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Kellogg Creek WWTP Installs Vaughan Rotamix System

Early last year PumpTech received an inquiry from the Clackamas county, Kellogg Creek WWTP about a Vaughan Rotamix system. They had installed one in their Tri Cities digester several years ago and because of its success they were considering one for their digester at Kellogg Creek. Bryan Dierick of Vaughan began working on the project in April and submitted a detailed system design to Brown & Caldwell last summer. The project was a put on a fast track because the county knew that the Rotamix system was the one that would provide the results they needed. Installation is almost complete and the system will be in operation by mid February.

The Vaughan Rotamix system is a hydraulic mixing technology that uses

high velocity nozzles that are spaced strategically in the bottom of the digester. This design provides more even mixing than air based mixers. The dual nozzle assembly is shown in the photo on the right. The nozzles are fed by a Vaughan chopper pump which is designed to eliminate nozzle clogging and also optimizes surface contact of the solids in the digester.



The staff at the Kellogg Creek plant expected intermittent foam formation on the digester surface due to the influent make up and their previous

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Hydronix 421 Lift Stations Selected for Filer & Buhl Projects

Ed Smith, Moses Lake

A couple of years ago Pumptech was selected to supply packaged lift stations for two projects for the cities of Filer and Buhl in Southern Idaho. Both projects included new wastewater treatment plant facilities and new influent lift stations.



Pumptech worked closely with JUB Engineers during the design phase and provided them with detailed specifications and drawings on our Hydronix 421, UL listed submersible lift stations. In the end, we were successful in convincing JUB to utilize our pre-packaged design. The picture on the left shows the Filer station after installation.

Each lift station required a 12 foot diameter wet well and three pumps in order to meet current and future build out capacities. A separate 10 foot diameter valve vault was also required because of shipping limitations. Wet

[Filer / Buhl](#) continues on [Page 3](#)



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City of St. Helens WWTP Saves \$58,000.00 Annually with SolarBee Mixers

Joe Evans, PumpTech Canby

Although there are over twenty SolarBee installations in the Pacific Northwest, none illustrate the potential power savings better than St. Helens, Oregon.

The city of St. Helens and Boise Paper Company share the local wastewater treatment plant and they work together to meet mutual goals. Their primary goal is to operate the plant as effectively and cost efficiently as possible. One of their largest expenses was circulation of their 40 acre secondary treatment lagoon. It required 24 mechanical, surface aerators that ranged from 50 to 150 hp (2100 hp/day). In 2010 Boise shut down its pulp processing operation and began operation solely as a paper mill. As a result, flow from the mill was reduced from 35 million gallons per day to about 5 million and BOD was reduced from about 55,000 pounds per day to 1500 pounds. These reductions also reduced the aeration required to about 550 hp/day.

When the mill reduced its loading on the treatment plant, the focus changed from aerator maintenance to reducing the power required to run them. Boise Paper was already working on energy reduction projects and began to focus on the treatment plant. Aeration had been reduced down to a point where mixing was the limiting factor. It appeared that lowering the cost of mixing could be the best approach.

Boise and Columbia River PUD asked Cascade Energy Engineering (a BPA ESI program partner) to conduct a study and consider energy saving solutions for the plant. It studied seven months of operational data from the plant's SCADA system as well as input from plant personnel. Based upon the study, three options were considered. 1) Reduce the aerator propeller blade pitch. This would reduce aeration power but it would also reduce mixing. 2) Replace some of the existing surface aerators with aspirating

aerators. This would provide adequate aeration but only localized mixing due to the small impellers. 3) Replace a portion of the existing aerators with solar powered mixers. This would reduce the run time of the existing aerators while improving mixing.

Data from the study showed that lowering the pitch would reduce power consumption by 119,553 kW/yr, using aspirating aerators would save 91,747 kW/yr and solar powered mixers would reduce consumption by 1,375,518 kW/yr. This translated into energy cost savings of 5 k\$/yr, 3.8 k\$/yr and 58 k\$/yr.

Option one was the lowest cost and offered a 0.8 year payback after incentives from Columbia River PUD and BPA. Option 2 was much more costly and because of the low energy cost savings, payback after incentives was 43 years. Option 3 was the most expensive but higher incentives due to the very high energy savings provided a payback of just two years.

