In this issue of Pump Engineer magazine:

- End User Interview: Helping Manufacturers Predict the Unknown with Smart Technology | Page 13
- Technical Article: 7 Ways to Improve Pump Efficiency | Page 18
- Special Topic: Use of Pumping System Instrumentations to Prevent Downtime | Page 24
Specialist for Piping Systems.

For safe drinking water, gas, solar, heating, cooling and sanitary applications

Register for our practical shop today: www.en.sanha-shop.com!
From the outset, Bungartz has sought to promote its exemplary expertise by offering the most original and advanced pumping systems solutions. In the beginning, this included the development of groundbreaking concepts and designs that permanently solved a number of prevalent pump issues. Building on its innovative foundation, Bungartz has continued to refine its knowhow by pushing the boundaries of technology to develop tailor-made products that allow it to remain ahead of the curve and offer a diverse range of high-quality pump solutions.

**7 Ways to Improve Pump Efficiency**

Energy efficiency is a topic that should be on everyone's agenda. Environmental concerns as well as the impact on business overheads means that reducing energy consumption is vital within industrial plants. With the U.S. Department of Energy being quoted as finding that 16% of a typical industrial facility’s electricity costs are generated by its pumping systems, pumps have a large part to play in this. So how can one improve the energy efficiency of a pump?

**The Next Step for Solar Collector: Developing Pumps for Higher Temperature Systems**

The technology to exploit renewable energy sources is continuing to advance, improving efficiency and reducing costs. In concentrated solar power plants with a central tower and molten salt, the sun’s energy is used to raise the temperature of molten salts, which are pumped into a steam generator that powers a turbine. The efficiency of this process can be improved if the working temperature is increased. This knowledge has led to a large-scale project to develop corresponding pump technology that will be able to cope with temperatures above 700°C (1,300°F).

**Conversion of NPSH-Values to Another Speed: Quadratic or Not? | Part 2**

The conversion of the head \( H \) of centrifugal pumps from the speed \( n_1 \) to the speed \( n_2 \) can be done by means of the well-known equation \( \frac{H_2}{H_1} = \left(\frac{n_2}{n_1}\right)^2 \). This equation is however, also valid for the conversion of Net Positive Suction Head (NPSH) to another speed? The use of the equation for both purposes therefore leads one to question: is it correct to use the exponent ‘2’ in the equation \( \text{NPSH}_2 / \text{NPSH}_1 = (n_2 / n_1)^2 \), without any restrictions?

**Use of Pumping System Instrumentations to Prevent Downtime**

Pump instrumentation used to monitor and control pumps, is an integral part of any successful pump commissioning and long-term operation. Having the right instrumentation and maintenance program in place not only gives the operator a visual of the pumping systems operating conditions, but it allows the user to maximize reliability and save on costly repairs and unnecessary downtime.

**How to Protect Pumps from Dead-Head and Underloaded Conditions**

In today’s always-on environment, there is a demand for predictive operations and proactive engineering strategies to prevent costly equipment damage and downtime. As pump systems are essential to many facilities operation, it is critical to have effective protection for pump systems. Low power protection devices are a great place to start.
Dear readers,

This month’s compilation of industry focused articles has provided me with the opportunity to gain insights about a wide range of industrial pumps from global experts and colleagues. As always, our contributors challenge ideas about the changing landscape of the industry, and provide technical and relevant information to the pump community. It is continually an excellent opportunity for me to witness how truly relevant, and essential, pumps are across many different industries and sectors. With that in mind, I am pleased to present you with this month’s issue of Pump Engineer magazine!

In this latest edition, we explore the vital role pumps play from the manufacturer, distributor, and end user perspective. Our focus on pump optimization systems, which is this month’s Special Topic, provides us with the opportunity to take a closer look at the systems and technologies used in tandem with industrial pumps to monitor and make improvements that will reduce energy consumption and improve reliability. Our Special Topic articles highlight how having the right instrumentation and maintenance program in place gives the operator a visual of the pumping systems operating conditions to reduce unnecessary downtime. They also discuss how effective protection, such as low power devices, are a great place to start, on pages 24 and 41 respectively.

In this month’s Cover Story, we explore how after 70 plus years in business, Bungartz continues to offer the most original and advanced pumping systems. By developing ground-breaking concepts and designs that are tailor-made to meet the most unique application requirements, Bungartz remains the go-to source for high quality pump solutions. With customer service at the centre of everything it does, Bungartz is continuously developing new ideas together with its customers to pre-emptively address potential problems and set out to create solutions. Discover the many ways that the company aims to keep aligning itself with their needs, and the progressive needs of the pump industry, on page 8.

industry experts Jeremy Drury and Rex Wetherill provide insight on how they use their experience and expertise to simplify the art of predicting unplanned downtime by making, moving, and managing data for manufacturers. By using smart technology that makes the sophisticated Internet of Things (IoT) ‘as easy as 1-2-3’, they help end users quickly convert reactive maintenance into a proactive strategy, on page 13. Our Market Report also sheds light on how Carbon Neutrality for could be extremely beneficial to the pump industry, on page 38.

With such a wide range of pump focused technical articles and industry outlooks, I am confident that there is something for everyone in this issue of Pump Engineer. I encourage you to send me your technical articles, case studies and press releases and I look forward to continuing to meet new industry professionals. Please feel free to contact me at a.pajkovic@kci-world.com, should you have any questions or would like to be featured in Pump Engineer magazine. Together, we can continue to connect the pump community and reap the benefits of being a progressively innovative industry!

Angelica Pajkovic
Editor, Pump Engineer
a.pajkovic@kci-world.com

Pump Engineer 2021
Special Topics

August 2021: Sealless Pump Technology
October 2021: Power Generation
December 2021: Seals & Bearings
Global Highlights

**COMPLETED PROJECT**

**Bedford Pumps Finishes Fish-Friendly Pumpset Installation**

Bedford Pumps successfully completed the commissioning of two of its fish friendly pump sets at North Lynn pumping station in Norfolk in the UK. Bedford Pumps manufactured two canister mounted submersible type fish-friendly pumps complete with 80 kW motors for the pumping station. One pump and canister was installed as a replacement for the existing equipment, and the other into the extra pump bay which had previously been empty. The pumps, which each provide a duty of 850 l/s at 5 m head, offer a safe passage to fish and eels. The scope of supply also included the control panels, VFDs, all pipework including modifications to the existing surge tank access, suction splitters, siphon breaker valves, condition monitoring devices, installation, commissioning, and site verification testing.

**NEW FACILITY**

**Ebara Operates New Vacuum Pump Overhaul Facility in Germany**

Ebara Precision Machinery Europe (EPME) recently started operating its new EUR €1.6 million dry vacuum pump overhaul center in Dresden, Germany. The new overhaul center has 800 square meters of factory space and more than 100 square meters of office space. This is EPME’s second overhaul center – the first was opened in 1993 in Livingston, Scotland. The first contaminated pump model EV-S100N was overhauled at the end of April. EPME is a European sales and service company whose business portfolio includes dry and turbo molecular vacuum pumps, as well as CMP systems for chip manufacturing in semiconductor production, and gas abatement systems.

**NEW TEAM MEMBERS**

**New Team Additions at KSB Inc.**

KSB Inc. has recently added new members to their team. Matt Erickson has joined KSB Inc. to serve as the U.S. director of KSB SupremeServ (Aftermarket Sales & Service). Erickson brings over 19 years of operations, technical services and project management experience to KSB. Prior to KSB, he was an operations manager at Fieldcore, the service business of General Electric.

Nick Abbatiello has also recently joined KSB Inc as the Southeast Regional Manager for the Water Market Area. Abbatiello comes to KSB with 15 years of experience in the collection system and wastewater treatment markets and has worked with manufacturer representatives across the U.S.

**PUMP ORDER**

**Abel Commissions 2 HMD Pumps in Normandy**

Abel has recently commissioned two HMD (Hydraulic Membrane) pumps in Normandy, France for a customer who specializes in recycling and soil reclamation. The pumps serve as filter press feed pumps with a maximum flow rate of 80 m³/h – 12 bar, and are equipped with Abel’s Smart Pump Assistant monitoring system. With remote access, Smart Pump Assistant delivers complete information on the health condition of the pump at any time as well as detailed visualization of operational parameters and alerts on exceeding parameters. Abel also recently received an order from a city in the South of France to supply two HMQ pumps to convey wastewater from a pumping station to a wastewater treatment plant.
**Product Developments**

**A. W. Chesterton Company** recently released its latest IoT innovation – Chesterton Connect Cloud – a web-based dashboard and analytics platform for viewing and analyzing data collected from Chesterton Connect equipment monitoring sensors. The Chesterton Connect Cloud provides 24/7 access to process and operating conditions of pumps or other equipment being monitored to easily recognize and solve issues before emergencies occur from any remote location, those in charge of equipment operation can view overall performance, explore variances and trends, add notes, and focus maintenance efforts where needed most. “We are finding that Chesterton Connect Cloud is helping customers not only identify issues within their pumps such as vibration or temperature, but also how valves and other supporting components are affecting the fluid flow and impacting overall pump performance and seal reliability,” says Juan Cid, Chesterton Connect Product Manager.

**Leybold** now offers a free online sound check tool for vacuum pumps on its website, which gives immediate feedback regarding the condition of the pumps. This feature initially applies to the Leybold Varadry and Novadry oil-free screw vacuum pumps, but will be extended to other pumps in the future. Users record a sequence of their pump’s sound with a smartphone or tablet directly at sound.leybold.com or upload the sound file. The sound analysis is then used to determine whether the pump is running properly or if service is due. While the human ear cannot perceive various pump noises above a certain frequency, the app can quickly and objectively detect the condition of the gears and/or bearings. If deviations occur, they are detected immediately by the test algorithm, and the probability of an error is then displayed.

