

Vane Pump Technology Offers Distinct Advantages for Soap & Detergents Manufacturing Processes

SLIDING VANE CONCEPT PROVIDES HIGHEST LEVEL OF PERFORMANCE AND EFFICIENCY OVER TIME

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Figure 1

Executive Summary

Over the past several years the manufacture of Soap and Detergents has become a more complex process with changes in raw materials, the introduction of new chemicals, changes in ingredients, expensive fragrances, colorants and preservative additives, and advanced soap-making processes. With this in mind, “traditional pumping technologies” no longer meet the demands of reliability, product loss prevention, environmental protection and process efficiencies. However, as the processes have evolved, sliding vane technology has emerged as the technological leader, and the preferred pump choice in Soap and Detergents manufacturing. Sliding Vane pumps are used in a wide variety of Soap and Detergents applications, including all types of high-purity chemicals, additives, enzymes, acids, surfactants, glycerin and concentrated perfumes and dyes, to name a few.

Introduction

Sliding vane technology has always offered high efficiency and low maintenance advantages over traditional gear and lobe pumps. These are important factors in today’s era of high energy costs, lean personnel staffs and high demand for increased profitability. But these reasons alone are only

part of a much bigger picture. For even greater flexibility, efficiency and productivity, advanced vane pump designs include motor speed technology, advanced “designed in” features such as a hydrodynamic journal bearing and one mechanical seal. These innovative features serve to further improve the fundamental pumping process in the manufacture of Soap and Detergents (Figure 1).

Key Design Benefits to Sliding Vane Pumps

Sliding vane pumps are designed with unique “self-adjusting” vanes that allow them to maintain near-original volumetric performance during the life of the pump — meaning these pumps are not subject to efficiency-robbing slip that occurs from wear in gear and lobe pumps. In addition, vane pumps are designed around the bearings and seals, so they offer longer life and greater product loss prevention than other technologies. Therefore, by virtue of their design, vane pumps are ideal for handling expensive, fine chemicals and fragrances where other pumps may experience seal difficulty. Vane pump features generally include:

- **Sliding Vanes** — nonmetallic composite vanes that automatically adjust clearances to allow the pump to sustain consistent volumetric performance while also offering exceptional suction and dry priming capabilities.
- **Cavitation/Noise Suppression Liner** — this unique feature, patented by Blackmer, a global leader in vane pump technology, minimizes the effects of cavitation on the pump and piping system while at the same time reducing noise levels up to 15 dBA.

In recent years, advances in traditional vane technology have resulted in even greater performance capabilities, longer service life and a wider range of process applications in the manufacture of Soap and Detergents. These advancements include:

