Clean-in-place technology for improved ROI

Everyone knows how difficult it is to disassemble a pump to clean it between processes. The eccentric disc pump design enables true clean-in-place technology – eliminating the work of taking a dirty pump apart and getting your process up and running quickly. Dave Bohne of Blackmer explains this 'eccentric' design.

Eccentric disc technology was invented in France and introduced to the market more than 100 years ago, but it has only been in recent years that the technology has actually reached the global stage. In 1998, U.S.-based Blackmer, a manufacturer of positive displacement sliding vane and centrifugal pumps and rotary vane and reciprocating compressors, acquired Mouvex, the French-based inventor and manufacturer of eccentric disc technology pumps. Formally known as the Blackmer Mouvex C-Series Eccentric Disc Technology (or by users simply as the 'C-Series'), these pumps are used in a wide variety of industrial and sanitary applications, including food processing, pharmaceuticals, chemicals, soaps, healthcare and cosmetics, agrochemicals, paper coatings, solvents, polymers and petrochemicals, to name a few (Figure 1).

Figure 1. A lucite/ clear C-Series pump.

The eccentric disc principle

Eccentric disc technology employs an oscillating eccentric disc to produce the pumping performance of a positive displacement pump, creating consistent flow, even when there are changes in pressure and viscosity. The oscillating motion of the pump disc on the cylinder causes very low internal velocity, resulting in a gentle, low-shear pumping action and reduced energy consumption.

Over the past decade, global competitive pressures and environmental protection regulations have forced companies to improve operating efficiencies, reduce product losses, and improve sanitary standards. Eccentric disc technology pumps are uniquely qualified to meet all of these demands, and, as a result, the global demand for these pumps has risen steadily. Eccentric disc pumps are sealless, which helps to eliminate high-value product losses. Perhaps one of the most beneficial reasons to use this technology, though, is its true clean-in-place (CIP) capability – a significant economic advantage over pumps that require time-consuming disassembly between batches in order to properly clean and sanitize them. The C-Series can be completely drained, flushed, and cleaned in place. No removal of piping, pump housing covers, or disassembly of any kind is required. And since the pump does not require disassembly, maintenance time and costs are reduced, and the process can be back on line quickly.

Sanitary and food applications

The stainless steel C-Series eccentric disc pump holds 3A Approval Certification and is EHEDG (European Hygienic Equipment Design Group) approved. The unit is designed specifically to be flushed and cleaned in place.

Other technologies (such as lobe pumps) can experience a 15-20% loss of volumetric efficiency when designed for CIP drain ability with vertical porting (Figure 2). The C-Series experiences no loss of performance due to porting and does not need to be by-passed to clean-in-place, provided that the pressure does not exceed 45 psi (30 psi for Micro C pumps).

In most cases, the CIP process begins with a water flush, concentrations of different cleaning solutions such as a mild caustic, and perhaps reheating of solutions that are circulated through the pump, piping, and valves. The process ends with a final rinse. In some cases steam is used in place of water or other cleaning solutions.

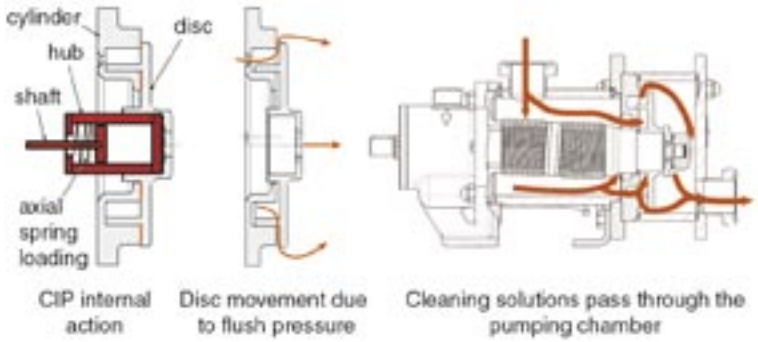

Figure 2. The flow of cleaning solution through the pump chamber.

