How Sliding Vane Pumps Outperform External Gear Pumps in Transport Applications

WHILE EXTERNAL GEAR PUMPS OFTEN CLAIM HIGHER CAPACITY, SLIDING VANE PUMPS PERFORM BETTER IN MULTIPLE KEY PERFORMANCE PARAMETERS THAT MAKE THEM THE CLEAR CHOICE FOR TRANSPORTING LIQUIDS VIA TRUCK

by Ron Crouch



While the sliding vane and external gear pump operating principles have set the standard in reliable, efficient and safe positive displacement pump operation for centuries, sliding vane pumps will functionally outperform their external gear pump cousins in a number of important ways, including volumetric consistency over the life of the pump.

Introduction

Lubricating liquids and petroleum products are the lifeblood of many industries around the world. From fuel to feedstock, products like diesel, kerosene and light lube oils keep vital sectors of the industrial landscape running smoothly. Transport of these liquids is handled through a combination of pipelines, railcars, barges, and tank trucks that make up a large and complex network that spans the globe.

According to the U.S. Bureau of Transportation Statistics and U.S. Census Bureau, approximately 1.31 billion tons of hazardous materials were transported by truck in the United States in 2022. For operators handling lubricating liquids and petroleum products, choosing the right pump for truck loading and unloading is critical to maintaining efficient transfer operations. Two of the most used positive displacement (PD) pumping technologies for fuel offloading are external gear pumps and sliding vane pumps. While both pump designs have proven trustworthy in their own ways, there are several design and operational distinctions that may lead to sliding vane pumps being the better choice for liquid loading and unloading via truck.

External Gear vs. Sliding Vane

External gear pumps deliver a constant amount of liquid with each revolution, while their tight clearances and mechanical actuation theoretically restrict any liquid from moving backward, or "slipping," during their operation. A smooth, pulse-free flow is the result of external gear pumps' rigid designs. This method allows external gear pumps to perform especially well when transferring high-viscosity liquids.

Sliding vane pumps, like their gear counterparts, minimize the chance for slippage to occur. Unlike external gear pumps, sliding vane pumps do this by maintaining a constant force between the vane and the casing. This robust design means that variances in pumping pressure will have little effect on the sliding vane pump's flow rate. This design also provides a gentle and shear-sensitive liquid-handling environment within the pump. Therefore, sliding vane pumps excel at handling ultra-thin liquids (0.20-100 cP), medium-viscosity liquids (100-5,000 cP) and liquids with a thickness of as much as 22,500 cP, with no fall off in performance at any viscosity level.

So, which pump is the better choice?

There are several key factors that can determine the answer to this question, including initial investment cost, pump longevity and more.

When offloading a truck, optimizing unloading times is one such concern. The time you spend loading your truck eats into the time spent on the road transporting fuels and product to your customers. Another key concern is the price of the pump itself. Like any purchase, the initial investment should undoubtedly be worth the money.

For example, competitors of Blackmer®, a PSG brand, claim to offer an external gear pump that boasts both a higher flow rate and lower purchase price than Blackmer Sliding Vane Pumps, so is this external gear pump the obvious choice? Not necessarily. Some drawbacks to external gear pumps – that are not present in sliding vane pumps – aren't immediately apparent, but can grow into a lack of reliability, reduced service life and compromised levels of performance.

Let's take a closer look at the ways that Blackmer Sliding Vane Pumps can reliably outperform competitor external gear pump models, despite some claims to the contrary:

1) Flow Rate and Friction Pressure

Actual flow rates for external gear pumps will be lower than promoted.

On paper, this competitor external gear pump delivers flow rates of between approximately 300 and 400 gallons per minute (gpm) (1,136 and 1,514 L/min). But due to the realities of the liquid-offloading process, that rate is rarely realized to its fullest extent. In many offloading applications, operators use 2-inch hoses, which can create significant friction losses at higher flow rates. Actual transfer capacity depends on hose diameter and length, fluid properties, and system pressure requirements. In a system with a pump that can output 300 gpm (1,136 L/min) or more, the liquid will build up friction pressure well above the capability of the pump, which can lead to failure.

