Run Times

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Self-priming centrifugal pumps play a unique role in centrifugal pump applications where positive suction head is not always available and it is desirable to have a 'plug and play' pump that that can lose and regain prime without operator intervention. In this issue we'll describe the self-priming pump, its operation, and limitations.

Dale B. Andrews

A positive displacement (PD) pump moves a constant volume of liquid or gas from inlet to outlet with each cycle of a rotor, piston or other motive device. The head developed by a PD pump is limited only by the mechanical design and the power available. Positive displacement pumps can start completely dry and evacuate gas from the suction line until absolute pressure acting on the liquid is able to push the liquid into the pump.

Centrifugal pumps are not capable of evacuating a suction line in a similar manner. The large clearances in a centrifugal pump allow gas to freely communicate between the inlet and outlet. This prevents the pump from lowering the inlet pressure sufficiently to allow the absolute suction pressure to push liquid into the pump inlet. Standard centrifugal pumps require either a positive suction pressure or an alternate means of priming, such as a small vacuum pump. Some installations attempt to avoid the need for priming by installing a foot valve to prevent liquid from draining out of the suction line when the pump is idle. Foot valves rarely work well due to their propensity to become hung open by debris within the sump. Self-priming pumps are a good alternative for a small pump application that requires priming, especially in an unsupervised environment such as a dewatering application.

Referring to figure 1 below. Self-priming centrifugal pumps utilize a self contained reservoir or external tank to furnish liquid that forms a seal between the pump inlet and outlet. During priming, the sealing liquid recirculates between the inlet and outlet. Gas on the suction side of the pump becomes entrained by the recirculating liquid and carried to the pump discharge where it is separated from the liquid. The liquid returns to the pump inlet and the gas is vented downstream or back to the suction vessel. As the cycle repeats, the pressure in the suction line is steadily lowered until upstream liquid is pushed into the impeller by absolute suction pressure. Once primed the pump operates as a normal centrifugal pump. If the pump should temporarily lose its prime, which is common for sump applications, it will just revert back to its priming mode until suction is once again established.

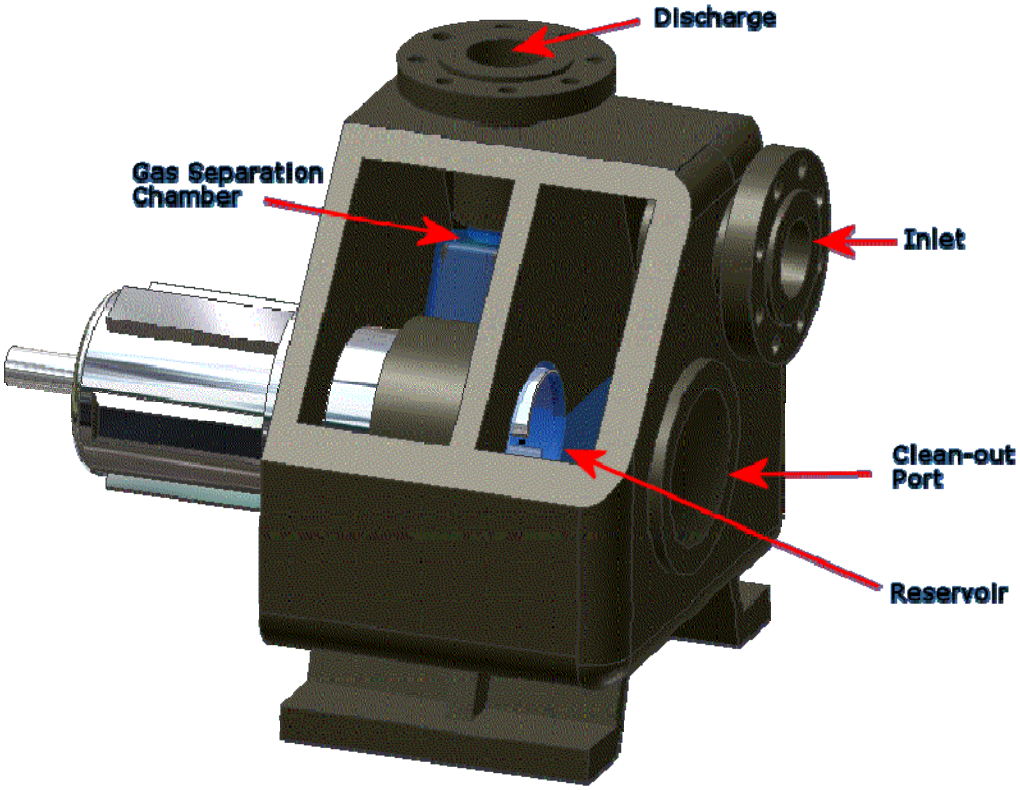

Fig. 1- Self Priming Pump

Self-priming pumps are found throughout industry, but are probably most prevalent in sump applications where the pump must also be able to deal with trash and other debris without clogging. Therefore many self-priming pumps are designed with access ports for ease of clean out and large impeller passages for passing solids.

The characteristics of a self-priming pump limit its performance range as compared to other centrifugal pump types. Self-priming pumps are generally capable of lifting liquids 6-8 m (20-25 ft). Pump size is generally limited to about 400 m^3/hr (1800 gpm) because of practical limitations for priming capacity. The maximum total dynamic head (TDH) is approximately 50 m. However, there are some multistage products available that substantially increase the (TDH) available.

Self-Priming pumps are not as efficient as regular centrifugal pumps because of losses that occur in the air separation chamber and as a result of the large solids handling capability. Also, because they retain a reservoir of liquid, they are often not considered for hazardous chemical applications. For compatible fluids within the available performance envelope however, self-priming pumps are often a good selection when positive suction pressure is not reliably available.