Reducing the expense and potential pitfalls of servicing diaphragm dispensing valves—a new paradigm

New Disposable Materials Path technology will reduce risk of damage, decrease maintenance costs and enable more widespread use of diaphragm valves for materials like two-part epoxies

The exponential increase in the availability and use of advanced two-part epoxy adhesives is providing valuable benefits in a growing number of manufacturing applications in industries including electronic assembly, automotive, medical device and many more. Often enabling significantly faster and surer bonding than conventional adhesives, two-part adhesives can, for example, create tight bonds between components with small surface areas, replace rivets or screws at lower weight and even greater strength, and deliver any number of substantial production throughput efficiencies. For many operations, the labor and materials savings have been significant, and will likely increase going forward.

However, the expanding use of two-part adhesives has also exposed an unfortunate gap in the existing product lines offered by manufacturers of automated dispensing valves, and this deficiency has until now unfortunately excluded many manufacturers from fully benefitting from the advantages that these materials can provide. This article will discuss the current state of dispensing technologies vis-à-vis two-part epoxy adhesives, and introduce a new diaphragm valve technology—Disposable Material Materials Path technology—that will, at last, enable nearly any manufacturer to take full advantage of the potential benefits of two-part adhesives, as well as gain even greater benefits from materials such as cyanoacrylates and UV curable resins.

Fast curing adhesives—a double edged sword

One of the most desirable properties of two-part adhesives is their rapid bonding speed and, indeed, many of these products advertise a "working life" of only a few minutes. But what this also means in real world practice is that if production lines are unexpectedly stopped, even briefly, for any of a multitude of common reasons—from a need to clear a product collision to a technician taking a break—the immobile mixed epoxies can cure very quickly in the dispensing valve. This can destroy an expensive valve, or at least lead to the need for a several hundred dollar repair, not to mention the cost of the line down time needed to remove, clean or replace the valve. Down time can easily extend to up to 30-60 minutes or more, and if sufficient replacement parts or stand-by repair resources are not immediately available, it can run into a loss of production of hours or days. Many operators justify shouldering the inventory carrying costs of several valves for this reason, and/or maintain the expense of an in-house or nearby repair infrastructure.

It should also be noted that while most of these types of issues occur with two-part adhesives, there are also similar risks associated with cyanoacrylates and UV curable resins. While, theoretically, these materials are "always" protected from air, moisture and light by proper valve selection and proper workplace procedure, many operations find that, in the real world, a technician forgetting to put a cap on the valve after the shift can quickly lead to a valve full of hardened adhesive in need of costly repair or replacement.

The risk and ongoing expense of routine maintenance

Even under more routine circumstances, such as at the end of each regular shift, operators must take the fast-curing properties of their dispensed materials into account when developing standard maintenance procedures. For example, in many operations, immediately upon scheduled stoppage of the line between shifts, technicians must quickly perform a flush of every dispensing valve nozzle to remove residual adhesive and ensure that it does not have a chance to harden. Time can be of the essence and the procedure can be especially risky for production lines

that have numerous valves and/or use particularly fast-curing material, and sufficient manpower must be provided to ensure that the flushing of each valve can be completed within the brief window provided by the working life of the material. Getting to a valve a "little too late" is not an uncommon scenario, and is another avenue that can quickly create the need for a several hundred dollar repair or the loss of a valve entirely.

In addition to the risk, the costs relating to these currently commonplace maintenance procedures can likewise be significant. Sufficient solvent for several rounds of flushing per day must be purchased and inventoried. And, depending on the solvent used, proper disposal procedures must be followed, and related expenses accrued, with the threat of regulatory issues and fines always a possibility. Proper equipment—often a minimum of gloves and face masks—must be provided for each technician, and health and safety risks to personnel on the line and in adjacent areas—and associated liabilities—are always of concern. And, of course, there is the added expenses of technician training and labor, and the time it takes to conduct the flushing procedure itself, which eats into the productive manufacturing time of each shift.

