spent tweaking the coating equipment to produce acceptable results. This is not the case in high-volume production environments, where coating processes need to be fast, precise and consistent.

High Reject Rates

When a device will be used in a surgical procedure or inserted into a human body, there is no room for error. Uncoated or partially coated areas, uneven coating thickness, or unwanted application onto nearby components can all result in costly rejects, lower yields and reduced profitability.

Waste

Besides increasing production costs, overapplication of coating materials can compromise device performance and appearance, and increase reject rates. For fluids classified as hazardous materials, excessive waste also means extra cleanup and disposal expense.

Downtime/Maintenance

To prevent contamination, brushes and wiper pads must be replaced frequently. Standard coating systems may be difficult to set up, not precise enough for the application, or use seals and O-rings that can wear out and leak. Clogging is a frequent problem with many spray systems. All of these issues result in time-consuming, non-value-added activity.

Safety

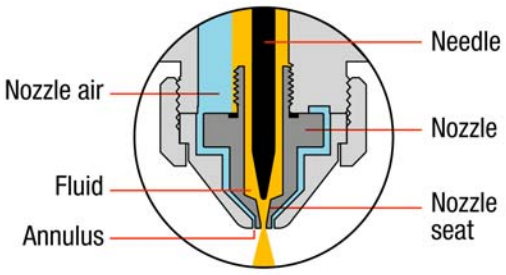
Manual coating processes typically involve open containers that release fumes or are easily overturned. Mechanical coating systems or standard spray systems may release an excessive amount of vapor, or deposit material on workstations and floors.

How LVLP Technology Works

LVLP coating systems consist of a precision spray valve, a microprocessor-based valve controller and a fluid reservoir. They operate on compressed air or compressed nitrogen, and electricity. The spray cycle can be initiated by either a 5-24VDC signal or mechanical contact switch.

The spray valve is an air-actuated needle type valve with two air inputs – one to actuate the valve, and one to control fluid distribution. The Low Volume Low Pressure design uses a low fluid flow rate so that only very low air pressure is required to apply the fluid as a soft spray. This approach provides high transfer efficiency without overspray or mist. A variety of spray patterns can be produced by changing the nozzle and air cap.

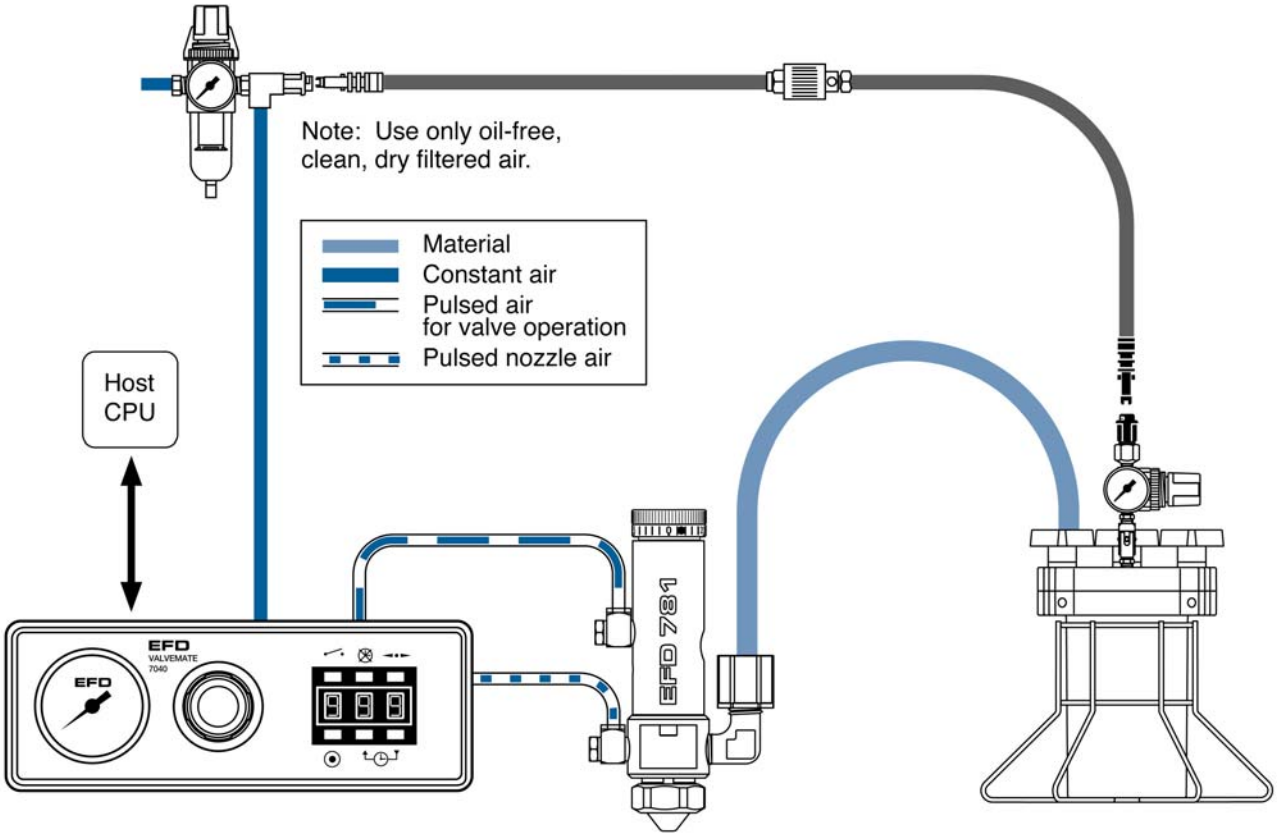
During system operation, actuating air from the valve controller acts on a piston that retracts the needle from the nozzle seat, allowing fluid to flow from the nozzle.