**TTP Ventus**, manufacturer of the Disc Pump range of micropumps, recently introduced their new UltraSlim Series product line, with a design that is half the thickness of previous models. The company says the UltraSlim models deliver exceptional pressure and flow, silent operation, millisecond-response time, precision controllability and pulsation-free flow. The first design in the series is only 5.8 mm thick and includes an integrated filter and axial airflow path through the pump. These changes reduce the space required when integrating the pump with products, which enables designers to create smaller, more tightly integrated systems. The new design is intended for manufacturers of wearable products, such as blood pressure measurement products and compression therapy devices.

**Watson Marlow Fluid Technology Group** has released its Maxthane pump food-grade tubing elements and confirmed certifications for its Qdos range. Maxthane is designed for use with the Watson-Marlow 530 Series cased peristaltic pumps that are fitted with a 520 RET pump head. It offers food-grade compliance in accordance with FDA regulations 21 CFR177.1680, EC1935/2004, EU regulation 10/2011, is fully compatible with all types of food oils, and is manufactured from fully recyclable thermoplastic polyurethane. Maxthane supports flow rates up to 3.5 l/m and pressure up to 7 bar to deliver dosing and metering accuracy for a wide range of applications. Qdos pumps provide a value-based solution in dosing and metering applications such as water conditioning, vitamin addition, or viscosity modifiers.

**Zenith** has launched its expanded range of Venturi type bottom aerators, the J-Oxy, commonly used in purification plants because of its effective combined mixing and oxygenation action. In addition to its use with the Uniq submersible pumps, with power up to 30 kW, the cast iron J-Oxy ejector with stainless steel diffuser cone can now be coupled with the Grey submersible pumps with power up to 4.0 kW. The system can be installed in two ways: in a mobile configuration or in a fixed configuration. The OXY 80 and 150 devices also feature an interchangeable Vulckollan-coated steel diaphragm that can be replaced without separating the pump from the ejector, which allows for the calibration of the air-to-water ratio.

**Pfeiffer Vacuum** has released their MVP 030-3 C DC, a new corrosive gas version of the diaphragm pump, which features a gas ballast valve and high levels of chemical and condensate compatibility. The new pump has a noise level below 45 dB(A), a compact design and low weight, so it fits easily into small analytical systems, mass spectrometers, and turbo pumping stations. The diaphragm pump and turbopump can be controlled via a single Pfeiffer Vacuum control unit and supplied with power via a single common cable. The brushless DC drive system allows the speed to be adapted to the requirements of the specific application. The pumps are also energy efficient due to the standby mode and intermittent operation option in combination with turbopumps.

**Visotec** has released a new product in their hygienic series portfolio, the vipura-PUMP 10T dosing and filling pump. This new pump is designed for food and pharmaceuticals, as well as household products and cosmetics’ applications. The vipura-PUMP 10T dosing and filling pump has a compact design, making it simple to integrate into complete systems. The special dosing geometry ensures precise dosing results and short cycle times and works non-destructively, even with lumpy materials up to 20 mm in diameter. The dosing volumes can be flexibly adjusted from 20–200 ml or higher, depending on the cycle rate. Due to its compact size and simple assembly/disassembly options, transportation of the vipura-PUMP 10T can be carried out by one person and cleaning is simple and quick via a CIP connection.
From the outset, Bungartz has sought to promote its exemplary expertise by offering the most original and advanced pumping systems solutions. In the beginning, this included the development of groundbreaking concepts and designs that permanently solved a number of prevalent pump issues. Building on its innovative foundation, Bungartz has continued to refine its knowhow by pushing the boundaries of technology to develop tailor-made products that allow it to remain ahead of the curve and offer a diverse range of high-quality pump solutions.

Pump Engineer had the pleasure of speaking with Frank Bungartz, CEO of Paul Bungartz GmbH & Co. KG, to discuss the company’s pioneering technologies, its dedication to sustainability, and how it is able to provide reliable solutions for the most unique and challenging applications.

By Angelica Pajkovic

Dynamic History

Originally established in 1947, under the Bungartz family name, founder Paul Bungartz took pride in the company’s ability to address the needs of a diverse range of pump issues through its patented applications. With an intent focus on the issues surrounding frictionless centrifugal shaft sealing, Mr. Bungartz turned original ideas into tangible products. His attention to detail and unique designs assured costumers that Bungartz was a dependable source for their various pump needs. In 1987 Mr. Bungartz son, Jürgen, took charge of the company, and it has remained in family hands ever since.

“In the beginning, my grandfather produced wear and tear pumps for difficult applications. As an inventor, he had a number of ideas on how to improve different aspects of a pump and strove to develop those solutions,” explained Frank Bungartz. “Some of the concepts he came up with, such as the self-leveling pump, are still being built upon today. While we have grown dramatically since our inception, we are still...
“While we have grown dramatically since our inception, we are still very much a family-run business whose standard for dependable products remains uncompromising.”

Frank Bungartz

very much a family-run business whose standard for dependable products remains uncompromising.”

Over the decades, Bungartz has broadened its offerings significantly, making its industrial pump services one of the most robust in the industry. To meet the demands of the ever-increasing number of loyal customers who entrust it with their business, the company has expanded its reach worldwide and is continually looking for more international partners.

“Since taking control of the company from my father in 2006, we have expanded our international presence and now co-operate with a number of freelance engineering consultants and marketing partners. This transition has led to the successful sale of approximately 60% of our products abroad,” stated Frank. “I feel very fortunate to have been given the opportunity to embrace the innovative and entrepreneurial spirit, which has always been the cornerstone of the company’s management, and use it to advance the systems in place to service a wider range of markets and industries.”

Achieving Longevity

Headquartered in Dusseldorf, Germany, with a production warehouse in Euskirchen, Germany, the staff at both of the Bungartz locations have one common goal: to exceed the expectations of each of its customers. With approximately 50 highly specialized employees who oversee every facet of the company’s operation, from the engineers who facilitate the customers’ orders, to the highly experienced customer service specialists,
Bungartz is able to approach each of its projects with vigor and vitality.

“Our primary objective is to create sustainable tailor-made solutions,” explained Frank. “We have pumps that have been in operation since the ‘50s and we can still provide spares for those units. Our philosophy, and ultimate aim, is to provide our customers with what we call FF pumps, or Fit and Forget pumps.”

As 90% of the Bungartz made pumps are commissioned as custom-made products, the company regards itself as a supplier of pumping systems and solutions. Its focus on applications that require specialized materials, or processes, allows the company to ensure that the pumps it designs have longer mean times between failure and that clients will use less equipment over time to satisfy their needs.

“Although we are a small company, we have a very large impact,” said Frank. “Our pumps are made for applications with sophisticated specifications, or that undergo extreme operations; they are made to handle whatever demands standard pumps simply cannot handle.”

**Inspired Innovations**

Over the past 40 years, Bungartz has developed pumps that address pain points in the chemical and petrochemical, power plant, and environmental protection industries. From its submerged and magnet-coupled chemical pumps, to its horizontal slurry pumps, Bungartz’s systems solve problems associated with:

- Shaft seals,
- Poor feed conditions,
- Challenging pumping media,
- Gas containing liquids,
- Liquids close to boiling point,
- Corrosive and / or abrasive pumping media, and
- Sophisticated plant technology.

“We have self-leveling pumps, cavitation free pumps, non-priming pumps, and pumps for difficult seal applications; all of these provide the customer with certain advantages,” expressed Frank. “For example, all of our pumps are safe to run dry for hours without causing damage. As a Bungartz pump will not fail in this scenario, there is a significant cost advantage for any customer whose pump has frequent dry running situations.”

In general, Bungartz pumps are dry-running, self-regulating, wear-resistant, low-maintenance, resistant to solids, and have a high level of intrinsic safety. They are also suitable for boiling, polymerising, crystallising and toxic media in all Atex zones. Although they perform exceptionally in a number of roles, Bungartz pumps are often used in stressful environments, such as tank loading operations, titanium chloride applications, gas and steam power plants, and salt melting applications.

“One of the most advanced products we offer are pump systems for applications that require ammonium nitrate,” stated Frank. “Ammonium nitrate is commonly used in both the fertilizer industry and explosives. It is a very dangerous material to be pumped, and I think there are only three or four manufacturers worldwide, including us, who make pumps that are able to safely process the chemical.”

By working as a collective unit and offering leading customer service to each of its clients, Bungartz is able to continually expand its products to service new and emerging markets. “As one of our core values is improvement, we are constantly challenging ourselves to make things better. Developing new features, preforming upgrades, increasing productivity, and looking for ways to integrate automation has allowed us to excel in cutting-edge industries,” said Frank.
“We are continuously developing new ideas together with our customers,” stated Frank. It is important that our engineers talk to the customers in order to preemptively address potential problems and set out to create solutions. At the moment we are working on a number of innovative projects, such as creating submersible pumps for liquids that reach up to 400°C to ensure we meet the demands of not only this market but future markets to come.”

With ‘Fit and Forget’ pumps at the basis of all of its projects, Bungartz is well situated to continue providing reliable solutions for the most unique and challenging pump applications in any industry.

Engineering Expertise

The company’s longevity has been attributed to its commitment to technology and innovation, while also recognizing the varied needs of its customers worldwide. Combined with the streamlined processes necessary to meet or exceed customers’ needs in a timely manner, Bungartz is dedicated to producing products that are not only certified according to ISO 9001 standards but engineered to outperform its competition.

In addition to employing highly qualified employees to develop and manufacture its pumps, Bungartz guarantees the quality of its products through the diligent and dedicated attitude that it approaches each project with. “The best quality insurance I have is in the hands of my employees. Their commitment, range of experience, and positivity ensure that we are always pursuing further innovations. As part of our core business is to invent new products, we are typically seen more as an engineering company that sells pumps, than a manufacturer.”

