AODD Pumps Can Put The "Pop" In Soda Production

WILDEN® HYGIENIC™ SERIES (HS) AND FDA SERIES AODD PUMPS POSSESS A LONG LIST OF FEATURES AND BENEFITS THAT MAKE THEM IDEAL FOR THE MANY LIQUID-TRANSFER POINTS IN THE SOFT-DRINK PRODUCTION CHAIN



From the time raw materials - concentrates, corn syrup, flavorings, phosphoric acid, etc. - arrive at the soft-drink manufacturing and bottling plant to the point where finished products are put in bottles and cans, there are a large number of liquid-transfer operations that must be completed successfully. Manufacturers of carbonated soft drinks, fruit juices, teas and energy drinks are discovering that the most reliable, safe and energy-efficient technology for these operations are air-operated double-diaphragm (AODD) pumps, in many cases Hygienic™ Series (HS) and FDA Series from Wilden®.

Though per-capita consumption of carbonated soft drinks, aka "soda pop," in the United States has been on a steady decline since peaking in the 1990s, the average American still consumes more than 41 gallons of the fizzy drinks annually, which is the equivalent of 437 12-ounce servings, or 1.2 cans a day. To address this decline, though, the major soft-drink conglomerates (Coca-Cola Co., PepsiCo, etc.) have begun expanding their product portfolios to include items that fit the new soft-drink definition, beverages such as juice drinks and, more significantly, the energy drinks that have become extremely popular with Millennials.

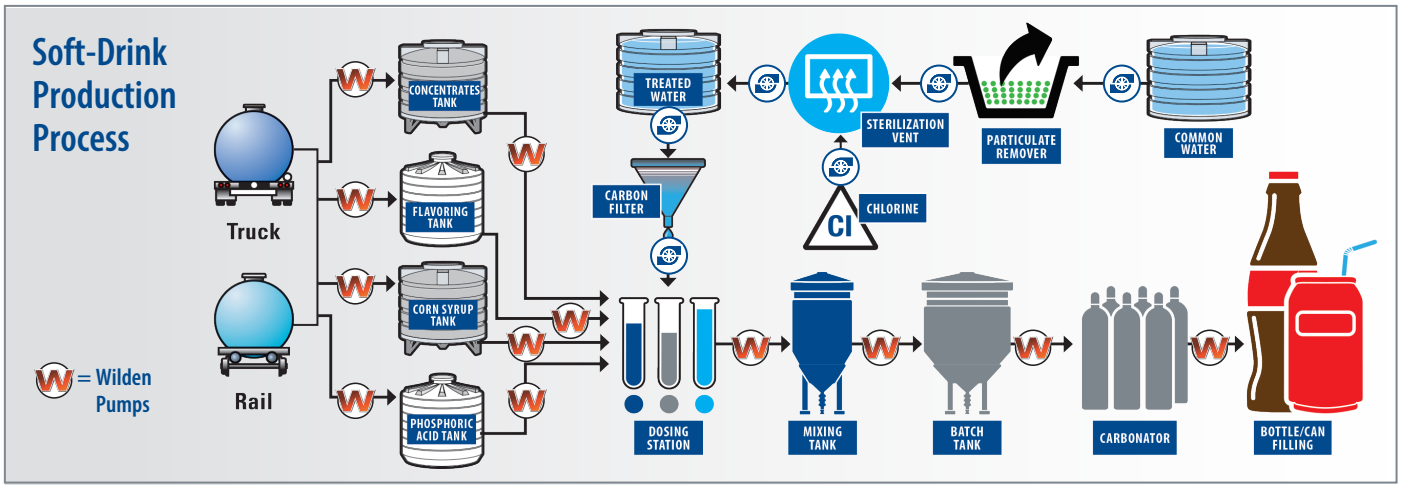
All of this means that billions and billions of gallons of soft drinks, both of the traditional variety and the newer formulations, are being produced and consumed annually. It also means that soft-drink producers must identify and employ the best systems and technology in order to meet production quotas that can be put under strain if the manufacturing process experiences any inefficiencies or breakdowns.

This white paper will illustrate how one type of pumping technology – air-operated double-diaphragm, or (AODD) – can help streamline the soft-drink manufacturing process by optimizing liquid-transfer operations at several critical points along the production and supply chain.