At the same time, low pressure nozzle air (also from the controller, and typically in the 1-3 psi range) is turned on and flows from an annulus around the nozzle. This creates a pressure drop around the nozzle, causing the fluid to break into fine droplets. The valve controller makes it simple to adjust nozzle air pressure for different coating materials and viscosities.

When the actuating air is shut off, the needle moves into the nozzle seat and shuts off the flow of fluid. Nozzle air continues for a split second to provide a clean cutoff and ensure clog-free operation.

The amount of material applied to the substrate is controlled by a combination of valve open time, fluid pressure, and needle stroke. The figure below shows a typical LVLP coating system setup.

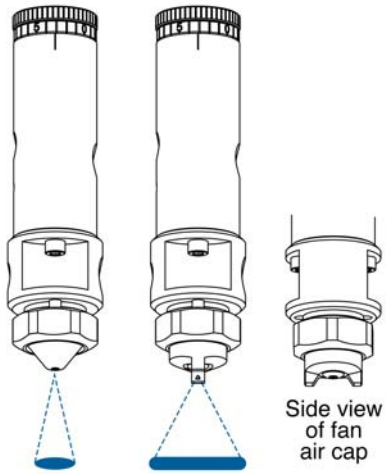


Typical LVLP Coating System Setup

How LVLP Technology Can Resolve Coating-related Issues

Greater Process Control

Precise control of nozzle pressure, calibrated stroke control, and high transfer efficiency combine to produce an even, consistent coating and predictable process results. Precision spray nozzles are available in several sizes and configurations to assure that coatings are applied in the correct location. For timed applications, spray time can be adjusted in increments as small as 0.001 seconds. All parameters can be recorded, so that results can be duplicated each time a particular device is produced.



Different nozzles and air caps produce different spray patterns.

Faster Production Speeds

LVLP coating systems can be cycled up to 400 times a minute.

Fewer Rejects

Consistent coating placement and thickness means fewer rejects

Less Waste

High transfer efficiency assures that coating is applied only where it is needed, without waste or overspray.

Less Downtime and Maintenance

LVLP systems are simple to set up and install, and feature a wear-resistant, low-maintenance design. The microprocessor-based controller simplifies setup and allows adjustments to be made quickly and easily at the coating station, without stopping the production line. A post-spray nozzle air delay removes any residual coating and keeps the nozzle from clogging.

Safer Work Environment

Whether fed from a tank or a syringe, LVLP coating equipment provides a sealed system that eliminates operator contact with the fluid and minimizes mist and vapors. Precise application also keeps material off workstation surfaces and floors, further reducing the risk of operator injuries.

Conclusion

LVLP technology offers medical device manufacturers an accurate, cost-effective coating method that will increase yields, reduce production costs, and improve process control.

Simple to install and operate, LVLP coating systems can be used to improve a wide variety of semiautomated and fully automated coating processes, with the flexibility to handle many different coatings and viscosities.

For more information on LVLP technology, or to discuss your specific coating application in strict confidence, please contact EFD's Fluid Application Specialists at 800-556-3484 or info@efd-inc.com.