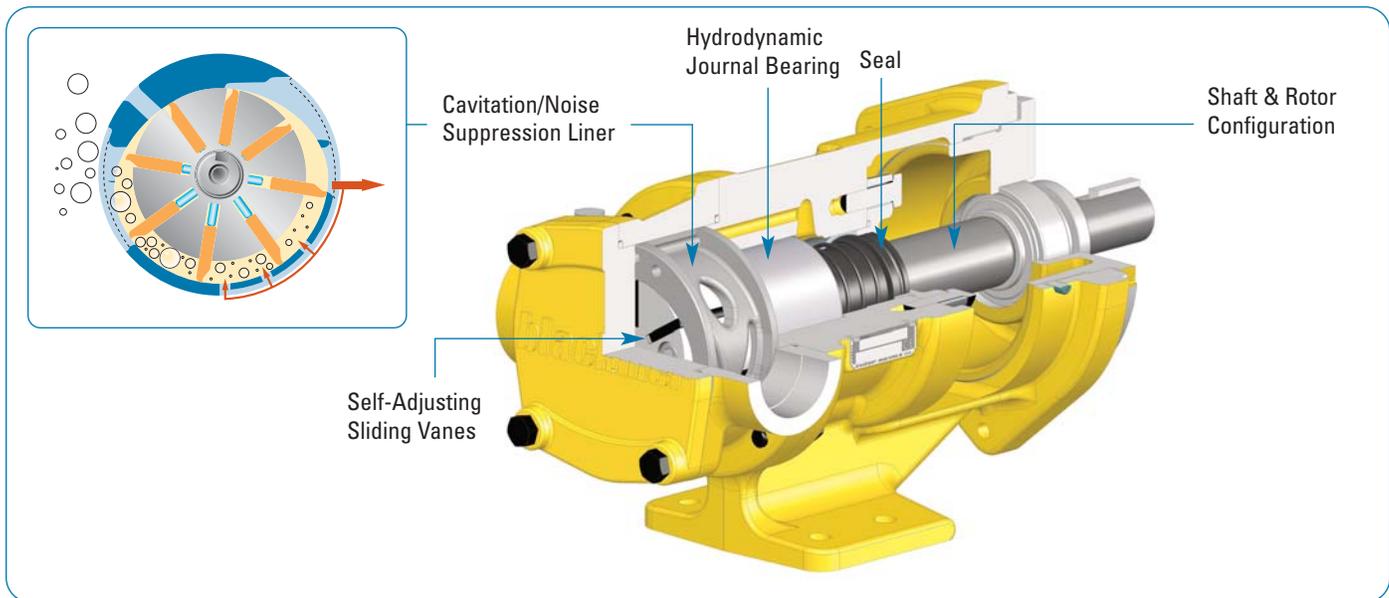


Figure 2

- **Motor Speed Designs** — serve to eliminate the need for a gear reducer; resulting in less complexity, lower upfront equipment costs, reduce downtime, maintenance, energy usage and space requirement.
- **Compact Profile** — motor speed vane technology offers a smaller pump and unit footprint, which allows for greater mounting flexibility and pump use within confined spaces.
- **Hydrodynamic Journal Bearing** — this performance enhancing design feature significantly improves overall pump efficiency, reliability, and extends bearing life. With this design, the pump shaft rides on a fluid boundary during load conditions to eliminate shaft-to-bearing contact, friction and wear.
- **One Mechanical Seal and Sealed-for-Life Bearings** — quality vane pumps are designed around the seals and bearings, which means no other technology is more suited for the demands of ultra-thin liquids to reduce the leak risks and product loss potential of expensive raw materials, concentrated dyes and fragrances.

The Sliding Vane Principle

Sliding Vane pumps have a number of vanes that are free to slide into or out of slots in the pump rotor. When the pump driver turns the rotor, centrifugal force, rods, and/or pressurized fluid causes the vanes to move outward in their slots and bear against the inner bore of the pump casing forming pumping chambers. As the rotor revolves, fluid flows into the area between the vanes (pumping chambers) when they pass the suction port. This fluid is transported

around the pump casing until the discharge port is reached (Figure 3). At this point the fluid is squeezed out into the discharge piping. Each revolution of a Sliding Vane pump displaces a constant volume of fluid. Variance in pressure has minimal effect. Energy-wasting turbulence and slippage are minimized and high volumetric efficiency is maintained.

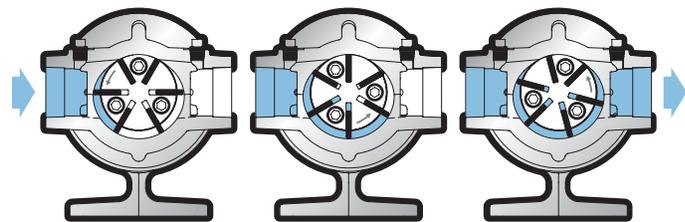


Figure 3

Advanced Technology in Sliding Vane Motor Speed Pumps

Advanced Sliding Vane pumps, such as the Blackmer ProVane® Motor Speed Vane pump are motor speed and offer special design features such as hydrodynamic journal bearings. This special line of vane pumps offer operating speeds up to 3,600 rpm with capacities to 100 U.S. gpm and are capable of handling viscosities up to 5,000 ssu (1,100 cP), operating temperatures up to 240°F (115°C), working pressures to 350 psi (24.1 Bar), and differential pressures to 125 psi (8.6 Bar). This pump is available in ductile iron and stainless steel models in five sizes ranging from 3/4" to 2". Motor speed vane pumps do not require a gear reducer, so they offer upfront equipment, installation and energy cost savings, and a smaller footprint than that of a conventional pumping unit.

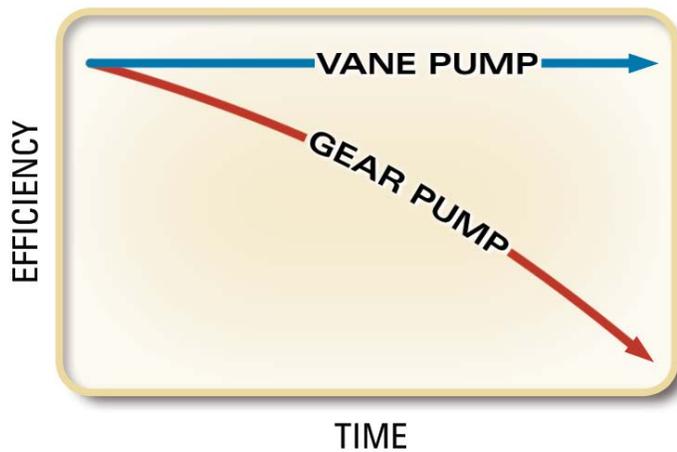


Figure 4

By comparison, gear pumps are constantly wearing due to the metal-on-metal design of the pump's gears meshing to move fluid. The result is constant wear, which increases internal clearances and reduces flow capacity. To compensate for the larger clearances (and hence reduced performance due to slip), one could increase the pump speed (resulting in increased energy consumption and accelerated pump wear). Alternately, put up with reduced capacity until performance drops to a totally unacceptable level. In contrast, the vanes on sliding vane pumps automatically slide out of their rotor slots to continuously adjust for performance and maintain near-original efficiency and capacity throughout the life of the vanes (Figure 4). By eliminating the need to increase the pump speed over time, sliding vane pumps save additional energy versus gear pumps over time.