The Challenge

The U.S. landscape is dotted with soft-drink production facilities, more commonly known as canning and bottling plants, that take such regularly required ingredients as high-fructose corn syrup, various concentrates, different flavorings and phosphoric acid (which adds acidity to the final beverage) and converts them into finished products that are ready for consumption. In many instances, the large multi-national companies that dominate the global soft-drink market contract with bottling companies to produce their soft drinks in accordance to their highly guarded, tried-and-true formulas. There are also littler mom-and-pop operations that produce their, for example, small-batch root beers and ginger ales on a much smaller scale, but still require the assistance of the canning and bottling company.

What all of these soft-drink production operations have in common is that the manufacturing process must follow strict

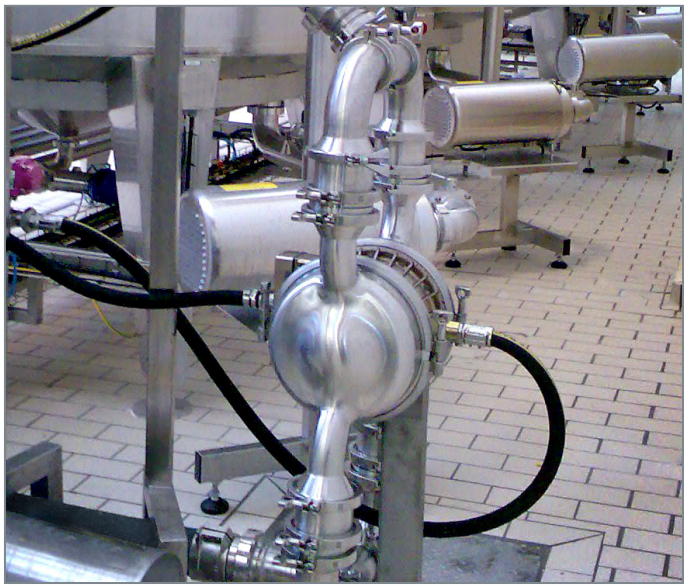


In order to ensure that soft drinks, juices, teas and energy drinks have the look, mouth feel and, most importantly, taste that consumers have grown to know and love, a series of critical manufacturing operations must be performed to exacting standards. Along the way, there are many important liquid-transfer points that require the use of the proper pumping technology.

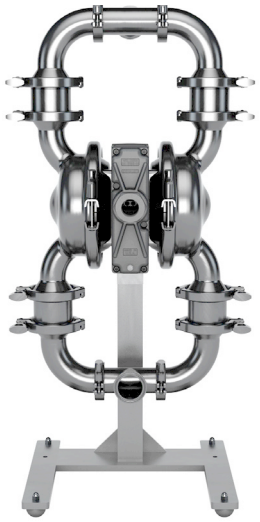
protocols that cannot be deviated from lest the finished product does not live up to the company's long-established standards for look, mouth feel and, most importantly, taste.

Achieving the desired end-product requires carbonated soft drinks to be manufactured according to a strict regimen:

- Common tap water is treated at the production facility so that any impurities that may affect the soft drink's taste or color are removed. The water's alkalinity level is also adjusted so that its meets a regulated pH level.
- The treated water is sterilized in order to destroy any bacteria or organic compounds it may still contain. A small amount of chlorine is used to complete the sterilization process.
- After the sterilized water "rests" in a storage tank for a few hours, it is run through an activated-carbon filter that dechlorinates it. From there, the completely sterilized water is transferred to a dosing station.
- The pre-mixed concentrate – which arrives at the facility in drums and totes – that gives the specific soft drink its color, flavor and sugar content is pumped into the dosing station, where it combines with the water. The amounts of concentrate used at this stage are usually determined by weight, not volume, so the batch tank is placed on a load cell or scale and when a pre-programmed weight – say, 500 pounds (227 kilograms) – is pumped into a tank before the pump turns off.
- This concentrate/water mixture is then moved to a batch tank where it is carefully blended to form the base of the soft drink and then flash pasteurized, which is a process that uses ultraviolet radiation to quickly heat and cool the mixture to ensure that any impurities are removed.
- At a precise temperature, the mixture is passed through a carbonator that adds carbonation to the product at pre-determined levels according to the recipe for the soft drink. Generally, juice drinks require far less carbonation than traditional soft drinks or carbonated energy drinks.
- The finished carbonated product is transferred to filling lines where it is injected into bottles and cans of varying volumes at high flow rates. When filled, the containers are sealed with pressure-resistant closures like aluminum caps or twist-off plastic tops.
- The filled cans and bottles (which must also be labeled first) are then packed into cartons or trays before being placed on larger pallets for shipment to distributors, who ensure they find their way to store shelves and into the hands of consumers.



