

The background is a complex technical drawing in white lines on a blue gradient. It features various mechanical components such as pipes, valves, flanges, and a large globe in the upper right corner. The lines are thin and precise, typical of engineering blueprints.

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2022 PRODUCTS AND SERVICES GUIDE

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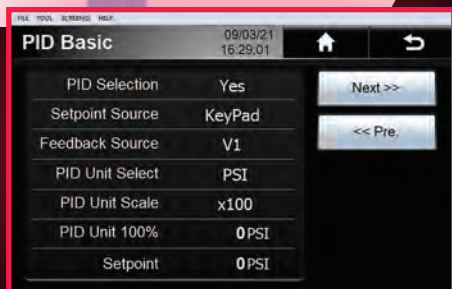
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A NOTE ON THIS ISSUE:

Welcome to the April's edition of MPT! We have a double-shot of informative stories leading off our Case Studies section this month. First up, Xylem's Molly Russell shares how her company helped the city of Hot Springs, Arkansas, implement a proactive maintenance program for their wastewater treatment system, which serves 23,000 customers and requires the maintenance of more than 600 miles of gravity sewers and force mains (pg. 14). Next, the United Kingdom's venerable Old Holly Farm may be renowned for its organic and time-tested dairy production, but they're no stranger to the benefits of modern technology. Soren Rasmussen illustrates how a Landia chopper pump is playing a vital role in the use of slurry as fertilizer (pg. 18).

Also, this issue contains our annual Products & Services Guide! Each spring, we collect a range of offerings from the myriad areas and markets that make up the worldwide pumping industry and present them to you, our readers. In this special issue, OEMs, parts suppliers, distributors, and point-of-service operators come together to showcase their best and brightest. If staying abreast of the best the market has to offer is of interest to you, we recommend you keep this issue handy throughout the year.



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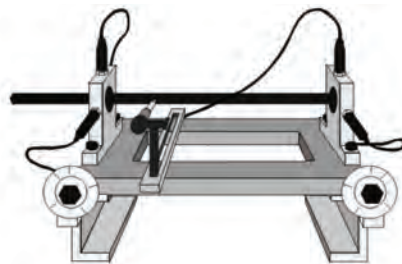
The benefits of Industry 4.0 continue to spread

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CASE STUDY AUSTIN, TX a 23-story, 320-unit high rise residence building with a grocery store and restaurant was plagued by frequent pump station clogs, 6 faults in 2 months! The culprit – not so “flushable” wipes! With no control over what the occupants flush, clogs persisted, and pump service charges were piling up. The building management team needed a solution.

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XYLEM APPOINTS MARK MORELLI TO BOARD OF DIRECTORS

Global water technology leader Xylem announces the appointment of Mark Morelli to the company's board of directors. Morelli currently serves as president and CEO of Vontier Corporation, the three-billion-dollar global industrial technology company focused on smarter mobility. He brings nearly two decades of experience leading industrial and technology corporations through transformative growth and innovation. Previously, he served as president and CEO of Columbus McKinnon, COO of Brooks Automation, CEO of alternative energy company Energy Conversion Devices, and as a president of United Technologies.

"It's our pleasure to welcome Mark to the board of directors," says Robert Friel, chair of Xylem's board. "Mark's deep leadership experience and global perspective, together with his extensive background in industrial technology and innovation, will be invaluable in guiding Xylem's strategy to accelerate the digital transformation of water. We look forward to working together to grow the company and create value for our shareholders."

Patrick Decker, Xylem's president and CEO, adds, "Mark brings rich experience leading companies at the forefront of smart and sustainable solutions, shaping high-performance teams, and advancing diversity, equity and inclusion in the workplace."

CENTRISYS/CNP PROMOTES MADHAVI BATCHU TO CHIEF OPERATING OFFICER

Centrisys/CNP, a leading North American manufacturer of decanter and thickening centrifuges and dewatering systems, announces Madhavi Batchu has been promoted to chief operating officer. She is a seventeen-year veteran of the wastewater industry and joined Centrisys/CNP in 2014, establishing the company's applications engineering department.

"I am thrilled to have Madhavi as part of our leadership team and excited to be working with her to keep Centrisys/CNP positioned as a leader in this competitive and diverse marketplace," says Michael Kopper, president and chief executive officer. "Her industry knowledge is second-to-none, and our team members and customers will benefit from her leadership and extensive experience."

Madhavi earned a bachelor's degree in civil engineering from Osmania University in India and a master's degree in environmental engineering from Cleveland State University in Cleveland, Ohio. In her new role as chief operating officer, she is responsible for the overall operations of Centrisys/CNP. She works directly with chief executive officer and president, Michael Kopper; vice president of product development, George Kueppers; Gary Stinson, chief financial officer; and other internal teams to develop and implement the strategic vision and values of the Centrisys/CNP organization.

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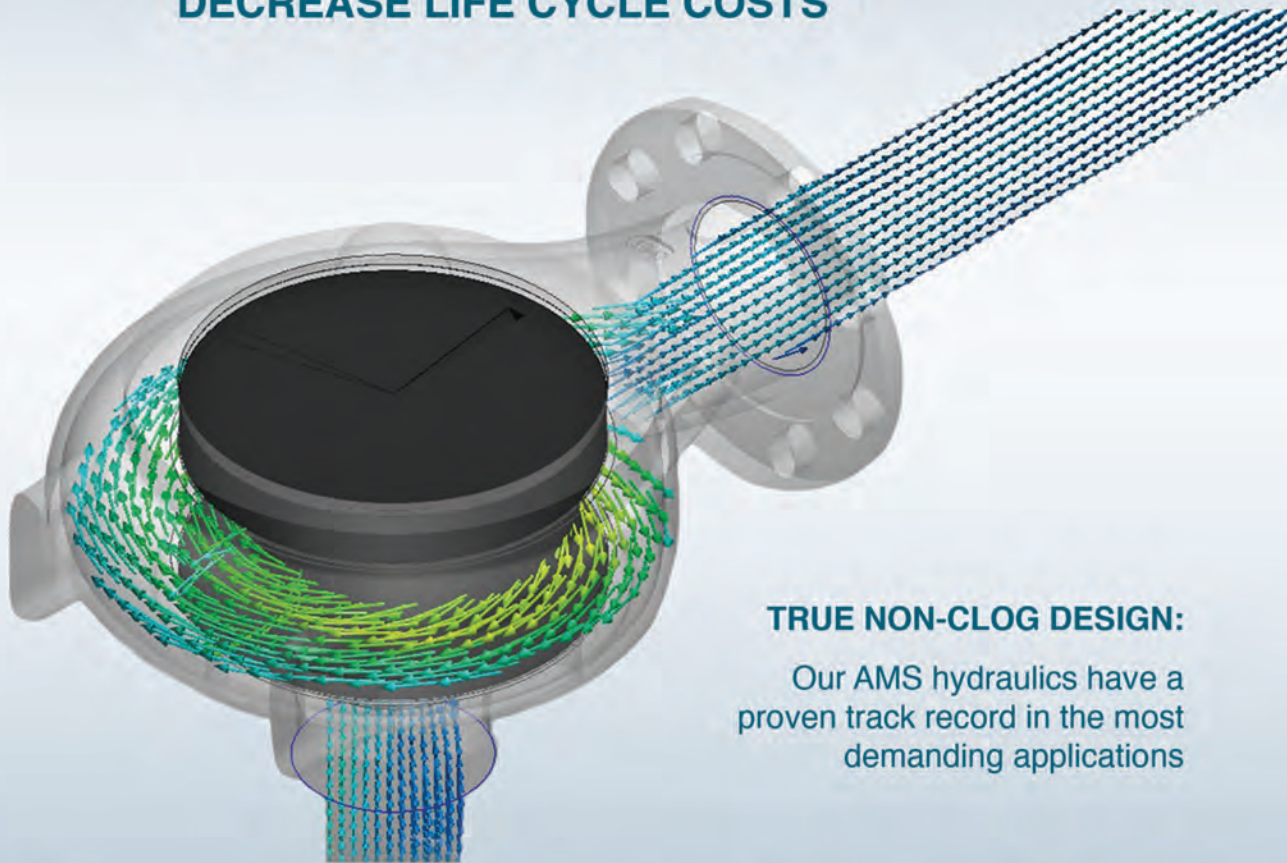
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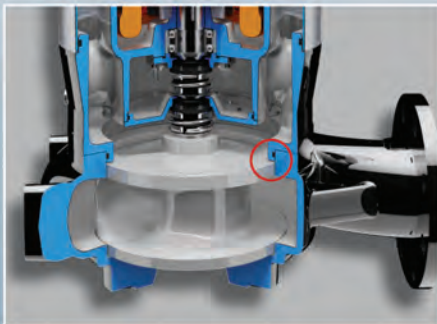


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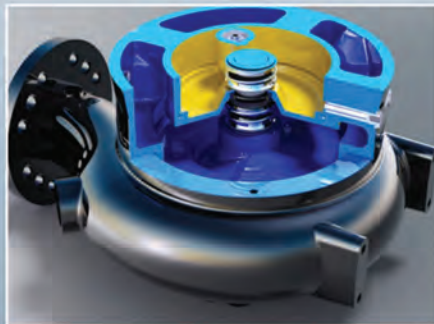


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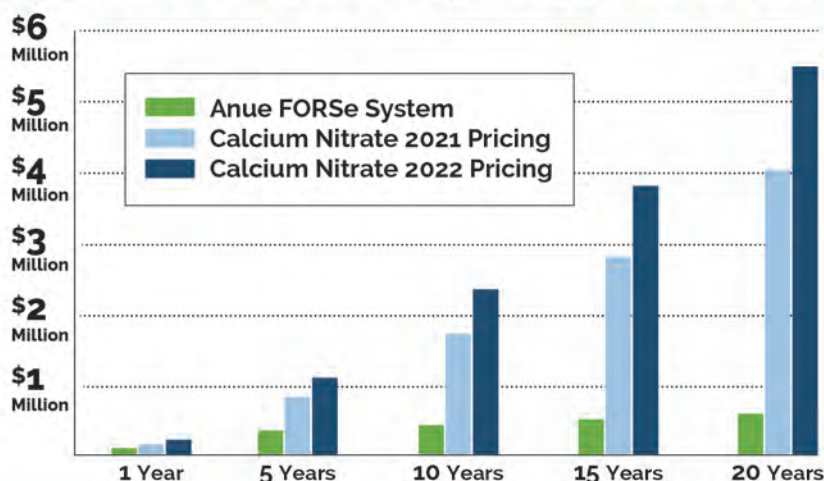
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MITSUI RAIL CAPITAL NAMES NEW HEAD OF SALES, MARKETING, AND BUSINESS DEVELOPMENT

Global railcar leasing company Mitsui Rail Capital has appointed Bryan F. Vaughan as vice president of sales, marketing, and business development. Vaughan brings more than three decades of experience in transportation and logistics to his new role at MRC, including fifteen years with Class I railroads.

"We are extremely excited to have Bryan join the leadership team here at MRC," Mitsui Rail Capital President Kevin Cook says. "Bryan brings us a wealth of experience from his time working with the Class I railroads and two other railcar leasing companies. Bryan has a real passion for our industry and the leasing business, which will make him a great addition to our team as we continue to grow our business at MRC"

Vaughan has experience with EDI implementation, rail cost analysis, and product line management, as well as sales for large bulk commodities accounts. Prior to joining MRC, Vaughan served as commercial leader of sales and marketing for railcar leasing at VTG Rail for the past six years. He also served as international director of sales and marketing while at Canadian National Railway. Along with his professional experience, Vaughan sits on the executive board of the Midwest Association of Rail Shippers (MARS) and was a recent president of the Traffic Club of Chicago.

MOTION NAMES NEW VICE PRESIDENT FOR THE SOUTHEAST

Motion Industries, Inc. announces the promotion of Jon Tart to vice president of the company's Southeast Group. Tart was promoted from his position of Baltimore division vice president. Starting with Motion in 1996 as a customer service representative, he transitioned to the corporate training program in 1997, then moved to a sales territory in 1998. Since then, Tart has served as branch manager of two branches, division sales manager, area vice president of corporate accounts for the Northeast and the Southeast, and Baltimore division manager. Tart will report to Kevin Storer, executive vice president, branch operations.

"Jon's impressive background and his ability to leverage his vast experience and competitive nature will ensure success in the years ahead," says Storer. "I look forward to seeing him successfully lead the Southeast Group to new heights."

A graduate of East Carolina University, Tart holds a bachelor's degree in marketing and an MBA. Motion North America expanded its footprint in 2022 to include Kaman Distribution Group and now has over 700 branch and service center locations and twenty distribution centers. With annual sales of over \$6.3 billion, Motion is a leading industrial distributor of more than twelve million items, including bearings, power transmission products, industrial automation and robotics, process pumps, and more. ■

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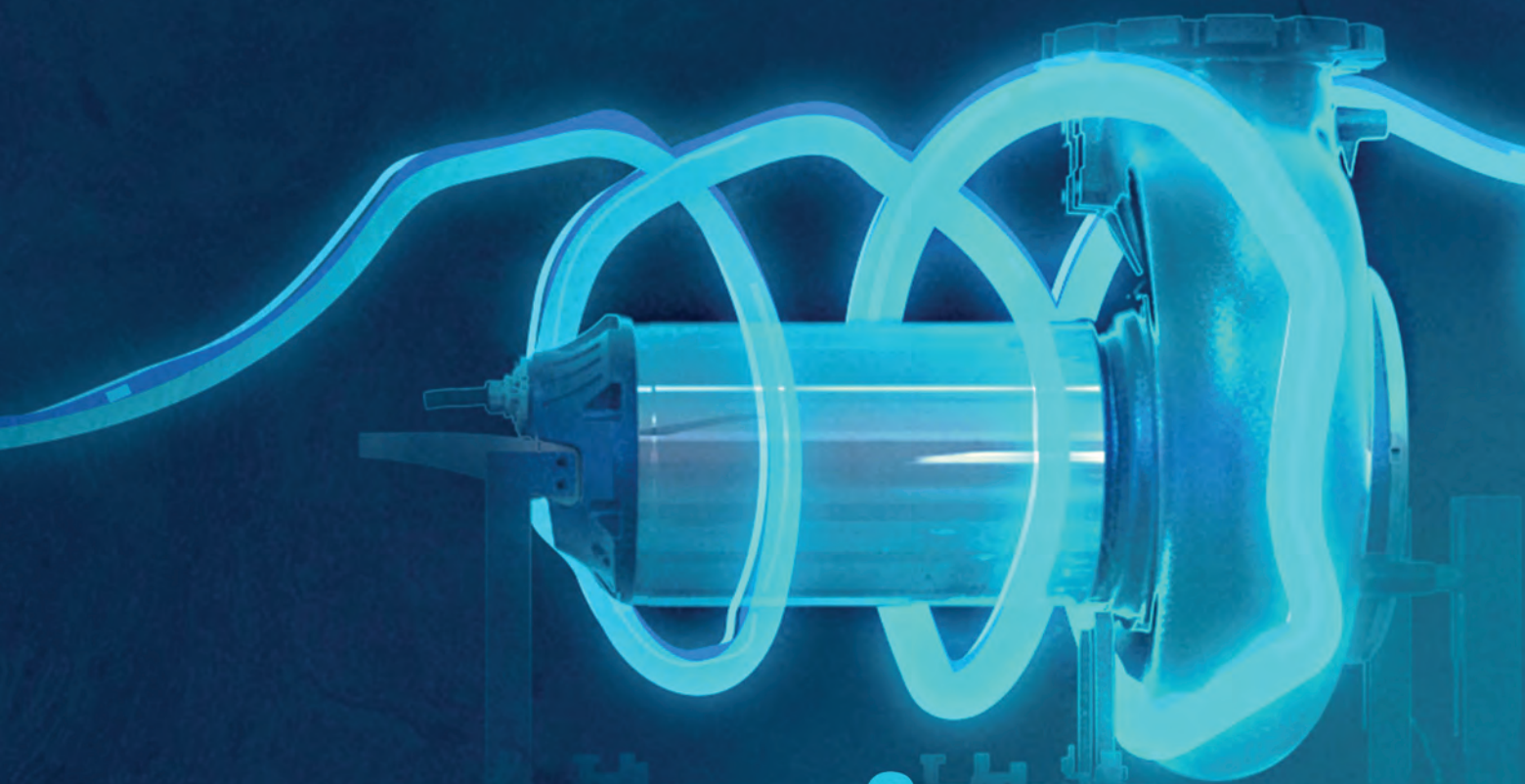
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OTC also has endorsing and supporting organizations.

