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from experience

Pump Up the Volume: Comparing the Efficiencies of AODD vs. Centrifugal Pumps

Many different types of pumps are capable of achieving similar liquid flow rates, but it's important to pick the right type of pump to optimize system conditions and efficiency. Two widely used types, centrifugal pumps and Air-Operated Double Diaphragm (AODD) pumps, each provide unique advantages.

An industry standard for pumping low viscosity liquids, centrifugal pumps require a constant flow and pressure for the pump to work correctly. In addition, particulates larger than the gap between impeller blades cannot pass through the pump. Alternatively, AODD pumps use diaphragms to open and close cavities which pull and push material in alternating pulses. The pre-determined cavity volumes mean that AODD pumps can meter material more accurately than centrifugal pumps. The inlet and outlet connections of these cavities can be modified to accommodate different-sized particulates. The required suction head for AODD pumps is typically lower than that of centrifugal pumps, allowing the pumps to be self-priming. Also, running AODD pumps dry is not as harmful to the pump as for centrifugal pumps.

Advantages	
Centrifugal Pumps	**AODD Pumps**
High flow rates	Lower required Net Positive Suction Head (NPSH)
High efficiency	Self-priming
	Can accommodate large particulates
	Pumping dry less harmful to pump
	Meter-pumped material
	Range of chemical-resistant Materials of Construction (MOCs)

It may seem like the AODD pump would always be a better choice, but one advantage of centrifugal pumps makes a big difference: efficiency. The energy it takes for compressed air to open and close the diaphragm is much greater than the amount of work provided by the pump. As a result, centrifugal pumps are more economical for high-volume applications, while AODD pumps are successfully operated for metering, and viscous, corrosive, or low-suction pressure pumping applications.

Consider this example of an AODD pump and a centrifugal pump performing the same amount of work: pumping water at a flow rate of 175 GPM with 60 psi head pressure. The AODD pump would need to be supplied with 160 SCFM of compressed air at 125 psi, which is equivalent to 40 HP of air compressor energy. However, a centrifugal pump can achieve the same flow with a 10 HP motor. At an average price of electricity per kWh of $0.12, this equates to $2,700 per 1,000 hours of operations in electricity cost savings. The difference in annual energy usage between these two pumps can be calculated using the formula:

$$E = \left(\frac{A}{4} - H\right) * 0.746\ kW/HP * t$$

Where...E = kWh/year, A = AODD pump air demand (SCFM), H = centrifugal pump motor horsepower, and t = hours/year run.

experience in brief

When considering the use of low pressure compressed air for any application, including pumps, other air-powered equipment, or air-broom sweeping, Hixson uses a rule of thumb of 1 HP of compressor energy required for every 4 SCFM of air demanded. This is useful for evaluating alternative sources for the air, such as electric blowers, vacuums, or the pump profiled in this article.

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