Progressing cavity pumps for pumping chemically aggressive liquids during biodiesel production

Progressing cavity pumps reflect an established design with decades of usage in many industries and applications. Pumps of this type embody highly mature technical designs. For many years, improvements and innovations have been at the margins. Examples of design improvements include the 2/3-screw geometry, which is more economical than the 1/2-screw geometry that had been used exclusively for decades. Open joints and optimized rinsing connections are two additional advancements with proven value for applications with high hygienic requirements. These features make it possible to use progressing cavity pumps not only for traditional wastewater and sludge applications but also for food, pharmaceutical, and cosmetics applications.

New applications for biofuels

Production of biodiesel and biogas is a relatively new application where progressing cavity pumps are increasingly utilized. Processing organic waste is the first step in production of biogas and another area where progressing cavity pumps have proven their usefulness.

When processing organic waste, resistance to mechanical wear is usually the primary consideration. But producers of biodiesel place their highest priority on chemical resistance. Biodiesel and its precursors are chemically aggressive. As a result, it is critical to develop materials that enable economical use of the pumps. Stainless steel has been used in hygienic applications for years and remains a good choice for metallic components like the casing and joint. However, achieving a similar level of resistance in elastomer stators requires specialized know-how and expertise in using a wide selection of potential synthetic materials.

Pumps for biodiesel plants

In the past several years, Allweiler AG has supplied pumps for a large number of biodiesel plants. In addition to fulfilling the two requirements mentioned above, this manufacturer has another major advantage: it produces its stators in-house at its own plant. This allows them to select from up to 20 different materials as needed,

while also having the ability to produce stators in common dimensions and materials quickly and economically.

These capabilities have proven to be extremely valuable for serving the German-Austrian firm PPM GmbH. This company has been manufacturing turnkey biodiesel plants and installing them worldwide since 1998. Allweiler progressing cavity pumps are a major component of these plants. Wilfried Alexiewicz is the project director for plant installation at PPM: “We have collaborated with Allweiler to develop the materials that deliver optimized service lives for each plant and each product." This teamwork includes tests of the elastomer in the plant itself and at Allweiler’s factory. Analyses have shown that, depending on specific applications, special PTFE and Viton stators exhibit particularly long service lives. According to W. Alexiewicz: “We expect these pumps to work without disturbance or the need for maintenance for at least two years, even under difficult conditions." Very chemically aggressive intermediate products, such as recovered methanol with volatile esters, require PFTE stators in addition to special mechanical seals. Allweiler progressing cavity pumps with Viton mechanical seals are used in every step of the process. They pump soapy water, glycerin, methanol, and recovered methanol as well as the final product. The ability of Allweiler pumps to move liquids with high precision is extremely valuable for dosing additives. Pump capacities range from 7 m^3/h for unrefined biodiesel and 0.006 m^3/h for additives. Allweiler pump series AE1E and AE2E are frequency-regulated units with a maximum discharge pressure of 6 bar. Currently, the largest plant produces up to 150,000 metric tons of biodiesel per year and utilizes approximately 30 Allweiler progressing cavity pumps.

Besides service life, having an attractive price/performance ratio is another important factor for maintaining long-term customer relationships. According to Managing Director Hagen Münzberg: “The quality, technical advisory services, execution, and prices from Allweiler meet our expectations.”

Technical challenges

In biodiesel plants, pumps must sometimes suck from a vacuum and be able to handle high suction-side liquid temperatures, resulting in significant technical challenges. Rotors and stators must be specifically designed to handle the

temperatures range of 75 to 110 °C. Precise adaptation to heat conditions ensures that the pumps operate with optimized efficiency across their entire temperature range.

When using elastomer stators, this is achieved by carefully adapting the rotor. In Allweiler pumps this is done in 40-°C steps. When using solid-material stators made of PTFE, the stator is adapted instead of the rotor. In these cases, the temperature gradations are significantly smaller. This approach makes it possible to optimize performance within the required temperature range. But even at this temperature range, stators and rotors are standard items at Allweiler. This is good news for plant operators and designers because it reduces the need to keep replacement parts in stock. New parts can be delivered quickly and economically; Allweiler guarantees that replacement parts will be sent within 24 hours. In addition, parts can be exchanged between pumps and plants. This is important because PPM promises its customers close to 100% availability of their plants. As a result, it is critical that their vendors be reachable at any time and react at very short notice.