The final decision was to install seven SolarBee mixers designed to handle 12 MGD of influent and an average sludge depth of 6.5 to 13 feet. The SolarBee mixers provide long range mixing and are spaced at approximately four acres. Each can displace between 30 and 60 hp of aeration. The actual hp dropped from 550 hp/day to approximately 250 hp/day. They expect to save even more in the future by turning off the aerators for even longer periods. The pictures at the bottom show several of the mixers at different locations in the lagoon.

With the wastewater treatment plant now redesigned for cost efficient operation, St. Helens is poised for industrial growth and their economic development association is actively seeking new industry. The partnership has paid off for the residents, the city and the mill by enhancing the community's potential for future economic growth.



Filer - Buhl continues

wells 10 feet in diameter and smaller usually include our integral valve vault. The picture below shows one of the stations after loading in Canby. Each station



included triplex ABS pumps and all associated guide rail components, piping, valves and fittings. The control panels for both stations were also supplied as engineered by AEI Engineers and built by L2 Sytems.

Both treatment plants went online in late 2011 and startup on our Hydronix 421 Lift stations was

successfully completed within the time frame required. A year later both stations are operating flawlessly. The photo below shows the Buhl station after



installation was completed.

These two projects show the full capabilities of PumpTech in providing engineering, design and manufacturing to meet specific project demands and requirements.

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Kellogg Creek Rotamix Continues

experience with the Tri Cities unit which was a similar design. This concern was taken into consideration by Vaughn during the design phase of the project.

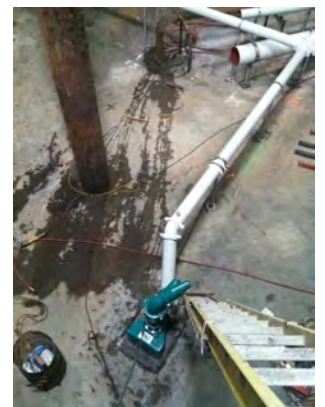
In addition to three, double nozzle assemblies mounted on the floor of the digester, two single nozzle assemblies were mounted at other levels in the tank. A "foam buster" nozzle and splash plate were installed above the maximum liquid level to break up the foam. It can be turned off by a valve when it is not required. Another nozzle was mounted about two to three feet below the liquid surface to provide continuous surface mixing. A 75HP Vaughn chopper pump provides the mixing flow to the system. It is controlled by a VFD and can be slowed down to match the optimum mixing requirements. This reduces the power required during lower digester loading. The pictures show the piping, nozzles and pump during installation by Slayden Construction.



Vaughn's Rotamix system is the most cost effective and has the lowest life cycle cost of any mixing systems used in digesters, sludge storage and other high volume applications.

Some of the proven advantages of the Rotamix system include increased gas production, reduced sludge volume, and improved volatile solids reduction. Another major advantage is reduced maintenance due to the elimination of all rotating equipment within the tank. Also, all Vaughn nozzles come with a full, ten year replacement warranty.

For more information on the Rotamix system, contact your local PumpTech branch.



Harvest Oil Sands Condenser Skid

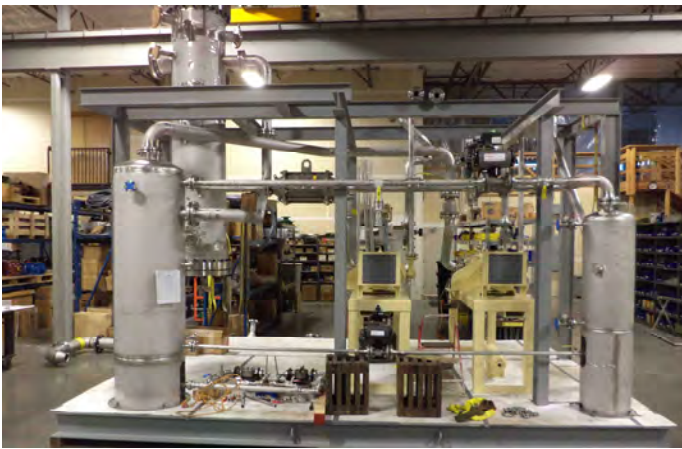
In the Summer 2012 edition of Pipeline we featured several injection skids that MeterMan built for GE Water & Process Technologies. They were installed in a water treatment plant that GE designed for the Harvest oil sands project in Calgary, AB. The picture below shows a very different MeterMan skid currently under construction for GE.

