Dutch Beer Maker Cuts Operating Costs With A Multi-Hose Axial Flow Peristaltic Pump

Innovative pump design enhances a centuries-old brewing process.

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Over the course of its centuries-long history, a well-known international brewery based in the Netherlands has achieved quite a reputation for having mastered both the art and the science of beer making. In large part, this owes to the company's continual quest for enhancements to its manufacturing processes. It constantly seeks ways that can help decrease costs and improve efficiency, productivity and profitability, while not compromising the quality of its world-renowned product.

One particularly successful innovation the brewery is adding to its operations comes in the form of a new multi-hose axial flow peristaltic pump system, otherwise known as a MAP. The company first tested two of these systems back in 1998—one for metering diatomaceous earth (DE), a yeast filtering aid, into the product flow, and the second, for metering a pre-coating onto the filter itself. Brewery officials report that the combination hose-pump/progressive cavity (PC) pump is more consistent and accurate than other types of pumps the company has tried.

The Product, Process and Problem

In business for more than 300 years, the company now produces roughly 75 million barrels of beer annually. Its various brands are brewed in some 50 countries and sold in over 160. In the U.S. market—where currently 10 percent of the overall beer market is made up of imports—the company's products rank near the top in sales of imported brews.

At its Dutch operations, beer is made by adding water to malted barley and cereal grains. The resulting mashes are combined, and natural enzymes in the mixture convert starch to sugar. This mixture is then strained, or lautered, to remove solids, leaving the beer wort. Wort is pumped into brewing kettles where hops are added. Boiling extracts flavor and aroma constituents from the hops.

The heated blend of wort and hops is then pumped into a settling tank, where it is cooled to room temperature. A pure yeast culture is added to the wort as it is transferred to fermenting tanks. Fermentation takes up to two weeks. During this time, the yeast converts sugar in the brew into carbon dioxide and alcohol. The finished product is beer.

By the end of the fermentation period, yeast slurry has settled to the bottom of the tanks. Fermented beer is drawn off and aged in storage tanks for an additional 3 to 4 weeks before being packaged. To filter yeast and other particles out of the beer, the DE suspension is injected into the process flow of the unfiltered beer (Figure 1). Solid particles, in turn, adhere to the DE, which is retained in filter cloths.

Cold filtering beer with DE is an expensive, painstaking process, which this brewery considers imperative because it is integral to a good, fresh, pure beer. However, because the disposal of the DE was so costly, those in charge of these operations began looking for ways to cut the brewery's consumption of the filter media, while improving the efficiency of its pre-coating method. Pre-coating is the most important step

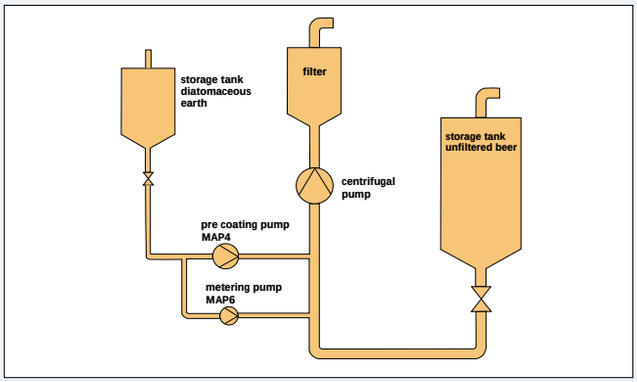


Figure 1. How DE suspension is injected into the process flow of the unfiltered beer.

during this production phase since both the quality and safety of the entire filtration process depend on the first coat.

The Solution

The solution to the problem lay in finding a pump that could:

- precisely meter the DE into the suction end of the centrifugal pump transferring the filter media and unfiltered beer to the filtration system; and
- transfer the pre-coat of 20% solids diatomaceous earth to the filter as quickly and smoothly as possible.

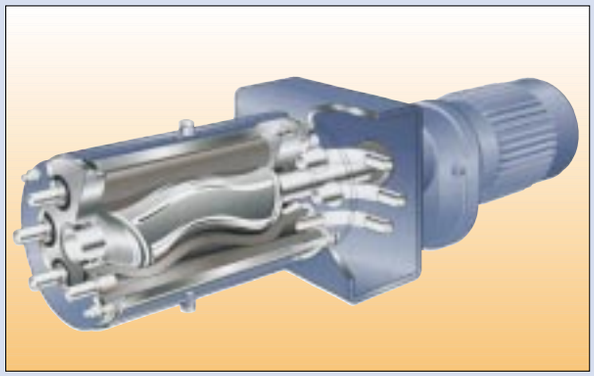
The brewery's officials first considered purchasing either a conventional peristaltic pump or an air-operated diaphragm pump. Both of these units were resistant to the abrasive nature of the DE, but proved unsatisfactory because of the pulsation that was created during the pumping process.