A proven concept

Since 1998, PPM has built, disassembled, transported, and then reconstructed at the customer's location 19 biodiesel plants. Their plants are characterized by being very compact. While other plants require multi-story towers, a PPM plant requires the surface area and height of only a small house. During on-site construction, the plants are measured precisely using GPS, so they are ready to begin production just a few weeks after starting construction at the customer’s site. "Our record is just five weeks,” according to H. Münzberg. This corporate group currently employs approximately 50 people who are involved with construction at their factory and at the final place of installation. Due to tax conditions in Germany, more and more plants are being delivered to other countries. PPM plants with Allweiler pumps have already been installed on the island of Mallorca, in Hungary, and Australia. Latin America appears to offer the greatest opportunities for growth. The Biofuels Conference awarded PPM the Biofuels Technology Award for 2008. The award was officially presented during the Biofuels 2008 3rd Annual Meeting in Berlin. The World Refining Association uses this yearly award to recognize companies that have successfully implemented innovative technologies and processes.

About the author

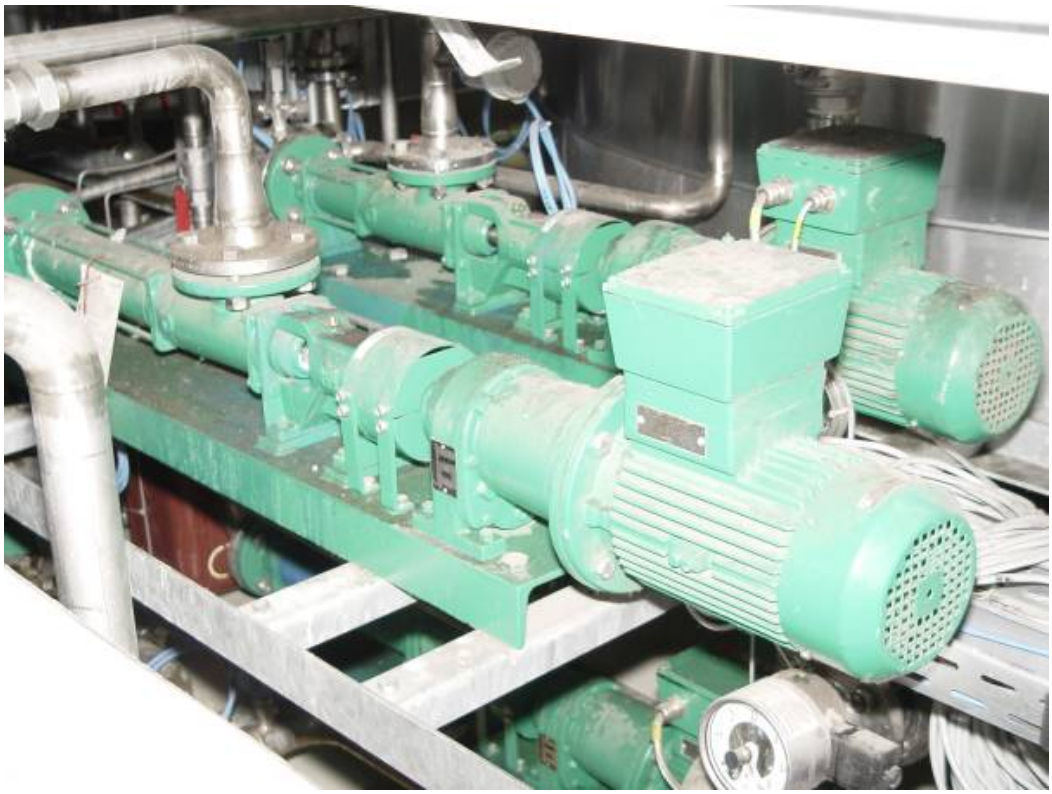
Jörg Gertz has been employed at ALLWEILER AG for eight years. For the past three years, he has been Director of Sales at Allweiler’s Bottrop location where he is in charge of "water/wastewater" and other segments.