“Although we are a small company, we have a very large impact. Our pumps are made for applications with sophisticated specifications, or that undergo extreme operations; they are made to handle whatever demands standard pumps simply cannot handle.”

Looking Forward

Deeply rooted in the industry, Bungartz strives to produce sustainable tailor-made solutions for all facets of the pump industry. With an inherent respect for its customers, who are at the forefront of each of its decisions, the company aims to keep aligning itself with their needs, and the progressive needs of the pump industry.
Optimize to Econonize

Are you getting the most our of your system for the lowest possible cost?

For pump operators, smooth and continuous activity is imperative. After long service times, outdated technology makes it impossible to comply with today's industrial and environmental standards. Do your pumps need to be modernized?

In RP, we have the equipment, software, technology and expertise to upgrade and optimize any pump system to guarantee the utmost performance.

Benefits:
- Increased productivity
- Reduced production costs
- Improved product quality
- Improved reliability
- Improved safety

Get in touch to learn how we can help you optimize your system for maximized efficiency.

RUHRPUMPEN PLANTS

GERMANY, Witten ■ USA, Tulsa ■ MEXICO, Monterrey ■ INDIA, Chennai ■ BRAZIL, Rio de Janeiro
ARGENTINA, Buenos Aires ■ CHINA, Changzhou ■ UNITED KINGDOM, Lancing ■ EGYPT, Suez ■ RUSSIA, Moscow

Contact us at info@ruhrpumpe.com ■ www.ruhrpumpe.com
Helping Manufacturers Predict the Unknown with Smart Technology:

Interview with Jeremy Drury and Rex Wetherill, IoT Diagnostics

Jeremy Drury and Rex Wetherill use their experience and expertise to simplify the art of predicting unplanned downtime by making, moving, and managing data for manufacturers. By using smart technology that makes the sophisticated Internet of Things (IoT) ‘as easy as 1-2-3’, they help end users quickly convert reactive maintenance into a proactive strategy.

By Michelle Segrest, Contributing Editor

Jeremy Drury and Rex Wetherill work every day with application-focused maintenance and reliability professionals, in a variety of industries, who all share one common nightmare.

“When I ask people what keeps them up at night, it is always their failing equipment,” said Drury, President of IoT Diagnostics. His background in global product management and brand strategy drives the company vision that: manufacturers can predict equipment failure and prevent it.

“The people who live and breathe the fear that something is going to break tomorrow when I get to work... those are our customers,” Drury said. “They also ask questions like, ‘What is going to affect my uptime?’ And it is these people that our technology helps.”

IoT Diagnostics creates smart technology that makes valves, pumps and other equipment smarter for the fluid power industries. “We are not an IoT company looking to solve fluid power problems,” Drury explained. “We are an industrial fluid power company using IoT to solve problems we have been seeing for years and years. We are not another software company telling people how to run their equipment. We make IoT simple and available.”

In their experience, Drury and Wetherill contend that the big overarching problem that manufacturers face is unplanned equipment downtime. However, approaching IoT to solve that problem can be intimidating for old-school operators as well as manufacturing management.

There are three big problems with using IoT in manufacturing:

1. **Unreliable Information:** “People are still using paper records,” said Drury. “They do not use good data. In some cases, they are using biased and gut assumptions.”

2. **Big Shift in Talent:** “There are all these machine whisperers who are retiring in droves,” Drury explained. “These guys would literally show up with a screwdriver, an ear, and their gut and tell you exactly what is going on, but this is not sustainable long term. I met with a phenomenal machine guy who is going deaf and is losing his greatest tool. This gap has not been filled so the whole training and handoff of knowledge is not happening.”

With the skills gap in manufacturing, late stage millennials entering the workforce must rely on technology. Without decades of experience or the vintage knowledge, they may not understand why the equipment fails or how to fix it. Therefore, training along with technology is crucial for these incoming professionals.

3. **The Disconnected Ecosystem:** The end user who is trying to understand their pumps and valves is surrounded by a value chain of original equipment manufacturers (OEMs), who will put an infinite amount of resources in the next pump that goes into the market. However, according to Drury, they may lose sight of the big picture because they are focused on designing and developing more equipment.
“There are hundreds of thousands of pumps and valves out in the field that the OEMs do not have any insight into—what we call brown field,” Drury explained. “The maintenance and service companies do not have enough quality data and information to service the equipment and the customers. The suppliers and the distributor channels do not really communicate well together. They are not delivering enough good data to the engineers and the OEMs to allow them to determine why things are failing in the first place. If all of these things come together, the response time to secure good data becomes a win across the board.

What Should Be Considered Common Sense When Monitoring Valves?

When monitoring valves, end users are primarily looking for efficiency, or better yet, what is causing inefficiencies. They look for things like:

• When the valve is not opening, or not opening fast enough,

• When the valve is not closing, or not closing fast enough (ongoing contamination build-up does not allow the valve to close causing an accelerating case of leakage),

• Seal Issues: sensing moisture at the connection point, as a failing seal can create drag,

• An actuator that is moving the valve: torque requirements to move/open/close the valve.

“Unmonitored valves can cause big problems at the site. Sometimes a valve can look open or closed but it is actually the opposite and causing leakage,” Drury said. “Whatever industrial process the valve is required for can either be slowed down (costing incremental production uptime) or shut down all together (downtime event). This could mean part of a critical process is suffering. For example, not having enough force for a pressing application downline to complete a process could cause failed parts and repeat processes (half-cured mold).”

Using Critical Data from Smart Sensors to Tackle Unplanned Downtime

Once the fear of technology is overcome, Drury and Wetherill believe in providing an easy solution to tackle the core problems of IoT.

“What most manufacturers do not understand is that you can literally get a device, get it on the network, get it scaled, and start looking at data in a matter of minutes,” Drury said. “Everything we build can plug right into a pump, a valve, a hydraulic press, or a hydraulic power unit with a minimal investment.

There are also three critical pieces to tackling the core problems with IoT:

1. **Make Data:** Use the correct, contextualized, smart sensors that will get the required data.

2. **Move Data:** Get the data to the right people. IoT Diagnostics uses an application called IoT Assist that easily configures new smart sensors. “For some companies, it takes eight PhDs to get the binary data into an actual readable temperature curve,” he said. “Through simple technology, this app eliminates that headache.”

3. **Manage Data:** End users can log into the app from anywhere and see all the sensing devices connected and providing critical data in real-time. They can immediately see event log and alarm states, performance changes, and determine what to do with all the data.

Filling the Manufacturing Skills Gap

Drury describes long-time manufacturing operators as ‘machine whisperers,’ because they use their senses to diagnose equipment failures more than concrete data. As these veterans are retiring, it leaves a significant talent and skills gap in manufacturing. New technology and data-retrieving devices can help to fill this gap.

By placing sensors on pumps, valves, and other equipment, performance trends can be considered, and possible equipment failures can be detected before they happen.

“In maintenance, when something breaks everyone comes together to decide what to do,” said Rex Wetherill, Founder & CEO of IoT Diagnostics. “Everyone reacts, and it is all hands on deck to get things up and running. Our mission is to provide the data that they can then use to do predictive analytics. They can see trends, for example with a pump that clearly shows that the end is near. They can then make sure this preventive maintenance gets in the next scheduled downtime.” Having the correct data can give crucial insight into equipment health.
“Most manufacturers have no visibility to the components of the machine, at least with hydraulics,” Wetherill said. “These guys are in a dark closet, and we just want to put a window in there so they can see when a storm is coming.”

Making a difference with data does not have to be a huge project, or an expensive one.

“We can put a sensor on a pump and within minutes be looking at key data, rather inexpensively. It can be put on a maintenance guy’s credit card. When they begin to understand how it works and see that it is remote, they begin to see the value.” Drury and Wetherill do not suggest that sensors can replace humans. Rather, key data can enhance and validate the gut instincts of the professionals.

“The machine whisperers can get great validation by having the data to match their instincts,” Wetherill said. “We have heard them many times say, ‘I knew it! I felt it in my gut!’ To have it confirmed with real data can be powerful.”

For the younger, less experienced, but more tech-savvy new generation of operators, IoT technology can help them dissect equipment failures without decades of operational experience.

**Boomerang Ted**

“We like to refer to a fictional guy on the manufacturing floor named Boomerang Ted,” Drury said. “He is a typical maintenance and reliability leader who walks the shop floor and cannot even have a conversation because his phone will not stop ringing. He boomerangs from one end of the floor to the other putting out fires and fixing breakdowns. He is the only one who can fix things. So, what happens when he goes on vacation or gets sick? Or worse, what happens when he retires? This can make manufacturers scratch their heads about what will happen when there is no one in the pipeline with his experience and knowledge.” This is where smart technology can relieve the stress of the retiring workforce.

“Boomerang Ted is still valuable,” Drury insisted. “Maybe you have a hose that blows and now you are shooting media everywhere. Someone still has to go fix that, but Big Data can create force multiplication. Sensor technologies simply multiply the skills and talents of Boomerang Ted. If a manufacturer has 500 pumps to take care of and only one person, it is not physically possible for him to do proper PMs on those all year long. If each piece of equipment has a sensor, now the maintenance and reliability force has been multiplied. Boomerang Ted can now sit anywhere in the world and literally have much more visibility to rank and prioritize the health of the pumps and perhaps focus on a particular 12 or so that are about to fail.”

**Can Data Predict Equipment Failures?**

One thing all operators agree on is that eventually equipment will fail. The secret is to predict when that will happen and to try to prevent it. Can enough predictive maintenance be performed so that systems do not have to be shut down, costing the manufacturer expensive downtime?

