Advancing Hygienic Product Transfer in Modern Food and Beverage Processing

ECCENTRIC DISC PUMPS PROVIDE THE LOW-SHEAR HANDLING, NON-PULSING FLOW AND PRODUCT RECOVERY NEEDED TO PROTECT COMPLEX FORMULATIONS AND INCREASE THROUGHPUT

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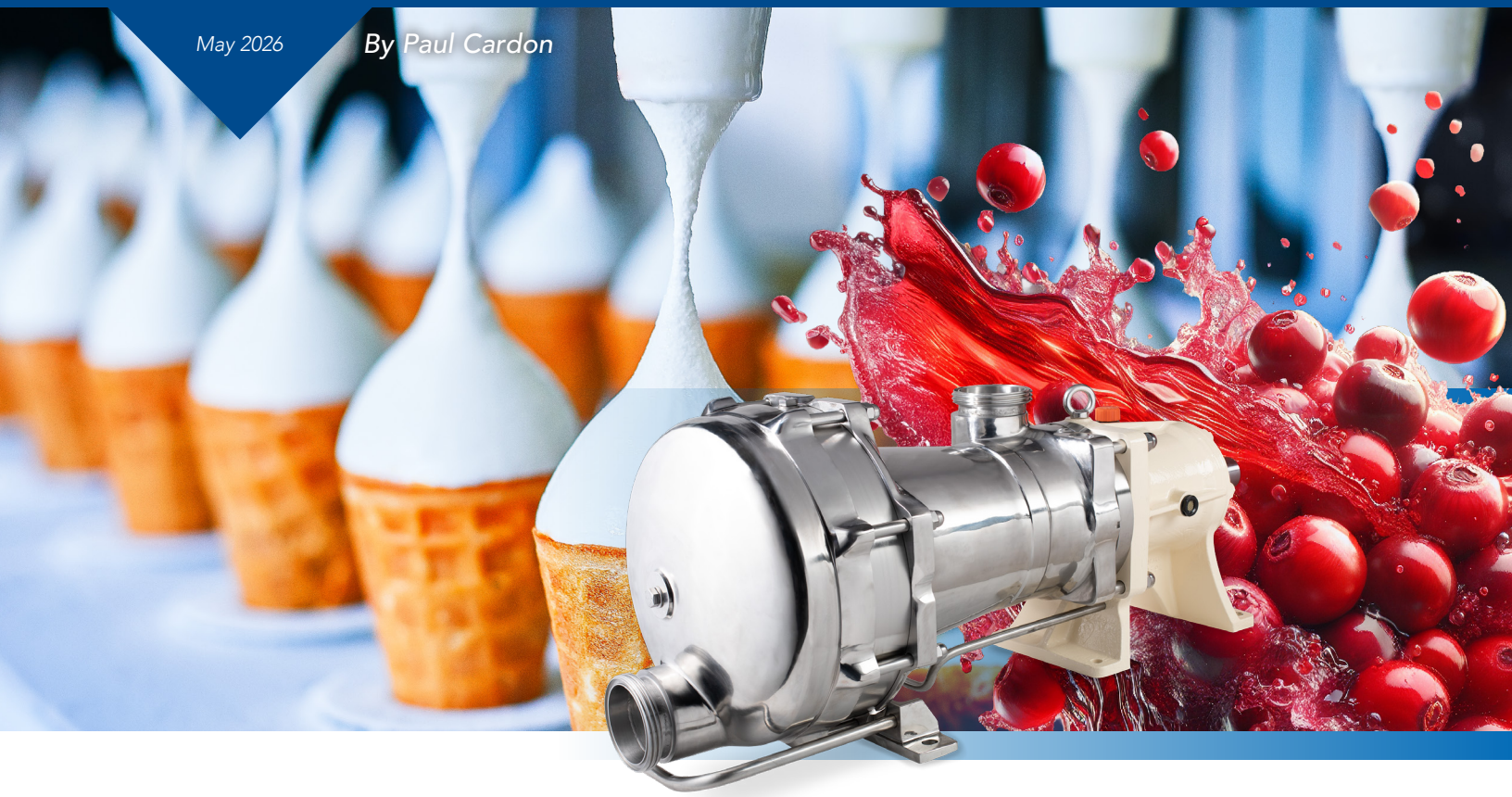

The Mouvex® H-FLO Series Eccentric Disc Pump helps preserve texture, structure and visual quality, particularly in high-viscosity, shear-sensitive and sticky products, including chocolate, nut pastes, dairy formulations and plant-based emulsions.