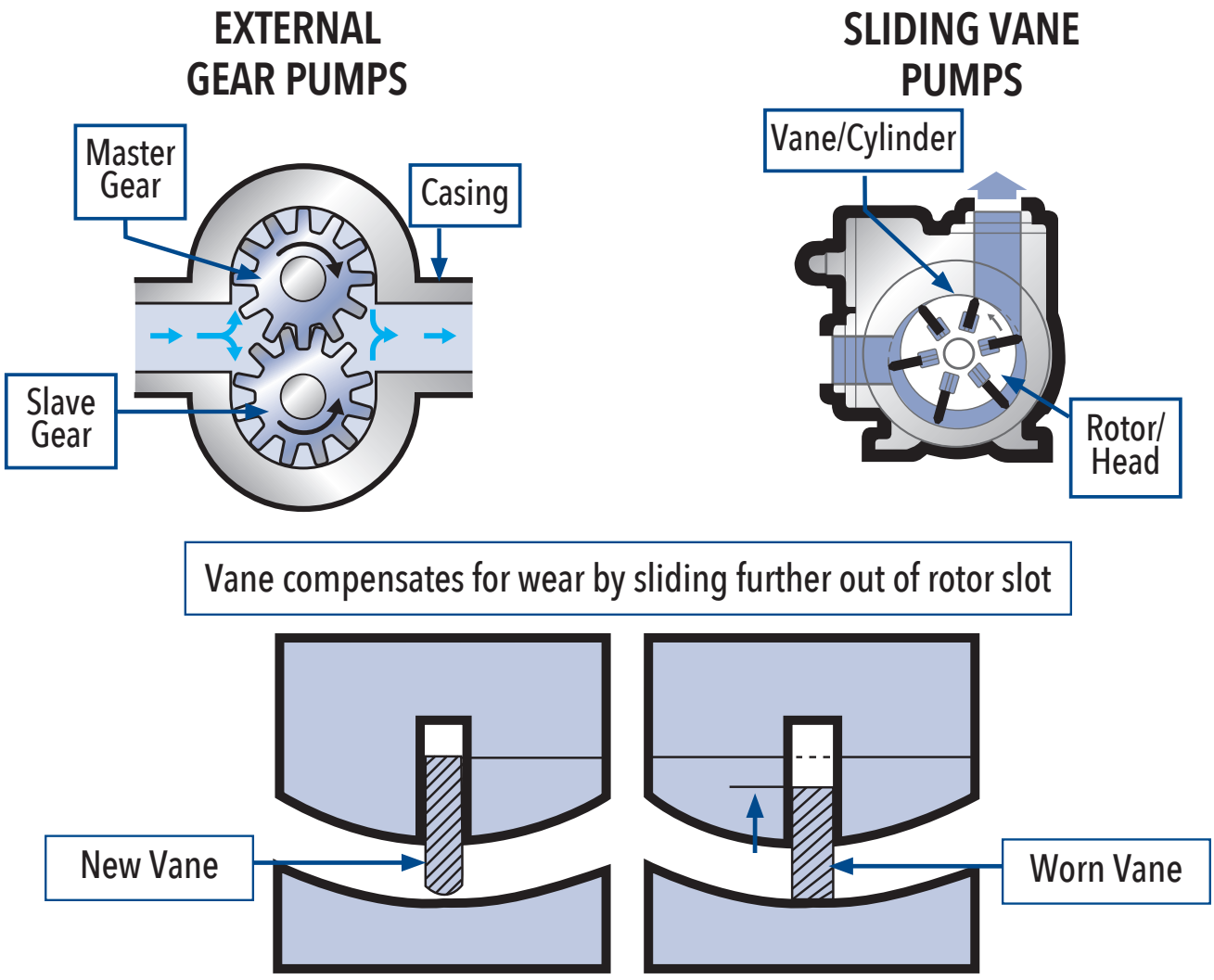
As a result, a flow rate of 300 gpm (1,136 L/min) is not necessarily feasible since the transfer system would not be able to handle it. This means that the actual flow rate would be lower in practice than in theory – usually around a 10% reduction initially. Therefore, in many transfer systems, a high flow rate isn't always the most important factor in ensuring efficient and effective liquid transfer.