Construction

Constructed with long-lasting, nonmetallic composite vanes that automatically adjust clearances and sustain the highest levels of flow performance and efficiency over time, Sliding Vane pumps eliminate slip, capacity loss and downtime for clearance adjustments. The self-adjusting vanes offer exceptional suction and dry priming capabilities, while being able to run dry for short periods of time. Advanced Sliding Vane technologies include pumps with a Hydrodynamic Journal Bearing — a unique fluid boundary forming principal — that eliminates shaft-to-bearing contact. The shaft hydroplanes above the bearing surface on a cushion of liquid. In this hydrodynamic condition there is no metal-to-metal contact or wear and bearing life can be indefinite (Figures 5 and 6). These pumps are engineered to achieve hydrodynamic mode (full film operation — the point offering the lowest bearing friction and least wear) faster than any other pump in its class to preserve bearing life. It also maintains optimum bearing characteristics even under a wide range of operating

conditions. Reduced shaft/bearing contact minimizes friction and results in higher mechanical efficiency and smart energy cost savings.

Advanced technology sliding vane pumps, such as the Blackmer ProVane® Motor Speed Vane Pump today include a patented Cavitation/Noise Suppression Liner that minimize the effects of cavitation and reduces noise levels up to 15 dBA (Figure 2). This liner is replaceable, giving the pump added protection and extended service life. In addition, the advanced ProVane® pumps include one mechanical seal and sealed-for-life bearings which significantly reduces the chance of leaks and product loss potential of expensive raw materials, concentrated dyes and fragrances. In addition, an advanced shaft and rotor configuration incorporating a heavy-duty shaft and rotor offers high fatigue and bending strength, minimizing shaft and vane stress.

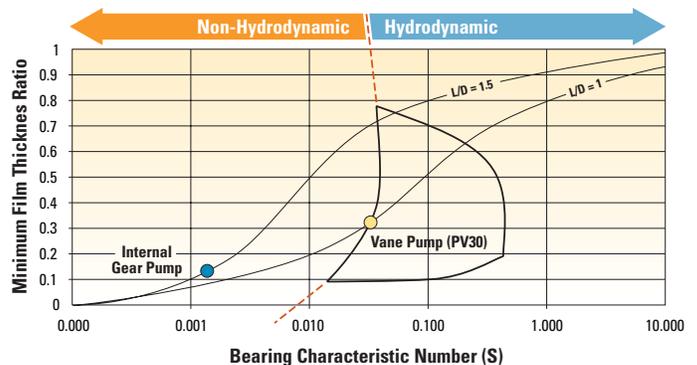


Figure 5: 32 ssu @ 60 psi

The graph above illustrates the journal bearing condition for pumps operating on 32 ssu fluid at a differential pressure of 60 psi. The Vane Pump (PV30B) has reached the hydrodynamic operating condition, meaning the shaft will run on a cushion of fluid not in direct contact with the journal bearing. The typical internal gear pump can be observed far left on the graph in the non-hydrodynamic realm, indicating the shaft and journal bearing will be in direct contact, leading to wear and reduced performance over time.

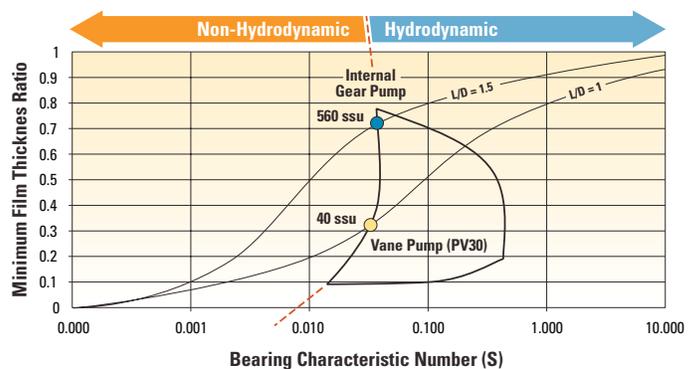


Figure 6: 125 psi

The graph above illustrates the fluid viscosity required to achieve hydrodynamic bearing conditions while operating at 125 psi differential pressure. The Vane Pump (PV30B) reaches hydrodynamic conditions on thin fluids, while the typical internal gear pump does not achieve the desired condition until it operates on 560 ssu fluid typical of motor oils.