TECHNICAL PROGRAM

Whether their background is in the sciences, engineering, research, or even business aspects of the offshore energy industry, everyone has something to learn from OTC's popular and heralded technical program. The 2022 edition of the event continues to focus on best practices, technical innovations, and emerging trends as presenters share their technical and scientific knowledge with attendees on a variety of important topics. Utilizing panel discussions, technical

demonstrations, and guided lectures, the OTC 2022 technical program provides the know-how attendees seek in a format they can use.

RECOGNIZING LEADERS IN THE INDUSTRY

Every year, OTC hosts a reception honoring individuals and organizations who represent the best aspects of the industry. The 2022 Distinguished Achievement Award recipients present the range of innovation, dedication, and reliability that OTC recognizes as standouts among their peers.

OTC DISTINGUISHED ACHIEVEMENT AWARD FOR INDIVIDUALS:

Drew Michel will be honored with the Distinguished Achievement Award for Individuals for his pioneering work on improving diver safety, the development and advancement of commercial remotely operated vehicles (ROV), and encouraging the next generation to study science and math and pursue careers in marine technology.

As the owner of ROV Technologies, Inc. for nearly three decades, including through a major acquisition, Michel was instrumental in the early design, development, and operations of commercial ROV systems and the technologies' acceptance by the offshore energy industry.

OTC DISTINGUISHED ACHIEVEMENT AWARD FOR COMPANIES, ORGANIZATIONS, AND INSTITUTIONS:

Shell will be presented the OTC Distinguished Achievement Award in recognition of its Appomattox Project in the Gulf of Mexico, Shell's largest and most complex deepwater



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megaproject to date. Appomattox started production in May 2019—four months ahead of schedule—and its forty-year design life provides modern and efficient infrastructure for the safe and sustainable delivery of energy to the United States. Appomattox is the result of hundreds of companies that came together to align on common goals related to safety, care for people, cost, and schedule.

In addition to maximizing production, Appomattox developed new technology to minimize its environmental footprint. A combined cycle power generation system reduced greenhouse gas emissions by 30 percent and the use of cold seawater below the surface shrunk the cooling system by 40 percent compared to established designs.

These technologies made it possible for the project to avoid impact to marine life in the shallower, warmer waters of the Gulf of Mexico.

OTC HERITAGE AWARD:

The annual Heritage Award will be presented to Roland Moreau for his leadership in advocating for the gathering and analyzing of safety data and sharing learnings from operations in the Gulf of Mexico to improve industry safety.

Moreau's nearly four decades of experience, extensive network, and effective recruiting skills have also contributed to enhancing the communications and bridging the knowledge gap between the offshore oil industry and government bodies such as the U.S. Department of the Interior's Bureau of Safety and Environmental Enforcement (BSEE) and the U.S. Department of Transportation's



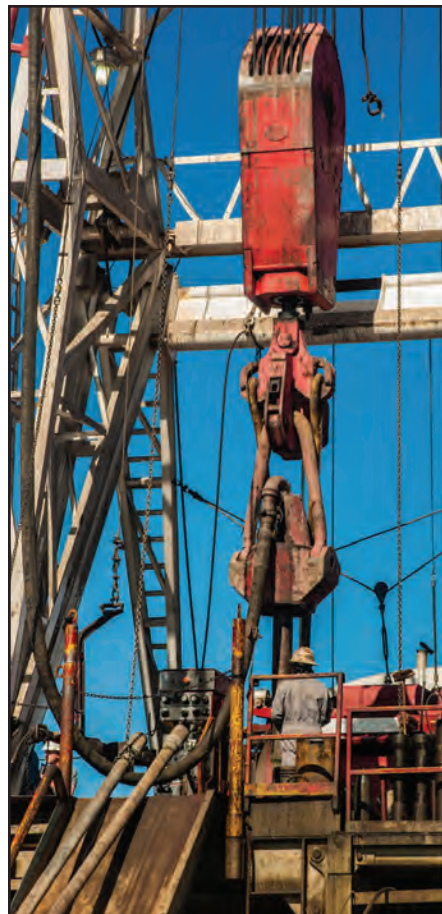
Bureau of Transportation Statistics (BTS) regarding their health, safety, and environmental (HSE) offshore programs.

ENERGY4ME TEACHER STEM WORKSHOP

One of the most popular components of OTC, this year's Energy4me Teachers STEM Workshop will have an emphasis on activities around reducing emissions in the industry. At this free, one-day workshop, science teachers receive hands-on training by qualified facilitators, listen to a presentation from a prominent energy professional, and tour the OTC exhibit floor.

Additionally, teachers receive a variety of free instructional materials to take back to their classrooms. As the United States and global community work toward developing technologies and methods to mitigate the release of carbon dioxide, it is important to understand the processes and technologies in place to do so. Carbon capture, utilization, and storage (CCUS) is one advanced method for mitigating the release of carbon dioxide into the atmosphere from fossil-fueled power stations.

These activities will help teachers and their students understand why CCUS is part of the solution and how it will impact energy supply, demand, and cost. In the workshop, attendees will hear from industry speakers about reducing emissions and the energy transition. OTC's Energy4me Teachers STEM Workshop provides educators and industry an opportunity to connect they would not find any other place. ■



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PUMP STATIONS THAT WILL NOT FAIL

Arkansas utility takes redundancy a step further with a permanent backup system

BY MOLLY RUSSELL, XYLEM



The Fairwood Pump Station is one of six pump stations to be equipped with Godwin Dri-Prime Backup pump units.

PROJECT SPOTLIGHT

CUSTOMER:

Hot Springs, Arkansas

CHALLENGE:

The city of Hot Springs sought lift station redundancy within its municipal wastewater infrastructure.

XYLEM SOLUTION:

The two-story building was designed to withstand the impact of a Category 3 hurricane. The design will allow Sarasota Memorial Hospital and other critical designated storm shelters to remain operational after a storm. City officials directed the project engineer, McKim & Creed, to bring critical equipment above ground to a height above Category 3 storm surge elevation.

The city of Hot Springs, Arkansas, wastewater treatment system serves 23,000 customers and requires the maintenance of more than 600 miles of gravity sewers and force mains. With the goal of implementing a more proactive maintenance program that would also address issues arising from capacity constraints and aging equipment, the city undertook a comprehensive overhaul of its municipal wastewater infrastructure.

As part of the program, Bobby Harris, the city's utility field operations manager, prioritized the system's seventy-six lift stations. Several of these stations had been identified as part of a consent administrative order (CAO) between the city and the Arkansas Department of Environmental Quality (ADEQ) in an effort to bring the wastewater system into compliance.

THE CHALLENGE

The infrastructure upgrades kicked off in 2013 with the Fairwood Lift Station, which serves as the main collection station for the west side of the city. The lift station, with a peak capacity of 5.8 million gallons per day, experienced frequent overflows. The city identified equipment failure/malfunction and loss of power at the pump station as the primary causes for overflows. The station experienced sewer overflows during heavy rainfall events or when the pumps clogged because of increasingly popular "disposable" products—such as cleaning cloths and

disinfecting wipes—which can build up on the leading edge of pump impellers and become tangled. This build-up reduces the efficiency of the pumps or even causes a complete stoppage.

The revamped lift station was equipped with Xylem Flygt Model NP 3231/765 "N" pumps. The 335-horsepower submersible pumps are operated via variable speed drives and are designed to deliver 4,050 gallons per minute each. The technology incorporates patented clog-resistant impellers, unlike the station's previous pumps.

Realizing that additional steps were needed to properly address long-term prevention of future sanitary sewer overflows, the city of Hot Springs investigated a permanent backup system. They wanted a system that would provide pumping not only during power outages but also during mechanical failures. A system that could also provide additional capacity would be even better. A typical would be to install a diesel-powered backup generator. This solution, however, would not help Hot Springs if the station's pumps or generator's switchgear failed—and wouldn't allow for additional flow capacity brought on by severe rains. The utility also wanted greater flexibility when the submersible pumps were taken offline for any reason.

THE SOLUTION

Instead of a backup generator, the Xylem team recommended a



The Godwin PrimeGuard controller provides greater visibility and peace of mind by connecting with a SCADA system, registering when the backup pump is running.

redundant pump system that would provide both mechanical and electrical backup capabilities. The primary benefit of redundant design is prevention of a total system failure. Harris, together with design engineer Jerry Williams, PE, principal of local engineering consultant Engineers, Inc., chose the Godwin Dri-Prime

Backup pump unit as a backup for the Fairwood Station.

The benefits of utilizing the natural gas-powered pumping unit in lieu of a diesel-powered electrical generator was introduced to Harris and Williams by Sherman Eoff, president of Jack Tyler Engineering, Inc., the local Xylem representative. Natural gas-



Xylem Flygt Model NP 3231/765 "N" pumps deliver over 4,000 gallons per minute.

powered pumps provide independent and resilient pumping during events when the permanent infrastructure is compromised. Natural gas also provides a continuous uninterrupted



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To ensure uninterrupted flow of wastewater, the city has equipped six lift stations with natural gas-powered Godwin Dri-Prime backup pump systems.

fuel supply, whereas a diesel-powered generator would require a large on-site storage tank or regular fuel delivery. After Harris and Williams researched and compared other offerings, the decision was made to utilize a Godwin DBS station backup instead of just an electrical backup.

Powered by a 425-horsepower natural gas engine, the HL250M DBS pump operates on an above-ground foundation adjacent to the wet well. The heavy-duty pump is well-suited for the backup mission because of its self-priming feature and ability to handle the high discharge pressure and high suction lift conditions at the Fairwood station.

The backup pump is also equipped with a Godwin PrimeGuard controller to provide greater visibility and peace of mind. The controller sends signals to the city's SCADA system, notifying department personnel when the backup pump is running, so they can initiate a visit to the lift station if needed. Another great benefit to

the city is the system's ability to only activate the backup pump when

Another great benefit to the city is the system's ability to only activate the backup pump when needed, therefore saving fuel and limiting operating hours.

needed, therefore saving fuel and limiting operating hours.

When a lift station is equipped with a generator, it runs constantly the whole time the power is out, whether the pump station is requiring standby power or not.

THE RESULT

Besides delivering 100 percent redundancy, the Godwin DBS provides convenience. Whenever the primary pumps in the lift station requires repair or maintenance, crews can manually start the

permanent backup pump, which is much easier than bringing in one of the department's portable pumps for a temporary hookup.

In all, six pump stations have been equipped with a backup pumping system using natural gas as part of the ADEQ-mandated, \$70 million overhaul of the wastewater system, including the Stokes Creek pump station in 2015 and the Hot Springs I, II, III, and IV pump stations in 2017. The DBS unit at the Stokes Creek station took over operation while the pumps inside the station were down for maintenance. Most importantly, there have been no overflows since the utility installed the DBS units. Even in the most extreme peak-flow weather events, the Godwin DBS is more than adequate to provide protection and coverage, providing additional capacity to handle wet weather flows and pressures when the submersible pumps cannot keep up. As Hot Springs continues to map out its maintenance and upgrade activity, there are plans to retrofit additional lift stations with backup pumping systems. ■

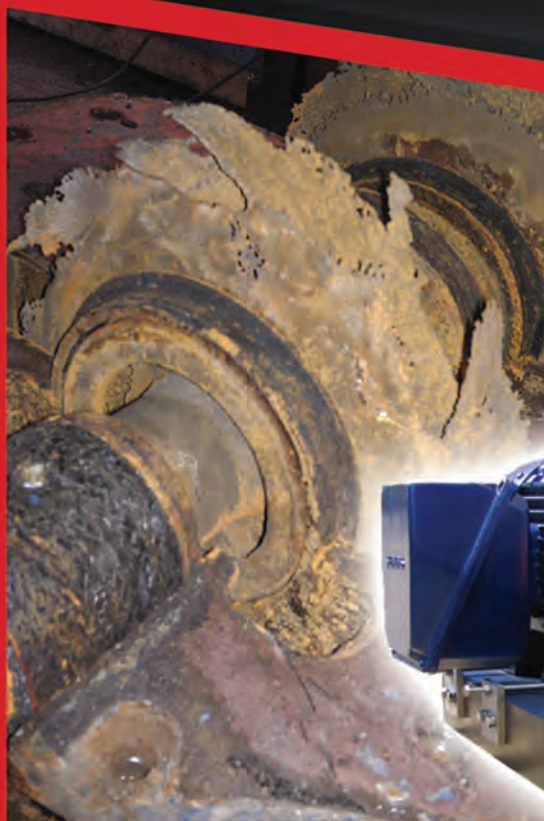
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WHEN EVERY DROP MATTERS, CHOOSING THE BEST IS A NO BRAINER

Slurry pump helps with efficiency at resourceful organic dairy farm BY SOREN RASMUSSEN, LANDIA, INC.



Ian Pye at Old Holly Farm.

At an organic dairy farm in Lancashire, where the ethos is firmly on maximizing efficiency over maximizing output, a Landia chopper pump is playing a vital role in the use of slurry as fertilizer.

Using energy captured from solar panels at the all-electric, 247-acre farm, the 7.5 kW pump transfers slurry nearly a third of a mile, directly from the main dry cow house to the external lagoon, making considerable savings on fuel and labor.

HIGH QUALITY WITHOUT THE HIGH COST

A supplier to the Arla dairy cooperative, which has one of the world's largest externally-validated climate data sets from dairy farms, Old Holly Farm near Garstang is run almost entirely by one person: Ian Pye.

"First, we tried a diesel pump," says Pye, "but the process was costly and took up way too much time. Every drop of slurry is important to us, so we wanted a simple and long-lasting solution, which to be honest, we believed we could achieve with Landia, but given their pedigree, thought would be too expensive.

"However, this just wasn't the case at all with cost," Pye continues, "and five years on, the decision has been more than justified; very good value for money, actually. It just works;



At Old Holly Farm, a Landia pump transfers slurry nearly a third of a mile, directly up from the main dry cow house to the external lagoon.



The pumping line is all part of the highly efficient Old Holly Farm.

very reliable. Compared to scooping up slurry with a tractor and then transporting it, sending it directly to the lagoon with a decent pump is a no brainer”.

TACKLING A TOUGH, THICK TASK

When manure from the farm’s 140 cows is particularly thick (depending on time of year/diet/maternity), it is moved over 300 feet to the lagoon in the yard, but the vast majority of time, the Landia Chopper Pump—which for flexibility, was supplied with a moveable control panel—sends the slurry straight to the lagoon. Continually breaking down solid particles, the pump’s knife system prevents harmful debris from entering the pump’s casing, so that it remains clog-free.

Pye adds, “In five years, all we’ve ever needed for the pump has been a new float switch, which is very good going. Even then, it was all very simple and economical; quick turnaround, with a part that our electrician could fit easily.”

MORE THAN A CLIENT, A FAMILY

Pye notes that Landia’s commitment to service after the sale was another winning component in his choice of pumps.

“Some companies can make the supply of spares unnecessarily difficult and very costly, but we’ve had nothing but friendly and helpful support from Landia,” Pye adds. “From day one, they listened hard to understand what we wanted to do, and how they could help us best achieve our goals.” ■

SOREN RASMUSSEN is the director of Landia, Inc. Landia uses its nearly ninety years of experience to continue to develop new and efficient products and solutions. Together with its customers, Landia is aiming for new heights. Customers get a partner with a strong team of happy employees who focus on what matters most to them: good solutions that solve the task at the lowest possible cost. For more information, call 919.466.0603, email info@landiainc.com, visit www.landiainc.com.

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AUTOMATIC SCRAPER STRAINERS PROTECT CRITICAL MEMBRANE SYSTEMS

Pre-filtering water and wastewater prevents particle damage, reduces maintenance, and lowers replacement costs

BY DEL WILLIAMS

For industrial process facilities, membrane filtration is a valuable, commonly used means of filtering water and wastewater. The challenge is that membrane systems are delicate and can be easily damaged by large particulates in the water. A pre-filtration step eliminates this risk by removing oversized suspended solids to prevent damage, eliminate unnecessary maintenance, and reduce the cost of premature membrane replacement.

Among the pre-filtering options available, automatic self-cleaning scraper strainers are increasingly popular because they are affordable, require very minimal maintenance or attention, and can remove solids down to 75 microns. The strainers allow for continuous, uninterrupted flows even during blowdown cycles. When compared to filters that must be manually cleaned or even conventional backwash systems, automatic scraper strainers can save substantial costs on maintenance and membrane replacement.

INDUSTRIAL WATER TREATMENT AND MEMBRANE SYSTEMS

Although various filtration methods use membranes, the most mature is pressure driven membrane filtration, which relies on a liquid being forced through a filter membrane with a large surface area. Depending on the size and type of the particles involved, the process could be categorized as reverse osmosis, nanofiltration, ultrafiltration, or microfiltration.

