By Jim Garrett and Richard Medairos

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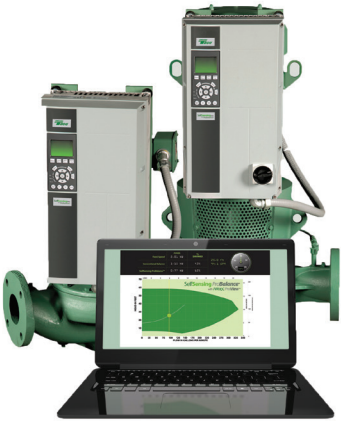
OPTIMIZING SYSTEM PERFORMANCE

Just a few years ago, if you were to engage a hydronics system designer in conversation about optimal system performance the discussion would easily veer toward type and efficiency of chiller or boiler equipment, the building envelope, system design or key components. Today this detour to single parts of the system isn't as likely because, by design, all parts of the system interact, combining as one.

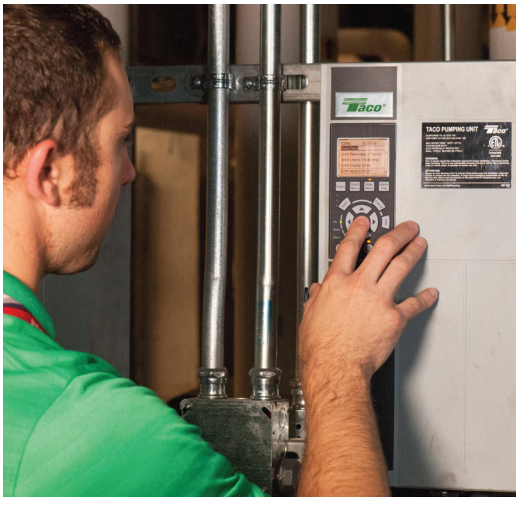
Technology has continued to avail new possibilities, allowing hydronics to advance because the art and mechanics of water flow now often plays an integral role in the operation of contemporary building systems. That's especially true for any system design that seeks to achieve optimal comfort combined with energy efficiency.



Systems integration is something we've worked toward in our industry for decades and the newest dimension for commercial hydronic system performance is the merging of all system equipment, components and terminal units, the piped network, highly efficient reactive pumps, and building automation systems with predictive controls based on current and future indoor and outdoor conditions.

One of the latest advancements has been the expanding reach of sensorless and ECM pumps. These pumps, which do not need external sensors, are making it possible to provide the pumping power for large heating and cooling systems with amazing efficiency.

With sensorless pumping, there is no need of holes in pipes for tubes or taps to connect remote differential sensors together with the pump. Also, self-sensing pump system design can offer the advantages of greater accuracy for variable flow, higher energy efficiency, lower installation costs, and improved system stability.



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Versatility and Control

Most commercial systems operate by tracking and controlling pressure differential, or Delta P (ΔP), although larger systems may track both temperature differential, Delta T (ΔT) and ΔP.

"A key benefit is that, if we can control the differential temperature, we can make the primary heating and cooling equipment more energy efficient," explains Mike Miller, director of sales of Engineered Products and Systems with Taco Canada. "For instance, a chilled water system may operate most efficiently at a Delta T of 12°F. If that system is controlled in the Delta T mode, optimal performance is relatively easy to dial in.

"Some systems or terminal devices may not operate as effectively with the higher Delta T because of their design limitations or the types of control valves used," continues Miller. "That's where varying flow – by operating with in a Delta P mode – may improve overall system performance.

"The challenge when retrofitting equipment instead of designing systems from scratch is that not all current systems were built to operate in a Delta T mode, so it's best to have pumps and controls that can respond to either method of operation: Delta T or Delta P," he adds. "The more versatile the system components, the greater the range of control system designers have; and the greater the level of operational efficiency."