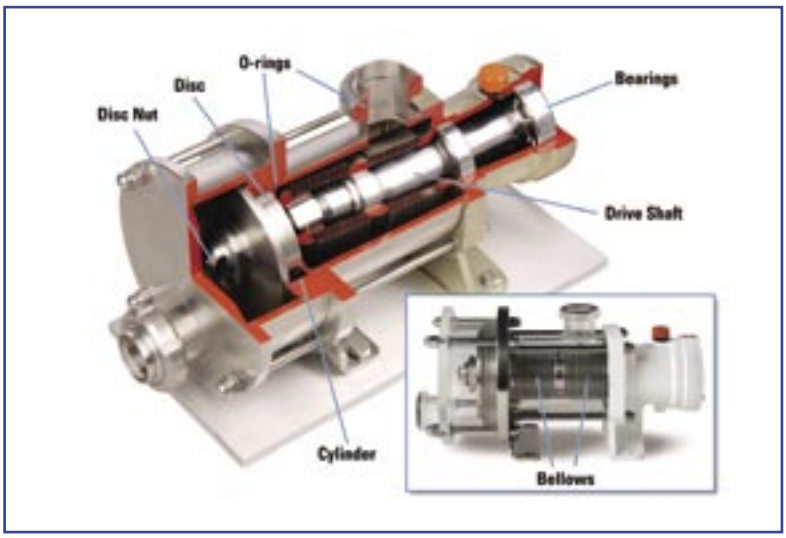

Figure 3. Pumps arranged in series, enabling them to be cleaned in place.

The amount of residual product must be minimized, especially if it is expensive or hazardous. It cannot remain in the pump and piping prior to starting the CIP cycle. The C-Series pumps, thanks to their suction lift and line stripping capabilities, enable reducing the quantities of residual products. This minimizes the loss of product, eases cleaning, and reduces cycle time. For optimum cleaning of sticky or viscous products, the flow through the pump is between 20-200 gpm, depending on pump model. The flow through is less for thinner, easier to handle products.

In CIP applications, the CIP and C-Series pumps are arranged in series to take advantage of the pumps' unique disc/cylinder design. Because the pressure at the pump inlet is higher than at the outlet, the disc lifts from the pump cylinder, permitting the water or cleaning solutions to flow through the pump and thoroughly cleanse the pump chambers. This unique feature eases the cleaning process and reduces cycle times so the pump can be back in operation quickly.

Typically, a centrifugal pump is placed upstream of the C-Series and installed in series (Figure 3). The centrifugal pump is used for CIP cycles. Unlike other technologies, the C-Series pump does not need to operate during the CIP cycle.

Generally, the most efficient CIPs include five stages:

1. Pre-wash with clean water at room temperature to evacuate remaining residues
2. Wash with an alkaline detergent, typically a soda at 2.5% at a temperature of 176ºF (80º C), to enable dissolving and evacuating grease and proteins
3. Rinse with clean water at room temperature to avoid mixing of two different cleaning solutions
4. Wash with acid solution, typically nitric acid at 2.5% at room temperature, to dissolve and evacuate proteins and inorganic salts
5. Rinse with clean water at room temperature to evacuate any trace of acid solution.

CIP technology improves operating economics because it is fast, efficient, and effective. Simply stated, if you have a sanitary process that requires routine cleaning between process batches, CIP technology can dramatically improve your uptime performance and reduce your maintenance costs. By design, eccentric disc technology is highly reliable and low-maintenance. The pump consists of very few parts: a single drive shaft; a single or double set of bellows that also act as a pressure retaining element; four bearings (separated from the liquid); one disc; one cylinder; one gear case; one disc nut; seven O-rings; and two lip seals.

A wide variety of applications

Eccentric disc CIP pumps are capable of handling up to 10,000 Cst (46,000 SSU) liquids and working pressures of 72.5-130 psi, depending on the model. The speed range is 50–1000 rpm with capacities of .15-158 gpm. Rated up to 3000°F (1,480°C), the C-Series has a particle size range of 1-3 mm and is effective at handling suspended solids with mild abrasives.

From high value, fine chemical applications to sanitary and food applications, CIP eccentric disc technology is being used worldwide. The unique design makes the pump extremely flexible and capable of pumping low viscosity, high viscosity and abrasive materials within a single process. The output is not affected by viscosity variations. The suction capability of the pump enables perfect priming and draining of mobile tanks and stationary pipes, even at low speeds. The pump's sealless design makes it particularly suitable for a broad range of mediums, from sticky and highly viscous liquid sugars to toxic chemicals and extremely thin products such as solvents. Gentle handling, high volumetric capability, sealless design, and ROI-optimizing CIP technology, all wrapped into one pump.■

Figures 4. Two C-series clean-in-place pump installations.

CONTACT
Dave Bohne
Product Manager Blackmer
1809 Century Avenue SW
Grand Rapids,
MI 49503-1530
USA
Tel: +1-616-241-1611
Fax: +1-616-241-3752
Email: bohne@blackmer.com
www.blackmer.com