Introduction

In modern food and beverage manufacturing, product transfer is not a secondary consideration. It is a critical process that directly influences product quality, hygienic safety, application efficiency and overall yield. Pumping systems operate at the center of this process, moving liquids and semi-solids through every stage of production, from raw ingredient intake to final packaging. Despite being indispensable equipment, the impact of pumps can often be underestimated until performance issues begin to affect the entire operation.

Variations in flow stability, suction performance or proper sanitation can introduce process disruptions. Product shear may alter texture or damage particulates. Pulsation can affect dosing accuracy. Incomplete evacuation of product from lines can reduce yield. Poor hygienic design can complicate cleaning requirements. These effects rarely remain isolated. Instead, they trickle throughout the production line. Ultimately, they contribute to reduced throughput, increased waste and higher operational costs. In more serious cases, they can increase the risk of contamination, leading to costly recalls that damage consumer trust. However, now more than ever, as product formulations continue to become more complex and production demands increase, the role of pump technology has become even more crucial.

This white paper explores the challenges of modern food and beverage processing, how pump technology plays a pivotal part and why many operators rely on eccentric disc pumps to address key operational challenges in an evolving industry that must remain agile and precise to satisfy the ever-shifting taste buds of its consumers.

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Industry Snapshot and Emerging Trends

Food and beverage manufacturing has historically developed alongside progress in food science and changing consumer tastes. That pattern continues, but at an accelerated pace. Global demand for processed foods continues to grow while product formulations become increasingly specialized and structurally complex.

According to Mordor Intelligence, the global food and beverage market reached approximately $9.8 trillion in 2026, up from $9.4 trillion in 2025, and is projected to reach $11.8 trillion by 2031, reflecting a compound annual growth rate of about 3.75%. Growth at this scale places increasing pressure on processing systems to handle higher volumes while maintaining consistent product quality, safety and efficiency.

At the same time, the materials moving through production lines are changing. Manufacturers are processing more viscous products such as chocolate, nut pastes, dairy formulations and plant-based emulsions. These products require greater transfer force but are also more sensitive to shear and flow instability, which can affect texture, structure and stability. Operational efficiency is also under greater scrutiny. Even small losses during processing can accumulate into significant cost in high-volume environments. Product loss, process inefficiencies and equipment limitations all contribute to reduced yield, while pump failures or maintenance events can disrupt production and lead to costly downtime.

Together, these factors have elevated the role of pump technology. Pumps are no longer limited to basic product transfer; they must also support product integrity, hygienic operation, uptime and yield under increasingly demanding processing conditions.

Key Challenges: Where Flow Meets Friction

From raw-ingredient transfer to filling and packaging, pumps are trusted to provide the performance required to safeguard the product. However, because of the wide range of product characteristics common in food and beverage manufacturing, these pumps must be able to address the following operational conditions and requirements that are both sensitive and complex.

Achieving Low-Shear, Non-Pulsing Flow

Many food products rely on delicate internal structures such as protein networks, particulates and emulsions. Excessive shear during pumping can disrupt these structures, altering texture, stability and appearance. Pulsation in positive displacement pumps adds another layer of risk. Pressure oscillations can affect flow meters, dosing systems and filling equipment. In precision applications such as yogurt filling or confectionery depositing, even minor flow instability can result in underfilled or overfilled packages. For operators, these issues show up as product defects, inconsistent fills and cumulative product loss. Maintaining continuous, low-shear, non-pulsing flow is therefore essential for both product integrity and stable operation.

Maintaining High Volumetric Efficiency in Variable Viscosity Media

When product viscosity varies, internal slip becomes a primary limitation. At low viscosities, product leaks backward through pump clearances instead of

moving forward, reducing flow consistency and overall efficiency. In applications with shear-thinning fluids (viscosity decreasing with shear), such as chocolate or nut pastes, increased slip forces higher pump speeds to maintain throughput. This introduces additional shear, heat and mechanical wear, further destabilizing the process. Changing back pressure from filtration systems, heat exchangers, or long transfer lines adds another challenge. Pumps that cannot maintain sealing under these conditions experience fluctuating flow rates. Sustaining volumetric efficiency across varying viscosities and pressures is critical to maintaining stable throughput and process control.

