Picking The Right Pump, The Hard Way

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Several years ago, a pump application was brought to our attention. A golf course community wanted to adorn its entrance with a waterfall. Rocks were arranged to form a wall about 12 ft. high, so that the water could flow over and spill down into a collection pond for recirculation.

The committee in charge of this project, wanting to save money on the equipment and installation, elected to use a quantity of six swimming pool pumps that could be purchased at the local pool supply. Also, because 115 volt power was all that was readily available, the 2HP, 3450 RPM pumps were provided with single-phase motors.

When the job was completed and the pumps turned on, it was discovered that not enough flow was provided by the six pumps and therefore the desired waterfall effect was not achieved.

So what’s wrong with the committee’s original equipment selection and what can be done to solve the problem of providing more flow? In reviewing the specs for the installed pumps, the total flow for all six pumps combined was about 350 GPM at 60 ft of head (about 25 PSI). We then checked the cost of operation for the six pumps and calculated an annual operating cost of $10,000 when run continuously. Yes, the committee had saved money by purchasing fairly inexpensive swimming pool pumps, but all of the savings were being wasted in operating costs. Also, much of the power was being wasted because the pumps provided far more pressure than what was required to lift the water up the required 12 ft. And finally, the use of single-phase motors required 75 percent more power than what could be achieved with three-phase power.

The solution we offered was to use a single larger pump operating at a lower speed. Affinity Laws say that when you reduce a pump's operating speed by half you also reduce the flow by half, but you also reduce the output pressure to one-forth and the required horsepower to one-eighth of its full speed value. For this particular application — since a high output pressure was not required — we were able to increase their total flow rate at a lower total horsepower requirement. Our offering was for a single, heavy duty 6x4 pump operating at 1170 RPM, which provides close to 600 GPM with a 7.5 HP motor. Their initial configuration provided 350 GPM, with a total horsepower requirement of 12 HP.

Yes, this single pump had an initial cost almost four times that of the six swimming pool pumps. But operating costs for this pump were calculated at less than 40 percent of the cost to operate the swimming pool pumps. This provided an return on investment of less than two years.

And there are added benefits to be gained by operating at reduced speed. Reduced operating speed translates into less bearing wear and longer motor life. Also, longer pump seal life is achieved while the damaging effects of abrasives in the recirculated water are reduced. And finally, less wear and longer life means a reduction in maintenance costs and system downtime.

What lessons can be taken from this pump example to the plant floor?

First of all, it's important to accurately estimate and specify the head and flow requirements for any given application. Why pay for added pressure that isn't required? Naturally, it's important to provide the required flow to achieve a desired result, and the parameters may not be easy to calculate, but the added time paid at the beginning of a project will yield dividends in the end.

Secondly, saving money on the initial purchase of pumping equipment does not necessarily save money on the total cost of a project. Consideration must be given to continuous versus intermittent service, proper selection of materials of construction for a given job, and the expected service life of the pump. A pump that breaks down and has to be replaced in two to three years is certainly no bargain.

And finally, pump operating costs are almost always greater than the cost to initially procure the equipment. Whether it's the cost of electricity, maintenance and repair costs, or costs related to downtime and loss of use, buyers need to carefully analyze all variables when specifying and selecting pumping equipment for a given application. And the proper pump operating speed is one tool that can be utilized to reduce operating costs. Today many applications, especially for larger pumps, specify the use of variable speed motors. This allows the user to "dial in" exactly the performance required for a given job while at the same time not using any more power than is necessary. Not all applications require variable speed motors, but selection of the proper pump operating speed can maximize operating efficiency. Today and into the future energy efficiency and conservation will be of ever increasing importance.

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