

Optimize your dairy farm's vacuum system with variable-speed motors

FACT SHEET

A dairy farm's vacuum system typically accounts for about 20 percent of the operation's total electricity use. Wisconsin dairy farmers can reduce this electricity consumption by up to 50 percent simply by replacing their conventional vacuum regulator system with a variable-speed vacuum pump. In addition to saving energy, a variable-speed drive improves vacuum regulation and extends the life of the pump while reducing pump noise.

VARIABLE SPEEDS, SWIFT SAVINGS

The vacuum systems used for milking dairy cows rely on air pumps to continuously remove air from the milking system to reduce the vacuum pressure. A conventional vacuum system runs the vacuum pump motor at a constant speed while admitting air through the vacuum regulator to maintain a constant vacuum pressure as operational loads shift.

By contrast, a variable-speed pump regulates the system's vacuum level by adjusting the motor speed and pumping rate instead of admitting air to reduce vacuum. The ability of the variable-speed motor to match the system's needs instead of running full-speed all the time not only saves electricity, but also reduces vacuum pump noise and wear.

Producers can purchase variable-speed pumps or retrofit existing pumps with variable-speed controllers, often called variable-speed drives



(VSDs) or variable-frequency drives (VFDs). Pump manufacturers recommend that variable-speed drives be used on blower and lobe-type vacuum pumps and most manufacturers support variable-frequency drives for use with rotary-vane pumps.

A vacuum-pump system controlled by a variable-speed drive is comprised of three main parts: a vacuum pump with a three-phase electric motor, a variable-speed drive unit, and a pressure transducer.

- **The motor** converts electricity into mechanical power and motion.
- **The variable-speed drive** modifies the voltage and frequency of the electricity delivered to the motor, regulating the motor speed based on the pressure transducer reading to maintain a constant vacuum level. The variable-frequency unit will also include a phase inverter for single phase to three phase electricity if necessary.
- **The pressure transducer** converts air pressure into an electrical signal used by the variable-speed drive to control the motor speed.

For more information,
call **800.762.7077** or
visit focusonenergy.com.

DEBUNKING A MYTH

A common myth—that VFDs cause stray voltage—sometimes deters farmers from installing variable-frequency drives on vacuum pumps. However, the myth is just that. The most recent research from several Midwestern universities, state agriculture departments, and the USDA demonstrates that properly installed systems **do not** cause stray voltage. For more information, call Focus on Energy at 800.762.7077.

TABLE 1					
Daily Run-time (hours)	Number of Milking Units (Vacuum Pump hp)				
	5 (5 hp)	13 (7.5 hp)	21 (10 hp)	38 (15 hp)	55 (20 hp) with three-phase motor
2	\$170	\$230	\$280	\$390	\$400
3	\$240	\$350	\$450	\$650	\$730
4	\$300	\$460	\$610	\$920	\$1,050
5	\$360	\$580	\$780	\$1,190	\$1,370
7	\$490	\$820	\$1,110	\$1,720	\$2,020
9	\$610	\$1,060	\$1,450	\$2,250	\$2,660
10	\$670	\$1,170	\$1,610	\$2,520	\$2,980
12	\$800	\$1,410	\$1,940	\$3,050	\$3,630
24	\$1,550	\$2,830	\$3,940	\$6,260	\$7,490

Table 1 illustrates the cost savings that can be achieved with a variable-speed drive, assuming 10 cfm/hp production and a vacuum demand of 35 cfm baseload plus 3 cfm/milk unit. Cost savings at \$0.10/kWh.

Focus recommends that farmers consider several factors when selecting and installing variable-speed vacuum pumps:

- Ensure the vacuum pump is sized properly. If a unit is either oversized or undersized, it will neither perform well nor produce the expected energy savings.
- Locate the variable-speed drive as close to the vacuum pump as possible. Electromagnetic emissions can be reduced when the variable-speed drive is placed within 10 feet.
- Make sure the minimum speed setting of the variable-speed drive is matched to your system's needs. Operating the vacuum system below the manufacturer's recommended minimum speed may reduce the lifespan of the equipment.
- Be sure your equipment dealer follows all manufacturer-recommended installation procedures and conforms to all electrical codes.
- Contact multiple vendors when acquiring bids or estimates. Implementation costs can vary considerably between installers and installing methodologies.

NON-ENERGY BENEFITS OF VARIABLE-SPEED VACUUM PUMPS

Producers who install variable-speed vacuum pumps can reap many important benefits in addition to energy savings and lower operating costs:

- **Improved vacuum regulation.** The variable-speed drive controller can be adjusted to provide improved vacuum regulation that results in more constant pressure.
- **Lower noise levels.** Because vacuum pumps need not operate at full load all the time, a variable-speed drive helps reduce noise that may affect workers and neighbors.
- **Longer equipment life.** Using a variable-speed controller slows the average speed of the pump to less than half of its full speed. Less wear means lower maintenance costs and longer life for the motor and vacuum pump.
- **Environmental benefits.** Because variable-speed drives consume less electricity, they help to reduce emissions from coal-burning power plants. Also, unlike rotary-vane pumps, blower pumps do not require constant lubrication at the pump cavity, reducing air and soil contamination from oil aerosols.

START SAVING TODAY WITH VARIABLE-SPEED VACUUM PUMPS

Looking to save energy and money at your dairy-farm operation? Focus on Energy's agricultural energy advisors can help you learn more about the economic and environmental benefits of variable-speed vacuum pumps. Call **800.762.7077** for more information or assistance, or visit our Web site at **focusonenergy.com**.