To reduce its production costs, the company knew that it had to establish and maintain a continuous feed of the DE to the beer flow—not an easy thing to do! After much research, it found what it needed in the recently introduced MAP-type multi-hose axial flow peristaltic pump, manufactured by Seeberger GmbH + Co. of Bottrop, Germany (the German headquarters of seepex, Inc.). Once it identified the solution, the company installed a MAP 06L (0.75-1.3 GPM cap.) for DE metering and a MAP 4L (13.2 GPM cap.) for pre-coating. Both units have an AISI 316 stainless steel housing and natural rubber hoses that meet U.S. Food and Drug Administration standards (FDA #177.2600).

A self-priming, combination hose/PC pump, the MAP is sealless, with a pumping area completely separated from the drive. Shaft sealing is unnecessary since the DE never comes into contact with the pump's shaft. Compared to conventional peristaltic pumps, the MAP uses six hoses instead of one, which evens out the pump's pulsing actions, making the unit almost pulsation-free (less than 2%).

With its two new MAP units, the Dutch brewery finally has been able to accurately and consistently meter the filter media into the beer flow, reducing consumption of DE by 10%, at the same time increasing flow rates of the pre-coat. The MAPs now permit metering accuracy to ± 1%, and are easily cleaned

The MAP...
A New Way to Meter & Mix



The Multi-Hose Axial Peristaltic Pump (MAP) is a different type of rotary positive-displacement pump. Its pumping action is based on the peristaltic principle—using the progressive contractions of a hose to convey the product. The MAP's pumping elements are designed in segments to form a reference cylindrical chamber. Each hose is inserted axially into the stator area. A revolving helical rotor then compresses the hoses into sections, forming progressive cavities, each of which is moved by the rotor from the suction side to the pressure side of the unit.

The MAP has no seals to maintain and its hoses can be easily changed by using a reversible motor starter. End users need only to take off the discharge flange adapter, turn on the pump and the hoses are "pumped" out of the assembly. By reversing the motor direction, the hoses can be "pumped" back in.

According to the manufacturer, MAPs offer several advantages, including:

- self-priming features—no prefilling of the suction pipe is required;
- reversibility—flow direction can be reversed simply by changing rotation;
- long life—the feed hose is the only wearing part;
- low-shear capabilities—sensitive products are handled gently;
- no dry running—no protection devices are needed.

MAPs are appropriate for metering, mixing and for the permanent transfer of a wide range of products. Applications include most industrial services, especially where solids, abrasives, adhesives, shear-sensitive, viscous and/or toxic materials are handled.

For more information about the products and applications referenced in this article, visit www.seepex.com

in place (CIP) with a 2% caustic soda solution. In fact these new pumps have proven to be so successful that the brewery now plans to install eight MAPs in the new plant, which will have six filtration systems. Two of the pumps will be used in pre-coating filters, with the other units being used in the metering of DE into the main product flow. **P&S**

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From a Historical Perspective

seepex/Seeberger GmbH + Co was founded in 1972 by Fritz Seeberger. He had brought the progressive cavity pump (PC) design to Germany in the early 1950s, when the PC concept was in its true infancy. Patented in 1936 by its French inventor, René Moineau, the PC was largely ignored until after World War II. At that time, the synthetic elastomers that had been developed during the war proved to be a boon to the acceptance of PC pumping.

Seeberger actually introduced the PC to Germany while working for a manufacturer of ceramics processing equipment. Although the original PC designs proved to be superior to other pump designs when handling clay slips, Seeberger saw some shortcomings and made improvements that have become accepted standards. He eliminated the hollow drive shafts that made the pumps shorter but tended to pack with heavy slurries; instituted sealed universal joints to increase service life without increasing the physical length of the pump; and developed stators molded to metal tubes to increase the pressure capability of the pump.

Seeberger GmbH + Co was the third pump manufacturing operation that Fritz Seeberger developed and managed. Starting in a small rented garage with just four direct employees, he continued to innovate and increase the utility of PC pumps by developing new long-pitch, long-lasting geometries, dry-run protection devices, molded-to-size stators, CIPable pumps, metering pumps and a complete series of open hopper pumps for viscous products. Today the company has more than 300 employees and produces more than 12,000 pumps per year.