“When you have data, you can immediately see trends and other information,” Wetherill explained. “We talk about unplanned downtime all the time. I have been in this business for 38 years. In my experience, we would maybe propose something that may help the customer, but we could not get the expense justified. They just could not find the money to do it, but they could find unlimited amounts of money to throw at it when the machine broke down. I could never understand that mentality—this you-can-pay-me-now-or-you-can-pay-me-later mentality.”
One of the biggest obstacles is convincing manufacturers that data retrieved from sensors and smart technology can predict and prevent failures.

"Industrial data can be a zero-sum game," Drury said. "We do not want to trade the time you spend fixing the equipment for time looking at data. Sexy dashboards will become like anti-lock brakes on a car. We do not even think about how we now have all these sensors on our car giving us data like low tire pressure. Can you image driving a car without a gas gauge? With smart technology we can see trends and reports in just a few seconds. There is no limit to the number of pieces of equipment that can be connected. There is a beauty to connecting the dots of data," he continued.

“The more data you have, the more the window opens. Then you continue to add to the system to open the universe of information. Now Boomerang Ted feels like he is in the driver’s seat instead of living on the edge of chaos. The biggest path to burnout is to have all the passion but lack the agency and equipment to get the things done that you want to get done. This data gives people the means to have control of their operation.”
Thousands of Pumps Have Never Seized

Pumps fitted with GRAPHALLOY® wear parts survive upsets.

- Run dry and keep running
- Self-lubricating
- Non-galling
- Won’t swell
- Corrosion resistant
- Dimensionally stable
- Improved efficiencies
- -400°F to 1000°F (-240°C to 535°C)

GRAPHALLOY®

GRAPHITE METALLIZING CORPORATION
Yonkers, NY USA

+1.914.968.8400 • www.GRAPHALLOY.com
7 Ways to Improve Pump Efficiency

Energy efficiency is a topic that should be on everyone’s agenda. Environmental concerns as well as the impact on business overheads means that reducing energy consumption is vital within industrial plants. With the U.S. Department of Energy finding that 16% of a typical industrial facility’s electricity costs are generated by its pumping systems, pumps have a large part to play in this. So how can one improve the energy efficiency of a pump?

By Michelle Jackson, Marketing Manager, Castle Pumps Ltd.

1. Avoid oversizing

Oversizing the pump during specification is common to cater for any uncertainties in the design process. However, as achieving higher performance, in terms of flow and pressure, requires the motor to run at a higher power, an oversized pump uses more energy than necessary. For that reason, a pump should be selected that can be run as close to its Best Efficiency Point (BEP) as possible.

2. Impeller trimming

If a pump has been oversized, then sometimes a throttling valve is used to achieve the lower duty requirements. This process is not the best course of action however, as it is not as energy efficient as trimming the impeller. Trimming the impeller is a relatively cost-effective way of reducing the pressure and flow that is produced. As the casing clearance becomes larger when the impeller is shaved, impeller trimming is also not the most energy efficient solution. For that reason, variable frequency drives (VFDs) are often selected for peak efficiency.

3. VFDs

The purpose of a variable frequency drive is to vary the speed of a motor to achieve the actual performance requirements of the application, as opposed to the maximum that the pump can provide. This provides operators with the chance to reduce energy waste caused by the pump in two ways. Firstly, it can slow down the motor on an oversized pump and secondly, it can control a pump in situations where there are differing duty requirements at different times; i.e. sometimes the pump is required to operate at full speed and others it is not. An example of this is a cooling pump, where the temperature of the component that needs to be cooled may vary considerably.

4. Parallel pumping systems

Another energy efficient solution for a pump installation that has varying performance requirements is the use of parallel pumping systems. When the occasional duty requirements of a system are significantly higher than the standard operating conditions, a single pump could be forced to operate way off from its BEP. By installing a second, smaller pump with lower power to meet the average system requirements, the larger, higher energy consuming pump would only need to be used when the system warrants it.

5. Limit pipework pressure loss

To determine the required power of a pump, the pressure loss in the system needs to be taken into account. As the length, diameter, layout, and internals of pipework all affect the pressure loss in a system, consideration should be given to the piping system layout. To increase the efficiency of a piping system, bends and changes in the size of the pipework should be kept to a minimum, and the diameter should be carefully selected, as smaller pipework results in more friction. Corrosion and rust can also increase resistance resulting in pressure loss, which means cleaning and maintenance of pipework is important too.
6. Prevent unnecessary use

It might surprise you how often pumps are in operation when they are not actually doing anything, due to lack of control. Control systems can be implemented to control and shut down pumps not in use. Using pressure switches, the number of pumps in service can be automatically adjusted as duty requirements vary.

7. Maintenance

Like any equipment, wear on a pump can reduce its efficiency. A pump’s energy efficiency can degrade as much as 10–25% before it is replaced, which is why routine maintenance is vital. It is important to replace wearing parts such as wear rings, as leakages mean that the power requirements to produce the same flow is increased.

Closing Remarks

If an operator is concerned about a plant’s energy efficiency and is looking for ways to reduce it, a good place to start is with the facility’s pumps. These seven tips can help reduce unnecessary energy consumption. It is important to note that despite consistent maintenance and diligent monitoring, eventually the most energy efficient option will be to replace the pump!

About the Author

Michelle Jackson has worked within the fluid handling industry for the last decade, with almost 8 years specifically in pumps. As Marketing Manager as Castle Pumps Ltd, she works to the premise that whilst many pumps can do the job, it takes the right pump to truly deliver a process.
Perfected Sealless Pumps

By Darren Martin, Global Product Line Manager, HMD Kontro Sealless Pumps

With the increasing stringency of environmental legislation and the tightening of international standards, ensuring the safety of chemical processes is vital. In addition, alongside the need to consider product liability and operator safety, cutting operational and maintenance costs is important. By charting the evolution of magnetic drive centrifugal pumps one can suggest that sealless pumps could be the key to future success.

Sealing Concerns

Conventional mechanical seal pumps have been used by the chemical sector, petrochemical refineries, and other industries for many years. They offer a low unit cost, the comfort of familiar products, and common designs across product ranges and manufacturers.

For the chemical industry, and many other processing applications, especially those involving the pumping of highly toxic or corrosive materials around a plant, managing risk is an exceptionally important operational issue; different ingredients are often mixed together to create new substances, some of which could be harmful to plant employees or the environment if leaked or spilled. In addition, the extremely high value of certain products makes it essential to maximize fluid handling efficiency and minimise loss, as any disruption of production can incur unexpected costs, leading to serious financial complications. This makes it vital to select pumps that are safe, reliable, and leak-free.

Whichever seal system is chosen, there is an inherent weakness; the seal must leak to lubricate the seal faces and, if it fails, the product being pumped could be released into the atmosphere. Almost 85% of premature pump failures can be attributed to the mechanical seal. Magnetically driven centrifugal sealless pumps, professionally installed and configured, offer a viable alternative to a typical mechanical seal.

Benefit of Magnetic Drive Sealless Pumps

The basic operating principle of a magnetic drive sealless pump is that the internal pump shaft and supporting journal bearings rotate within the process fluid. The pump shaft is supported by internal plain bearings located in a rigid holder; it has an inner magnet ring connected to one end and the impeller connected to the other. Both the shaft and bearing holder are located inside a can, or containment shell, that completely contains the process fluid.

This containment shell is rated for the same process conditions as the pump casing.

In 1947, HMD Kontro developed the very first version of a sealless pump. Although they have been in operation as a proven technology for decades since, there remains a reluctance to specify them as a solution for solving pumping applications. In part, this barrier to adoption is due to the reluctance and risk averse nature of the industry; the legacy of a few early historical failures is another factor that often plays a part in resisting the alternate technology. Since its inception
however, new technologies and materials have been applied to further advance and perfect magnetic drive sealless pumps, allowing them to offer new advantages in terms of substantial time and cost savings.

Risk Mitigation
A key concern with early sealless pumps models, which has since been addressed, was the inducement of eddy currents into a metallic containment device while a driving magnetic field rotates around it. The resultant heat generation from this process could ‘flash’ heat sensitive process liquid, disrupting bearing lubrication. The latest sealless pumps have the option of a non-metallic containment shell to prevent this type of overheating and mitigate induction losses. With excellent fire, erosion, and impact tolerance, these pumps are very much suited for chemicals which are toxic, pungent, corrosive, extremely hot/cold, or hazardous. A noteworthy advantage of the next generation containment shells is that power consumption and/or motor size can be reduced to increase overall efficiency. The perception that sealless pumps use more energy and are therefore more costly to run is another barrier for sealless pumps that requires de-bunking. The elimination of heat generation in the latest containment shells enables smaller motors to be specified, with a 20% reduction in power consumption, ultimately making magnetic drive sealless pumps a lower energy solution.

To further mitigate the risk of pump malfunction or failure, many of the sealless pumps offered today come equipped with instrumentation to detect and shut down the pump when issues occur.

Accidentally running a sealless pump dry can cause a loss of process liquid flow which results in heat removal from the containment shell as well as a loss of lubrication for the internal process bearings. A range of detection devices can therefore be employed to protect against dry running. For example, power monitors on the motor and temperature sensors on the containment shell itself.

A more recently adopted detection technology can also be employed to prevent damage by measuring the gas vapor content. Traditional temperature and power control monitoring solutions sense the secondary effects of a gas build-up in the pump, but in most cases, pump damage occurs before any change is registered. By using ultrasonic technology, the occurrence of bubbles in the liquid is detected, and the operator is immediately alerted to the incorrect priming or venting, entrained process gas, or incipient vaporisation in the pump. This new technology is adaptable to any application and can be retrofitted to many existing magnetic drive pumps.