In general, reverse osmosis is used to produce potable water or deionized water. Nanofiltration is used in wastewater treatment as well as by the

Automatic scraper strainers like those from Acme Engineering can provide continuous removal of suspended solids to comprehensively protect membrane systems.



petrochemical industry to purify gas condensates, and the chemical industry for solvent recovery. Ultrafiltration and microfiltration are increasingly used in water and wastewater treatments.

Numerous industries have high water usage that can require further treatment of water, including automotive, aerospace, oil and gas extraction, refining, textiles, and pulp and paper mills. Ultrapure water, which must meet strict limits of certain constituents in the water such as suspended and dissolved solids, dissolved gases, organic carbon, and biological organisms, is utilized in electronics and pharmaceutical manufacturing processes.

In industrial applications, water treatment is also vital to protect downstream equipment from fouling, scaling, corrosion, and other forms of damage or premature wear due to contaminants present in the source water. For these reasons, cooling tower and boiler feed water are generally pre-treated.

Membrane filtration is also utilized to treat non-potable water sources such as gray water and reclaimed/recycled "purple pipe" water. Because the membranes are made using thin, porous sheets of material, failing to sufficiently pre-filter any large, suspended particles from the water can cause severe damage and fouling – leading to premature replacement and unnecessary maintenance, according to Robert Presser, vice president of Acme Engineering Products, Inc., a North American manufacturer of industrial self-cleaning strainers.

"Most membrane filter manufacturers recommend that all influents be pre-screened from 100 to 500 microns to maintain membrane filter efficiency," says Presser, whose company is an ISO 9001:2015 certified manufacturer of environmental controls and systems with integrated mechanical, electrical and electronic capabilities.

He adds that automatic scraper strainers are typically installed before the intake plenum of membrane filters, after the supply pumps.

EXTENDING MEMBRANE LIFE

As an alternative to sand filters, centrifugal separators, and basket type strainers, automatic scraper strainers provide superior membrane protection while drastically reducing required maintenance.

Automatic scraper strainers like those from Acme Engineering can provide continuous removal of suspended solids to comprehensively protect membrane systems. The automatic units are motorized and designed to continually remove suspended particulates in industrial process water and wastewater to the specific size required down to 0.003 inches (75 microns).

Conventional manual strainers can become clogged quickly due to limitations in straining area. When that occurs, cleaning or media replacement is required, which increases maintenance costs. The other alternative for fine straining is automated backwash-style strainers of various designs. As particle sizes grow larger, however,

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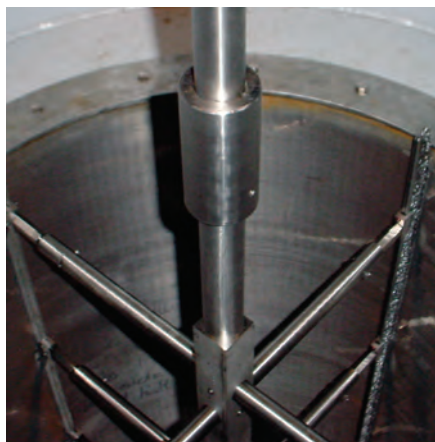
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Automatic self-cleaning scraper strainers are increasingly popular because they are affordable, require very minimal maintenance or attention, and can remove solids down to 75 microns.



With the automatic scraper strainer, cleaning is accomplished by a spring-loaded blade and brush system, managed by a fully automatic control system.

large contaminants can jam up the backwash system or remain in the body of the strainer, requiring manual removal and interruption of the process flow.

With the automatic scraper strainer, cleaning is accomplished by a spring-loaded blade and brush system, managed by a fully automatic control system. Four scraper brushes rotate at 8 RPM, resulting in a cleaning rate of 32 strokes per minute. The scraper brushes get into the wedge-wire slots and dislodge resistant particulates and solids. This approach enables the scraper strainers to resist clogging and fouling when faced with large solids and high solids concentration. It ensures a complete



Automated scraper strainers pre-filter water and wastewater to protect fragile membrane systems from damage caused by large, suspended particles, reducing maintenance, and replacement costs.

cleaning and is very effective against even organic matter "biofouling."

With this type of system, manual maintenance for cleaning is eliminated. Blowdown occurs only at the end of the intermittent scraping cycle when a valve is opened for a few seconds to remove solids from the collector area. Liquid loss is well below 1 percent of total flow.

With so much to gain, industrial plant managers should consider selecting an automated, self-cleaning system that is essentially "set-and-forget," where automatic scraper strainers comprehensively protect delicate membranes and allow personnel to focus on other aspects of the facility. ■

DEL WILLIAMS is a technical writer who lives in Torrance, California. Acme Engineering Products offers a wide range of standard product boilers but distinguishes itself by providing custom solutions with ease and minimal additional cost. Acme has always produced packaged solutions that include controls and instrumentation. This required the development expertise in pressure vessel design, on which its boilers' technology is based, to complement the electrical engineering for its heating and control systems. For more information, contact Robert Presser at Acme Engineering via email at rpresser@acmeprod.com, calling 518.236.5659, visit www.acmeprod.com.

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THEREIN LIES THE RUB

The effects of shaft rub on bearing housing vibration signatures

BY LIN LIU AND SURI GANERIWALA, SPECTRAQUEST INC.



Figure 1: Rub kit diagram.

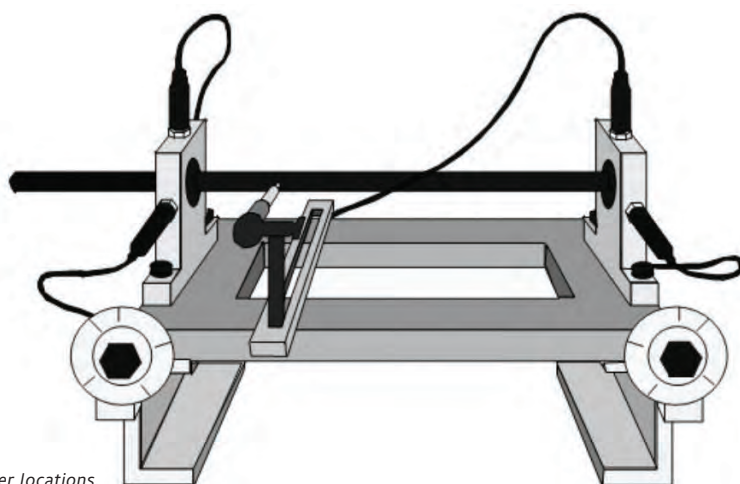
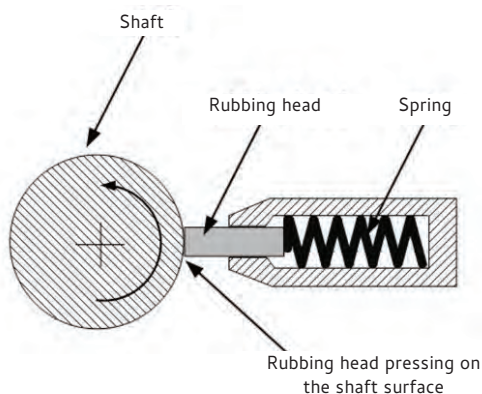


Figure 2: Accelerometer locations.

In this article, the vibration signature on bearing housing caused by shaft rub was studied through applying a rotor rub device on a Machinery Fault Simulator (MFS)TM. Full annular rub was simulated with three types of rub head materials. These three rub materials are aluminum, brass, and plastic. The experiment was carried out under three speeds, i.e., 1,000; 2,000; and 3,000 RPMs. Acceleration signal on bearing housing were collected and analyzed. Several observations about the effect of rub on bearing housing vibration were presented.

INTRODUCTION

For rotating machinery, rub is an undesired contact between a rotating and stationary part. It causes direct damage to the contacting parts. The damage can range from mild, for light rub, to complete destruction of the machine.

Generally, rub is caused by some malfunction that produces a shaft/rotor and stator contact. Some examples of the malfunction which can cause rub include: excessive radial loads, looseness, misalignment, etc. The rub can be divided into partial radial rub and full annular rub. When the actual

rub contact occurs over a fraction of the vibration cycle, it is called partial rub. When it occurs over the entire vibration cycle, maintaining continuous contact, it is called full annular rub.

How to identify the vibration signature caused by rub on bearing housing is very critical in preventing rub related machinery failure. Also, the effects of rub material and speed on vibration signature associated with rub are two other key issues. In this work, efforts are made to answer the above questions by simulating rub in a controlled way.

EXPERIMENT SETUP

Shaft rub was simulated on a Machinery Fault Simulator (MFS) with a rub kit. The rub kit is illustrated in figure 1a. This kit permits the simulation and evaluation of typical rub phenomena associated with a variety of materials under different angle, loading, and lubricant conditions. The kit consists of an adjustable tool holder for the rub material, a vertical post, a horizontal bar, and clamping mechanism. A spring inside the tool holder is compressed and exerts a moderate pushing force which presses the rub head against the shaft or rotor surface (figure 1b). Therefore, the rub head will maintain continuous contact with the shaft all the time. The type of rub simulated with this rub kit is full annular rub.

The shaft in the MFS is 5/8 inches in diameter and made of steel. It is supported by two rolling element bearings. During the test, the shaft is not connected with any other components except the motor.

Three types of rub head materials were tested in this work. They are aluminum, brass, and plastic. The

experiment was carried out under three speeds, i.e., 1,000; 2,000; and 3,000 RPMs.

Two accelerometers were installed on each of the two bearing housings in horizontal and vertical directions respectively to collect the vibration data as illustrated in figure 2.

EXPERIMENTAL RESULTS

The vibration signal used for displaying and analyzing in this section is from the acceleration on the inboard bearing housing in the horizontal direction. Figures 3a and 3b display the baseline and shaft rub (aluminum rub head) vibration waveforms with the same time period at 1,000-RPM speed respectively. The amplitude range of figure 3a is 1.2×10^{-2} . The amplitude range of figure 3b is 2.4×10^{-1} . The vibration amplitude of bearing housing increases significantly with rotor rub for 1,000 RPMs.

Figures 4a and 4b display the baseline and shaft rub (aluminum rub head) vibration waveforms with the

same time period at 3,000-RPM speed respectively. The amplitude range of figure 4a is 1.1×10^{-1} . The amplitude range of figure 4b is 3.7×10^{-1} . The vibration of the baseline and rub one have the same amplitude level. Comparing figure 4 and figure 3, it can be noticed that the vibration amplitude of bearing housing of the baseline increases significantly with speed.

The vibration spectrum of bearing housing without rub and with rub (different rub head materials) for 1,000 RPM-speed are illustrated in figure 5. Figure 5a is the spectrum without rub. Figures 5b, 5c, and 5d are the spectrums for rub head materials of plastic, aluminum, and brass respectively. From figure 5, it can be noticed that the spectrum with rub has significant difference to that without rub. A careful inspection of figures 5c and 5d indicates that the spectrums for rub materials of aluminum and brass are similar to

each other. The spectrum for the plastic rub material has a unique characteristic as illustrated in figure 5b. In figure 5b, there is a dominant resonance component close to 2KHz. Figures 5c and 5d suggest that the spectral

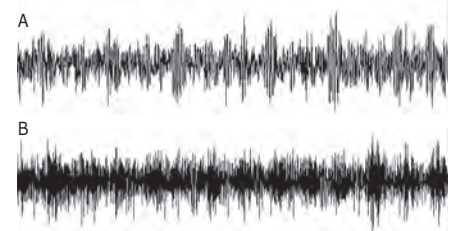


Figure 3: Baseline vs. rub vibration waveform for 1,000 RPMs.



Figure 4: Baseline vs. rub vibration waveform for 3,000 RPMs.

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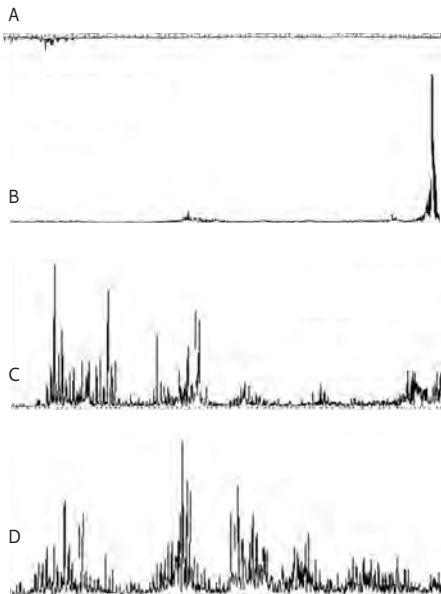


Figure 5: Baseline vs. rub vibration spectrum for 1,000 RPMs.

components for the aluminum and brass rub materials are much more complicated than the case of plastic rub material. A lot of structural resonances are excited by the rubbing with these two materials. A comparison of figures 5b, 5c, and 5d indicates that there is a common resonance excited around 900Hz.

The vibration spectrum of bearing housing without rub and with rub (different rub head materials) for 2,000-RPM speed are illustrated in figure 6. Comparing figure 6 with figure 5, similar bearing housing vibration signatures can be

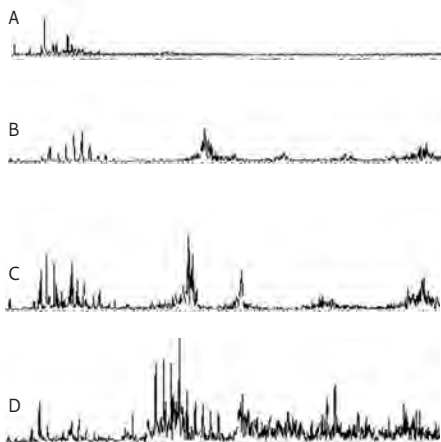


Figure 6: Baseline vs. rub vibration spectrum for 2,000 RPM.

observed. The plastic rub generates a dominant resonance component around 2KHz. The spectrums for the aluminum and brass rub materials are close to each other. And a common resonance around 900Hz emerges much more clearly in figures 6b, 6c, and 6d. However, the amplitude difference between baseline and rub cases decrease. In figure 5a, the baseline vibration is very low. However, the baseline vibration in figure 6s cannot be neglected.

The vibration spectrum of bearing housing without rub and with rub (different rub head materials) for 3,000-RPM speed are illustrated in figure 7. Figure 7 indicates that with the continuous increase in speed, the baseline vibration has increased to the same level with the rub cases. The spectrums below 600Hz for the baseline and all the three rub cases are very similar. The difference between baseline and rub spectrum are in the high frequency range. The rub excites high frequency structure resonance which is illustrated clearly by the frequency components above 600Hz in figures 7b, 7c, and 7d. Comparing figure 7 with figures 5 and 6, the spectrums for the plastic and aluminum rub have the largest changes. Interestingly, it seems their spectrums switch characteristics between figure 7 with figures 5 and 6, i.e., figure 7b is similar to figures 5c and 6c and figure 7c is similar to figures 5b and 5b.

SUMMARY AND OBSERVATIONS

In this study, the vibration signature of rotor rubbing was studied by applying a rotor rub device on a Machinery Fault Simulator. Full annular rub was simulated with three types of rubbing head materials. The three rub materials are aluminum, brass, and plastic. The experiment was carried out at three speeds, i.e., 1,000; 2,000; and 3,000 RPMs. Acceleration signal

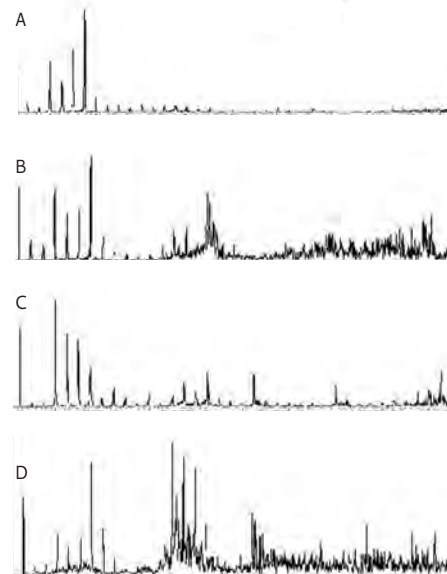


Figure 7: Baseline vs. rub vibration spectrum for 3,000 RPMs.

on bearing housing were collected and analyzed.