Maximizing Product Recovery and Yield

Residual product left in pumps and piping is a direct and often overlooked source of loss. The amount retained depends heavily on pump design, with some configurations trapping product in internal cavities or dead zones. In high-volume operations, even tiny retained volumes per batch can accumulate up to significant losses. For example, a few kilograms of unrecovered product per cycle can add up to tens of tons annually, representing substantial lost revenue. Improving drainability and reducing internal hold-up volume allows more product to reach packaging, directly increasing yield and reducing waste.

Securing Seal Reliability and Minimizing Contamination Risk

Pump seals are a common failure point in hygienic systems. When seals degrade, they can allow product leakage, introduce contaminants or permit cleaning fluids to enter the product stream. These failures often require production to stop for maintenance and sanitation, impacting uptime. That is the best-case scenario when considering the alternative: the impact of overlooked contamination, which can pose harmful food risks to consumers and erode the reputation of operations. Additionally, food safety standards, such as those outlined by the FDA and EHEDG, emphasize prevention of contamination, making seal reliability not only a maintenance concern but also a key factor in both food safety and operational continuity.

Strengthening Clean-in-Place (CIP) & Sanitize-in-Place (SIP) Capability

Effective cleaning depends on pump designs that allow full fluid circulation and complete drainage. Dead zones or poor drainability can trap residues, creating conditions for microbial growth. Incomplete evacuation of cleaning fluids can also dilute the product in subsequent runs. For operators, this increases the complexity of cleaning and the risk of contamination. Alternatively, pump designs that promote smooth flow paths and full drainability support more effective CIP cycles, helping maintain hygienic conditions while reducing operational burden.

Evaluating Pump Technologies

Several pump technologies are commonly used in food processing environments, each using different operating principles with unique advantages and limitations.

Centrifugal Pumps

Centrifugal pumps use a rotating impeller to impart velocity to a fluid and convert it into pressure. They are well-suited for low-viscosity products such as milk, beverages and cleaning solutions, offering simple design and low cost. However, performance declines with viscosity with a low limit, resulting in reduced flow, higher energy use and limited suction capability. As non-positive displacement pumps, they also offer poor product recovery and are less effective in viscous or yield-sensitive applications.

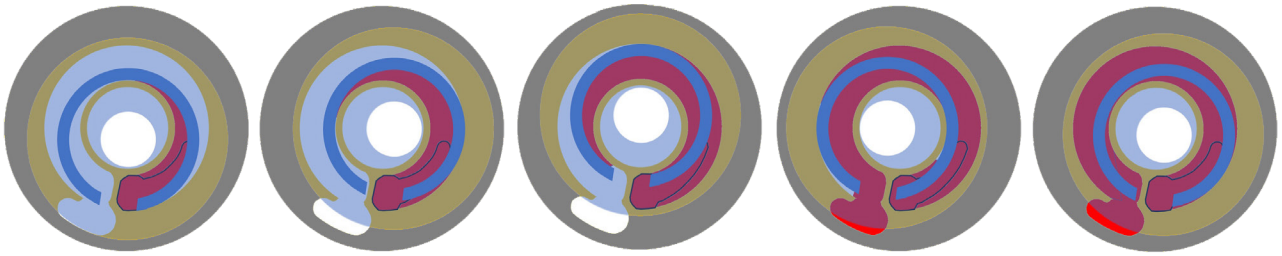
Lobe Pumps

Lobe pumps use synchronized rotating lobes to move product through the pump chamber. They provide gentle handling and good cleanability, making them

Comparative Chart

Pump Type	Shaft Sealing	Viscosity Handling	Product Recovery Ability	Maintenance Complexity
Centrifugal	1 Mechanical Seal	Low	No	Low
Lobe	2 or 4 Mechanical Seals	High	No	High
Progressive Cavity	1 or 2 Mechanical Seals	High	No	Medium
Twin Screw	2 or 4 Mechanical Seals	Medium-High	Low	High
Eccentric Disc	Seal-less	High	High	Low

Mouvex Principle



The Mouvex® H-FLO Series operates via an eccentric shaft that drives a pumping element to form expanding and contracting chambers, drawing fluid through the intake and displacing it uniformly through the discharge port.

common in dairy and sauce processing. However, their performance can be significantly affected by pressure or viscosity variation, which can affect dosing accuracy. Internal clearances also allow slip in low-viscosity applications, reducing volumetric efficiency.