New Regulations
New regulations have led to recommendations, now mandated under ASME and ISO, which may require the fitting of a secondary containment system. In this situation, the leak path of the process liquid is directed into a secondary housing. For magnetic drive pumps, the secondary barrier can be easily achieved with the inclusion of a leakage restriction device on the outer magnet assembly drive shaft.

Working Towards Better Business Outcomes
While capital expenditure when planning a new installation or upgrading processes is considerable, ongoing servicing and maintenance costs should be the major concern. Since sealless pumps were first introduced more than 70 years ago, they have evolved considerably, constantly changing, both to conform to emerging safety regulations and to extend their application and use. The result is a proliferation of choices and the existence of different pump types within
processing operations which can add to the cost of maintenance and problems with compatibility including when replacing ageing plant. Responding to user concerns, the latest magnetic drive pumps are modular in design, allowing easier and quicker specification and supply, with lead times considerably reduced.

Choosing the right pump is essential in future proofing and protecting plants against potentially dangerous leaks and avoiding unexpected downtime in processing. Having left early teething problems behind and revisited design principles to meet changing needs, perfected magnetic drive sealless pumps now offer an attractive option for the future.

About the Author
Darren Martin is the Global Product Line Manager at HMD Kontro. Working closely with the Sundyne global sales team, Darren is responsible for the identification of new market and product opportunities, based on feedback from territory customers and channels. He is then involved in the development of new and upgraded products right through to their release and ongoing promotion.
Use of Pumping System Instrumentations to Prevent Downtime

Pump instrumentation used to monitor and control pumps, is an integral part of any successful pump commissioning and long-term operation. Having the right instrumentation and maintenance program in place not only gives the operator a visual of the pumping systems operating conditions, but it allows the user to maximize reliability and save on costly repairs and unnecessary downtime.

By Salih Moaied P.Eng., Senior Project Manager, Aquatech Dewatering Company

There are a variety of different instrumentation devices available in the market today that can be used to virtually monitor every aspect of pumps, and pumping systems. These devices can be used both locally and remotely though a smartphone application or a web browser. One particularly useful monitoring systems is the use of pressure gauges on a centrifugal pumping system to monitor and collect data that can be used to proactively troubleshoot system issues and prevent unnecessary failures.

Knowing the working suction and discharge pressure of a pump is one of the most critical pieces of information for any pumping system. Suction and discharge pressure readings, along with an understanding of how to read pump curves and system curves, allows a user to quickly identify the operating condition of the pumping system and make quick adjustments if necessary, to mitigate the risk of equipment damages and downtime.

Determining the Total Dynamic Head

To determine the pump operating point using the pressure gauge reading, operators will need to estimate the system total dynamic head (TDH) first. TDH is the total head (energy) developed by the pump at any given set conditions and is measured in terms of head expressed in feet or meter of liquid. Pump system designers use different equations and site conditions such as length of pipe, diameter of pipe, change in discharge, and suction elevation, to calculate the TDH. If, however the operator has access to accurate suction and discharge pressure gauges, TDH can be estimated without the need of additional system details. In this case, the following simple formulas can be used to accurately estimate the TDH and the operating point of a pumping system.

**Equation 1:**  
\[
\text{Head in feet} = \frac{(\text{psig} \times 2.31)}{\text{spgr}}
\]

This equation is used to calculate the pump’s total discharge head as well as suction head when pump is under a positive feed (liquid is fed into the pump suction by gravity or other means).

**Equation 2:**  
\[
\text{Head in feet} = \frac{(\text{inHg} \times 1.13)}{\text{spgr}}
\]

This equation if used to calculate the pump’s total suction head in suction lift or restricted suction application. In this case, pump must be primed in order to start moving liquid.

---

**Equation Glossary**

- **spgr:** is the specific gravity of the pumped liquid
- **psig:** is the discharge pressure gauge reading in psi
- **inHg:** is the suction/vacuum gauge reading in inches of mercury

The TDH of a pump is equal to total discharge head minus the total suction head, or plus the total suction lift. If the pump’s suction is under vacuum, the water source is below the suction eye of the impeller, the suction pressure will be a negative number and the TDH formula will require that the discharge and the suction pressure readings be added together. If the water source is above the eye of the impeller, the suction pressure reading would be a positive number and the formula will require that the suction pressure be subtracted from the discharge pressure.

One important aspect to note here is that velocity head is not accounted for in the estimation of TDH using pressure gauges. For more accurate results, velocity head will need to be calculated using the dynamic pressure equation and added to the TDH calculated from the two pressure gauge readings.

**Calculating Velocity Head**

\[ \text{Velocity Head (ft, m)} = \frac{V^2}{2g} \]

**Equation Glossary**

- **V:** fluid velocity (m/s, ft/s)
- **g:** acceleration of gravity (9.81 m/s², 32.174 ft/s²)

Consider for example, a flow velocity of 12 feet per second, with a velocity head of just 2.2 feet that increases...
exponentially with any increase in flow velocity. The velocity head would quickly become a factor that could easily influence the TDH results, in applications where the velocity is high, and the static and friction losses are low.

Once the TDH of the system is calculated, it needs to be imposed on the pump curve provided by the manufacturer to establish the pump’s operating point which will allow the operator to better understand the pump performance. It is recommended that the operating point falls between 80% and 110% of the best efficiency point (BEP) to minimize wear and to reduce the risk of premature failure, as seen in Figure 1. If the operating point falls far right or far left of the BEP, the operator is required to make some adjustments to the pumping system, such as increasing or reducing the pressure, to bring the operating point within the BEP range. Figure 1 also highlights the impact of moving away from the BEP and the potential of risk associated.

**Alternative Methods**

An alternative way to estimate pump’s operating point is to use a flowmeter to determine the flow rate of the system and in turn, estimate the operating point along the pump performance curve. If the system is not equipped with a flowmeter, a clamp-on portable flowmeter can be used to measure flow rate in most cases. Typically, these flowmeters require smooth flow free of particulates or vapor and the pipe is flowing full unless the meter is equipped with a depth sensor for use in partially full pipes.

**Final Thoughts**

The use of pressure gauges by an operator on a pumping system is like the use of Stethoscope by a doctor to listen for heartbeat. Usually, one of the first steps a doctor performs is to take the patients heart rate and decide if and what the next steps are. In pumping systems, taking an accurate suction and discharge gauge readings should be one of the first steps in diagnostics. Taking the readings with the pump in operations for TDH purpose, and when the pump is off for static head purpose, can add additional value to the operator. The results will give the operator a good idea of the pump and system conditions and whether additional tests are required.

As seen in Figure 1, if the calculated duty point falls to the right of the curve and outside the recommended range, increasing discharge pressure by closing a valve or other means can help move the operating point into the recommended range. On the other hand, if the operating point falls to the left the curve, reducing the discharge pressure by opening a valve can move the duty point to the recommended range. Sometimes, all it takes to prolong the life of a pump, and/or to prevent system damages, is simply adjusting a discharge valve i.e. closing a valve to increase pressure, or opening a valve to reduce pressure.

**Reading the Pressure Gauge**

There are three recommended practices that can be employed to ensure an accurate and representable pressure gauge reading:

1. Be sure to take suction and discharge pressure readings while the pump is in operation and has reached a steady state condition. Pressure readings while the pump is operational, will provide the total head of the system, including friction losses and static head. Pressure gauge reading while the pump is off provides static head only.

2. Measure pressure gauges as close as possible to the discharge and suction flange of the pump. Total head is proportional to the difference between these two measurements. Pressure adjustment will be required if the pressure gauge is placed higher or lower than the pump eye of impeller (centre line).

3. Pressure measurement must be taken by a calibrated gauge in a pounds per square inch gauge (psig) or inches of Mercury (inMH).

**Figure 1: Reliability Curve.**

![Reliability Curve](image)

**About the Author**

Sal Moaied is a Professional Engineer who graduated from McMaster University with Bachelor’s degree in Mechanical Engineering and a Minor degree in Business Management. During the past decade, Sal worked in multitude of civil and mechanical applications, designing, troubleshooting, training and managing multi million-dollar projects related to fluid handling systems. His current position is a Senior Project Manager focusing on managing and training a group of estimators and project managers throughout North America. Previously, Sal served as Senior Applications Engineer and QA/QC Manager.
CFturbo is an advanced, user-friendly interactive design tool to create axial, mixed-flow, and centrifugal pumps. In combination with CFTurbo SMP, it represents a robust, fast, accurate and affordable solution for hydraulic pump design and 3D-flow simulation.
Canada – British Columbia: Canoe Zone 2 Pump Station Upgrade
Description: Canoe Zone 2 Pump Station Upgrade
Contact point: tpepokalin@salmonarm.ca, 1-(250) 832-5871
Time limit for receipt of tenders or requests to participate: June 24, 2021
Language in which tenders or requests to participate may be drawn up: English

United Kingdom: Water Pump & Filtration System
Description: Water Pump & Filtration System
Contact point: procurement@ore.catapult.org.uk, 0333 0041418
Time limit for receipt of tenders or requests to participate: June 24, 2021
Language in which tenders or requests to participate may be drawn up: English

India: Supply And Commissioning Of Motor Pump Sets At Rwph Treatment Plant
Contact point: +91-0485-2835637
Time limit for receipt of tenders or requests to participate: June 25, 2021
Language in which tenders or requests to participate may be drawn up: English, Hindi

India: Improvement Work Of Kalthotty Sump & Pump House
Description: Improvement Work Of Kalthotty Sump & Pump House
Contact point: 91-0485-2835637
Time limit for receipt of tenders or requests to participate: June 25, 2021
Language in which tenders or requests to participate may be drawn up: English, Hindi