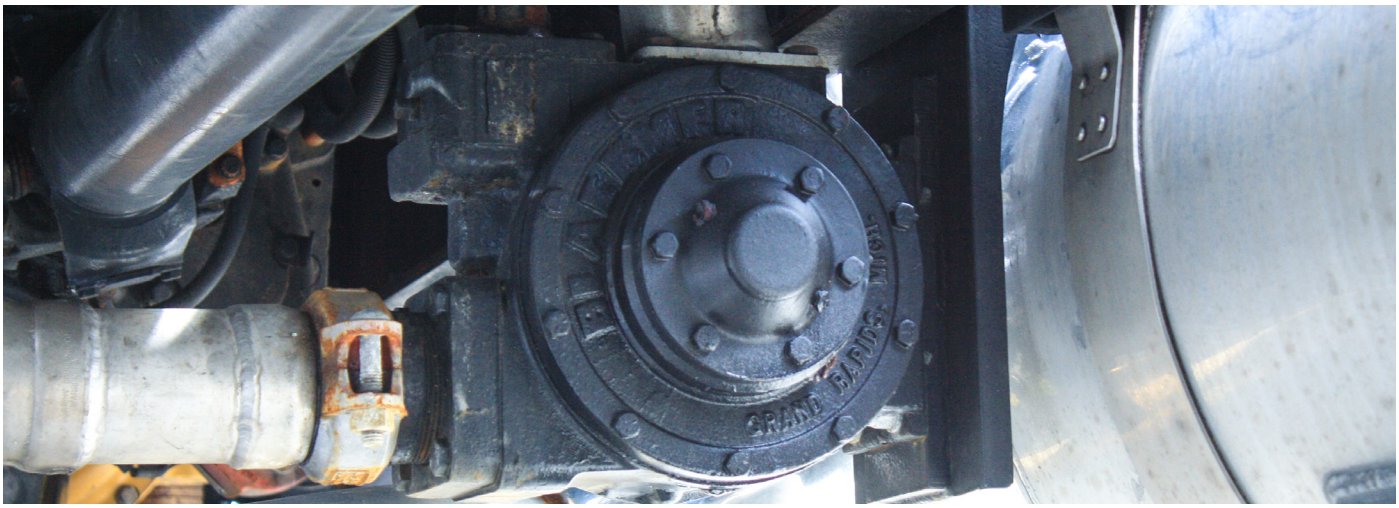
2) Flow Degradation

External gear pumps depreciate over their lifespans.

For most technologies, pump-performance levels change dramatically with age. This is true for external gear pumps that have meshing metallic gears within the pump chamber. With every turn, the meshing gears wear, especially during priming and line stripping cycles. Over time, the shaft wears to such a degree that the clearances between the pump's rotor and gear become too large. As a result, the pump becomes less efficient and outputs less flow due to leakage, or "slip," of the pumped liquid from the discharge side back to the suction side.

This slippage phenomenon can lead to significantly reduced productivity if left unchecked. So, for every gallon that is moved through an external gear pump, its efficiency is irreversibly lowered, with the eventual solution being to simply replace the pump altogether. Since all external gear pumps will experience increased product slippage over time, this change in operational capability, which will lead to decreased flow rates, should be a real concern for anyone considering purchasing an external gear pump system. In fact, decreased capacity can often lead to slower delivery times by more than 50%.





The sliding vane design of Blackmer Vane Pumps addresses the issue of flow-capacity degradation by using self-adjusting vanes that sustain flow capacity and maintain fast delivery times throughout the life of the pump.

3) Vane Pump Resilience

Vane pump design actively resists flow degradation.

As mentioned earlier, most external gear pumps have a higher output on paper than they can reach in practice. And the 10% reduction in flow capacity is just the beginning. As time goes on, flow reduction becomes even more pronounced in external gear pumps. Wear causes the pumps to shift, and their flow capacity decreases steadily, up to as much as 50% over the course of five years of continuous operation.

The sliding vane design of Blackmer Vane Pumps addresses the issue of flow-capacity degradation by using self-adjusting vanes that sustain flow capacity and maintain fast delivery times throughout the life of the pump. Performance of the pumps are consistent during the vanes' lifespan – something that cannot be said for external gear pumps.

4) Pump Life and Repair Considerations

External gear pumps have considerably shorter lifespans and are harder to service.

Knowing the cost and difficulty of pump maintenance is another critical aspect to consider. In the case of external gear pumps, it is usually easier and cheaper to replace the pump altogether when repairs are needed, leading to extended downtime and system disruption. Sliding vane pumps can be economically and easily serviced in the field, saving money by providing optimized uptime.

There's a clear difference when comparing the wear/age timelines between gear and sliding vane pumps. Expanding clearances and wear within external gear pumps can become noticeable within a few years from the start of use. Comparatively, it takes around 10 years for sliding vane pumps to start showing signs of excessive wear. That means that within the lifetime of a single sliding vane pump, you could be expected to replace an external gear pump up to three times. During those replacement times, the pump-mounted truck would need to be put out of service.

Conclusion

The claim that external gear pumps outperform Blackmer Sliding Vane Pumps isn't as cut and dry as some might think. Remember, a higher reported flow rate doesn't always lead to more efficient pumping. Since external gear pumps are susceptible to more pronounced and predictable wear than sliding vane pumps, Blackmer pumps will continue to perform long after the competition's offerings have lagged behind.

Ultimately, sliding vane pumps deliver improved performance over external gear pumps where it counts, while avoiding many of the issues that pop up as external gear pumps age and wear. Although the implied higher flow rates and lower price provided by competitor external gear pumps might seem like a good deal, the longevity and performance of Blackmer Sliding Vane Pumps will provide any truck-transport operation a better return on investment in the long run.

About the Author:

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