This unit is a condenser skid that will be used in their water reclamation system. The steam that is injected into the oil sands is reclaimed after it condenses but it is contaminated with hydrogen sulfide. In order to

contain it, the reclaim tanks are blanketed with nitrogen gas. The condenser skid extracts the nitrogen and hydrogen sulfide from the reclaim tanks, condenses the water vapor and sends the gases to a flame tower for incineration.

The skid consists of two rotary compressors, two condensate pumps, a tube type condenser, control panels and the associated piping. The large vertical structure is the condenser shell. The unit is scheduled to ship in mid February.

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Canby Hydronix Projects



In addition to several MeterMan projects, our Canby manufacturing facility has many Hydronix packaged systems in production. Several are shown in the pictures below and on the right.

The picture below is an air gap / booster system for the Olympia WWTP. It consists of six booster pumps and an air gap tank that protects incoming potable water from plant contamination. The top right photos are two 421 submersible lift stations. The one on its side is for Grangeville and the upright one is for Hanford. Both have integral valve vaults. The middle photos show a 185 self priming station for Pacific Coast Canola in Warden WA. The bottom photos show a 735 gull wing booster station for the Cheyne landfill in Zillah, WA.



Pump Ed 101 – Motor HP and Torque Versus VFD Frequency

Joe Evans, Ph.D Education & Training

The relationship between the HP and torque produced by an electric motor can be a bit perplexing. When that motor is controlled by a VFD, it can be downright confusing!

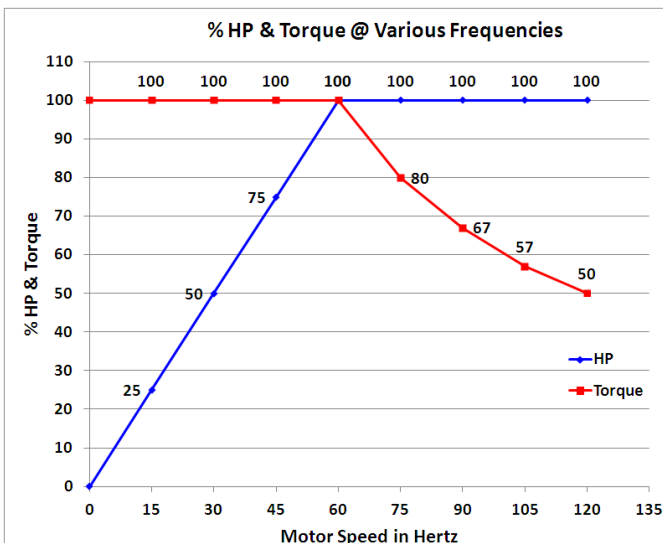
In a linear environment, work is the product of the force applied to an object and the distance the object travels due to that force ($w = fd$). In a rotational environment, torque is the equivalent of work but, its value is a bit more complex. Torque is equal to the force applied, its distance from the axis of rotation (radius) and the angle (θ) at which the force is applied ($t = f(r \sin \theta)$). In the US, torque is expressed in foot pounds (ft-lbs).

Power is the rate at which torque (work) is performed ($p = t/\text{time}$). In the US we use HP as a unit of power. The two equations below show the relationship of HP and torque when motor rpm changes. The constant, 5252, is the result of dividing James Watt's original test data (33,000) by 2 pi.

$$\text{HP} = (t \times \text{rpm}) / 5252 \quad t = (\text{HP} \times 5252) / \text{rpm}$$

Based upon these relationships, torque must double if HP is to remain constant when speed is reduced by one half. In order to produce the same HP at the lower speed, a motor has to do twice as much work per rotation which requires twice as much torque. That is why the shaft and frame of a 900 rpm motor is larger than those of an 1800 rpm motor of the same HP.

