



Energy Conservation in Agriculture

Variable Speed Milk Pumps

Scott Sanford

Variable speed (VS) milk pumps increase energy efficiency by slowing the flow rate of the milk passing through the pre cooler. The slower rate increases the water-to-milk ratio, resulting in greater cooling of the milk. A typical VS milk pump installation can cool milk by an additional 15°F to 20°F, but this varies by installation.

VS milk pumps are useful on farms where water flow rates cannot be increased to an acceptable cooling level because of high capacity milk pumps, as well as on farms with low water system flow rates. A pre cooler

on a typical Wisconsin farm without a variable speed milk pump will only have a 0.5:1 water-to-milk flow ratio. A VS milk pump with the same pre cooler could change the water-to-milk ratio to 1.0 to 1.5:1 or higher.

A variable speed milk pump consists of a variable frequency drive, a probe assembly to sense the level of milk or wash solution in the receiver and a milk pump with a 3-phase motor (figure 1). Some manufacturers offer other options and features but these are the minimum. The VS milk pump controller (figure 2) varies the milk pump motor speed between a minimum and maximum speed while trying to maintain the milk level in the receiver jar between high and low level probes or floats. The VS controller replaces the conventional on/off liquid level controller.

Figure 1. Variable speed milk pump



Figure 2. Milk pump control



A variable speed drive is a very useful tool but you might achieve the same results for less money in other ways. If you are considering a variable speed milk pump, weigh the options of:

- 1) purchasing a larger capacity pre-cooler,
- 2) adding additional plates to an existing pre-cooler,
- 3) upgrading the water supply plumbing,
- 4) installing a water reservoir and pump; or
- 5) installing a simple orifice in the milk discharge line. If an orifice plate is used, it must allow milk to be pumped fast enough to avoid flooding the receiver jar and should be removed during system washing.

Variable speed drives are electronic components that are subject to damage from voltage spikes produced by lightning. They also emit RF (radio frequency) noise that can affect computer communications from milk meters and detachers and radio reception. Proper installation will minimize the amount of RF noise and interference. Filters can be installed to reduce the RF noise interference when necessary. RF noise is not stray voltage and does not pose any threat to a cow's health or production level.

You can estimate the average milk flow rate with a pre-cooler as follows:

$$\text{Average Flow Rate} = 2.0 \times (\text{Total Milk Produced Per Day} \div \text{Total Milking Time Per Day})$$

A properly adjusted variable speed milk pump will run continuously for long periods of time during milking.

Many VS controllers have a "Milk" and "Wash" mode. In the "Milk" mode, the VS controller attempts to operate the pump at the lowest possible speed. In the "Wash" mode the controller ramps the motor to full speed anytime there is a signal from the probe assembly in the receiver jar.

If the variable speed (VS) controller should fail, the motor will not operate properly (if at all), which could hamper the ability to continue milking operations. To provide a backup, some manufacturers include a standard liquid level control mounted in the VS controller enclosure so if the VS controller fails, one switch can be thrown and milking can continue with high/low level control of the milk pump.

For more information

Information on different technologies and energy conservation opportunities are contained in the *Energy Conservation in Agriculture* publication series, available from Cooperative Extension publications at <http://cecommerce.uwex.edu>.

The logo for the University of Wisconsin Extension, featuring the letters "UW" in a small font above the word "Extension" in a large, bold, italicized sans-serif font.

Author: Scott Sanford is a senior outreach specialist with the Department of Biological Systems Engineering at the University of Wisconsin–Madison.

©2003 by the Board of Regents of the University of Wisconsin System. Send inquiries about copyright permission to Cooperative Extension Publishing Operations, 103 Extension Building, 432 N. Lake St., Madison, WI 53706 or call 608-262-2655.

This publication was funded in part by the *Wisconsin Focus on Energy* program.

University of Wisconsin–Extension provides equal opportunities in employment and programming, including Title IX and ADA requirements.

To order multiple copies of this publication, call toll free: 1-877-WIS-PUBS (947-7827).

To see more Cooperative Extension publications, visit our web site: <http://cecommerce.uwex.edu>

Energy Conservation in Agriculture: Variable Speed Milk Pumps (A3784-7)

I-02/2004