

How VFDs Minimize Electrical Operating Costs



Variable torque loads such as centrifugal pumps and fans, are the best candidates for energy saving VFD applications. Pumps and fans are often sized for worst-case conditions and usually operate at 10-50% of their rating. Traditionally, these motors are operated at full speed, and control valves or air dampers are utilized to control (or block) the extra output not required by the process.

Since power requirements for variable torque loads drop off by the cube of the speed decrease, a VFD can be used to decrease the motor speed so that only the needed energy is utilized. This results in significant savings whether you are considering a new installation or contemplating a system retrofit.

The U.S. Department of Energy reports that the average pumping system operates below 40% efficiency. The report also notes that 70% of pumping systems are oversized. If this is the case in your facility, you can reduce your energy bill. Consider a VFD that delivers 100hp to a 100hp centrifugal pump. When the pump is operated at 50% of full speed, the drive efficiency is 89.1%. At 1/2 of its rated speed the pump requires only 1/8th of its full load power ($1/2^3 = 1/8$). The power required by the pump is reduced from 100hp to 14hp ($1/8 \times 100hp/0.891$).

A typical pump application has a 100hp motor operating a centrifugal pump 24 hours a day, 365 days a year. This requires about \$27,500 worth of electricity a year, at \$0.04 per kilowatt/hour. If the control valve is replaced with a VFD, the pump requires only 14hp to operate the pump at half speed. This results in energy costs of only \$4,000 per year.

Additional advantages from the use of VFDs include efficiency gains of the overall system; improved motor power factor; elimination of emissions that come from overpressure; ease in ability to closely control the process; reduced wear on motor, fan, and pump bearings; extended life on pump seals; and overall system installation economy, given the new generation of VFDs.



For more information...

on VFDs go to: www.drivesmag.com and www.oit.doe.gov/bestpractices (do a word search for ASDs).

If you have comments or questions, please contact Doug Post at (800) 827-1662 x159 or e-mail him at doug.post@interstates.com.

ASD Efficiency (in Percent) as a Function of Percentage of Full Operating Speed

Variable Speed Drive hp Rating	Percent of Full Operating Speed			
	25%	50%	75%	100%
1	9.4%	44.2%	70.5%	82.5%
5	29.6%	74.7%	88.3%	92.4%
10	35.3%	79.0%	90.3%	93.5%
25	35.6%	79.4%	90.6%	93.8%
50	43.3%	83.5%	92.1%	94.4%
100	54.8%	89.1%	95.0%	96.6%
250	61.2%	91.3%	96.1%	97.3%

These values are provided by a VFD manufacturer. There is no widely accepted test protocol that allows for efficiency comparisons between different drive models or brands. An inverter can be set up many ways and that can affect operating efficiency.

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