United States – Ohio: Pump Unit Rotary
Description: Pump Unit Rotary
Contact point: Margaret.Cotton@dla.mil, 1-6143811946
Time limit for receipt of tenders or requests to participate: July 1, 2021
Language in which tenders or requests to participate may be drawn up: English

United States – Michigan: Primer Fuel Pump Assembly
Description: 4310009397098 Primer Fuel Pump Assembly
Contact point: jacob.m.wonsowicz.civ@mail.mil
Time limit for receipt of tenders or requests to participate: June 21, 2021
Language in which tenders or requests to participate may be drawn up: English

United States: Pump Axial Pistons In Repair/modification Of
Description: Pump Axial Pistons In Repair/modification Of
Contact point: brendan.heasley@navy.mil, 1-(717)605-2892
Time limit for receipt of tenders or requests to participate: June 21, 2021
Language in which tenders or requests to participate may be drawn up: English

India: Procurement Of Seal Water Pump Spares
Description: Procurement Of Seal Water Pump Spares
Contact point: 91-8532-246151
Time limit for receipt of tenders or requests to participate: June 21, 2021
Language in which tenders or requests to participate may be drawn up: English, Hindi

India: Procurement Of Seal Water Pump Spares
Description: Procurement Of Seal Water Pump Spares
Contact point: 91-8532-246151
Time limit for receipt of tenders or requests to participate: June 21, 2021
Language in which tenders or requests to participate may be drawn up: English, Hindi

United States – Pennsylvania: Pump Unit Centrifug In Repair/modification Of
Description: Pump Unit Centrifug In Repair/modification Of
Contact point: amber.l.miller@navy.mil, 1-(717)605-3261
Time limit for receipt of tenders or requests to participate: June 21, 2021
Language in which tenders or requests to participate may be drawn up: English

South Africa: Supply And Delivery Of Centrifugal Pump
Description: Supply And Delivery Of Centrifugal Pump
Contact point: sigapn@eskom.co.za
Time limit for receipt of tenders or requests to participate: June 18, 2021
Language in which tenders or requests to participate may be drawn up: English, Afrikaans

United States – Michigan: Primer Fuel Pump Assembly
Description: 4310009397098 Primer Fuel Pump Assembly
Contact point: jacob.m.wonsowicz.civ@mail.mil
Time limit for receipt of tenders or requests to participate: June 21, 2021
Language in which tenders or requests to participate may be drawn up: English
To subscribe to the Projects & Tenders newsletter, please contact Josh Gillen (j.gillen@kci-world.com). To submit a project or tender, please contact Angelica Pajkovic (a.pajkovic@kci-world.com).

**Moldova:** Gpm, Machine Tools, Pumps, Devices  
**Description:** Gpm, Machine Tools, Pumps, Devices  
**Contact point:** 373-219) 79127  
**Time limit for receipt of tenders or requests to participate:** June 22, 2021  
**Language in which tenders or requests to participate may be drawn up:** English, Romanian

**Sri Lanka:** Pro Of Fuel Injection Pumps For Mtu Engines  
**Description:** Pro Of Fuel Injection Pumps For Mtu Engines  
**Contact point:** procurementinquiries@navy.lk, 94-0112212372  
**Time limit for receipt of tenders or requests to participate:** June 29, 2021  
**Language in which tenders or requests to participate may be drawn up:** English, Sinhala

**United Kingdom:** Design And Build Of A New Off Line Pumping Station  
**Description:** Design And Build Of A New Off Line Pumping Station (mill Fleam Pumping Station) And Associated Works  
**Contact point:** procurement@derby.gov.uk, 44-1332-44 1332640768  
**Time limit for receipt of tenders or requests to participate:** July 9, 2021  
**Language in which tenders or requests to participate may be drawn up:** English

**Kuwait:** Supply Of Spare Parts For The Maintenance Of Gas Pumps (14 Stages)  
**Description:** Supply Of Spare Parts For The Maintenance Of Gas Pumps (14 Stages)  
**Contact point:** 965-2462 5050  
**Time limit for receipt of tenders or requests to participate:** August 13, 2021  
**Language in which tenders or requests to participate may be drawn up:** English, Arabic

**Tunisia:** Acquisition Of Submersible Pumps  
**Description:** Acquisition Of Submersible Pumps  
**Contact point:** 216-76221044 /76220104  
**Time limit for receipt of tenders or requests to participate:** June 28, 2021  
**Language in which tenders or requests to participate may be drawn up:** English, Arabic

**Uganda:** Provision Of Mechanical Works (submersible Pumps)  
**Description:** Provision Of Mechanical Works (submersible Pumps)  
**Contact point:** 256-41-7333250  
**Time limit for receipt of tenders or requests to participate:** June 24, 2021  
**Language in which tenders or requests to participate may be drawn up:** English

**Slovenia – Celje:** Annual Inspection And Servicing Of Gas And Oil Heating Devices And Servicing Of Heat Pumps  
**Description:** Annual Inspection And Servicing Of Gas And Oil Heating Devices And Servicing Of Heat Pumps  
**Contact point:** javno.narocanje@dars.si, 386-13009928  
**Time limit for receipt of tenders or requests to participate:** July 6, 2021  
**Language in which tenders or requests to participate may be drawn up:** English, Sloven

**Sweden:** Service Of Pumps At Recycling Centers And Hazardous Waste  
**Description:** Service Of Pumps At Recycling Centers And Hazardous Waste  
**Contact point:** sanna.sterner@sysav.se  
**Time limit for receipt of tenders or requests to participate:** June 28, 2021  
**Language in which tenders or requests to participate may be drawn up:** English

**United States – New York:** Pumps Premium Efficiency Solids Handling Pumpshydromatic Or Approved Equalfurnish And Deliver  
**Description:** Pumps Premium Efficiency Solids Handling Pumpshydromatic Or Approved Equalfurnish And Deliver  
**Contact point:** purchasing@co.rockland.ny.us, 1-845-364-3820  
**Time limit for receipt of tenders or requests to participate:** June 24, 2021  
**Language in which tenders or requests to participate may be drawn up:** English
EXPANSION JOINTS AND CHECK VALVES

Complete line of products suitable for a vast number of industries

WATER/WASTE WATER
MARINE
HVAC
POWER GENERATION
OIL & GAS

PROCO PRODUCTS, INC.

THE EXPANSION JOINT AND CHECK VALVE PEOPLE

Find our complete range of products at procoproducts.com
Habermann Aurum Pumpen is one of the worldwide leading manufacturers of centrifugal pumps, ideally suited for handling solids-laden liquids.

Over almost 100 years we have invested in developing and perfecting our craftsmanship and today with more than 30,000 pumps installed worldwide, serving various industries, we have built a strong and competitive market position across the globe.

Manufacturing quality pumps is our core competency. Whether standard or custom-made design, we always offer complete solutions to your specific area of application.

Get it done and get it right with Habermann Aurum Pumpen solutions:

www.habermann-aurum-pumpen.de
sales@aurumpumpen.de

Made in Bochum. Made for the world.
The Next Step for Solar Collector: Developing Pumps for Higher Temperature Systems

The technology to exploit renewable energy sources is continuing to advance, improving efficiency and reducing costs. In concentrated solar power plants with central tower and molten salt, the sun’s energy is used to raise the temperature of molten salts, which are pumped into a steam generator that powers a turbine. The efficiency of this process can be improved if the working temperature is increased. This knowledge has led to a large-scale project to develop corresponding pump technology that will be able to cope with temperatures above 700°C (1,300°F).

By Claude Mockels, Product Development Manager, Sulzer

High temperature salt pumps are primarily used in nuclear and solar power generation, as well as chemical and salt manufacturing. While these pumps are currently used at temperatures up to 600°C (1,100°F), designers are now looking to extend the current limitations by creating pumps that can be used in applications where higher temperatures can be beneficial.

Raising the Bar

In large-scale solar plants, mirrors focus the sun’s energy to a central tower where it is used to increase the temperature of the molten salts. Pumps are used to transfer molten salts from the ‘cold’ tank through the pipes to a hot salt tank and on to a steam generator. The steam powers a turbine, which turns a generator and produces electricity for the local grid.

For renewable solar energy plants, efficiency can be improved by increasing the temperature of the salt used to store the sun’s energy. Until recently, various salts have been used at temperatures around 600°C (1,100°F) and the pumping technology for this application is well-established. In order to improve efficiency, operators and manufacturers intend to increase the working temperature for new systems beyond 700°C (1,300°F).

At these temperatures, molten chloride salt has to be used. The use of this type of salt presents additional issues, such as its corrosive properties, that are not a problem with 600°C pumps, which operate with more benign salts. To address this, the existing second generation pumps have many proven design characteristics that now need to be extended.

The Next Generation

For the next phase of more advanced solar plants, third generation pumps are in development, with projects being funded by the Department of Energy (DoE) in the United States and other organizations in Europe. Work is underway to establish the materials and components that need to be upgraded for this project to be successful.

Both designers and product developers are working together to develop new materials for wear components that will be used in this arduous environment. One group of high-toughness, ceramic-metal composite materials, known as cermets, will be used to manufacture strong, long-lasting components, such as bearings and sealing elements.

Material Evaluation

To overcome the challenges with this unique application, the materials need the correct mechanical properties
as well as temperature and corrosion resistance. The mechanical properties of any material must also be sufficient to handle the energy required to drive these pumps; driveshafts must be capable of delivering the torque necessary to pressurize the system.

The pump design must take account of the thermal expansion of the pump components to ensure clearances are maintained. This is an important consideration for mechanical parts such as press-fit bushings, where clearances and axial elongation are important for reliable operation of the plant.

**Theoretical Modeling**

At the heart of any design for a pump that will operate in such a hostile environment is the computer model. Although parts that are in contact with the molten salt will be designed to handle the elevated temperatures, other parts need to be kept cool to ensure optimum performance.

