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Smarter Pumps, Safer Food

Today's pumps are designed not only to move product efficiently but also to improve cleanability, reduce downtime, and protect product integrity. Source: surapon/Adobe Stock

Advances in hygienic pump designs are helping food and beverage processors improve sanitation, reduce downtime, and lower total cost of ownership while protecting product quality and supporting increasingly demanding production environments.

Pumps rarely attract attention—until something fails. A worn seal, extended cleaning cycle, or improperly specified pump can disrupt production, compromise product quality, and increase maintenance costs. As food safety standards tighten and labor constraints persist, hygienic pumps are evolving to address operational realities across sanitation, maintenance, and lifecycle performance.

Today's pumps are designed not only to move product efficiently but also to improve cleanability, reduce downtime, and protect product integrity. Advances in hygienic design, materials, and condition monitoring are helping processors reduce total cost of ownership while supporting increasingly complex production environments.

Designing for Sanitation Realities

One of the most significant changes in hygienic pump design over the past two decades reflects a better understanding of how pumps fail.

"The big evolution in hygienic pump design is driven by the actual causes of pump damage," says Calle Danielsson, Sales Engineer at Unibloc Hygienic Technologies. "Most damage doesn't occur during operation, but rather during cleaning and maintenance."

Unibloc's UltraLobe Food First 700 series lobe pump carries a small footprint in relation to its productivity, which according to Unibloc, can do the work of two smaller pumps in just 20% of the space.

Sanitation crews often work within tight production windows and with limited staffing. Disassembly and reassembly under time pressure can lead to damaged components or improper assembly.

"Scratches, bent parts, mis-torqued rotor bolts, lost O-rings… crews are notoriously hard on pumps," Danielsson says. "Older pumps weren't designed with that reality in mind."

To address these challenges, manufacturers have redesigned pumps for easier access and faster servicing. Tool-free disassembly, bolt-free rotors, and front-loaded seals reduce maintenance complexity and minimize the risk of assembly errors.

These improvements significantly reduce labor requirements. "Crews can clean a lobe pump in minutes rather than hours," Danielsson says. He cites air-operated double-diaphragm pump designs that "can be disassembled by removing a single large nut, cutting maintenance from two hours to just 15 minutes."

These features reduce product hold-up, improve cleanability, and help processors meet regulatory and quality requirements.

Supporting Product Diversity

As product formulations grow more complex, pumps must handle a wider range of viscosities, solids, and shear-sensitive ingredients. Applications now include delicate dairy products, sauces, protein beverages, and plant-based formulations, each with specific handling requirements.

Six hygienic pump types are commonly used in food processing: centrifugal, lobe, gear, twin screw, progressive cavity, and air-operated double-diaphragm pumps. Each offers distinct performance advantages depending on product characteristics and process requirements.

"Our particular focus is on hygienic applications in food, beverage, meat and poultry, bakery, dairy, as well as pharmaceutical applications," Danielsson says. These industries require pumps "to be not just reliable, but also easy to clean and maintain."

Versatility is also becoming increasingly important as processors seek to simplify system design. Twin screw pumps, for example, can perform both product transfer and clean-in-place (CIP) functions within a single unit.

This dual functionality reduces equipment count while improving system efficiency and cleanability.

Lifecycle Value Drives Pump Selection

Processors are increasingly evaluating pumps based on total cost of ownership rather than initial purchase price. Maintenance requirements, downtime risk, and service life now play a larger role in purchasing decisions.

Ease of maintenance is especially important as plants face skilled labor shortages. "Managers we talk to are still struggling to find reliable labor," Danielsson says. "They love pumps that can be disassembled without tools and can be cleaned in minutes rather than hours."

Reliability improvements have also extended service intervals.

Proper Selection and Long-term Performance

Despite advances in pump design, improper pump selection remains a common source of operational issues. Selecting pumps based solely on flow requirements or purchase price can lead to premature wear, product damage, and maintenance problems.

"The most common mistake engineers make when selecting a pump is selecting a small pump and running it near or at its maximum capacity," Danielsson says. "Pumps run best in the middle of their RPM range. When in doubt, size the pump larger and run it slower."

Operating pumps at maximum capacity accelerates wear and shortens service life. Matching pump technology to product characteristics is equally important.

"A centrifugal pump, for example, is fine for thin liquids, but pushing a viscous product through one will damage the product and eventually the pump," Danielsson says. "We've seen processors put in tomato chunks that wind up as tomato soup, an unintended outcome."

Of course, selecting pumps based solely on initial cost can result in higher long-term expenses.

Incorrect specifications can create ongoing operational costs. "We've seen customers spend more than $200,000 per year on seal replacements alone because the wrong type of seal was specified," Danielsson says.

Food Safety Compliance

Food safety requirements continue to drive improvements in hygienic pump design.

Solid stainless steel construction, for example, improves durability and hygiene. “Each rotor and pump housing is milled from a single billet of stainless steel, avoiding seams or weld transitions where bacteria could hide,” Danielsson says.

Simplified designs also reduce foreign material risk. “Eliminating small parts reduces the risk of foreign material entering a process stream,” he adds.

These capabilities help processors meet sanitation requirements while improving operational efficiency.

Intelligent Monitoring Improves Reliability

Digital integration is becoming an important factor in pump design, supporting predictive maintenance and improved reliability.

Monitoring vibration, temperature, and seal condition allows maintenance teams to identify potential issues early and schedule repairs proactively. Predictive maintenance reduces unexpected failures and improves uptime.

And as production demands increase and formulations grow more complex, pumps play a critical role in maintaining product quality, sanitation, and operational efficiency.

That’s why proper pump selection and maintenance require collaboration across engineering, quality, and operations teams.