From this experiment, it can be observed that rub generates high frequency structure resonances. Although the profile of the vibration spectrum caused by rub with a certain material will change with the speed, the excited structure resonance positions do not change. Under a certain speed, a specific structure resonance might be more dominant in the vibration spectrum caused by one rub material than those caused by other materials. ■

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LEAD-FREE SOLUTIONS TO REDUCE EXPOSURES

Vesconite's bearing materials play a key role in combatting dangers to drinking water

BY DEBORAH SPICER, VESCONITE BEARINGS

Vesconite Bearings hopes to be part of the global program to reduce lead exposure from drinking water. It produces products resistant to corrosion-combatting chemicals (which are necessary to reduce lead leaching into the water system). It also provides lead-free bearing materials for pumps and water systems.

Fuel and paint were the most important sources of lead exposure in many countries. But, with lead

removed or likely to be removed from these sources, drinking water has become an integral source of controllable lead exposure. Global governments are increasingly drawing attention to lead in water systems and setting guidelines and regulations for control.

MORE THAN ONE SOLUTION NEEDED

A staggered, multifaceted approach towards getting rid of lead in water

systems is required due to the legacy use of lead in water systems. For governments, utilities and households, preventing exposure to lead can mean:

- Using chemical corrosion measures to reduce the level of lead in drinking water
- Flushing pipework where water has been standing for long periods in a lead pipe
- Replacing old lead service lines

- Ensuring that all new pipes and fittings are lead-free and that the solder is of a lead-free variety

CHEMICAL-CORROSION DOSING

For many countries, lead-service-line replacement is prohibitive because of the cost. Such is the case with the United Kingdom, for instance, where the cost of replacing lead piping has been estimated at between eight and ten billion pounds.

Lead service lines and components need to be replaced in the long term, but the short- and medium-term strategy is to reduce the likelihood of lead dissolving in the system by introducing a corrosion inhibitor, most commonly orthophosphate.

Vesconite can play a role in a corrosion-reduction strategy to combat lead exposure. Its bearing products are resistant to most chemicals and will not degrade in water systems. At the same time, Vesconite has the benefit of being

lead-free and will not introduce additional lead into the system.

Orthophosphates and Vesconite products work particularly well where organic material is removed from water systems, since orthophosphates may increase bacterial growth on some plastics.

INSTALLATION AND REPAIR OF WATER SYSTEMS

Some countries have introduced legislation affecting the installation and repair of water utilities. This ensures that no additional lead is introduced into the water system and that there is a reduction in the quantity of lead in the system.

Such is the case with the United States Safe Drinking Water Act which prohibits the "use of any pipe, any pipe or plumbing fitting or fixture, any solder, or any flux, after June 1986, in the installation or repair of (1) any public water system; or (2) any plumbing in a residential or non-residential facility providing water

for human consumption, that is not lead-free." For utilities implementing this policy, Vesconite's Hilube bearing material has NSF61 approval for use in potable water applications.

This certification should provide comfort and assurance to utilities that need to abide by the US's Environmental Protection Agency's (EPA) final regulation on the "Use of Lead-Free Pipes, Fittings, Fixtures, Solder, and Flux for Drinking Water." The September 2020 regulation requires that manufacturers and importers of components used in drinking water systems certify their products have met the requirements of the regulation within three years of the final rule publication date.

REPLACEMENT OF LEAD SERVICE LINES AND COMPONENTS

Strategies on whether lead service lines and lead components must be replaced entirely or partially differ between and within countries.

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FURTHER READING

1. CHARTERED INSTITUTION OF WATER AND ENVIRONMENTAL MANAGEMENT, *"Policy Position Paper: Lead in Drinking Water."*
www.ciwem.org/assets/pdf/Policy/Policy%20Position%20Statement/Lead-in-drinking-water.pdf.

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www.epa.gov/sdwa/use-lead-free-pipes-fittings-fixtures-solder-and-flux-drinking-water.



An example of a Vesconite Hilube pump bearing.

For instance, Southern Germany prohibited lead pipes more than 100 years ago, while Northern Germany, which continued to use lead piping into the 1970s, is currently focusing on getting rid of lead service lines.

There seems to be a worldwide groundswell of interest in replacing lead piping since piping is the main cause of lead contamination in water systems. Other parts of the water system, while they may not be the priority source of lead exposure, are also not being ignored. Solder, fittings (including alloy fittings with high lead content), and service connections contribute to lead in tap water and remain a concern for the World Health Organization, as indicated in its Guidelines for Drinking-water Quality.

Lead-containing bronze, for instance, has been seen as problematic for the bearings and impellers contained in pumps and water systems. Alloys such as zinc, tin or aluminum have sometimes replaced lead—this replacement will benefit the health of countries that introduce such products but these alloys tend to be adversely affected by chlorine dosing over an extended time. However, should lead-free, chlorine resistant, long-lasting Vesconite bearing materials replace these materials, they would lower maintenance time and

costs while at the same time reducing lead exposure.

SOLUTIONS TO LEAD IN DRINKING WATER

Different countries have set the allowable quantities of lead in drinking water. However, the lower the levels the better. There are no safe levels of lead, say experts. This statement is notably true for children who can experience behavior and learning problems, lower IQ and hyperactivity, slowed growth, hearing problems, anemia and, in rare cases, seizures, comas, or death with even low levels of lead in the blood.

However, lead exposure does not need to be a permanent threat to the world's potable water supply. The tools are already available to combat the problem as is the will to take it on. All that is needed today is to bring the two together. ■

Vesconite Bearings is a world-leading manufacturer of low-friction, low-wear polymer bearing materials for a wide range of industries. Selling to over 100 countries, these include the pump, agriculture, railways, mining, heavy transport, hydro, renewable-energy, earthmoving, marine, and construction industries. For more information, visit www.vesconite.com.

The background of the advertisement is a technical drawing of a piping system, featuring various lines, dimensions, and callouts. Scattered across this drawing are several brass plumbing fittings, including elbows, tees, and straight connectors. Some fittings have hexagonal bases, while others are standard threaded. One fitting on the left is partially white, possibly a plastic-to-metal adapter. The lighting is bright, highlighting the metallic texture of the brass.

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OUTSTANDING RESULTS FOR 8 MW PUMP

Sulzer overachieves stringent test criteria for main feedwater pumps in nuclear plant BY BRIAN GERMAINE, SULZER

Equipment designed for nuclear power stations requires extensive testing before products are accepted and delivered to the build process. For high energy

pumps, vibration levels both at the best efficiency point (BEP) and at low flow rates need to be kept to an absolute minimum in order to meet the strict specifications laid out by the operator.

During a recent project, Sulzer became the first pump manufacturer to achieve a vibration level below 0.17 inches per second at 30 percent of BEP flow, which is outstanding for an 8 MW

main feedwater pump with a single-stage design.

Sulzer won the tender to design, supply, test, install, and commission six complete main feedwater pump trains for the nuclear power plant. In China, Sulzer's Suzhou plant is one of the latest manufacturing sites to open for the company and provides the local power generation market with access to its global network of engineering experts. The project was delivered by the team in Suzhou and involved support from the company's facilities in Switzerland, Germany, and the United Kingdom.

DEMANDING SPECIFICATIONS

From the outset, the specifications for the main feedwater pumps were very demanding. Specifically, the vibration limits, which were set at 0.11 inches per second for the preferred operating range (POR) and 0.17 inches per second in the allowable operating range (AOR), including the maximum speed at 30 percent of BEP flow.



One of the feedwater pumps underwent a thermal shock test as part of the project delivery.

The pump Sulzer selected for this challenging application was the HPTd main feedwater pump, supported by a HZB booster pump, supplied with a fluid coupling and an 11.6 MW drive motor. The single stage delivers over 2,000 feet of head and had to be precisely designed and engineered to pass the demanding test schedule.

The engineering procurement and construction (EPC) company in this case was responsible for overseeing the manufacture of the main feedwater pumps. As part of this process, Sulzer needed to complete a number of comprehensive test routines to validate the performance of the design. Of the first set of three

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String testing of one of the feedwater pumps at Sulzer's manufacturing plant in Suzhou.

HPTd pumps, one was put through a hot test to verify its optimum operation when pumping water at 356 to 392 degrees Fahrenheit (180 to 200 degrees Celsius); then it was subjected to a thermal shock test and finally it was assembled into a purpose-built test loop and a full string test was completed.

ENSURING A SIXTY-YEAR SERVICE LIFE

The testing requirements for these pumps were very detailed and required considerable investment from Sulzer, but were essential in order to meet the expected service life of sixty years.

One of the major criteria that needed to be achieved was the overall efficiency of the pump. This is primarily a feature of the equipment's hydraulic design, although the drivetrain does have an effect on the final figure. In projects such as this, the EPC issues the build specification,

part of which will state the minimum efficiency figure for the pump. Today, these are typically above 85 percent and for pumps of this scale, achieving the criteria can be a challenge for some manufacturers.

For Sulzer, using its in-house expertise and applying it to a proven pump design enabled the company to deliver a pump that exceeded expectations. In terms of overall efficiency, the highly engineered design achieved a full one percent higher in the actual efficiency than the specification, which will deliver significant additional savings in running costs.

ACHIEVING LOW FLOW OPERATION

The specifications for the vibration figures were very stringent, especially considering the size of the pumps. However, the requirement for a vibration level below 0.17 inches per second when the flow is at 30 percent of BEP is a significant challenge. Typically, the minimum flowrate would be higher, making the target vibration figure easier to achieve.

The design of the main feedwater pumps was led by Sulzer's Product Development Team working seamlessly with the Order Related Engineering group in Suzhou. The pumps were then manufactured and tested in Sulzer's Suzhou facility.

For every component of a nuclear installation, the traceability of the materials used in their manufacture is essential. The supply chain

validation process means that the procurement procedures can be protracted, but as one of the world's leading pump manufacturers, Sulzer has considerable experience in meeting all the demands of such a challenging project.

PRECISION ENGINEERING SOLUTIONS

The combined facts of the exceptional efficiency figures and the achievements with regard to the outstanding mechanical performance, all point to the precision engineered hydraulics made up of the pump casing and impeller, which have enabled these targets to be surpassed.

The Chinese nuclear market is very competitive, and the EPCs are looking to deliver the best possible solutions for operators.

Sulzer has continuously invested in its capabilities in Suzhou to enhance its offering of highly engineered pumps for the most demanding applications. The latest additions to the testing facilities will strengthen its support for customers in a wide range of industries including power generation and specifically the nuclear business.

Sulzer's pumps can be engineered to suit the specific performance characteristics of each application. Further, the design, procurement, manufacturing, and testing processes have been thoroughly validated to meet the strictest industry requirements such as those of nuclear installations. ■

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TINY MOTOR, BIG IMPACT

Piezomotor creates new opportunities within the medical device market

BY MARK BRODERICK, PHD, PIEZO MOTION CORP.

A novel, low-power, high-performance rotary motor built around the piezoelectric principle overcomes the limitations of conventional high-precision miniature DC stepper motors. It opens new opportunities for motion control design within the medical devices and technology industries.



MINIATURE PIEZOMOTOR

The miniature piezomotor developed by Piezo Motion provides significant advantages in motion control applications that demand small size, high performance, precision motors.

The new piezomotor provides exceptional resolution, fast response time, ultra-smooth motion—without the vibrational interference caused by traditional DC stepper motors. The motor design enables accurate angular positioning and the ability to maintain any set position without the need for applied power, characteristics that are essential for many medical devices and high-tech applications.

Until now, precision miniaturized positioning devices have relied solely upon rotary electromagnetic (EM) motors (e.g., stepper motors).

CONVENTIONAL STEPPER MOTION

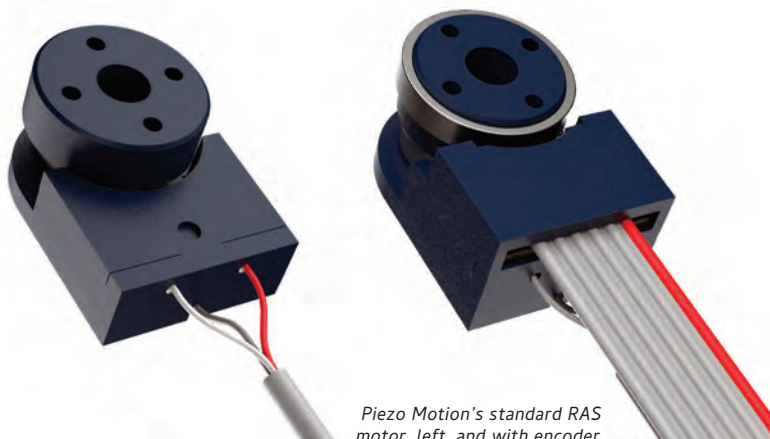
A conventional DC stepper motor is essentially a brushless DC motor (BLDC) in which a full 360-degree rotation is divided into several equal steps. Stepper motors have multiple electromagnets arranged as a stator around a central magnetic rotor which is connected to the motor shaft.

The rotor looks like a cog wheel in design because it has raised cogs/teeth around its circumference. When the electromagnets are energized (e.g., an external driver circuit), they attract the nearest cog. The rotation of the rotor is controlled by the sequential energization of each electromagnet.

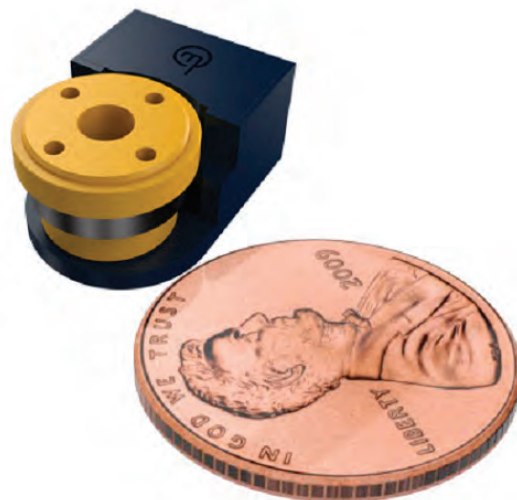
This occurs when the cog is attracted to the first electromagnet. The next electromagnet is turned on. The first is turned off, causing the rotor to rotate to align the cog with the second electromagnetic. The process is repeated to the next electromagnetic, causing rotation. Each of those rotations is essentially a step combined to form a full rotation.



In the conventional DC stepper motor, electromagnets are as they attract the nearest cog during a 360-degree rotation. (Source: Wapcaplet; Teravolt)



Piezo Motion's standard RAS motor, left, and with encoder.

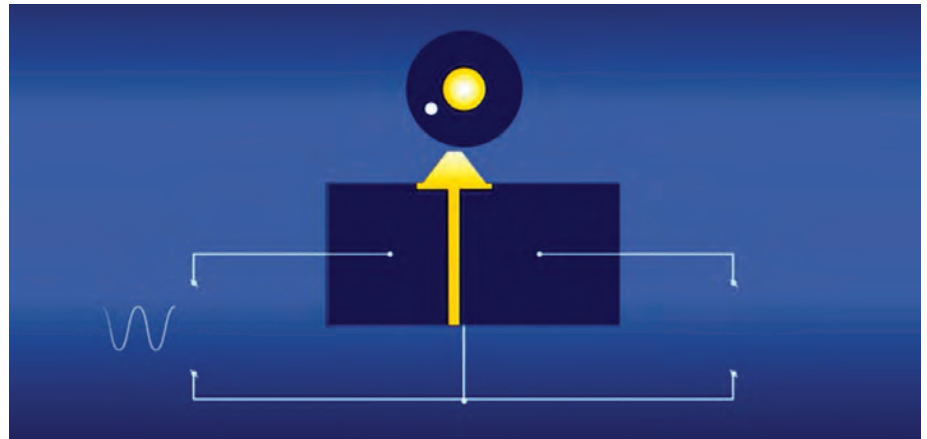


DRAWBACKS OF CONVENTIONAL DC STEPPER MOTORS

DC stepper motors move in discrete steps in response to electrical step and direction pulses. They are often distinguished by size, torque rating, speed, and/or the angle of the step. Typical stepper motors have a step angle of between 1.8 degrees and 0.72 degrees, providing between 200 to 500 steps per full rotation. These large step sizes create motor vibration leading to poor smoothness of rotation, mechanical noise, and resonance problems. The problem is even worse at slow speeds, which amplify the unevenness of rotation of the stepper motor.

One way to alleviate this lack of smoothness and mechanical noise is to reduce the size of the stepper motor's steps. This is achieved using a technique called microstepping, which enables the motor to rotate less than one complete step—often between 16 and 256 microsteps per one full step, thereby providing up to 51,200 microsteps per full rotation. Microstepping is achieved using a pulse-width modulated (PWM) voltage to control current to the motor and requires more complicated and costly control circuitry.