When the speed of an AC motor is controlled by a VFD, HP or torque will change depending upon the change in frequency. The chart below provides a



graphical illustration of these changes. The X axis is motor speed from 0 to 120 hz and the Y axis is the percent HP and torque. At 60 hz (base motor speed), both HP and torque are at 100%. When the VFD reduces frequency and motor speed, it also reduces voltage in order to keep the volts/hertz ratio constant. This allows torque to remain at 100% at lower speeds, but HP is reduced in direct proportion to the change in speed. At 30 hz, HP is just 50% of the 60 hz HP. The reason this occurs is because the total torque produced per unit of time is also reduced by 50% due to fewer motor rotations. You can use the HP and torque equations to prove this relationship.

When a VFD increases frequency above 60 hz, HP and torque do a complete flip-flop. HP remains at 100% and torque decreases as frequency increases. Torque reduction occurs because motor impedance increases with increasing frequency. Since a VFD cannot increase voltage above its supply voltage, current decreases as frequency increases thus decreasing available torque. Theoretically, torque is reduced by the ratio of the base speed to the higher speed ($60 \text{ hz} / 90 \text{ hz} = 67\%$). In real life other factors can reduce the actual available torque well below the theoretical values shown in the chart. These include increased bearing friction, increased fan loading and additional rotor windage. A motor's full load torque must be derated when operated at speeds above 60 hz. Typical manufacturer's derating guidelines suggest using the base frequency to maximum frequency ratio for speeds up to 90 hz. At speeds above 90 hz, the square of the ratio is often used.

Check with the manufacturer before operating a motor above its base speed. Rotor balance, bearing life and critical speed are typical concerns. High quality 1800 rpm and 1200 rpm motors up to 200 HP should be able handle up to two times the base speed without problems. Over speed is usually not allowed on 3600 RPM motors over 50 HP. NEMA MG1 provides several over speed guidelines that manufacturers must meet.

A novel way to provide constant torque at higher than base speeds is to run a 230V motor on a 460V VFD. In these applications, the drive is programmed to provide full voltage at 120 hz and then reduces voltage proportionally as speed is reduced. At 90 hz the output voltage would be 345V and at 60 hz it would be at the motor nameplate voltage (230V). The volts/hertz ratio remains at a constant 3.83 throughout the speed range.

Cornell REDI-PRIME Outlasts Standard Self Primers in Light Slurry Mining Application

Mike Shoemaker, Moses Lake

In 2011 a local mining operation in the Pacific Northwest approached PumpTech for a solution to recurring pump failure and maintenance issues. The mine had been using a leading manufacturer's self priming trash pump to move light slurry (1.1 specific gravity) from a collection area to a silt clarifier. With a design flow requirement of 1100 GPM @ 75' TDH (which included a 12' suction lift) the existing pump was running at 1500+ RPM (belt driven) and required a 50 HP motor when the slurry reached the optimum 1.1 specific gravity. Originally the pump wouldn't run more than 45 days before failure so it had been converted to the manufactures suggested wear resistant material. Even with this change the mine might see 120 days of operation before the pump was completely worn out.

The Cornell REDI-PRIME selection offered them the opportunity to install a guaranteed priming system that would pass the solids & slurry independent of the pump operation (no continuous recirculation through the volute). It also ran at a 20% lower speed than the existing pump, was

direct driven (no belts) and increased pump efficiency from 58 to 75. Together these features greatly reduced component wear and power consumption.

The REDI-PRIME pump recently surpassed the one year anniversary of commissioning and so far the pump has not been pulled from service or required any maintenance attention since installation. Testing indicates the pump is still operating at optimum efficiency. The deferred maintenance costs have more than paid for the project and installation costs and the estimated power savings of 6.7kw/hr is producing another \$3,500.00 in annual savings. Contact your local PumpTech branch for more information on the REDI-PRIME series.

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Vaughan Self Priming Choppers Excel in Food Processing Applications

Mike Shoemaker, Moses Lake

Speed kills – **especially** when you're dealing with abrasives. Couple that with materials that are not compatible with light slurries and you have a recipe for recurring poor pump performance and high maintenance costs.

Two recent opportunities in the food processing industry allowed PumpTech to test the newer style self primer by Vaughan. Both applications had utilized a variety of self primer designs manufactured by several pump companies. All experienced a loss of performance within thirty days and required replacement in less than twelve months. They were also plugging due to potatoes that fell into the rock trap when trucks were unloading. Some of the sweet potatoes were the size of footballs!

