

Closed system technology drives the trend toward safer, more cost-efficient chemical dispensing

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In dozens of industries and in millions of applications around the world, dangerous chemicals are transferred from their original shipping containers into smaller jugs or buckets or applied to other end-use processes. Historically, the predominant dispensing method in many of these applications has been through an open system where the liquid is poured out of the container. In many industries using high-purity chemicals, a popular dispensing method is a semi-closed system that pumps the liquid out of a drum or container. In these systems, a dip-tube draws chemicals from vertically-oriented containers using an attachable hand or electric pump. While a step in the right direction, the semi-closed dispensing system requires a dip-tube that needs to be removed and re-inserted each time a new drum is used, exposing the end user to drips, leaks and fumes during transfer. The primary drawback of all open and semi-closed systems is that they needlessly expose the user, equipment and the environment, to potentially hazardous chemicals and vapors.

INDUSTRY DRIVERS

OSHA, along with other health and safety organizations, is taking aggressive steps to minimize the risk of personnel and the environment being exposed to chemicals. These increased environmental and safety concerns are driving the trend toward disposable systems that require chemicals be transported from container to point-of-use in a closed manner. At the same time, chemical packagers and end-users are well-aware of the liabilities involved and are increasingly looking to incorporate closed systems into their chemical management solutions, both in hazardous and non-hazardous industries.

The semiconductor and life sciences industries were among the first to implement completely closed systems, not only to minimize the risk of workforce chemical exposure, but also to prevent contaminants from getting into their chemicals. With highly sensitive manufacturing processes, the presence of even the smallest amount of dirt or foreign material can prove extremely costly. A closed system allows them to control chemical purity from the point-of-origin to the point-of-use.

Another key driver is simply the high cost of open systems, including expenses related to clean up, wasted product, and accidents or injuries. For example, long-term exposure to some chemicals can cause workers to become sick, resulting in an increase in worker compensation claims. Additionally, companies might be able to reduce their insurance premiums if they can show their insurer that a closed system minimizes chemical exposure and improves overall plant safety.

For chemical and packaging industries that need to transfer, protect and use hazardous materials in their manufacturing processes, a closed system is the safest and presents the least risk of exposure. Moreover, in the case of a facility using high-purity chemicals in their processes, a closed system can help prevent particle contamination.

While the applications for closed systems vary widely from benign materials, to highly dangerous liquids, such as sulfuric acid, the overall objective is the same: to enclose the product and to protect it against oxygen and

particle contamination while protecting the environment and personnel who must handle the containers. This includes minimizing or completely eliminating the potential for chemical or vapor exposure at the point of connection, during dispensing and when the container is disconnected.

In many semi-closed, top-dispensing systems, the biggest source of chemical exposure is from the constant reuse of the “stinger” type dip-tube, which exposes the user to drips, leaks and fumes during transfer. The best way to minimize this exposure is to limit the need to remove the dip-tube from the drum. This is accomplished with containers that have an integrated dip-tube based dispensing system that includes a common bung closure, a disposable dip-tube and a reusable quick disconnect coupler. This ensures that both ends of the dispensing system are sealed from point-of-origin to point-of-use. To dispense the chemical, the user simply removes a shipping plug and then connects the coupler. The end user doesn’t have to worry about moving dip-tubes in and out of drums or opening the container in any significant way.

SAFETY REINFORCEMENT

Fully closed systems also have additional safety mechanisms, such as a ported vent system, which allows air into the system to speed chemical flow and safely manage venting without releasing vapors. The vapors can either be routed to atmosphere by using a check valve to prevent harmful vapors from contaminating the work environment while allowing make-up air in, or it can be connected to a pressure source to force liquid out of the container. It can even be connected to an inert blanket gas source (N₂, CO₂, etc.) to protect sensitive liquids from oxidation resulting from contact with air.

This type of integrated system eliminates the need to install, remove or clean a dip-tube, minimizing the potential for fluid or vapor contact while allowing fast container changeovers. Moreover, because the dip-tube can be disposed along with the drum after use, the chemical remains benign to the end-user. Where previously the cost

of such integrated closed systems could only be justified by large facilities, today’s newer technology also offers advantages for smaller end-user applications. These systems provide more user-friendly features for companies looking to better control costs while maintaining cleaner performance and greater worker safety.