One fundamental problem with microstepping is that as you increase the number of microsteps per full step, the incremental torque per microstep decreases substantially. For example, at 16 microstep the holding torque is lowered by 10 percent of the



A simplified model of new piezomotor illustrating the principle of rotation using a rectangular piezoelectric resonator electrically excited to create rotation of the bearing. The design enables ultra-smooth precision bi-directional rotation.

original torque at a single full step, as the number of microsteps increases the torque rapidly decreases by more than 70 percent.

The drawbacks of stepper motors get worse with smaller frame sizes. Miniature high precision stepper motors are complicated to manufacture and can be unreliable and expensive. Generally, most stepper motor suppliers offer frame sizes in the range of 0.78 to 3.5 inches (NEMA 8 to NEMA 34). Precision Stepper motors smaller than 0.78-inch frame size are difficult to find and costly.

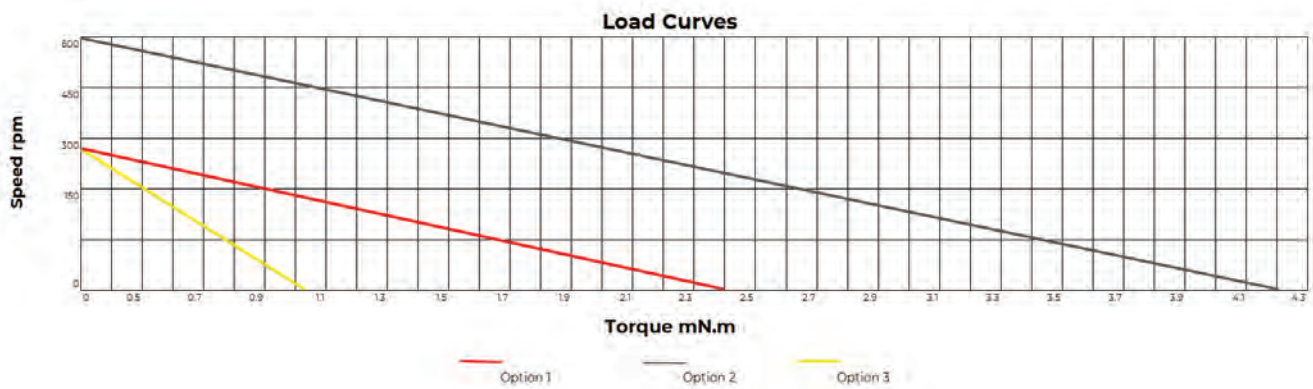
THE NEW PIEZOMOTOR SOLUTION

The need for an alternative rotary motor that can overcome these limitations has been met with the development by Piezo Motion of a novel high-performance miniature rotary piezomotor, the model RAS.

reinforced engineering thermoplastics, and with a rotor diameter of just 0.44 inches, this piezomotor provides superior precision and ultrafast response/start-stop characteristics; all within an affordable design. The motor is highly energy-efficient and consumes zero power in hold position while still providing significant torque.

What is exciting about the new motor is its minimum step size of just 30 μ rad, which equates to more than 200,000 steps per full rotation of control. Furthermore, unlike a microstepping stepper motor which loses more than 70 percent torque during a microstep, the piezomotor maintains full torque during every step and provides ultra-smooth and silent rotation.

With a reaction time of fewer than thirty microseconds, the piezomotor is at least 100-times faster at responding than a stepper motor.



Load characteristics of three different versions of model RAS piezomotor using different firmware options.

PIEZOMOTOR SPECS VS. TRADITIONAL STEPPER MOTOR

SPECIFICATION	RAS PIEZOMOTOR	EQUIVALENT STEPPER MOTOR
MODE OF OPERATION	STEPPING OR CONTINUOUS	STEPPING
RESPONSE TIME	<30 μ S	MS
MAXIMUM SPEED	UP TO 600 RPM	RPM
MINIMUM ANGULAR STEP	μ RAD (>200,000 STEPS)	MOTOR VIBRATES DURING ROTATION
MAXIMUM TORQUE DURING STEP	UP TO 4.2 MN.M	<0.08 MN.M (WITH MICROSTEPPING)
SELF-BRAKING TORQUE	UP TO 7.5 MN.M	MINIMAL
BACKLASH	ZERO	0.1 TO 1 PERCENT PER STEP (WITH GEARHEAD)
HYSTERESIS	<30 μ RAD	NOT AVAILABLE
REVERSAL TIME AT MAXIMUM VELOCITY	< 30 μ S	MS (APPROX.)
DYNAMIC RANGE BANDWIDTH	KHZ	HZ
NOMINAL POWER CONSUMPTION	0.1 W @ 1 RPM	1.9 W
SUPPLY VOLTAGE	TO 7.5 VDC	6.3
MASS	4G	G
DIMENSIONS	13X18.7X8.2 MM	14X45 MM (NEMA 6)
COST	<\$100	\$130 (>\$200 WITH GEARHEAD & BRAKE)

PRINCIPLES OF OPERATION

Piezo Motion's motors work on the principle of ultrasonic standing waves, which cause electrically induced excitation within a monolithic rectangular-shaped piezoelectric resonator/ceramic. The patented principle of excitation uses two orthogonal vibration modes. The two modes of vibration cause the piezo ceramic to oscillate and create rotation of the rotor which is

pushed against the piezoceramic. The technique greatly simplifies drive circuit design and requires very low voltages, reducing the drive electronics cost.

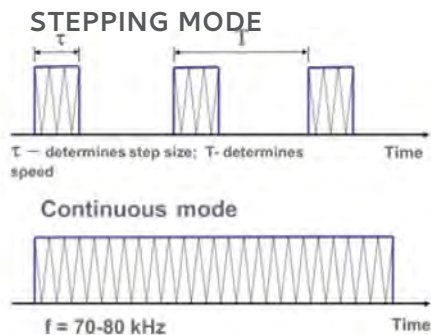
The new piezomotor is the ideal choice for OEM applications where superior performance and competitive unit cost are important factors. Available in a variety of configurations, including hollow-shaft, solid shaft and with/without

integrated encoder, they provide superior performance compared to a conventional stepper motor.

The piezomotor provides micro-radian resolution, ultra-smooth rotation, and zero backlash. The use of engineering thermoplastic in the design enables the motor to be manufactured with non-magnetic materials, making it suitable for MRI and other applications where high electromagnetic fields may be present.

SUMMARY OF KEY BENEFITS OF PIEZOMOTOR VS. STEPPER MOTOR

PARAMETER	PIEZOMOTOR	STEPPER MOTOR
PRECISION	@>200,000 STEPS = >1000 X GREATER PRECISION	200 STEPS = POOR PRECISION
TORQUE	FULL TORQUE DURING STEPS	TORQUE DECREASES >70 PERCENT WITH MICROSTEPPING
HOLD POWER	ZERO POWER TO HOLD POSITION	POWER REQUIRED TO MAINTAIN HOLD POSITION
ROTATIONAL SMOOTHNESS	ULTRA-SMOOTH ROTATION	MOTOR VIBRATES DURING ROTATION
NOISE	SILENT ROTATION WITH ZERO HARMONICS	MECHANICAL NOISE AND HARMONICS DURING ROTATION
RESPONSE TIME	<30 μ S (>100-TIMES FASTER)	10 TO 100 MS
MASS	LIGHTWEIGHT THERMOPLASTIC DESIGN	HEAVIER DESIGN DUE TO WINDINGS AND MAGNETS
PART COUNT	FEWER PARTS = BETTER RELIABILITY	INCREASED NUMBER OF PARTS
ENVIRONMENTAL/EMC ISSUES	NON-MAGNETIC DESIGN ELIMINATES INTERFERENCE AND SUSCEPTIBILITY TO EMC	MAGNETIC DESIGN CREATES EMC ISSUES.



In the stepping mode (PWM mode), the size of each step is determined by the pulse duration, and the pulse repetition rate determines the speed of travel.

CONTROL OF MOTION

The Piezo Motion motor is straightforward to control using an external signal source on the motor driver board. A digitally controlled AC voltage source applies a train of electrical pulses directly to the piezoceramic. Motor speed is controlled by changing the sequence or duration of the pulses (i.e., PWM). Modulation of the excitation voltage source enables switching between a continuous rotation to a precise stepping mode.

The piezomotor electronic driver PCB has been designed to provide an economical user-control interface. The driver PCB is supplied with pre-programmed firmware for optimization of motion control and enables factory customization of motor output performance specifications, including rotational speed and torque. ■

MARK BRODERICK, PHD, is president of Piezo Motion Corp. Piezo Motion is a leader in piezo motor technology with multi-million-dollar investments in research and development of affordable piezoelectric motors to meet, and exceed, the needs of today's global markets. The company is committed to developing innovative piezoelectric technology and motion products that enhance their functionality in a multitude of applications. Piezo Motion partners with startups, OEMs, research institutions, and industrial companies. For more information, visit www.piezomotion.com.

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Remote commissioning combines remote alterations to software and control systems with local adjustments to physical equipment.

REMOTE COMMISSIONING WILL CONTINUE AFTER COVID

The benefits of Industry 4.0 continue to spread

BY MATT HALE, HRS HEAT EXCHANGERS

The COVID-19 pandemic has had huge effects on economies around the world, including reducing raw material production, limiting workforce availability, suppressing demand for many products and services, and reducing the ability to travel. Businesses have

adapted to these challenges in numerous ways, changing working procedures, stockpiling goods, and working remotely where possible.

In many cases working remotely is straightforward with good levels of online communication and access to the necessary technology. For many

office-based workers it is as easy to complete their jobs from home (provided domestic distractions can be minimized) as from their desks. Restrictions on global travel have also increased the use of remote working by international businesses: while holding online meetings may be

more convenient and better for the environment than flying halfway round the globe for a half-day conference, there are some things that, according to conventional wisdom, can only be carried out successfully in person.

TECHNOLOGY TO THE RESCUE

Until recently several stages of production and installation of manufacturing equipment would have fallen firmly into this category. Clients would have travelled to manufacturer's facilities to carry out Factory Acceptance Testing (FAT) as new projects were begun, and manufacturer's engineering staff would visit the client to assist with the final installation and commissioning of the finished equipment. Over the last two-years COVID-19 has made many of these trips impossible, or harder to justify.

Technology has once again come to the rescue, with remote metrics and connections to machinery and equipment allowing the equipment manufacturer's own staff to assist local onsite engineers with the connection, installation, and commissioning of new equipment. Over the last two years HRS Heat Exchangers have used such an approach at both national and international levels to assist with the installation of a wide range of equipment

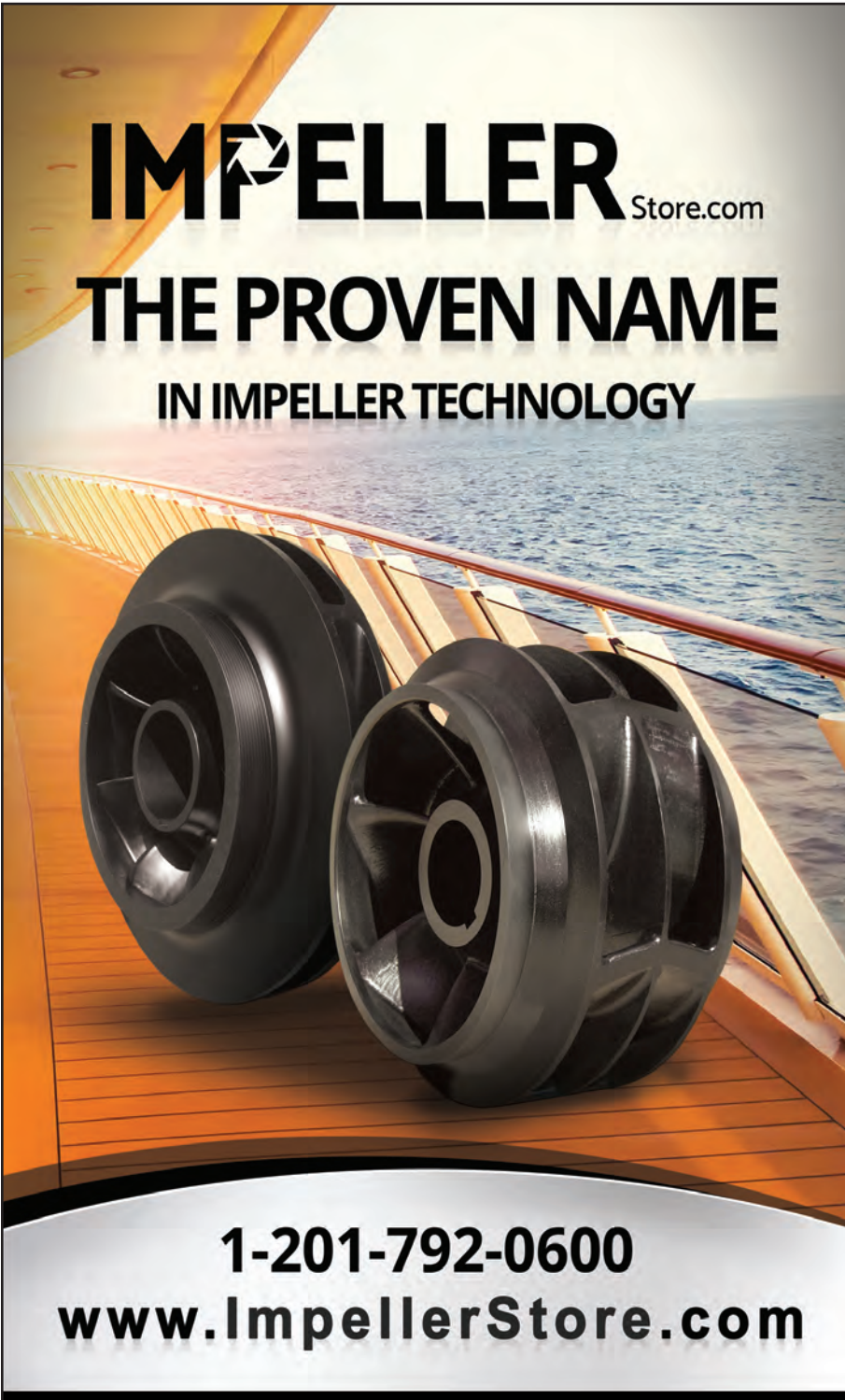
FAT helps verify that newly manufactured and packaged equipment meets its intended purpose, validating the operation of the equipment and making sure that customers' purchase order specifications and other requirements have been met. Later in the supply process, commissioning can be defined as a systematic process of verifying that all equipment and facilities perform interactively in accordance with the design and intent, and in accordance with the client's operational needs, including the preparation (and training) of operational personnel. It is usually carried out between the design phase and up to one year after installation.

INDUSTRY 4.0 AND VIRTUAL INSPECTION

Thanks to remote telemetry, engineers and others can perform virtual inspection of assets and can see virtually what works and what doesn't, including "fault" finding

and identification. These digital solutions help to reduce the number of personnel on site as well as the duration of tests and can be applied to both FAT and final commissioning.

Remote commissioning is becoming one of the most visible



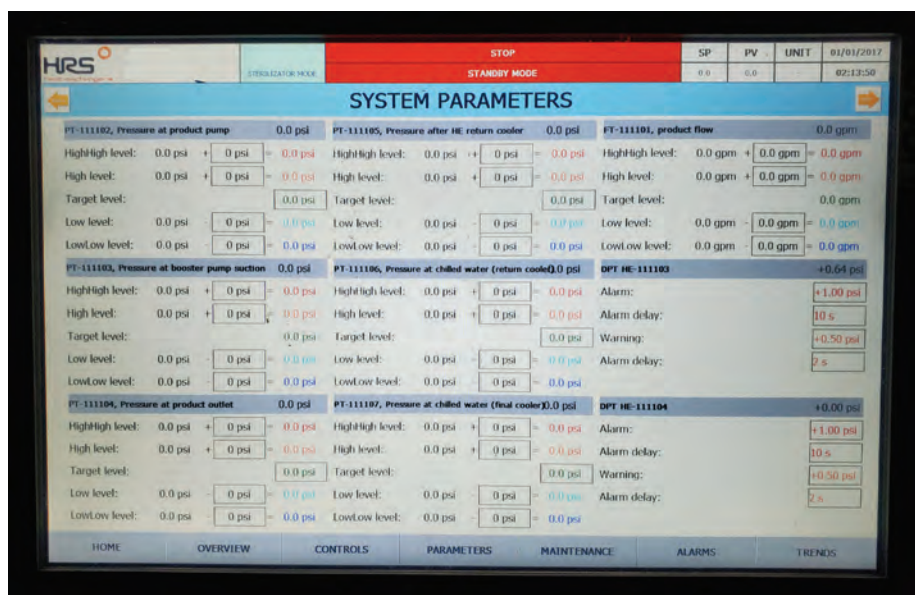
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aspects of Industry 4.0 and the Internet of Things (IoT). Although each case will be different, there are a number of stages which are common to most remote commissioning processes, including verification that

the plant or equipment has been installed in accordance with the plans and piping/instrumentation diagrams. There is also likely to be a pre-commissioning stage that includes systematically checking connections, wiring and human-machine interfaces (HMIs) as well as installing and updating software components, cleaning, flushing equipment, etc.