ALLWEILER AG

Founded in 1860, ALLWEILER AG is the oldest German pump manufacturer and the European market and technology leader for centrifugal, propeller, screw, progressing-cavity, cogwheel, rotary lobe, macerators, and peristaltic pumps. ALLWEILER AG owns a foundry and produces its own stators. It manufactures ready-to-use fuel and lube-oil skids and rinsing-water facilities. ALLWEILER AG has its main German headquarters in Radolfzell on Lake Constance as well as a major production site in Bottrop-Kirchhellen, Germany. ALLWEILER AG has been part of Colfax Corporation since 1998.

Colfax Corporation

Colfax Corporation is a global leader in the development, design, production, sales, and maintenance of systems that pump and process liquids. In particular, its displacement and centrifugal pumps are used in a wide variety of industries and applications, including power generation, movement and processing of oil and gas, as well as ship-based and offshore applications. Colfax Corporation member companies include ALLWEILER®, Fairmount Automation, Houttuin™, Imo®, Lubrication Systems Company, Portland Valve, Tushaco®, Warren®, and Zenith®. With such an extensive range of products, Colfax has the ability to provide highly specialized solutions for pumping liquids under very difficult conditions. Colfax Corporation is headquartered in Richmond, Virginia.



ALLWEILER progressing cavity pump for moving glycerin phase, discharge pressure 1 bar, capacity 1.3 m^3/h.

ALLWEILER progressing cavity pump for moving glycerin phase, discharge pressure 2 bar, capacity 6 m^3/h.

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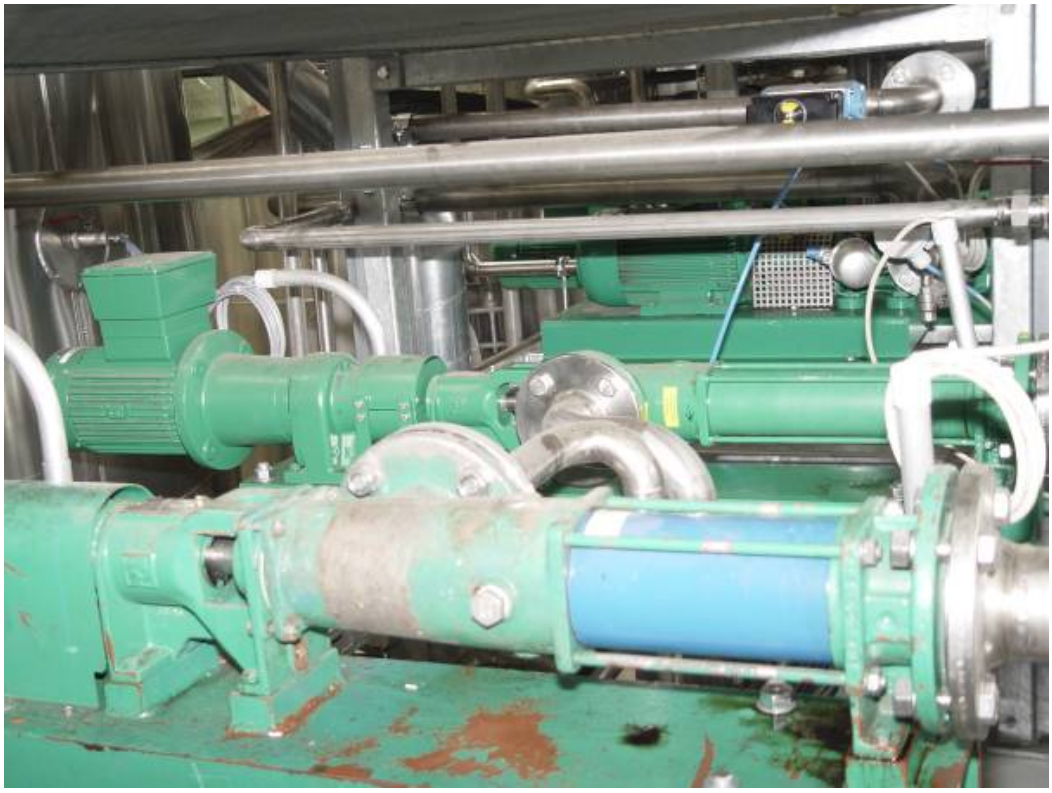

ALLWEILER progressing cavity pump for moving glycerin phase, discharge pressure 2 bar, capacity 6 m^3/h.