The huge variations in temperature distribution have a significant effect on the mechanical design of the pump. Theoretical models help the engineers to understand this distribution and to develop both the materials and a physical design for the pump.

Heat radiation must also be examined to ensure that the components that are not in contact with the molten salt, such as the electric motor and the top bearing, remain cool. Sophisticated thermal models can be used to examine the differences between the current designs and those required for the next generation. This has led to refinements of the cooling system which will be important in creating a reliable pump with a long service life. The numerical model will then be compared to the real-world results that are obtained from the pilot project.

**Seal Design**

Together with the University of Wisconsin-Madison, design teams will validate the manufacturing processes and evaluate the performance of the pump at these elevated temperatures. The goal is to establish a design and prove its performance in an environment that will be even more challenging than before.

As with any pump, the seals play an important role, but the materials and physical design must withstand the rigors of the application. In this case, a floating ring seal, a similar system to the existing design, will be implemented for the third generation pump.

**Cost-Effective Solution**

Using expertise and knowledge in hot salt pump design, the research team is tasked with building and testing a corrosion-resistant pump and related components. The prototype will be used to evaluate performance and the manufacturing processes used to create it.

The data collected from this trial will enable the costs of a pilot plant to be estimated and establish the effectiveness of using cermets or other alternative hardfacings for high temperature solar applications. In addition, the project will highlight the durability of the pump design and predict the wear of components that are exposed to molten salt.

The aim is to refine the materials required for a process that will improve the efficiency of solar power generation. The need for high temperature performance as well as excellent corrosion resistance and manufacturability to achieve this goal, will undoubtedly lead to a new generation of pumps that will serve the industry for years to come.

---

**About the Author**

Claude Mockels, is a Product Development Manager at Sulzer. Claude is a graduate of University of Liège, Belgium, with a Master in Mechanical Engineering. At Sulzer, he is responsible for the development of pumps for Downstream Oil & Gas application, Industry application, as well as Power application like solar thermal power plant.
A trend-setting modern creation is needed in order to completely empty a tanker. The self-regulating V-AN centrifugal pump manages to perfectly master this art. Whether transporting boiling media up to the surface from below ground or by means of suction from above – this pump will immediately captivate the observer.

More information on +49 (0) 211 57 79 05-0 and online at: www.bungartz.de/masterpieces2
Q & A | SEALING SYSTEM DESIGNS

Q & A | SEALING SYSTEM DESIGNS

Q & A | SEALING SYSTEM DESIGNS

Q & A | SEALING SYSTEM DESIGNS

We are considering standardizing the design of the mechanical sealing systems in our plant. Are there any special considerations?

Many pump users think of centrifugal pumps in terms of the pump and the mechanical seal. In practice, there can be additional components which improve the reliability of the mechanical seal or perform other functions required by the end user. These solutions are commonly referred to as piping plans and range from simple process fluid flushes to complex systems involving vessels, coolers, and instrumentation.

It is relatively common for end users to standardize the types and models of mechanical seals used throughout their plant. The obvious benefits of this practice are proven experience, operator familiarity, and reduced inventory. It is less common for end users to standardize the design of sealing systems or piping plans. Although there are certainly elements of the systems that are defined in the purchaser’s specifications, it is common for a seal OEM to prepare a proposal which goes back to the purchaser for approval, is modified or revised, and cycles back and forth several times before final approval. This process can lead to multiple systems designs used throughout the plant which can create confusion for operators and maintenance personnel.

The overhead involved with the design and purchasing of these systems is reason enough to consider standardizing sealing systems. Standardizing the design of these systems can not only reduce this confusion, but also create a more streamlined process throughout the lifecycle of the pump.

Benefits of Standardizations

Seals systems can range from relatively simple process fluid flushes to complex systems involving components such as coolers, reservoirs, and instrumentation. Due to the scope of disciplines involved, multiple departments are often required for the fabrication of unique system designs, which are often more costly and have long approval processes.

Many end users streamline this process by creating pre-engineered solutions which have been vetted and approved in advance. These standardized designs may be unique to the one purchaser’s company or the end user may select a standardized solution which is already offered by the seal or sealing system OEM and mitigate the risk of production delays.

A second advantage to standardized sealing system designs is that they can create a more uniform interface between the operator and the equipment operators. This can make it easier for the operator to use a piece of
equipment and familiarize themselves with how to adjust the system or monitor its performance. Standardized maintenance interfaces can also make it simpler to maintain the equipment or add critical fluids to support the system, while standardized instrumentation can make it easier to interface with data collection systems. All of these factors make it simpler to provide uniform training for the operators and maintenance personnel who use these systems.

As pre-engineered systems reduce the upfront engineering on a specific order, standardized sealing systems can also benefit the procurement process; it can reduce lead times for the purchaser since the OEM can order and stock components in advance. End users who maintain inventory can see reduced stocking levels since the same systems and components are used throughout the plant.

**Challenges with Standardizations**

While there are many benefits of standardized sealing system designs, there are also some challenges which must be considered. There is not just one mechanical seal piping plan nor is there just one set of application conditions. Different applications will use different pumps with different fluids at different pressures and temperatures. For example, the sizing of cooler components will depend on the piping plan and heat removal requirements; more aggressive chemical environments may require more exotic materials to control corrosion.

Many standardized systems offer flexibility in their designs to handle these challenges. A system may have a standardized design while providing options for components such as reservoir sizes, seal cooler designs, and material selection. Although the selection of instrumentation will need to be specified to meet the required pressures, temperatures, and flowrates for the application in question, a common design and/or model should be used as much as possible.

Many plants do not have engineers who specialize in mechanical seals. Purchasers will therefore rely on the expertise and experience of the seal OEM to select the correct seals and materials for a specific application. Sealing systems, however, may be comprised of pipes and tubing, instrumentation, pressure vessels, and electrical components; virtually every plant has engineers and technicians who are local subject matter experts in these fields. The challenge with this situation is that each discipline may have established best practices for their plant. This can result in different designs for the same equipment depending upon who places the order. In some cases, these special requirements are necessary but often they are the result of personal preferences or the purchaser's experience.

For an end user to establish more standardized designs for sealing systems, there must be some level of commitment from various experts within the plant. This requires a commitment from all personnel to use a specified standard on all future purchases, and not buy a potentially lower cost, non-compliant offering.

**Options in Standardizations**

**Industry standards**

The most obvious place to start the search for sealing system standardizations is within the industry standards for pumps and mechanical seals. Most pump standards have limited requirements for mechanical seals and sealing systems (e.g., ASME B73, API 610). The most complete standard specifically focused on seals and sealing systems is API 682. This standard is the most commonly used reference for the definition of seal piping plans and the design of sealing systems.

API 682 was written with the intent to capture the practices which had a proven record of performance and reliability in the field. The definitions of piping plans are thoroughly documented in this standard. This includes P&IDs of the basic layout of the plans, general definitions of the plans and their functions, and minimum requirements for piping and instrumentation.
The standard gives in-depth tutorials on the installation, commissioning, and use for many of these plans. There are also some specific examples for calculations used to select components and estimate system performance.

While the standard does an excellent job of defining the piping plans, it provides fewer designated requirements for the sealing system design and components. Many of the seal system components only have a few requirements which specify their most common attributes. Other components, such as reservoirs, will have a more complete set of requirements, including dimensional requirements for many of the reservoir’s features.

As complete as API 682 is for sealing systems, it falls short of fully defining a standardized design, or offering, for piping plan systems. It does, however, provide the minimum set of requirements for most end users and can help ensure a safe and reliable system. For a plant to create a standardized system design, there must be a more thorough review of the options and intended benefits of the standardization program.

Specific end user standards

Some end user companies have defined standard system requirements and designs at the plant and/or corporate level. These standards are most often created in collaboration with the seal or sealing system OEMs. This allows the end user to gain the benefits of the seal OEMs large installed base of applications across industry with their insights on the design and procurement implications of the various options.

One of the most mature outcomes of this process is a pre-engineered design that is standardized by the end user. As stated earlier, these pre-approved designs can be used throughout the end user’s company without additional engineering review.

OEM standards

Another option is to rely on the system design expertise of the seal OEM. Seal and systems OEMs have decades of experience in designing and supplying vessels. Many of these designs, were however, heavily influenced by the purchaser’s individual preferences. This has resulted in literally thousands of different designs for equipment which basically serve the same function.

Many seal OEMs are beginning to address this challenge by creating standardized component and system designs which capture many of the best practices used throughout the industry. This can create opportunities for easier procurement along with the other benefits of standardization. This does not imply that the purchaser should simply buy readily available products. It implies that there are standardized systems designs which offer the flexibility of meeting many common applications requirements. This can serve as the foundation for a company’s standardization program. The end user should consult with their seal OEM to identify these opportunities.

About the Author

Michael Huebner is a Principal Engineer at Flowserve Corporation in Pasadena, Texas. He has over 30 years of experience in the design, testing and application of mechanical seals both in the USA and Europe. He has authored numerous articles and lectured extensively around the world. He has a BS in Engineering Technology from Texas A&M University.
TEADIT® NSF-61
Sealing Solutions

Tealon™ 1572 SAN
1082 SAN
2261 SAN

Designed with what is most important in mind!

METAL GASKETS - TEALON™ - CUT GASKETS - COMRESSED FIBER SHEET - COMPRESSION PACKING
EPTFE - ORIGIN™ TECHNOLOGY

Rio de Janeiro and Campinas, BRAZIL - Buenos Aires, ARGENTINA - Houston, USA - Kufstein, AUSTRIA - Köln, GERMANY - Baroda, INDIA - Shanghai, CHINA

(+1) 800-999-0198 www.teadit.com sales@teadit.com
The Silver Lining in Carbon Neutrality for the Pump Industry

At first glance, the carbon neutrality initiative could be considered harmful to the pump industry, but there is actually a silver lining to this cloud.