Wilden® Hygienic™ Series (HS) and FDA Series AODD Pumps offer a number of operational benefits that make them better suited for soft-drink production than centrifugal pumps, including seal-less design, dry-run capability, shear-sensitivity and higher energy efficiency.



Wilden® Hygienic™ Series (HS) Pumps have been redesigned with a more efficient flow path that ensures desired flow rates are met while reducing the risk of product entrapment.

Transfer pumps are required at several junctures along this production and supply chain, and for many years, the pump technology of choice for bottlers and canners of soft drinks was the centrifugal-style pump. For many bottlers and canners, the lower purchase price of centrifugal pumps when compared to the cost of positive-displacement (PD) pump technologies is the key determinant in their selection.

However, while centrifugal pumps may have a lower up-front cost than PD pumps, they do feature some operational inefficiencies that usually lead to higher ancillary costs during the lifetime of the pump. Upon closer inspection, centrifugal pumps are not self-priming, which hampers their efficiency at startup. Also, they can encounter operating issues when pumping at higher flow rates, especially when handling higher-viscosity liquids like corn syrup, and they are unable to deadhead, which can lead to pump damage if a dry-run condition is encountered. Centrifugal pumps also have mechanical sealsl, which can lead to costly leaks, while their mechanical seals generally cost more to repair than some other pump technologies. Seal damage and breakage can be caused by the heat that is generated during dry-run operation. Double mechanical seals are also required for tacky or sticky concentrates, which creates additional costs, increased operational complexity and the need for a water flush for cleaning. Centrifugal pumps are also powered by electrical motors that must be kept dry during operation, which can be problematic when the product being pumped is a liquid.

The Solution

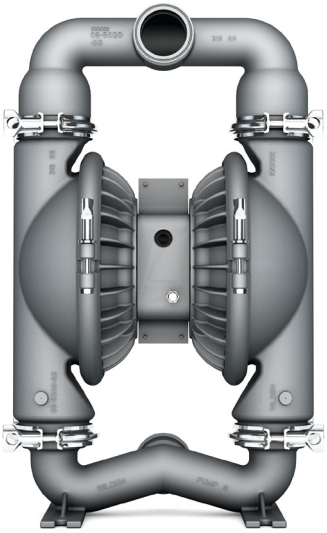
Taking all of the potential shortcomings in centrifugal pump operation into consideration, a much better choice for the numerous liquid-handling links in the carbonated soft-drink production chain is the AODD pump. Specifically, the Wilden® Hygienic™ Series (HS) and FDA Series AODD Pumps from Wilden® Pump and Engineering Company, located in Grand Terrace, CA, USA, have been engineered to meet the highest standards for operation in the manufacture of carbonated soft drinks. Wilden, a global leader in the design and supply of AODD pumps for use in hygienic applications, is a product brand of PSG®, a Dover company, Oakbrook Terrace, IL, USA.

Wilden's Hygienic Series and FDA Series AODD pumps possess the versatility to safely and efficiently pump a wide range of viscosities and shear-sensitive products, and are perfect for the corn syrups, phosphoric acids, concentrates and flavorings that play such a major role in the production of soft drinks. The Hygienic Series model employs a straight-through flow design and both have Tri-clamp®-style fittings that ensure that desired flow rates are achieved. The wetted-path material is 316L stainless steel with interior-polish levels that range from 0.8 to 1.3 µm (31.5 to 51.2 µin) for ease of cleaning.

Wilden Hygienic Series pumps are some of the only pumps in the industry to have earned 3A certification for both clean-in-place (CIP) and clean-out-of-place (COP). The free-draining flow path, wash-friendly clamp bands and CIP capability simplify cleaning, and have enabled Wilden's Hygienic Series and FDA Series AODD pumps to earn certifications from a number of regulatory agencies in the hygienic industry, including 3A, FDA CFR 21.177, USP Class VI and EC 1935/2004. FDA Series models are also available in various materials of construction to meet FDA compliance in diverse applications.