Progressive Cavity Pumps

Progressive cavity pumps use a helical rotor within an elastomer stator to form cavities that move product forward. They perform well with viscous materials and deliver smooth, low-pulsation flow. But its design has limitations, including stator wear, inability to dry run, sensitivity to chemical and thermal conditions and more complex cleaning requirements, which can be a drawback in hygienic environments.

Twin-Screw Pumps

Twin-screw pumps use intermeshing screws to convey product axially through the pump. They are versatile and can handle both product transfer and CIP processes, making them suitable for multi-use systems. However, they require tight internal tolerances and can introduce shear under certain conditions, which may impact sensitive products. Additionally, the wide variation in absorbed power between the process and CIP phases requires an oversized motor, which is costly.

Eccentric Disc Pumps

Eccentric disc pumps use an off-center rotating disc within a cylindrical chamber to create continuous expansion and contraction of the chamber volume, moving product through the pump. This continuous displacement produces nearly a pulse-free flow, improving dosing stability and reducing system vibration. Close internal tolerances minimize slip, maintaining volumetric efficiency across a wide viscosity range, while the sweeping motion of the disc helps evacuate product and reduce residual hold-up.

By removing mechanical seals, the Mouvex® H-FLO Series Eccentric Disc Pump reduces the risk of leaks, product loss and contamination. Additionally, the stainless steel bellows used in place of seals are engineered to withstand the thermal and chemical stress of cleaning cycles.

How Eccentric Disc Pumps Excel in Hygienic Processing

Across food and beverage production, eccentric disc pumps are used to protect product integrity, reduce waste and maintain consistent, reliable operation. Their design balances gentle handling with strong performance, making them well-suited for a wide range of hygienic applications.

Reduce Maintenance with Simplified Design

In day-to-day operation, fewer components mean fewer things to maintain and fewer opportunities for failure. By eliminating components such as timing gears and mechanical seals, eccentric disc pumps reduce the number of wear points within the system. Fewer moving parts lower maintenance requirements and minimize failure modes, improving uptime in continuous processing environments. Additionally, flexible installation allows integration into existing processing lines.

Improve Reliability with Seal-less Design

Mechanical seals are a common source of maintenance challenges in hygienic pumping. By removing this wear component, eccentric disc pump designs reduce the risk of leaks, product loss and contamination. The multiple-wall stainless steel bellows used in place of seals is engineered to withstand the thermal and

chemical stresses of cleaning cycles, supporting longer service life and more consistent performance.

Gain Application Flexibility with Broad Operating Range

Food and beverage facilities often require a single pump to handle multiple products and varying process conditions. Eccentric disc pumps are capable of managing a wide range of viscosities, from thin liquids to highly viscous or particulate-laden products. Strong suction capability also supports product lift and long transfer distances, increasing flexibility across applications.

Accurately Transfer Product with Stable Flow

Flow consistency plays a critical role in maintaining product quality and filling accuracy. The operating principle of eccentric disc pumps creates a continuous, nearly pulse-free flow, minimizing pressure fluctuations throughout the system. This stability is especially valuable in filling and depositing operations, where even small inconsistencies can lead to overfill, underfill or rejected product. The design also maintains consistent volumetric performance over time, supporting reliable throughput across changing conditions.

Enhance Process Efficiency with Dry-Run Capability

Short interruptions in product flow are common during startup, shutdown or changeovers. Unlike many positive displacement pumps that rely on product lubrication, eccentric disc pumps can operate dry for brief periods without damage. This capability provides greater operational flexibility and reduces the risk of downtime during process transitions.

Protect Shear-Sensitive Products with Gentle Handling

Maintaining product structure is essential for many food and beverage applications. Eccentric disc pumps move product with low internal velocities and minimal turbulence, helping reduce shear. This gentle handling supports the integrity of delicate ingredients such as particulates, emulsions and viscous formulations.