The High Costs of Avoiding Automation

In addition to all this, there is a hidden cost attributed to this current state of the dispensing industry, and although not showing up on ledgers, it is nonetheless significant. Seeking to avoid the risk and expense of periodically losing valves to hardened material, thousands of manufacturers are actually continuing the use of manual dispensing processes long after the volume of their operation would otherwise dictate that they upgrade their operations to automated dispensing processes. That is, instead of high speed operations, many operations are utilizing rows of technicians dispensing adhesives using a syringe and a foot pedal, incurring potentially avoidable labor costs that can be considered significant even in lower labor cost areas. Further, not only is speed and productivity suffering by this

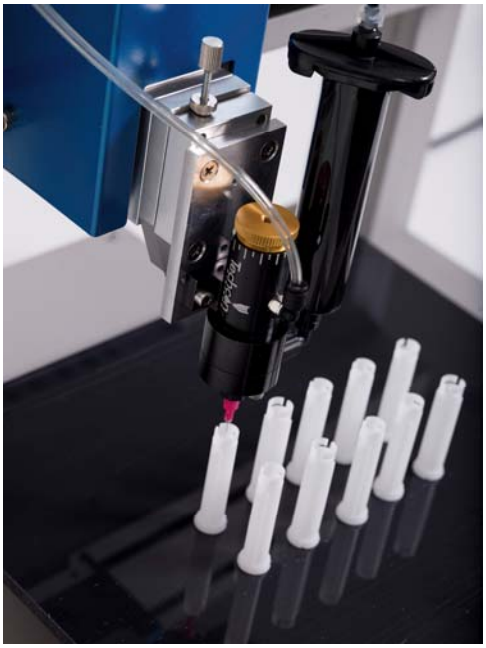
methodology, but so is quality and repeatability, with the ability to maintain consistent size and placement of material beads severely limited in a technician-dependent process.

Fortunately, these manufacturers operators will soon have little impediment to upgrading their dispensing operations to a fully automated solution. And, thousands more will be able to significantly reduce the risks and the ongoing maintenance costs of their current dispensing operations.

Introducing the first diaphragm valve with Disposable Material Path technology

At one time, operations dispensing high viscosity materials of about 30,000 to 1,300,000 centipoise utilizing rotary (auger) dispensing valves faced very similar problems to those outlined above, but, for most rotary valve users, this situation has long been a thing of the past.

The ultimate solution was a patented micro-valve technology developed by Techcon, an OK International company specializing in the manufacturer of precision liquid dispensing equipment. The company re-imagined the state-of-the-art in rotary dispensing valves, creating a highly effective valve with a low cost wetted path insert that was removable, disposable, and replaceable in a matter of seconds. Thousands of these valves have been proven in use, forever changing the economics of dispensing for many operations.



A significant investment in research and development has enabled Techcon to create a similar solution for operations using low to medium- viscosity materials of 1-50,000 centipoise that are dispensed using diaphragm valves. This new Disposable Material Path (DMP) diaphragm valve was released in July 2015. The new diaphragm valve has helped thousands of operations significantly reduce their dispensing costs, and helped thousands more step up to the benefits of automated dispensing of low viscosity two-part adhesives without fear of damage to costly equipment.

How it works—and how it saves

In operation, the new DMP diaphragm valve operates not dissimilarly from standard top-of-the-line diaphragm valves. Air pressure forced through the air inlet port drives a piston assembly back, opening the material path and allowing fluid to flow from the material inlet to the material outlet. Relieving the input air pressure allows the piston return spring to close the diaphragm, ensuring fast cut-off of fluid and the dispensing of an accurate, repeatable bead down to .002 ml in size, and an external stroke control adjuster makes it easy to fine-tune bead sizes with a high degree of precision.

However, in the design of the materials path, similarities between the new valve and standard diaphragm valves quickly end. The wetted parts of the DMP valve are designed to be self-contained, easily removable and disposable. Manufactured from black high density polyethylene, these highly durable inserts provide long life cycle, are compatible with a wide range of chemicals, and cost just a few dollars each. They can be quickly accessed without removing the valve from the line, simply by removing two Allen screws from the valve housing. The estimated time to remove the old insert, replace it with a new one and be ready to re-start the line is about 30-45 seconds.

Users can analyze their labor and maintenance costs and decide on an optimal cleaning schedule, choosing to continue to flush the valves each time, do so periodically or not at all, instead simply replacing the inserts quickly and inexpensively at the rate they prefer, and thereby saving significantly on the purchase of solvent and associated labor, equipment and disposal costs. Even more valuable to most will be the fact that the new technology brings the risk of expensive damage to the valve due to hardening material down to zero. With DMP technology, the worst case scenario becomes the need to take 45 seconds to replace a very inexpensive part, as opposed to shutting down for hours to repair or replace a costly valve, as had been the case previously.

Can you benefit?

Unfortunately, this new paradigm in diaphragm valve technology is not for every user. While the DPM diaphragm valve is compatible with most commonly dispensed materials, users of particularly abrasive or caustic materials incompatible with polyethylene will need to continue to make do with conventional valves featuring metal or other appropriate wetted path. Techcon offers potential users a complementary service for testing the compatibility of their dispensed material with the new valve. For those who can benefit use it, the savings in materials and labor, and the potential boost in productivity can be significant.

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