These systems offer users a number of cost-saving advantages and are ideally suited to cost-sensitive, one-way container applications. For example, the dip-tube is designed for single use and can be incorporated into the cost of the drum without significantly adding to the unit cost, while the coupler can be reused thousands of times. In addition, post-use handling, clean-up and disposal of the drum is much more straightforward because the low-cost drum insert and closure are recyclable right along with the drum. For high-volume users, cost savings and return on investment are realized very quickly.

Any open system can be converted to a closed system using integrated dip-tube based technology, such as the DrumQuik[®] PRO or the DrumQuik PUR from CPC. It is ideal for high volume, single-use applications as well as for smaller end-user systems. The drum insert assembly is made from virgin natural polyethylene or HDPE material so it can be easily recycled with the drum. The coupler is available in superior polypropylene or PVDF to assure long-term chemical resistance with most general and high purity uses.

SAFETY MEETS EFFICIENCY

Core benefits of an integrated closed system include:

- Reduced liability risk and cost
- Improved worker safety due to minimized exposure
- Reduced environmental contamination
- Less product waste
- Easy setup and operation
- Support of cost sensitive one-way and single-trip packaging
- Elimination of return shipping costs

The first priority in considering your need for a closed system is always the safety of people. In other words, is anyone's health being affected by the chemicals you're using or their contact with them? If the answer is yes, then you should immediately begin implementing a plan to minimize this exposure.

A secondary consideration is the potential for incorrectly mixing incompatible chemicals, resulting in wasted product, or worse, the destruction of an entire facility. Depending on the application and the environment, the ability to prevent misconnections or accidental blending of incompatible chemicals is critical. If this is a potential concern, a closed system with integrated color and/or mechanical keying is an important option to consider.

Additional operational and safety benefits can be realized with innovative RFID technology, such as CPC's patented RFID-enabled IdentiQuik® technology, which can be incorporated into the dispensing system. With these systems, before the final connection of the body and insert is made, the IdentiQuik technology automatically exchanges product data to help prevent misconnections or to validate process steps. Manufacturers can use this feature to verify machine cycle counts, improve quality control and automatically calibrate dispensing equipment for the fluid being dispensed.

Evaluation of the entire closed system, not only the drum connection, is recommended. The connection at the process end of the line should also be taken into consideration. Typically this is a piece of equipment or some end-user process that also requires a safe, reliable connection. This is where non-spill quick disconnect couplings can play a key role by providing an easy-to-use connection. This is an important, but often overlooked part of a safe, reliable closed system design.

When considering an integrated closed system, compatibility is a critical component. Select a system that is compatible with many types of common drums and containers. Depending on your application requirements, it should also be capable of passing United Nations and U.S. Department of Transportation approval standards for the transport of HAZMAT grade chemicals

Until end users begin to re-think their chemical dispensing philosophy, or come under a clear mandate from regulatory authorities, open systems will continue to be employed. Still, with the ever-increasing desire to minimize chemical exposure, closed system delivery with an integrated dip-tube design offers efficiency and safety benefits that clearly establishes it as a best practices approach.

CLOSED SYSTEM CONSIDERATIONS

Why Use DrumQuik® PRO?

- *Safety:* Minimize spills, fumes and environmental impact
- *Performance:* High flow capacity
- *Easy:* Intuitive locking ring design for quick connection
- *Durability:* Built to withstand harsh operating conditions
- *FDA Materials:* Suitable for transfer of food products
- *Vapor Management:* Ported vent allows control of fumes, blanket gas connection or pressure dispensing
- *Economic:* Low cost for high volume, single-trip containers
- *Recyclable Materials:* Allow easy disposal with containers

About CPC

CPC is the leading provider of quick disconnect couplings, fittings and connectors for use with tubing in low-pressure fluid-handling applications. Employed in a broad range of applications, CPC's 10,000+ innovative standard products allow flexible tubing to be quickly and safely connected and disconnected. CPC also engineers custom solutions to improve the overall functionality and design of equipment and processes for life sciences, bioprocessing, specialty industrial and chemical-handling applications.



Smart fluid handling to take you forward, faster.