Ask Al

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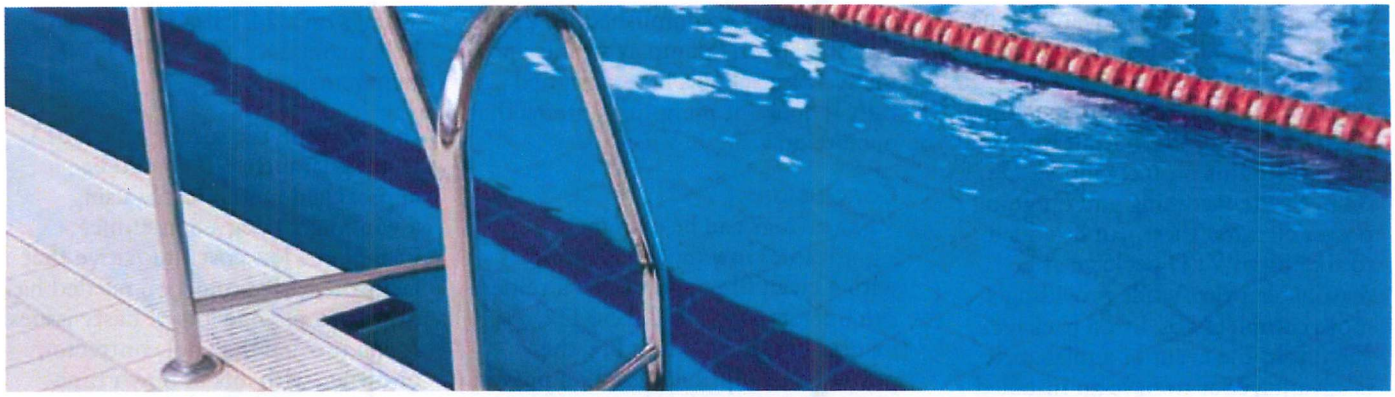

Welcome back to our "Ask the Expert" feature that is designed to assist you with any and all issues related to swimming pool water, mechanical equipment, space conditioning and code compliance. Ask us a question and we will answer to the best of our ability.

Q: What are the limitations and opportunities of swim school VFD pumping applications?

A: Over the past few years there has been a lot of growth in the use of Variable Frequency Drives (VFD's) on both residential and commercial swim school applications. VFD's have been a popular staple in municipal water and wastewater pumping systems, along with (Heating and Cooling) HVAC applications for many years. They were a bit slow gaining acceptance into the pool industry.

There has also been a lot of confusion and misinformation regarding savings and application options. We are going to try to shed some light on this in order to help clear up any lingering questions.

Basics:

An over-simplification of the technology is that VFD's are electrical devices that convert AC voltage to DC, then back to a controlled AC signal. During this process they take direct control of the Hertz (Hz or speed) that the motor operates at (out of a possible 60 Hz).

Limitations:

This process requires a 3-phase motor in order to work and some sites only have single-phase power.

Options:

In order to operate a 3-phase pump, the VFD system can convert single-phase power to 3-phase power when given proper sizing.

Residential Swim School Applications:

Many residential service companies have utilized a traditional "VFD mounted directly on a pump" package. These are marketed by the major pump manufacturers and they have a sleek, sexy appearance. Under the hood, they utilize a 3-phase motor to allow the VFD to operate as needed. They have simple push button controls and tie seamlessly into residential pool automation systems.

Limitations:

These are available only in limited sizes, normally 2 to 3 HP max. Companies have complained that they have had significant service issues due to the quality of motors, location of VFD device, heat and vibration effect on VFD, etc. Many say that the mounting configuration, while convenient, makes the units difficult to service.

Options:

There are alternatives to VFD-on-pump packages which include an industrial grade wall-mounted VFD that hooks onto any 3-phase pump. These are a similar price to VFD-on-pump models. They offer advanced features like Modbus internet-ready communications, 4-20mA control circuit connections to flow meters and chemical controllers, along with monitoring and documentation of electrical supply power mishaps.

Commercial Applications:

Many commercial operators have complained of limited success with "VFD-only" applications, including premature failure of the VFD's AND the pumps. At the same time, some other companies have experienced great success with many hundreds of highly successful "VFD-package" installations. What is the difference? One big difference has been the "completeness" of the commercial VFD package. Historically, "VFD-only" installations cost less but they also offer less protection.

Limitations:

While the "VFD-only" configuration offers a bit of inherent power conditioning, it has NOT proven to be robust enough to protect the VFD or the motor in an alarming number of (dirty) pump room power systems. This leads to failures. Also, connection of starters, interlocks, line reactors, etc. call for in-field design of both high and low voltage circuits and *(field) UL* approval in many municipalities.

Options:

Once you get to larger and more

expensive pumps, it is advantageous to add more pump protection features to the VFD package. These have included phase protection, incoming power conditioning, output isolation relays, etc. This protects the VFD's on both the incoming and outgoing power circuits. These can be added to the initial VFD package at a reasonable price, while providing a more complete UL-listed package. Finally, in the event of a mishap, it is advantageous to have an installed "bypass loop" to allow direct operation through an integral starter at the flip of a button. If not so equipped, it would be necessary to have an electrician rewire the pump directly in the event of any VFD issue. This means that the pool would be "down" until that was accomplished. A VFD can operate one pump at a time, and many swim schools have designed fully redundant pumping systems that operate on a single VFD.

Conclusion:

VFD savings can be extremely significant. How much? A pump with a clean filter and basket strainer can operate as low as 40-50 Hz, instead of 60 Hz. At 40 Hz, the power consumption (based on proven affinity laws) would be around 29% of normal power. Yikes!

Advanced packages, via chemistry control systems, provide reliable and direct control of pool GPM (through the VFD) for even more dramatic savings on a 24/7 basis. They also help maintain EXACT DOH flow requirements.

In any event, the success of a VFD is not guaranteed. It should be approached methodically, using a winning strategy. Sometimes installing a low cost alternative that lacks the basic protection needed has proven to provide lots of nasty issues. It can provide the pool contractor, or owner, with lots of down time and plenty of egg on their face. Conversely, providing a well-designed package can provide huge savings and smooth sailing.

Best Regards,

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Please feel free to forward your questions & comments through the USSSA office, or directly to me via email at **amendoza@ceswaterquality.com**