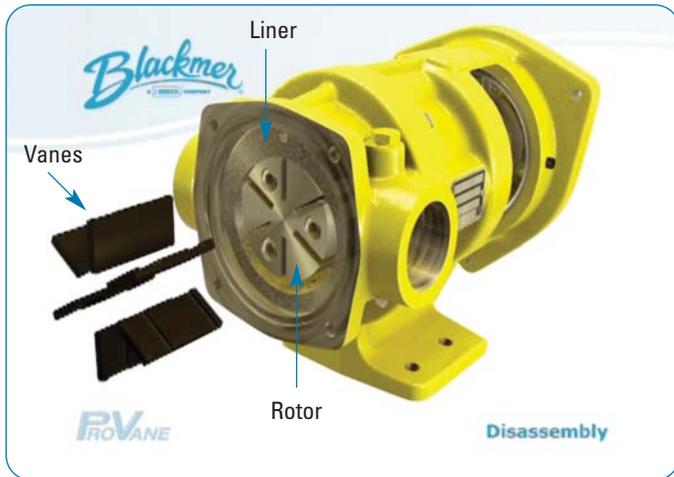


Figure 7

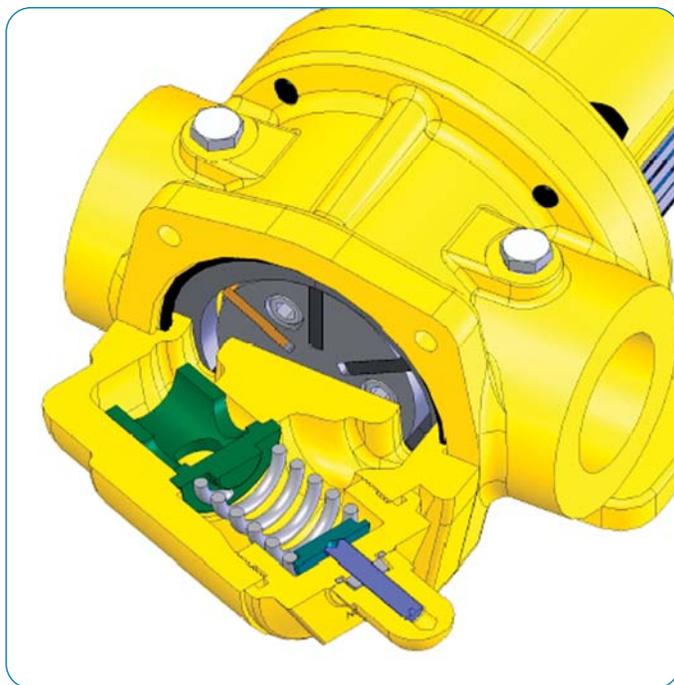


Figure 8

Ease of Maintenance

Sliding Vane pumps can be completely rebuilt with piping attached, allowing for quick and easy maintenance. If a vane becomes damaged, replacing it can be accomplished by simply removing the outboard head assembly, sliding out the old vanes, inserting the new ones, and reinstalling the head (Figure 7). In a matter of minutes, the pump can be back in operation. Simple vane replacement requires no special tools.

An optional Relief Valve is also available to help protect the pump in a high-pressure buildup situation (Figure 8). Capable of holding pressure under variable flow and pressure conditions, the valve offers an additional level of protection for pump operation.

Used in a Wide Variety of Soap and Detergents Applications

One of the leading manufacturers of sliding vane, eccentric disc, peristaltic hose and centrifugal pump technologies is Grand Rapids, MI, based Blackmer. Its unique ProVane® Sliding Vane Motor Speed pump is the most advanced sliding vane pump available.

For Soap and Detergents applications from high-purity chemicals to concentrated dyes and perfumes, ProVane®'s sliding vane technology is being used worldwide to solve everything from seal, suction, product shear and volumetric efficiency problems to offering unique benefits such as leak-free assurance, line stripping capabilities, metering and non-pulsating flow. Its sliding vane principle offers efficiency at low flow rates and allows for higher operating speeds and pressures on low viscosity fluids compared to other types of positive displacement pumps. The ProVane® pump is capable of low flow, high head applications on low viscosity fluids where centrifugal pumps can't run. ProVane® pumps offer superior priming and suction capabilities for clearing tanks, stripping lines and pump chambers when making in-line Soap and Detergents material changes. Designed without a gear reducer, this pump offers upfront equipment, installation and energy cost savings, and a smaller footprint than that of a conventional pumping unit. ProVane®'s sliding vane motor speed technology is the answer for difficult pumping applications in the Soap and Detergents industry.