The actual remote commissioning process will also consist of various steps but is greatly assisted by remote monitoring and telemetry of equipment using either an ethernet connection or an integrated data SIM. This allows system software to be adjusted as necessary while the equipment is operating. Other parameters and physical adjustments can be discussed

during online meetings facilitated by conferencing systems and other forms of communication, such as WhatsApp. To date HRS has carried out a number of successful projects have demonstrated the effectiveness of this approach.

THE BENEFITS COMPOUND OVER TIME

One practical aspect which must be considered when operating internationally is the potential time difference between the on-site engineering team and the equipment supplier and overcoming this presents some logistical challenges and additional costs. However, none of these issues are insurmountable. When additional out-of-hours overtime charges are compared to the costs of travel and accommodation, there are often financial benefits, not to mention to considerable the reduction in carbon emissions and unproductive time spent travelling.

These benefits are undoubtedly one of the drivers which will ensure that remote commissioning continues to be carried out in the future whether or not our ability to travel is limited by the COVID-19 pandemic or other unforeseen factors. ■

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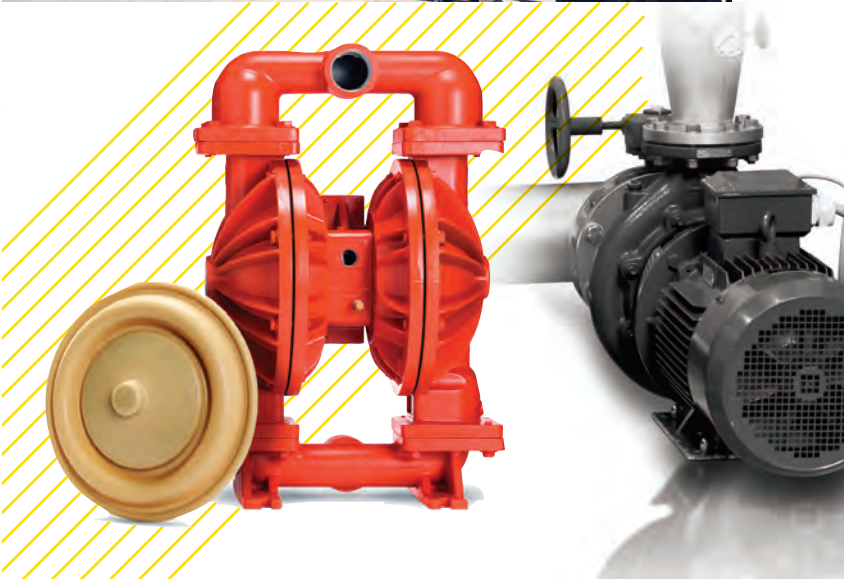
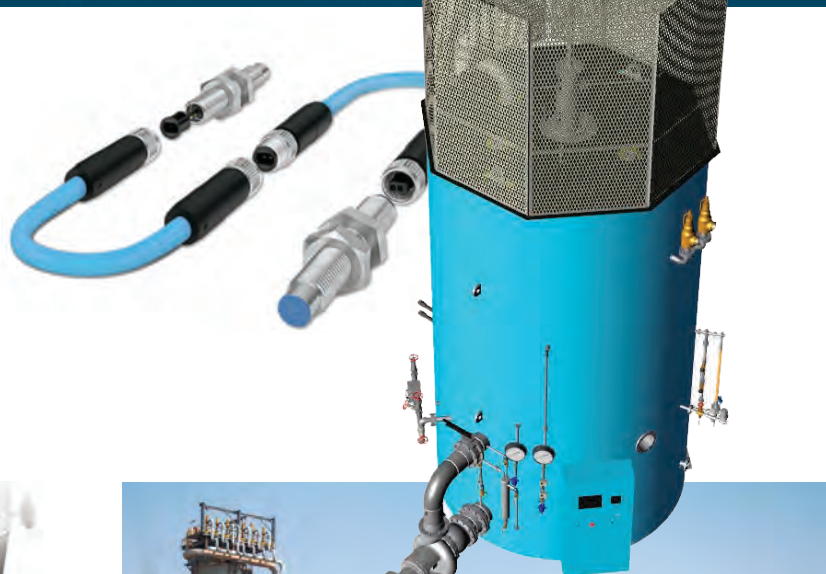


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Blacoh

BACK PRESSURE AND PRESSURE RELIEF VALVES

Redesigned from the inside out, Blacoh back pressure and pressure relief valves feature patent-pending flow stabilization technology to deliver improved flow, extend valve service life, and eliminate dreaded valve chatter.

Blacoh engineers solved the problem of valve chatter with a better design. Most back pressure valves are based on a pressure relief design where the valve is normally closed. When a set pressure point is reached, the valve opens quickly with maximum flow to relieve pressure. This action doesn't work well for back pressure valves that need to flow continuously to hold pressure upstream. When the valve opens quickly, pressure upstream drops rapidly and the valve slams closed. The sudden stop in flow causes a pressure spike that forces the valve open again. In a back pressure valve application, this cycle occurs many times per second, creating a loud, chattering valve with inferior performance and a shorter service life. Blacoh's flow stabilization technology meters flow when the valve



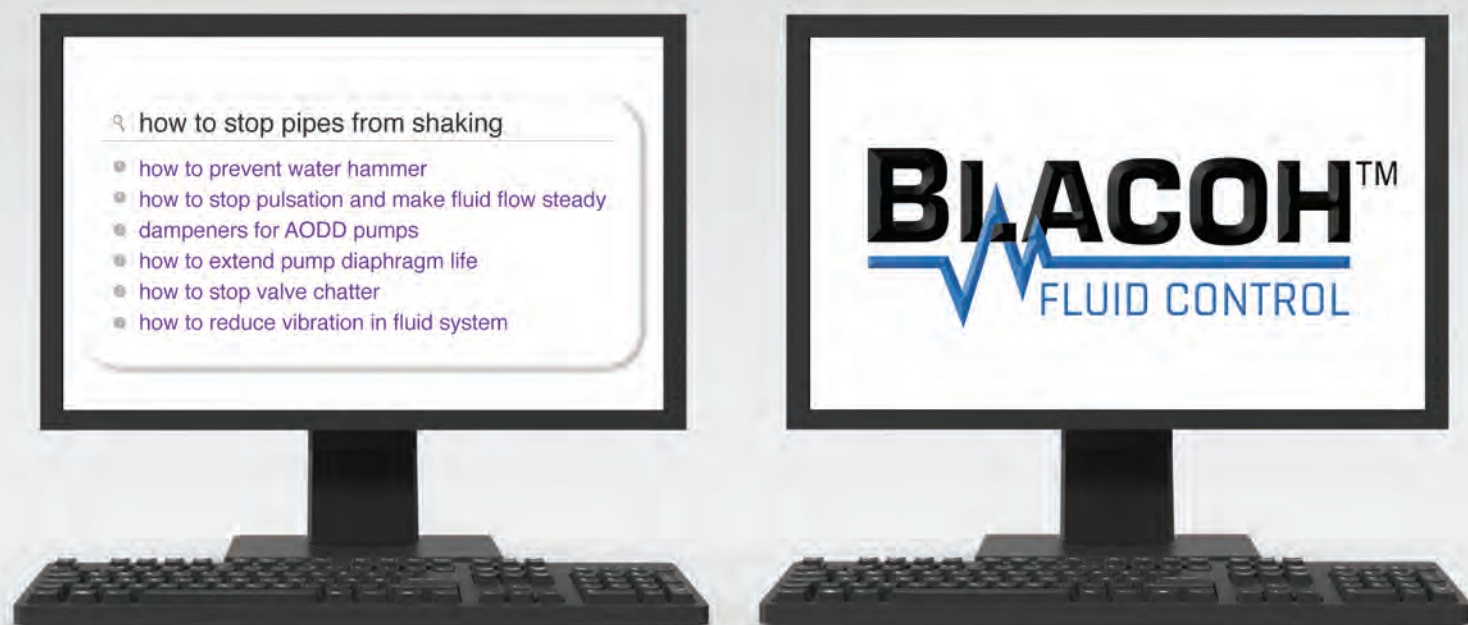
opens to minimize the pressure drop that initiates this cycle. The result is a valve that doesn't chatter, performs better, and lasts longer.

All Blacoh back pressure and pressure relief valves use a unique swiveling spring seat to ensure spring force is applied evenly over the diaphragm for more consistent and complete valve closure. Both plastic and metal valves have a separate

ring attachment that provides a more uniform clamping load and improved seal performance. Standard plastic valves use a threaded connection, eliminating the need for metal fasteners. Blacoh valves are available in sizes from 1/4 up to 2 inches in a variety of materials, port configurations, and inlet options, with spring pressures up to 350 psi. ■



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Environment One Corporation

E/ONE BACKGROUND

For more than fifty years, Environment One Corporation has manufactured 1 horsepower SPD grinder pumps designed specifically for use in pressure sewer systems. From the 200 Series in the 1970s to the 2000 Series in the 1990s to today's Extreme model, almost two million end users in over forty countries rely on E/One grinder pumps daily.

SPD GRINDER PUMP FOR WASTEWATER APPLICATIONS

In a low-pressure sewer system, constant, predictable pump output is the foundation for proper hydraulic design. It enables the engineer to minimize retention time, pump wear, and keep scouring action at effective levels.

The system pressures to be overcome by any given grinder pump in a low-pressure sewer system vary dramatically over the course of a day. E/One's progressing cavity pump readily accommodates these pressure variations while maintaining a nearly constant flow without ever operating at "near shut off"—thus avoiding the wear and motor burnout suffered by other pump types.

E/One's SPD pump has a nearly vertical H-Q curve. It is by far the most "forgiving" pump design—providing predictable flow over the full range of typical system pressures; strengths

critical in large-scale, low pressure sewer systems.

E/One's superior high head capability allows a system to have few, if any, lift stations. And, it easily accommodates additional future connections without compromising system performance. E/One grinder pumps offer reliable operation from negative heads to 185 feet of total head.

SEWER ANYWHERE, IN ANY TERRAIN

Pressure sewer systems are cost-effective and can be installed in any terrain—flat, wet, rocky, even on sites with dramatic elevation changes. They are much more affordable than conventional gravity sewers, which require major excavation, and much safer for communities than septic systems, which can eventually fail, polluting ground and recreational water and endangering public health. Pressure sewer systems can cost as much as 80 percent less to install vs gravity sewers and reduce the number of lift stations required—or even eliminate lift stations altogether.

SEPTIC TO SEWER CONVERSION PROJECTS

E/One sewer systems have been chosen for septic-to-sewer conversion projects both in the United States and abroad, especially in coastal areas

where the soil is not conducive to septic tank usage and as sea levels rise. At Rincon Point in California, failing septic tanks at oceanfront homes polluted the ocean. Surfers were getting sick and avoided the water after rainstorms. One resident could see the tide rise and fall inside his septic tank. Septic tanks were replaced with the E/One sewer system, resulting in a cleaner ocean.

PRESSURE SEWER SYSTEM UPGRADES

E/One offers its grinder pump as a replacement for existing pressure sewer systems. E/One grinder pumps use integrated pressure switches instead of floats, which are less susceptible to grease buildup and eliminate nuisance alarms that result from stuck floats. The Upgrade is a one-piece pump that installs quickly and easily into the existing tank.

Environment One's Upgrade, the aftermarket grinder pump that works and goes on working without any preventive maintenance. It's the original grinder pump design, the one others have tried to copy but they just haven't gotten it right. Maybe that's why E/One's Upgrade has been the pump of choice for many pressure sewer upgrade projects in the mountains of Tennessee, the lakes of the Midwest, and many coastal communities. ■





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LEADING THE INDUSTRY WE INVENTED.

Environment One not only pioneered the grinder pump category, but consistently leads the industry both in system deployment and innovation. E/One remains dedicated to Total Quality, Continuous Improvement, and Extreme Customer Satisfaction.



SEWER SYSTEMS

Environment One Corporation
www.eone.com/sewers

A Precision Castparts Company

Gorman-Rupp Pumps

Gorman-Rupp has been revolutionizing the pumping industry since 1933. Many of the innovations introduced by Gorman-Rupp over the past eighty-five years have become industry standards.

We continue to update our machinery, processes, research and development, and engineering to ensure that our pumps and systems are among the most reliable and efficient on the market. With nearly one million square feet under roof, our facilities house some of the most modern manufacturing, testing, and warehousing facilities in the world. Our experienced engineers take advantage of the latest technologies and innovations to custom-design, manufacture, and assemble our products.

With over one million Gorman-Rupp pumps installed to date, we have the knowledge and experience understand your specific application. We provide solids- and clean-fluid handling pumping solutions for municipalities, industrial plants, construction and rental businesses, refineries and petroleum plants, mining sites, agricultural operations, and a variety of original equipment manufacturers.

One of our most successful and innovative lines of pumps has been our self-priming models. Gorman-Rupp also manufactures complete lines of submersible, priming-assisted (dry-prime), standard centrifugal, horizontal end suction centrifugal, and rotary gear products built for the most aggressive pumping applications. In addition, our ReliaSource® pump packages that incorporate these

products are designed, manufactured, and tested and include pumps, motors, piping, and controls to ensure superior operation and easy installation.

We perform rigorous testing based on Hydraulic Institute Standards and test to customers' actual operating conditions in our one-of-a-kind testing facility guaranteeing innovative, superior-quality products that are ready to tackle your toughest jobs. To ensure you get the right equipment for your requirements,



Gorman-Rupp partners with a worldwide network of distribution and provides them with the most extensive training. Gorman-Rupp distributors will work hand-in-hand with you to recommend, customize, and specify equipment. And Gorman-Rupp is always available should you ever require any assistance.

PHILOSOPHY

Gorman-Rupp stands behind the quality of our pumps to ensure they meet your requirements for the long haul. To maintain industry-leading client satisfaction well beyond product installation, we offer a variety of services to meet your needs, including world-class training, service, and industry-leading warranty.

INDUSTRY-LEADING SUPPORT AND WARRANTY

Gorman-Rupp stands behind the quality of our pumps to ensure they meet your requirements for the long haul. To maintain industry-leading client satisfaction well beyond product installation, we offer a variety of services to meet your needs, including:

INDUSTRIAL

If your application deals with abrasive, corrosive fluids, or liquids containing large solids, we have the right pump for the job. Gorman-Rupp pumps are constructed in a variety of materials to move fluids in steel mills, paper mills, underground mines, food processing, automotive and chemical plants, canneries, power plants, tanneries, glue and resin plants, and any other facility where dependability and ease of service are essential.

MUNICIPAL

When you choose Gorman-Rupp, you benefit from one of the largest and highest quality lines of municipal pumps, engine-driven pumps, sewage lift stations and water booster/reuse stations available on the market. Our ReliaSource® packaged lift and booster stations ship complete from the factory with pumps, motors, and controls and are 100 percent tested before they leave the facility to ensure product efficiency and operation. ■

GORMAN-RUPP PUMPS

P.O. Box 1217
Mansfield, Ohio 44901





The Pump People®

GET RID OF WATER... SO YOU CAN GET TO WORK.

INTRODUCING GORMAN-RUPP VALUPRIME® PUMPS

Gorman-Rupp's new line of general purpose, priming-assisted pumps is designed to dewater your job site without taking a bite out of your bottom line. Available in 4" and 6" sizes, ValuPrime® pumps feature 3" solids-handling capability, oil-lubricated mechanical seals and Final Tier IV engine technology.

And, like all Gorman-Rupp pumps, the quality engineering, manufacturing and testing that go into every ValuPrime pump will keep your site dry and your project on track.



> Call Gorman-Rupp at 419.755.1011 or visit
ValuPrime.GRpumps.com for more information.

Mueller Water Products

Mueller Water Products, Inc. is a leading manufacturer and marketer of products and services used in the transmission, distribution, and measurement of water. Since 1857, Mueller has been helping municipalities increase operational efficiencies, improve customer service, and prioritize capital spending, demonstrating why Mueller Water Products is “Where Intelligence Meets Infrastructure®.”

