Energy Savings & Optimised Control with VFD Systems

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iDayliff Remote Monitoring & Control

In a traditional pump booster system one or more pumps are operated at all times based on a preset pressure value that is selected to meet the peak water demand. However, in most applications the pressure and flow requirements will vary depending on time of day or operating process. At times therefore the pumps may cycle on and off to meet low demands or when there are leaks in the system. Cycling creates an abrupt current surge eachtime the pump starts, subjecting the motor to intermittent current loads that can be up to ten times the full-load currentand that could damage the pump motor. The frequent on-off operation will also lead to pressure surges in pipe work and associated water-hammer problems. This results in high energy costs and reduced equipment life.

Using Variable Frequency Drives (VFDs) in pump booster systems offers many advantages over traditional methods of constant pressure control. As well as addressing the challenges of pump cycling, current surges and water hammer, they offer more accurate pressure control, increased pump and motor life and also reduce energy costs.

How do they work?

A VFD is an electronic controller that adjusts the speed of an electric motor by changing the frequency of the power being delivered. VFD controlled pump booster systems maintain a constant pressure in the system by taking a 4-20 mA signal from a pressure transducer installed on the delivery pipe and adjusting the pump motor speed accordingly.

The typical operation of a VFD pump booster system is as follows; when there is demand for water, eg when a tap is opened, the pressure in the pipeline gradually drops.

When the feedback from the system's pressure transducer shows that the pressure has dropped to just below a presetpressure point, the controller starts the first pump. The variable speed controller will speed up this pump until the pressure has been restored to its original set point.

If the variable speed controller speeds the pump up to its maximumrated output and the flow rate is still insufficient to meet demand, the pressure will again begin to drop. A second pump unit will then be started and the speed of the first pump will be adjusted to maintain the required pressure in the system. If there is still further demand for water, the speed of both pumps will be increased towards their full operating speed and a third pump started up as necessary. This can be further applied to systems with four or more pumps.

Benefits of VFD Systems

By adjusting the pump motor speed to meet demand, the VFD system ensures that pumps only draw as much power as is needed to meet existing demand thus keeping them operating at close to their maximum efficiency. It is estimated that by reducing the motor speed by 50%, power consumption can be reduced by as much as 88%.

Some of the other benefits of using VFD systems include:

More even distribution & control of system pressure (typically within 1 PSI) throughout the pipe network.
Elimination of water hammer reducing stress on pipe work and pipe fittings.
Soft start and stop operation eliminates cycling and the effect of start current surges on the motor and electrical supply system.
Elimination of pressure switches and motor contactors from the control system.
Reduced maintenance costs as pump sizes will be smaller.

Increased redundancy.

Instead of using a pressure transducer as the controlling signal for VFD systems, other sensors such as temperature or flow sensors can be used so that the speed of the pump increases or decreases to maintain constant fluid temperatures or flow rates.

VFDs offer many advantages over the traditional methods of pressure control in a distribution network. They provide precise pressure control, reduce water leakage, increase pump life and result in significant energy savings.

Davis &Shirtliff is the leading supplier of water pumping equipment in East Africa. The company has developed a range of packaged Dayliff VFD pumping systems that have become quite popular in the market and many companies using these systems have been able to able to achieve significant cost savings through reduced power consumption.

Davis &Shirtliff can help clients select and design the appropriate VFD pumping system that will guarantee trouble-free operation and enable them to reap the maximum benefits of the VFD technology.