Efficiently Strip Lines with High Suction Capability

At the end of a production run, product recovery directly impacts yield. Eccentric disc pumps generate a strong vacuum on suction in combination with high air compression on discharge, allowing them to self-prime and effectively strip product from piping and process vessels. This reduces residual product loss, which is particularly valuable in high-viscosity or high-cost applications.

Minimize Contamination Risks with Hygienic Design

Cleaning is a constant concern in food processing, and pump design affects how easily systems can be sanitized. Eccentric disc pumps are engineered to minimize dead zones and product buildup, allowing cleaning solutions to fully circulate and drain. This supports effective cleaning-in-place (CIP) processes, reduces contamination risk and helps maintain compliance with sanitary standards.

Optimizing Product Transfer with the Mouvex® Series Eccentric Disc Pump

While eccentric disc pumps offer clear advantages in hygienic processing, not all designs deliver the same level of performance. Among available options, many operators turn to the Mouvex H-FLO Series Eccentric Disc Pump for its refined positive displacement design, which addresses common limitations found in both traditional pump technologies and other eccentric disc pump designs.

Building on the core benefits of eccentric disc technology, the H-FLO Series enhances reliability through a fundamentally different sealing approach. Instead of relying on conventional mechanical seals, it incorporates a multi-layer stainless steel bellows that hermetically isolates the product chamber from the drive. This design reduces the risk of leaks and contamination while simplifying maintenance in hygienic environments.

From a performance standpoint, the H-FLO Series is engineered to handle a broad range of operating conditions. It supports both low- and high-viscosity fluids, delivering flow capacities up to approximately 70 m^3/h (308 gpm) and discharge pressures up to 10 bar (145 psi). This versatility allows processors to use a single pump across multiple applications, reducing the need for specialized equipment.

Operational flexibility is further enhanced by its ability to run dry for up to five minutes without damage. This capability helps accommodate normal process interruptions during startup, shutdown and changeovers, minimizing the risk of unplanned downtime.

In addition to performance and reliability, the H-FLO Series is designed with hygiene in mind. Stainless steel wetted components and smooth internal surfaces, finished to Ra 0.8 µm (32 µ-inch), support effective cleaning. The pump is also compatible with both CIP and SIP processes, helping maintain sanitary conditions across production cycles.

Taken together, these features enable gentle yet efficient product handling. The H-FLO Series helps preserve texture, structure and visual quality, particularly in high-viscosity, shear-sensitive and sticky products under approximately 10,000 cP, including chocolate, nut pastes, dairy formulations and plant-based emulsions.

Conclusion

Food and beverage manufacturers are operating in an increasingly demanding environment shaped by higher-viscosity products, stricter hygienic requirements and growing pressure to reduce waste. Many traditional pump technologies were not designed to meet these demands simultaneously, leaving facilities with inefficiencies that affect product quality and reduce overall yield.

Eccentric disc pump technology addresses these gaps by combining gentle product handling, stable non-pulsing flow and high volumetric efficiency within a hygienic design. With more than 50 years of proven performance in food and beverage applications and tens of thousands of pumps operating worldwide, this technology gives processors the confidence to maintain product integrity, stabilize processes and recover more usable product throughout the production cycle.

As formulations continue to evolve and production expectations increase, pump performance will play a more central role in overall system efficiency. Technologies that support consistent flow, effective cleanability and reliable operation will be critical to maintaining both product quality and operational performance.

About the Author:

Paul Cardon is the Industry Product Manager for Mouvex. He can be reached at paul.cardon@psgdover.com. Mouvex is a product brand of PSG, a Dover company, Downers Grove, IL, USA. PSG is comprised of several leading brands, including Abaque, All-Flo, Almatec, Blackmer, Ebsray, em-tec, Griswold, Hydro, ipp, Malema, Mouvex, Neptune, PSG Biotech, Quantex, Quattroflow and Wilden. PSG products are manufactured on three continents – North America, Europe and Asia – in state-of-the-art facilities that practice lean manufacturing and are ISO-certified. PSG is part of the Pumps & Process Solutions segment of Dover Corporation. For additional information on PSG, please visit psgdover.com. PSG: Where Innovation Flows.