COMMITTED TO SAFE DRINKING WATER

From life-saving fire protection to data intelligence, we are committed to developing products and solutions that help cities and water utilities deliver clean, safe drinking water. Our broad product and service portfolio includes engineered valves, fire hydrants, pipe connection and repair products, metering products, leak detection, pipe condition assessment, and software that provides critical water data.

When you invest in water infrastructure, quality matters. That's why we select rugged materials and build state-of-the-art software to provide products and services that are designed and engineered for the long run. When you choose Mueller, you choose lasting value that can ultimately translate into cost savings.

SERVING ALL YOUR WATER DISTRIBUTION NEEDS

Mueller is one of the only companies that can fulfill your water system needs from end to end—at the source, at the plant, below the ground, on the street, and in the cloud. Built on a legacy of innovation, we have the vision and expertise to provide advanced infrastructure and technology solutions for transmitting, distributing, measuring, and monitoring water more safely and efficiently than ever before.

Mueller brands provide products and solutions for:

FLOW CONTROL SOLUTIONS

Mueller offers a full line of products for controlling water safely and efficiently across your distribution system, including valves and control systems. And for easy and effective maintenance and repair, we offer superior service line connection products and equipment.

Products in this category include:

- **VALVES:** resilient wedge gate, butterfly, check, plug, cone, air release, knife gate, slide gates, and more
- **WATER NETWORK CONNECTIONS:** drilling and tapping machines, service brass, and pipe repair
- **CONTROL SYSTEMS:** pressure and flow

FIRE PROTECTION SOLUTIONS

Safety is built into every Mueller® solution. All of our fire protection solutions are compliant with Underwriters Laboratories and Factory Mutual requirements.

Products in this category include:

- **VALVES**
- **HYDRANTS**
- **HYDRANT SECURITY**
- **INDICATOR POSTS**
- **TAPPING MATERIALS**

PIPELINE MANAGEMENT TECHNOLOGY

Proven technology that enables utilities to assess and optimize water networks.

Products in this category include:

- **CONDITION ASSESSMENT**
- **LEAK DETECTION AND MONITORING**
- **SOFTWARE:** utility dashboard, monitoring services, notifications

METERING AND COMMUNICATION TECHNOLOGY

Smart metering paired with the Mi.Net® system allows municipalities to enhance how they serve the community. Our Advanced Metering Infrastructure (AMI) system is a

flexible communication network that grows as your needs change.

Products in this category include:

- **METERS:** residential, commercial and industrial, fire service, registers, valves, setters, and boxes
- **COMMUNICATIONS:** nodes and data loggers.
- **SOFTWARE:** water intelligence platform for water utilities to monitor, control and monetize water distribution networks; as well as utility dashboard, billing consumer information software, customer portal, and leak/network operation services.
- **SERVICES:** field operations, network operations center, network-as-a-service

THE MUELLER ADVANTAGE

Mueller solutions are born from the collective products, services, and professionals in our family of the most trusted companies in the industry. Together, we are a consultative, dedicated team of engineering, sales, support, and distribution experts working collaboratively toward one goal—your success.

We go above and beyond what's expected to help your water infrastructure system work harder and smarter and last longer, now and in the future. And we continue to invest in innovative ways to help you see insights across your system so you can proactively address concerns, extend the life of your operations, and improve your customer service and bottom line.

Mueller Water Products brands include Mueller®, Echologics®, Hydro Gate®, Hydro-Guard®, HYMAX®, i2O®, Jones®, Krausz®, Milliken®, Pratt®, Pratt Industrial®, Singer®, and U.S. Pipe Valve & Hydrant. ■

For more information, visit www.muellerwaterproducts.com.

MUELLER RESILIENT WEDGE GATE VALVES & SUPER CENTURION® HYDRANTS - NOW WITH THE HYMAX GRIP® RESTRAINT



4"-12" A-2361 Mueller Resilient Wedge Gate Valves and Super Centurion® 250 Fire Hydrants are now available with the HYMAX Grip® restraint. The HYMAX Grip restraint is a versatile single-bolt coupling capable of joining a wide selection of pipe types and diameters, resulting in easier, more flexible installations using Mueller products you already know and trust.



Easy Installation – No assembly required. The stab-fit design and top-facing bolt enable quick and easy installation.



Flexible Design – The patented gasket transforms the pipe joint into a flexible connection and allows dynamic deflection of the pipe up to 4 degrees per side.

Ready to take the next step towards fast and easy installations with one ready-to-use product?

• Scan the QR code to get in touch.



MUELLER

MUELLER® | ECHOLOGICS® | HYDRO GATE® | HYDRO-GUARD® | HYMAX® | i20® | JONES® | KRAUSZ® | MI.NET® | MILLIKEN® | PRATT® | PRATT INDUSTRIAL® | SINGER® | U.S. PIPE VALVE & HYDRANT

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Pedrollo



“MADE IN ITALY” PUMPS THAT ARE SYNONYMOUS WITH QUALITY, RELIABILITY, DESIGN, AND INNOVATION

Pedrollo S.p.A., founded in San Bonifacio (Verona) in 1974, is one of the major family-owned industrial companies in Italy and is globally recognized as a benchmark in the electric water pumps industry, with more of 2.5 million pumps manufactured every year.

Pedrollo currently distributes products in more than 160 countries around the world through its ten commercial branches and through its parent company, Pedrollo Group Inc, which is led by Giulio Pedrollo, as chairman, and is now officially present in the North American marketplace through its recent acquisition of Superior Pump. Superior Pump is now part of Pedrollo Group Inc. since the majority acquisition in 4Q2020 and is active in the design, production, and marketing of pumps with a particular focus on the United States and Canada markets. Pedrollo USA is headquartered in Minneapolis, Minnesota, and led by Charlie Michel III as president.

Pedrollo is a leading company in manufacturing and supplying electrical water pumps for residential, commercial, agricultural, and industrial use. Pedrollo is a producer of a complete range of electric water pumps, motors, electronic controls—including VSD and pressure systems. With a focus on innovative products, the wide range of pump includes many diverse types of pump products, such as peripheral, centrifugal, horizontal and vertical multistage, self-priming, pool pumps, deep well submersible pump end as well as electric motors, sump, sewage, effluent, and grinder pumps. Pedrollo will also offer a wide array of accessories, electronic controls, including VSP, and pump systems and packages.

Pedrollo's headquarters occupies a significant area of space and is in

continuous expansion, and currently occupies more than 1.6 million square feet with more than 1,200 employees. Pedrollo's physical size and presence makes it a true and proper industrial district, spread over various specialized plants allowing it to offer practically the entire production and supply chain internally.

Pedrollo's highly automated systems guarantee competitiveness and is constantly investing in innovation, accounting for over 16 percent of revenues, and integrating innovative and original solutions in manufacturing, mechanics, design, electronics, and human intelligence.

The research and development performed at Pedrollo does not only concern the final product, which it holds numerous international patents, but is also applied to machinery and the productive processes employed. The required skills on both the engineering and technological levels are so elevated that, in many cases, they require the direct building of ad hoc dedicated production machinery, designed exclusively by Pedrollo Engineering of the same applied to the numerous registered patents—more than 200 exclusive and original patents—which requires maximum protection through the internal realization of processes, machinery, and safe and ergonomic systems. Such a holistic strategic choice determines a positive position of control and guarantee over both the finished products and the entire production process.

Pedrollo's worldwide success is based on a great innovative capacity sustained by constant research and a strong commitment to development. These efforts are ultimately aimed at the technical improvement of systems and products. Upon ensuring the models' functional priorities, Pedrollo continues with regular design updates: a much-appreciated detail in the market and a

distinctive sign of Italian quality. There is also a constant renewal of products also from an aesthetical point of view, making them more pleasing both to the eye and touch as well as being more efficient—another indicator of the complete attention that Pedrollo promises to its customers. Moreover, Pedrollo uses an advanced prototyping center that enables the invention and realization of new increasingly improved performing products and designed to solve to customers' ever-changing requirements. Pedrollo possesses a tradition of creativity and technology that signifies the excellence of “Made in Italy.”

Pedrollo has committed significant investment aimed at guaranteeing its own companies the capability to produce energy from renewable sources with a positive impact on the environment and society, making it almost entirely autonomous from an energy standpoint. Pedrollo has over 2.5 MW of electricity generated by solar panels and the company recovers rainwater and uses it for industrial and commercial purposes in its plants.

Innovation, quality, service, professionalism, self-reliance, and its innovation-focused business model, along with commitment to sustainability and social responsibility (www.pedrollo4people.com), are the foundations of its long-established reputation.

Pedrollo S.p.A. is a part of Pedrollo Group (www.pedrollogroup.com). ■

PEDROLLO USA

45 Maryland Avenue East,
St. Paul, Minnesota 55117
877.PEDROLLO (733.7655)
info@pedrollo-usa.com
www.pedrollo.com



- **Manufacturer of a Complete Range of Electric Water Pumps, Motors, Electronic Controls including VSD and Pressure Systems**
- **Excellent Reliability**
- **Family-Owned and Managed Company**
- **Innovative Designs**
- **100% Made in Italy**
- **High Quality, Efficiency and Performance**

PEDROLLO USA

45 Maryland Avenue East - St. Paul, MN 55117

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Vaughan Chopper Pumps

THE VALUE OF MADE IN AMERICA



Pumps should be reliable. Not only do they serve a vital purpose for many industries, but they are also often located in tough-to-reach areas. This makes replacing a broken pump difficult, time-consuming, and expensive—both in terms of the pump itself and the clean-up of the area around it. Vaughan Company's high-performing and exceptionally reliable chopper pumps can handle the severe workloads of correctional facilities, dairy farms, wastewater treatment plants, and more. Because these pumps are American-made and sourced, they support American jobs and companies as well as reduce lead times and costs incurred from international suppliers.

FROM THE PACIFIC TO THE ATLANTIC AND EVERYWHERE IN BETWEEN

In the late 1950s, Jim Vaughan, the company's founder, spent hours in the bay of the service station he owned in Elma, Washington, repairing manure pumps for local dairy farmers. The pumps constantly broke down due to clogs caused by animal bedding and twine. Jim asked himself what could make these pumps better. He knew there had to be a solution, so he invented the world's first chopper pump. After he officially introduced it in 1960, Vaughan Company was born.

In the early years of the company, Jim would strap a pump on the back of his pick-up truck and drive to dairy farms across the United States to give demonstrations. In the decades since, the company has sold Vaughan Chopper Pumps all over the

world and has been awarded over thirty patents. The company is still located west of Elma in Montesano, Washington, and remains committed to precisely manufactured chopper pumps that can withstand the toughest applications. In addition to multiple centrifugal chopper pump configurations like horizontal, pedestal, submersible, and the world's only self-priming chopper pump, Vaughan Company also manufactures the Triton screw pump and the Rotamix hydraulic mixing system.

BENEFITS OF BUYING AMERICAN-MADE

Vaughan products begin with raw materials that are nearly 100 percent sourced locally in the United States. This reduces shipping time and cost, so customers across the nation can get these industry-leading products without the mark-up and wait times associated with imported systems. This is important since each chopper pump or mixing system is custom-built to meet the end-user's specific needs. Even without current supply chain disruptions, global sourcing would not allow for this level of customization within a feasible timeline. In addition to fast builds, the Washington-based manufacturing facility holds a large surplus of spare parts, so Vaughan products are easily maintained.

Knowing every pump user faces a unique situation, Vaughan Company also has local sales representatives across the country to provide exceptional customer service when it is needed most—whether that is working closely with customers to tailor pump solutions for an exact situation or providing post-installation support.

PRODUCTS THAT SUPPORT AMERICA

While Vaughan's locally sourced and American-made chopper pumps keep

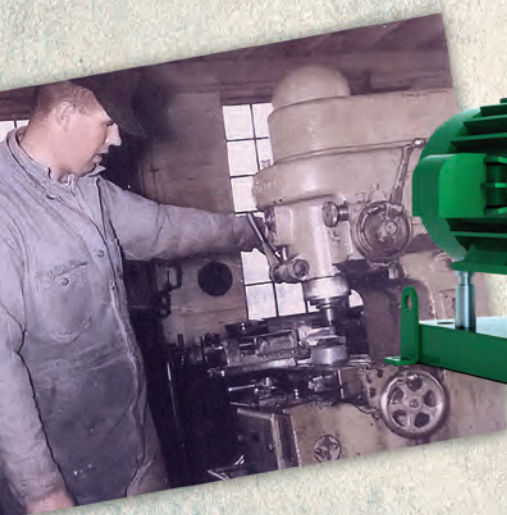
projects moving, their benefits don't stop there. Vaughan Company has been family owned and operated for four generations and is still asking Jim's question, "What could make this better?" The company's commitment to continuous improvement has led to products that are efficient and reliable. The company uses cutting-edge technology like 3D computer modeling, which helps create exacting fits and precision castings for all components. Always pushing boundaries, Vaughan Company also uses both computational fluid dynamics (CFD) to analyze flow patterns and velocities within the pumps to maximize their performance and computer numerically controlled (CNC) automated machining to ensure every Vaughan replacement part fits precisely and consistently.

But the answer to Jim's question extends beyond the walls of the manufacturing facility. As a major, local employer, the company strives to better its community by giving to charities and community organizations. Vaughan Company developed its own scholarship program for graduates of the Elma or Montesano school districts, who are planning to pursue a post-secondary degree or technical certificate and supports many industry associations to help provide scholarship opportunities in the water and wastewater sector. Vaughan products are not just made in America, they also support the future of America. ■

To learn more about American-made Vaughan Chopper Pumps, Rotamix hydraulic mixing systems, and our other specialty products, contact the company at:

888.249.CHOP (2467)
info@chopperpumps.com
www.chopperpumps.com





PROUDLY MADE IN THE USA.

Since 1960, Vaughan Company has been manufacturing the toughest no-clog pumps in the USA. Our 3rd and 4th generation family-owned and operated company builds cutting edge products that are built to last and keep things flowing smoothly.

Choose the unmatched reliability of Vaughan. Ask about our free trial program and on-site demos.

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EXPEDITED DELIVERY | ELIMINATES COMMUNUTORS | EXTERNALLY ADJUSTABLE CLEARANCES

Vaughan
Unmatched Reliability

Check-All Valve Mfg. Co.

Since 1958, Check-All Valve Mfg. Co. has manufactured a complete line of in-line spring-loaded piston-type check valves. With worldwide service, Check-All Valve serves a wide range of industries including the chemical, petrochemical, pharmaceutical, food and beverage, water treatment, OEM, MRO, and many others. Lightweight, efficient, and rugged, every Check-All valve is designed and built to perform to exact needs and specifications. The company is ISO 9001-2008 certified and manufactures product lines compliant with CE/PED requirements, Canadian Registration Number guidelines, 3A Sanitary Standards, and others.

Check-All valves are engineered for silent operation. They close quickly and smoothly to eliminate

hammer noise. They are designed to function equally well in either a vertical or horizontal position, with proper spring selection. They are also designed to reduce installation costs. The insert series check valves easily fit into existing line components, which reduces initial cost and installation time. The seating surfaces are parallel to each other thereby eliminating the excessive wear occurring in plug, cone and ball seats. Check-All valves can also be used as low-pressure relief valves and vacuum breakers.

With many styles available, Check-All Valve provides check valves for practically every service application. Valves are offered with metal-to-metal or soft seats in sizes ranging from 1/8-inch NPT to 20-inch flange connections.

Pressure ratings are available from full vacuum to 10,000 PSI. Standard or exotic materials are available and you can choose from a wide variety of spring settings and seat materials for any valve. Most options are available with fast delivery. Specially designed valves are another option that Check-All Valve performs on a regular basis. Check-All Valve Mfg. Co. is staffed to supply you with a quality product as well as personal technical services. ■

CHECK-ALL VALVE MFG. CO.

Contact us for a complete
catalog or see us at
www.checkall.com.

More than a Check valve

It's a Check-All®

SILENT OPERATION!
Our check valves close quickly and smoothly to avoid water hammer noise and vibration.



SPRING-LOADED!
Multiple spring settings as well as seat and body materials available to meet your application needs.



UPSTREAM TRIM!
The upstream trim is protected from corrosive media mixing; thereby, extending valve service life.



And most lead times are less than one week. That's what makes our check valves Check-All®.

Proudly manufactured in the USA



www.checkall.com
Call us at 515-224-2301 or
email us at sales@checkall.com



Proudly manufactured in the USA

EASA

PLAN TO ATTEND THE EASA CONVENTION AND SOLUTIONS EXPO IN JUNE

Gather together your friends and colleagues and travel to St. Louis for the EASA Annual Convention and Solutions Expo June 26-28, 2022, at the America's Center. Plan to arrive on June 24 and take advantage of EASA bonus education on June 25.