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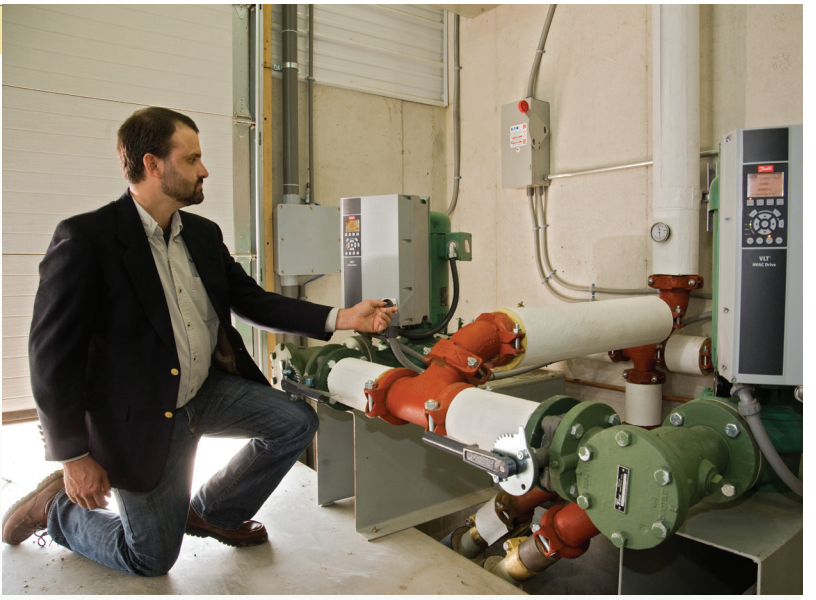
BOLDLY Go



To make the primary equipment more efficient, we need to control the Delta T and also to match capacity with the load. That's where variable speed pumping makes its greatest contribution.

When there's equilibrium between a system's capacity, load and optimal ΔT, maximum efficiency is attained.

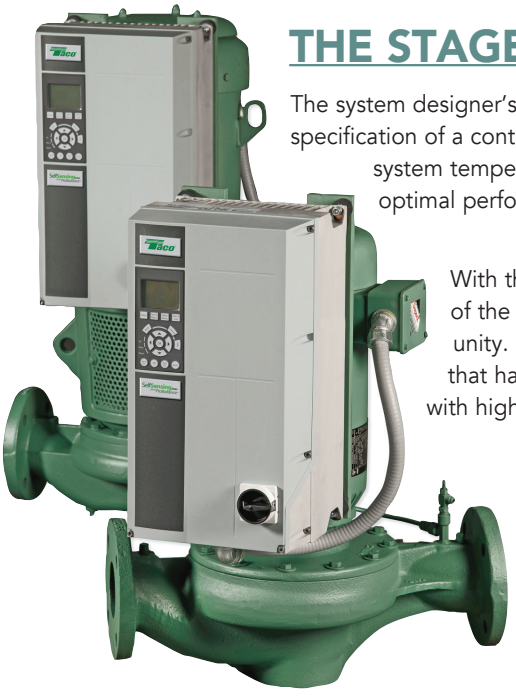
Boldly going into a new and exciting operational realm is now the Holy Grail for system designers. After all, highly efficient equipment and individual components, if not matched and backed up through optimal system design invariably contribute at less than peak performance.

A key driver is the rapidly growing use of variable speed pumps in the hydronics industry. These bring substantial benefits.

For example, if the load varies there's a corresponding reduction in pump speed. With a drop in pump speed, there's a significant reduction in pump power. At half speed only 1/8 of the full horsepower is required. By reducing speed to a third, power is reduced to 1/27th.

In addition, with variable speed, power is gradually increased. This soft-start is beneficial to the motor, pump and system components.

So, by reducing pump speed to match the load, energy is saved and equipment longevity is greatly improved.



THE STAGE IS SET

The system designer's next interest might well be the specification of a control system that ensures the right system temperatures and flow rates to maintain optimal performance under all conditions.

With the right BAS in place, all facets of the system are designed to work in unity. Designing with terminal devices that have sufficient surface areas to work with high Delta Ts translates to healthy advantages back at the central plant. Matching the variation in system loads is an issue of maintaining proper flow, and there's no better, more fitting challenge for modern pumps and BAS controls.

Advanced building automation systems combine management of all system operations, as well as diagnostics with predictive controls based on current and future indoor and outdoor conditions. Also in the mix are automatic alarming, trending capability – even predictive maintenance scheduling.

A key advantage is the installer's ability to see all facets of system performance, and if adjustments are needed, they then have the ability to easily balance pump curves to precisely fit system resistance. This greatly reduces system balancing and commissioning time while moving that capability to the installer, instead of an expensive add-on control or commissioning agent.

For instance, in a chilled beam system it's common to monitor supply air temperature separate from the air handling unit's dedicated controller. The key advantage is that this gives system operators predictive control of relative humidity beyond the terminal units, allowing faster reaction to changes to provide more stable and comfortable indoor space conditions.

Having to wait for a thermostat to tell you that there's a comfort issue in a room, or rooms, is simply too late.