The Vaughan self primer integrates a replaceable liner, unique to Vaughan, that is heat treated to Rockwell 70C. This, combined with a larger impeller diameter, allows for slower pump operation, and an overall reduction in maintenance while increasing efficiency. It also had no trouble passing those football sized potatoes!

With over twelve months of operation in both applications the pumps have not shown any loss in performance and have required zero maintenance.

One of the plant's maintenance managers said "We've **never** had the success with our rock trap to the degree we are seeing with the Vaughan self primer. Not only does it meet our required performance needs, we're able to increase the truck unloading by nearly double each day. This increases both plant throughput and operational efficiency. Coupled with no maintenance or replacement costs it is proving to be a real winner for us".

For more information on Vaughan self priming chopper pumps, contact your local PumpTech office.

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PumpTech PumpChat - From the Presidents Desk - Doug Davidson -Bellevue

Happy New Year!!

In January, PumpTech exhibited at the 99th NW Food Processors Expo and Conference in Portland where we displayed Cornell potato pumps, Vaughan chopper pumps, Grundfos boiler feed & booster pumps along with our Meterman Polymer makedown system (photo on the right). Many of you may not know of the vital role PumpTech plays in supporting our NW food industry. PumpTech stocks over \$1,000,000 worth of specialized pumps and parts for the food industry in the Pacific Northwest. We stock pumps that will pump a whole potatoes, carrots or peas; hot oil pumps for frying potato products; dosing pumps for water conditioning as well as pumps that handle the waste streams of these plants. By stocking all of the critical parts needed to keep our equipment running, we are able to keep the food processors from losing valuable production time while waiting for equipment. We offer

immediate response to emergencies with our 24 / 7 service department. For many of these plants, we are considered a key provider and, as such, we are involved in continuous improvement programs for many of their plants. Continuous improvement allows us the opportunity to suggest ways the customer can reduce down time, maintenance costs, power costs and improve reliability thus providing another valuable service to our customers. Next time you have a Freedom (French) fry or any type of processed potato there is a good chance that the potato you are eating went through a pump supplied and supported by PumpTech. Let's Eat!!



New Employees at PumpTech

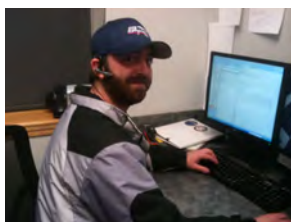
Bev Quigley has joined the Canby branch as Administrative Assistant / Receptionist. She has been the friendly voice answering your calls for several months as she came to us through a temporary staffing agency. Bev won us over with her cheerful attitude and we were thrilled when she accepted a permanent position. Bev prides herself on great customer service and attention to detail. Welcome Bev!



Steve Starbuck is the new Service Technician in the Canby branch. He came on board in December and lives in Salem. Prior to joining PumpTech he worked for Johnson Controls and brings a wealth of technical experience with him. Steve has his private pilot's license and spends his spare time flying. Welcome Steve!



Bob Otto joined our Moses Lake branch in December and takes the position of inside sales and support. He recently graduated from Big Bend CC with an AA degree in Applied Science. Bob lives in Moses Lake and enjoys

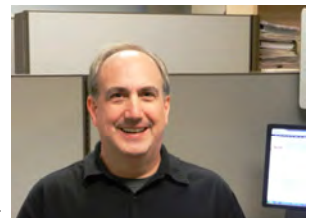


motorcycling and Sturgeon fishing in his spare time. Welcome Bob!

Andrea Ashurst joined PumpTech as Administrative Assistant / Receptionist and has taken over the helm as your first point of contact at PumpTech headquarters in Bellevue. She has extensive experience in administration and account management. Andrea is passionate about excellent customer service and she prides herself on her ability to work with customers, establishing trusting and lasting partnerships. We are thrilled to have her as a very important team member. Welcome Andrea!



PumpTech welcomes **Mike Parks** on board. He is based out of our Bellevue headquarters and joins our industrial team. Mike's 26 years of experience makes him very knowledgeable about pumps, parts and motors in the marine, industrial, and municipal markets. He takes great pride in providing his customers with the exact right solution to their needs as well as follow-up for prompt delivery of their products. Mike is now teaming with Mike Shoemaker, Jason Green, Steve Manwell, Scott Bush and Matt Browne to add bench strength in our very important industrial market segment. Welcome Mike!



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