Other features and benefits of Hygienic Series and FDA Series AODD pumps, which are available in sizes from 1/2" to 3" (13 mm to 76 mm), include:

- Availability of multiple sanitary elastomers
- Seal-less design for superior product containment
- Delicate, shear-sensitive operation
- Ability for self-priming or dry-priming operation
- Damage-free dry-run capability
- Flow rates from 15 to 245 gpm (57 to 927 L/min)
- Solids Passage up to 3" (76 mm)
- Highest energy efficiency on the market

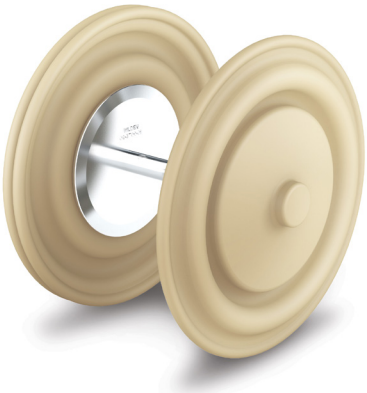


Among the many operational benefits that Wilden® FDA Series AODD Pumps provide to soft-drink manufacturers are their availability in many materials of construction that meet U.S. Food & Drug Administration regulations for hygienic manufacturing.

Additionally, Wilden has also designed and developed next-generation diaphragm and air distribution system (ADS) technology that can be used to further optimize the operation and reliability of its Hygienic Series and FDA Series pump models:

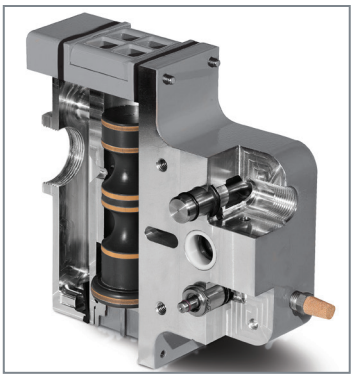
- **Pure-Fuse Diaphragms** — This innovative design

combines food-grade plastics and elastomers with a stainless-steel core in a patented configuration that uses no adhesives or nylon fabric that can contaminate process fluids in the event of a breech. The diaphragm features an unbroken fluid-contact surface with no product-trap areas. As a result, Pure-Fuse has exceptional CIP capability and greatly reduces contamination risks. The elimination of the outer piston also reduces a common abrasion point, which results in longer diaphragm life. Finally, the Pure-Fuse's large internal piston and full-stroke shaft provide greater fluid-transfer displacement while simultaneously allowing the pump to achieve twice the dry vacuum when compared to short-stroke CIP-capable diaphragms.



The Pure-Fuse Diaphragm has been designed with an integrated stainless-steel core that uses no adhesives or nylon fabric, which eliminates product-entrapment areas and greatly reduces contamination risks.

- **Stainless-Steel Pro-Flo® SHIFT ADS** — The availability of the stainless-steel Pro-Flo SHIFT ADS allows the Hygienic Series and FDA Series pumps to be used in a wider range of hygienic or sanitary liquid-handling operation in food-and-beverage manufacture. The operation of the Pro-Flo SHIFT ADS also represents a major breakthrough in achieving energy-efficient operation for AODD Pumps. Thanks to its revolutionary design, the Pro-Flo SHIFT allows Wilden AODD pumps to achieve up to a 60% savings in air consumption over competitive AODD pump technologies, while providing higher flow rates per SCFM. The Pro-Flo SHIFT also costs 50% less to operate than electronically actuated ADS units, is submersible and features plug-and-play operation. It also has fewer operating parts, which equates to less downtime for repair or simple maintenance.



The innovative Pro-Flo® SHIFT Air Distribtion System (ADS) helps reduce AODD pump air consumption by up to 60% while providing higher flow rates per standard cubic foot per meter (SCFM) of air that is used.

Conclusion

Though carbonated soft-drink consumption in the U.S. has been inexorably declining, it still remains the most popular drink among the country's inhabitants. The category has also been buttressed with the new fruit-juice and energy-drink formulations that annually keeps it a multi-billion-dollar industry.

No matter the design or formulation of soft drinks, however, they will only resonate with the consuming public if they achieve long-held standards for appearance and taste. That puts tremendous pressure on soft-drink manufacturers to ensure that there is no deviation in the production process that may alter the formulas that are beloved by consumers. That's why AODD pump technology, specifically the Hygienic Series and FDA Series from Wilden, are a wise choice for the many liquid-transfer points in soft-drink production and packaging. AODD pumps can help guarantee that product quality is preserved, while also adding the benefit of lower operating and maintenance costs to the bottom line of the producer.

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