SOLUTIONS FOR BUSINESS

Accelerate Savings with Variable-Speed Drives

What you need to know about motor control and its impact on your operations

Motor-driven systems make up nearly half of the electricity in commercial and industrial facilities. Variable-speed drives (VSDs) can reduce motor electricity usage by 25 to 85%, depending on the application. VSDs minimize wear and tear on motors, reduce maintenance costs and extend equipment life. **Rebates (anywhere from $30 to $70 per hp) are available** to implement VSDs on pumps, fans, blowers and compressors. Learn how VSDs work and how you can make the most of them below.

Why VSDs Matter

Conventional motors operate most efficiently at a single speed. In many pump and fan applications, flow is regulated by mechanical dampening, throttling or bypass loops. This wastes considerable energy and can increase wear and tear on the equipment. VSDs adjust motor speed to match demand with greater efficiency. They provide energy savings, high power factor, improved speed control and soft-start capabilities. When powered by direct current (DC), a VSD motor is referred to as an electronically commutated (EC) motor.

Quick Tips
Get the most from your VSD

- Size a VSD based on amperage rating of motor (not hp)
- Replace mechanical dampening, throttling or bypass loops with VSDs
- Keep VSDs clean, cool, dry and tight
- Add grounding brushes to the motor shaft when necessary to prevent bearing damage
- Implement inverter-rated motors, if possible
- Consider EC motors for HVAC fans
- Use only one VSD motor as a trim unit with multiple compressors

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The Best Applications for VSDs

- Mechanical dampening, throttling or bypass loops used to decrease flow rate waste considerable energy. Replace with a VSD.

- Multiple-speed applications produce the most savings. For oversized motors running at a continuous slower speed, it is more cost effective to use a gear reducer, to replace the motor with a smaller unit or to trim impellers.

- Equipment that is easy to get moving, but more difficult to operate at fast speeds (variable torque loads) are the best applications.

- Motors that are heavily loaded (constant torque) at startup provide significantly less VSD energy savings than variable torque applications. Examples include conveyor belts, machine tools and rotary/screw compressors.

- Shaded-pole (SP) and permanent split-capacitor (PSC) fan motors are very inefficient. Replace with EC motors.

Operating a VSD: Quick Tips

Proper application and operation will ensure maximum energy savings.

- **Limit start-up power draw:** Conventional motor inrush current is five to 10 times the normal operating power. A VSD automatically draws only 10 to 15% more than rated power during startup.

- **Maintain your VSD:** Use a NEMA 12 enclosure to keep VSDs dry. Keep cable connections tight. Check by tugging (offline) or using an infrared camera to detect hot spots.

- **Use inverter-rated motors:** On standard wound motors, the VSD high-frequency pulses can degrade insulation and windings can overheat at slow speeds.

- **Anticipate power quality issues:** Apply harmonic protection like filters or multi-pulse drives. Keep lead lengths short to avoid reflected wave voltage spikes.

- **Add grounding brushes to the motor shaft:** On rare occasions, VSD voltage pulses produce stray high-frequency currents that can pass through motor bearings, causing arcing, sparking and pitting. This can result in bearing and motor failure.

Operating Costs

When determining VSD savings, power draw is proportional to the cube of speed (rpm).

$$HP \approx rpm^3$$
$$HP_\% = HP_{100\%} \times (\text{reduced } \%)^3$$

For example, at a reduced speed of 50%, the power draw would be roughly 13% of rated (100%) power draw.

$$HP_{50} = HP_{100} \times (0.5)^3$$
$$= HP_{100} \times 0.13$$

Example Calculation

Think about a 50 hp (41.4 kW) pump motor operating at reduced speeds (but equivalent flow) compared to a motor running at full load for 16 hours per day. If the VSD motor operated at three lower speed levels running more total hours (23 vs. 16), it would still reduce energy consumption by half.

50 HP Motor Full Load vs. VSD					
Speed	Power	kW	VSD Run Hours	Eqv. Hours*	kWh
100%	103%	43.5	2	2.1	87
75%	42%	17.4	8	6.0	139
67%	30%	12.4	8	5.3	99
50%	13%	5.4	5	2.5	27
		Totals	23	16	(352)

Full load energy = 41.4 kW x 16 hrs = 662 kWh

VSD energy = (352) kWh (@ 23 hrs)

Savings = 310 kWh per day

At an electric rate of $0.06/kWh and operating 260 days per year (5-day workweek), the VSD would save $4,836 annually

VSD savings = 310 kWh/day x 260 days/year x $0.06/kWh = $4,836

* Equivalent full load run hours = (2 hrs x 1.0 speed) + (8 x 0.75) + (8 x 0.67) + (5 x 0.5) = 16 hrs full-load equivalent

Start saving today.

For more ideas and to learn what rebates are available, call the Solutions for Business team at (866) 277-5605, email us at aps.solutionsforbusiness@dnvgl.com or visit aps.com/businessrebates.

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