This year's education line-up features a wide-ranging program designed to address all areas of the electromechanical sales and repair business, including:

- **VISIONS ON IIOT FOR INDUSTRIAL MAINTENANCE:** The promises of the Industrial Internet of Things (IIoT) are big, but there are limiting factors that may constrain the more optimistic predictions of the impact on the industrial repair business segment.

- **UNDERSTANDING CORROSION IN PUMPS:** Understanding the different types of corrosion and how to identify them will help service centers work with customers to eliminate them or mitigate the damage.
- **CENTRIFUGAL PUMP IMPELLERS:** Those who have had a pump and system not meet performance expectations will want to attend this presentation. This session will include explanations on how a centrifugal pump converts mechanical energy (rotation) into hydraulic energy (head and flow).

Each day of the EASA Convention features the Solutions Expo where the industry's leading manufacturers

and service providers showcase the latest developments in electric motors, drives and controls, generators, and other equipment and services for the electromechanical industry.

"Attendance at the EASA 2022 Convention is open to all, both members and non-members," says Linda Raynes, CAE, EASA president and CEO. "The technical program is a unique opportunity for plant engineering and maintenance personnel to learn about the latest practices to improve their operations and reduce downtime."

To view the full convention schedule, book a hotel room or register for the convention, visit www.easa.com/convention. ■

EASA 2022 CONVENTION & SOLUTIONS EXPO

St. Louis, Missouri • America's Center

JUNE 26-28

Bonus Education on June 25

ATTEND THE HIGHLIGHT EVENT OF THE YEAR FOR THE ELECTROMECHANICAL INDUSTRY!

- Take advantage of technical, sales, marketing and management sessions - including industry research.
- Learn about the latest product and service developments from the leading manufacturers and suppliers at the Solutions Expo.
- Enjoy fun social/networking events in the city known as the "Gateway to the West."

**RECALIBRATE
REALIGN
REFOCUS**



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easa.com/convention

Electro Static Technology

Electro Static Technology, an ITW Company, is a global manufacturer and the inventor of AEGIS® Shaft Grounding Rings used in electric motors and other rotating equipment to safely discharge stray voltage from variable frequency drives (VFDs) to ground. AEGIS® Shaft Grounding Rings are installed in all ranges of motors from fractional horsepower to large medium-voltage motors.

Our dedication to providing an effective and lasting solution that prevents electrical bearing damage, motor failure, and expensive downtime has led to our adoption by electric motor users in manufacturing, HVAC, energy, water treatment, electric vehicles, and other commercial and industrial applications.

The AEGIS® Shaft Grounding Ring is the standard for protection against VFD-sourced shaft voltage and bearing current. Each ring employs 360 degrees of specially engineered conductive microfibers that surround the motor shaft in a multiple-row design to provide incomparable shaft grounding that keeps motor bearings safe and working.

The AEGIS® SGR product family includes several ring and mounting options to ensure reliable bearing protection no matter the details of your motor system. We have solid and split grounding rings, rings with a clamp-on design or bolt-through mounting, press-fit rings, and the ability to customize a ring for your specific needs.

AEGIS® Shaft Grounding Rings can be specified at the time of motor purchase or installed in the field. Several motor manufacturers include them as standard components on many models. Millions of motors around the world depend on AEGIS® rings because keeping motors running keeps business running. Companies use Shaft Grounding Rings more than any other electrical bearing protection.

The AEGIS® Bearing Protection Handbook details best practices

for protecting VFD-driven motors from electrical bearing damage and preventing costly repairs, downtime,

and lost production. The Handbook can be downloaded for free at www.est-aegis.com/handbook. ■

VFD-Induced Shaft Voltages Destroy Bearings!



Electrical bearing damage causes unplanned downtime

Variable frequency drives (VFDs) are used to control pumping systems. But VFDs create a motor shaft voltage that discharges through the bearings, blasting millions of pits in bearing surfaces. Both motor and pump bearings are at risk. These discharges oxidize the bearing grease and cause bearing fluting, premature failure, and costly downtime.

Protect motor bearings with AEGIS® Shaft Grounding Rings

By channeling VFD-induced discharges safely to ground, AEGIS® Shaft Grounding Rings prevent electrical bearing damage. Proven in millions of installations worldwide, AEGIS® Rings provide unmatched protection of motors against electrical bearing damage, motor failure, and unplanned downtime.



Fluting Damage

See our shaft grounding case studies and resources for pump users, contractors, and manufacturers at: est-aegis.com/pump



1-866-738-1857 | sales@est-aegis.com

Electro Static Technology™
An ITW Company

Helwig Carbon

BPK: ULTIMATE SOLUTION TO SHAFT GROUNDING

Many pumps utilize a variable frequency drive (VFD) to increase pump motor efficiency. While VFDs lower power consumption, they also induce currents onto the motor shaft. These shaft currents will often discharge through the motor bearings causing fluting, burnt grease, and eventual bearing failure. Downtime, repairs, and warranty claims can be the result of bearing failure and can be extremely costly to any company.

Helwig's BPKs (Bearing Protection Kits) have been leading the industry in shaft grounding solutions for years. Our proven silver graphite brush technology is unlike other shaft grounding system because it eliminates the need for maintenance and will keep bearings protected year-after-year. Helwig BPKs effectively

divert induced electrical currents away from the bearings, protecting them from damage and failure. What's more, our BPKs are economical, easy to install, and can be used on almost any electric motor application!

Another unique feature of the Helwig BPK solution is that one size fits most! While other shaft grounding systems need a different grounding ring for each motor shaft size, the same BPK can be applied to a variety of motor models. Our MultiFit Bracket mounting system allows for a BPK to be attached to multiple bolt designs while keeping constant contact on the motor shaft.

With the success of Helwig's BPK shaft grounding solution, the innovation has continued. Helwig Carbon's Shaft Voltage Detection Device, otherwise known as the BPK-

Probe™, is an instrument designed to measure common mode voltage on a motor shaft. Test results from the BPK-Probe will inform a user if there is current present on the motor shaft, and, therefore, show the risk of bearing damage due to electrical discharges. The patented instrument also has the capability to demonstrate the effectiveness of Helwig's Bearing Protection solution. This feature allows the user to mimic the installation of a BPK and then measure the voltage present on the shaft, proving that the parasitic shaft current is being instantly grounded through the silver graphite brush. The BPK-Probe is an excellent tool for any engineer, technician, or preventative maintenance professional that needs to evaluate motor health on a regular basis. ■

STOP BEARING FAILURE

CAUSED BY VFD-INDUCED CURRENTS

WITH HELWIG'S
INDUSTRY LEADING
SHAFT GROUNDING SOLUTION



BPK



Premature bearing failure is a major cause of motor downtime and costly repairs. Helwig Carbon uses proven silver graphite technology in a variety of bearing protection kits (BPK) for motor shaft grounding. They effectively divert electrical currents away from the bearings, protecting them from damage.

For more info, visit
www.helwigcarbon.com

Hoosier Pattern Inc.

Hoosier Pattern firmly believes that innovation drives productivity. We understand that industries are evolving and staying up-to-date with the latest technological advancements must always remain our highest priority. Located in Decatur, Indiana, Hoosier Pattern started in 1997 in a 3,500-square-foot space with just a couple of machining centers.

Today, we operate a 90,000-square-foot facility with state-of-the-art technology. Our cutting-edge CNC manufacturing and rapid prototyping practices provide manufacturing solutions for businesses throughout the Midwest, United States, and worldwide. Hoosier Pattern provides you with the highest-quality foundry tooling and 3D printed sand molds and cores that our industry demands.

We are one of the only service providers to own and operate multiple 3D sand printers in-house. In addition,




we have over twenty-five machining centers, including multiple vertical machining centers, horizontal machining centers, a five-axis mill, and CNC lathes.


We understand our customers' demand for expedient delivery times, and product excellence is a must. Therefore, these expectations are the driving force behind our day-to-day operations. We are committed to "On-Time Delivery," and we're constantly striving to meet our customers' deadlines.

Regardless of your tooling or 3D printing needs, we will provide your job with the absolute best quality and in-depth knowledge you expect only at Hoosier Pattern. To better understand Hoosier Pattern's technology, go to our website and select our virtual tour located at the top. 📍

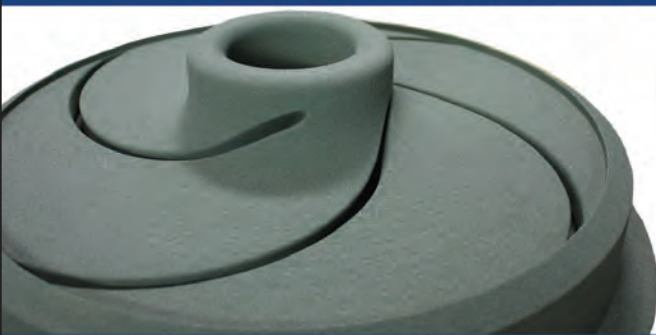




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Now Officially Printing - A Third 3D Sand Printer



3D Printing for the Foundry Industry
with printed sand molds and cores

- True Design Freedom
- Reduced Lead Times
- Print Directly from CAD Files

Integrated Foundry Solutions

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SCHENCK USA CORP

SCHENCK USA CORP. is a subsidiary of SCHENCK CORP. Its parent company is Carl Schenck AG of Darmstadt, Germany; whose shares are ultimately held by Dürr, AG of Bietigheim, Germany.

SCHENCK USA CORP. is the company's new name as a result of the merger of Schenck Trebel Corp. and Schenck RoTec Corporation into one entity that comprises Schenck's Balancing & Diagnostic Systems Group for North America under Schenck RoTec GmbH.

SCHENCK USA CORP. is on four acres in Deer Park, New York, that includes a 22,800-square-foot manufacturing and assembly plant and 17,000 square feet of office space for sales, service, administration, and engineering personnel. The company's Southfield, Michigan, location is also a manufacturing and assembly plant serving the automotive customer base with a local engineering and service support staff.

SCHENCK USA CORP. provides a range of balancing and vibration analysis equipment for the production, maintenance and repair of rotating components, and recent integration of BENZ Tooling, metal division, expands its capacities. The company's engineering staff offers a range of experience for any balancing application and maintains a close presence on the balancing committees of the International Organization for Standardization (ISO) and the Society of Automotive Engineers (SAE), to ensure the latest practices and procedures are applied. The company is ISO 9001:2015 accredited.

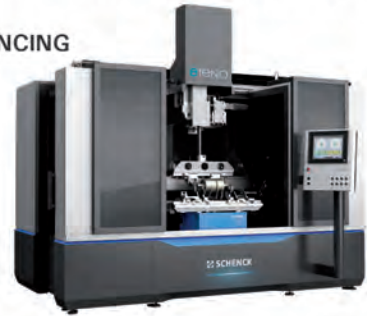
The service team is available for the commissioning and calibration of balancing equipment from multiple North American service points, in addition to leveraging a global service support structure.

With the company's acquisition and merger of the legal entity TEST DEVICES INC. (TDI) of Hudson, Massachusetts, into SCHENCK USA CORP. of Deer Park, New York, it expanded its capacities in the spin testing and balancing services areas and streamlined and strengthened its presence in the North American market.

SCHENCK USA CORP. today has further expanded its footprint in the aerospace industry with the acquisition of the building and property site of SCHENCK's business unit Test Devices, situated on 6.8 acres, in Hudson, Massachusetts, operating a state-of-the-art 57,000 square-foot facility with 5,500 square feet of office space, strengthening its trajectory for growth in support of increased activities with local and global markets in the e-mobility and aerospace industries. The successful business unit is an integral part of SCHENCK's business. ■

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For thirty years, W&A has worked to offer quality consulting, training, and products to meet the needs of our customers across the country. Our goal is to provide excellent service—whether through our books, manufactured products, representative products, seminars or speeches, customer satisfaction remains our priority. Nick Westerberg has been in the industrial community for thirty years, teaching, consulting, and servicing industrial equipment.

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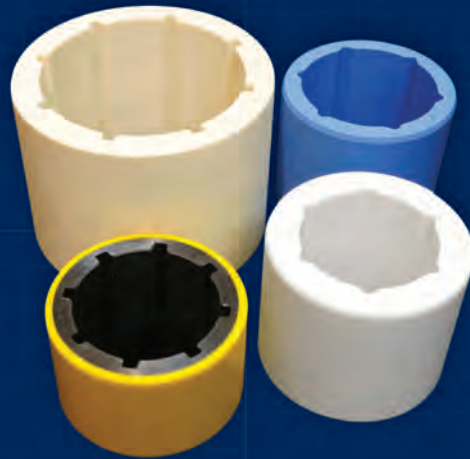
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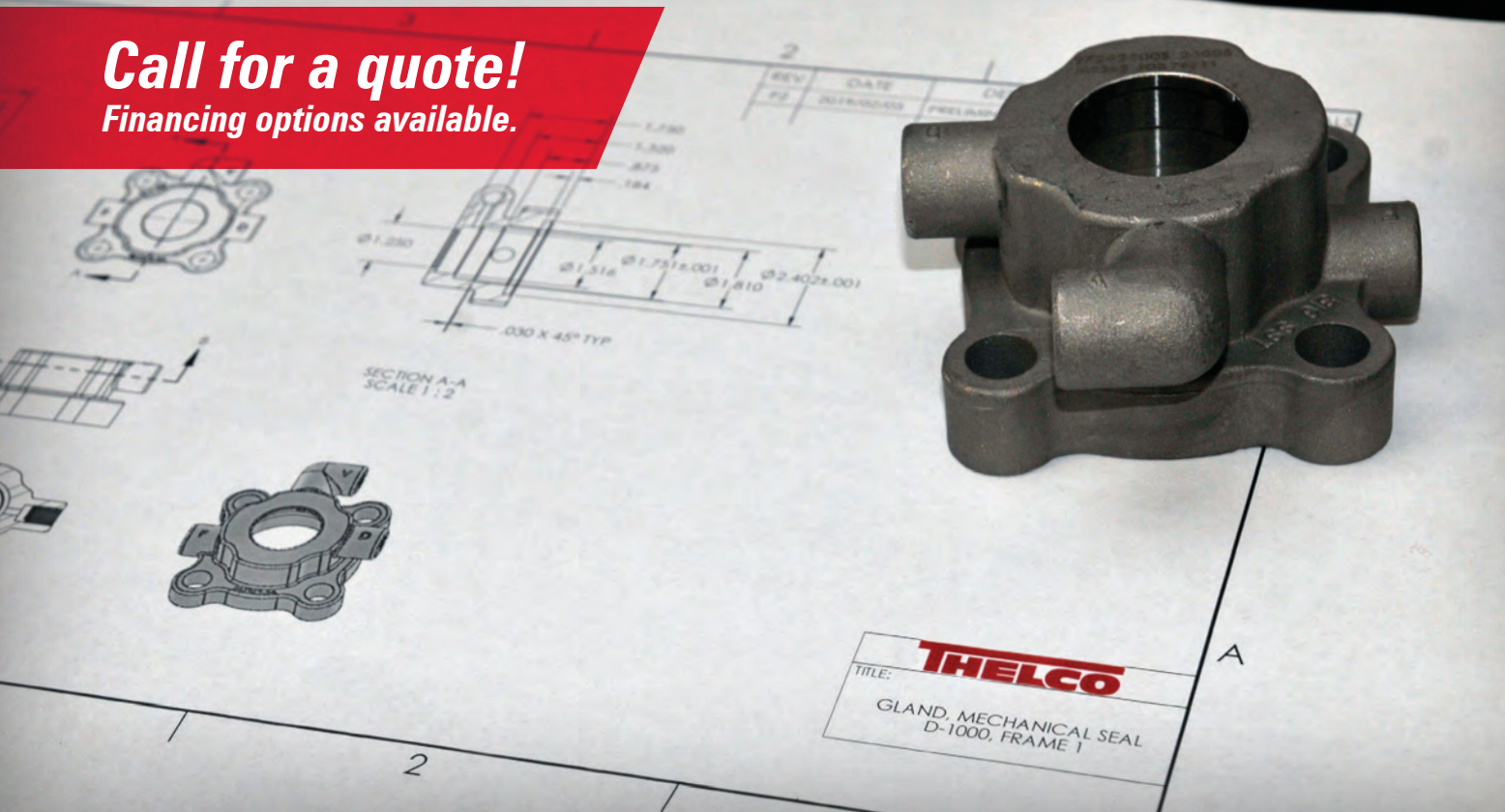


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