By Robert McIlvaine, President & Founder, The McIlvaine Company

Push and Pull Approach

The Biden Administration has pledged to cut greenhouse gas emissions in the United States by 50% to 52% (based on levels recorded in 2005) by 2030. The administration has also pledged to reduce emissions to zero by 2050. This is called ‘net CO₂’ emissions, as the goal is not to eliminate all sources of CO₂. If one considers that humans exhale CO₂, the goal of reducing emissions is to benefit humans, rather than cause the extinction of the human race.

China is, similarly, planning for a carbon neutrality by 2060. Is this bad news for the pump industry? At first glance, it could appear to be. The switch from coal power to wind and solar greatly reduces the need for pumps in these applications. However, there is some irony associated with this transition. The push for carbon neutrality, will not eliminate the use of coal-fired plants; instead it will result in the plants being used in alternate methods. The plants will transition to use different fuels, which will result in a different fate for the CO₂, and will ultimately increase pump sales.

Carbon Capture and Sequestration

There is universal agreement that carbon capture and sequestration process will be needed; there are however, few available options to choose from on the market.

One of the current processes available is a direct air process that utilizes potassium chloride as an absorbent. Utilizing this process could mean a lot of positive revenue for pump manufacturers, but many companies believe the process is too expensive for serious consideration.

The second available option, which is considered more practical, is actively being pursued by the United Kingdom. This process is called Bioenergy Carbon Capture and Sequestration (BECCS).

An example of a company who is utilizing the BECCS system is Drax, a U.K.-based renewable energy company engaged in renewable power generation; it operates a 4,000 MW power plant in England. The company has purchased forests in the U.S. and transports wood chips from these forests to their plant. In this way, the company is already achieving carbon neutrality. Drax expects to be carbon negative, on a progressing basis, over the next 20 years. They will accomplish this by continually transforming its plant to use more carbon capture and sequestration technologies.
Converting Plants to BECCS

The cost of the BECCS approach is greatly reduced by the availability of existing coal-fired plants. Minimal capital investment is needed to switch to biomass. However, potential problems occur if the coal-fired plants are retired and then dismantled too soon, resulting in no leftover plants to convert to biomass.

Global energy related CO₂ emissions amount to approximately 33 gigatons (GT). Coal contributes 15 GT (or 45%) of total global energy production. If all coal fired plants adopted the BECCS process, they would create a negative 15 GT of CO₂ and help offset emissions from other sources. From this perspective, it becomes obvious that it is very important to not retire coal plants, but to convert them to BECCS instead.

<table>
<thead>
<tr>
<th>Category</th>
<th>2020</th>
<th>2050</th>
<th>2070</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>14</td>
<td>-14</td>
<td>-14</td>
</tr>
<tr>
<td>Other</td>
<td>86</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>0</td>
<td>-4</td>
</tr>
</tbody>
</table>

Table 1.

Implementing BECCS Technologies

It is also important for the companies building new plants to consider technologies that will lend themselves to a cost-effective conversion to biomass.

To address climate change, companies like Sumitomo have developed technologies such as the Flexi-Burn™, which allows circulating fluid bed boilers (CFBs) to operate in either conventional firing or carbon capture mode without significant plant modification. This gives clients the flexibility they need to endure an uncertain regulatory and carbon credit market.

Detailed analyses were conducted relative to flexibility for new coal plants in India. The ability to use lower cost coals was one of the cost advantages. The conclusion was that Fluid Bed Combustion (FBC) was competitive for high quality coal sources and had advantages for low quality coal or biomass combustion.

BECCS and Pumps

This BECCS program will be of immediate benefit to the pumps industry. Coal plants which would have been retired will instead buy replacement components, including pump for various processes. When the plants make their full conversion, there will be a large number of new pumps used for the capture and transmission of CO₂.

There are a number of people in the pump and power industries who are aware of this situation. However, it is not clear that governments or environmentalists understand the options that are available. Whether or not it was intentional, the advocates of carbon neutrality are going to cause existing coal fired plants to be converted to BECCS, rather than retired.

Reference

1. Pumps: World Markets published by the McIlvaine Company

About the Author

Robert McIlvaine is the President and Founder of The McIlvaine Company, which publishes reports across worldwide pump and valve markets. He was a pollution control company executive prior to 1974, when he founded The McIlvaine Company. He oversees a staff of 30 people in the USA and China.
Where Giant Redwood Trees are Known for their Longevity, so is DualPac® Packing

Achieve Longer Equipment Life with Innovative Packing Technology

Chesterton’s DualPac® packing technology creates an entirely new level of packing reliability.

- Low friction and high sealability of PTFE without the consolidation and extrusion
- Strength and resiliency of aramids without the shaft wear
- Fewer gland adjustments translate to longer life
- Heat resistant fibers that will not burn up at higher speeds
How to Protect Pumps from Dead-Head and Underloaded Conditions

In today’s always-on environment, there is a demand for predictive operations and proactive engineering strategies to prevent costly equipment damage and downtime. As pump systems are essential to many facilities operation, it is critical to have effective protection for pump systems. Low power protection devices are a great place to start.

By Jim Rosner, Lead Industrial Application Engineer, Motor Control and Protection, ICD, Eaton

Dead-Head Detection

If a pump operates with no flow through the pump, due to a closed discharge valve or line blockage, a dead-head will occur. The pump re-circulates the same water, causing water temperature to continually rise. If the pump continues to run in a dead-headed condition for too long, excessive heating can damage the seals and reduce the life of the pump.

As there is a significant amount of energy being added to the liquid in a pump in a dead-head state, dead-heading in a centrifugal pump can lead to explosions. Hydraulic overpressure and possible chemical reactions in the pump can also be caused by the overexertion of pressure. The same results can be caused by running the pump dry for an extended period; this can lead to cavitation.

Although it may seem like a ‘no brainer’ to address these concerns and fix them, dead-heads are extremely hard to detect. A pump float switch will not detect a dead-head because the water level does not decrease. The key to accurate pump protection against dead-head damage is monitoring the motor load to see if it decreases. Two methods are available to determine motor load: motor current and input power.

Monitoring current for underloaded conditions is not effective because the current is relatively constant up to 80% of the motor load. Even at light loading, the current and the power factor is high, as current is flowing to the motor but it is not doing useful work (power). As the input power varies linearly across the motor load range, low power detection is an extremely reliable method for catching even small decreases in the load due to a dead-head. For light loads, input power is up to 10 times more sensitive than current-based methods of detection.

Figure 1. Current and input power vs. motor load. Image courtesy of Eaton.

Detection Tools

So, how can a user protect their pump? It is ideal to detect the development of an underloaded condition, like a dead-head, before the damage occurs. Traditional pump diagnostic methods, like a float switch, are ineffective in detecting a dead-head condition because water levels do not decrease. The key to fast and accurate detection is being able to identify decreases in motor load.

The best method for detecting underloaded conditions is using tools that can monitor power. This is because of the difference between how the power varies across the load profile compared to current, making low power protection a reliable method for quickly detecting even small decreases in the load due to a dead-head. For light loads, input power is up to 10 times more sensitive than current-based methods of detection.

For example, tools like motor management relays provide industry-leading configurable protection options for current, voltage, and power conditions. The low power protection can accurately detect a dip in power when a dead-headed condition occurs, taking the motor offline before costly damage occurs. Low power protection can be set to the desired percentage of rated power and provide separate warning trip levels and delays. The motor management relay therefore provides a single, compact solution for pump protection, as well as thermal overload, ground fault and other current or voltage based protections.
How to Protect a Pump

To help shield assets from costly damage, here are 11 tips and reminders for protecting a pump system.

1. **Expand monitoring beyond pump float switches:** Because the water level does not decrease with the use of a pump float switch, dead-heads are commonly overlooked with this detection method.

2. **Do not monitor motor current alone:** In dead-head conditions, motor current remains high even at light loading. The power factor may also be high, as current is flowing to the motor, but not doing useful work. Therefore, a protective device looking at current may not be able to accurately distinguish between ‘normal’ and ‘dead-head’ conditions.

3. **Monitor the pump motor load carefully:** Accurate discovery of motor load decreases can be critical for identifying dead-head conditions.

4. **Explore possible underload conditions:** While monitoring current, observe whether the motor current remains nearly constant (up to 50%) of the motor load. Input power should vary linearly across the motor load range.

5. **Always monitor for low power:** Small decreases in motor load may be significant; but even at light loads, power is up to 10 times more sensitive than amperes. This makes low power detection an extremely reliable method for catching even small decreases in motor load.

6. **Leverage global motor management relay for optimal protection:** Motor management relay provide current, voltage and power-based monitoring and protection – including low power protection – for the most comprehensive defense against harmful dead-head and underloaded conditions.

7. **Take motors offline as soon as a dip in power is detected:** Look for global motor management relay products that offer reliability and response without the addition of separate relays. When a pump dead-heads, these products will more quickly and accurately detect the dip in power; but they will also prevent further damage by automatically taking the motor offline.

8. **Avoid or upgrade separate ‘pump-off’ or dedicated dead-head protection relays:** Quality global motor management relay products now embed low power detection capabilities directly with the device’s connectivity options. Leading solutions can be set to the desired percentage of rated power and offer full customization for separate warnings, trip levels and delays.

9. **Invest in flexible solutions with advanced protection features:** Configurable protection options provide critical pump protection while also providing additional critical motor protections such as thermal overload and other current and voltage-based protections.

10. **Optimize equipment lifecycles by choosing solutions with predictive analytics:** Durable pump protection solutions should help optimize equipment lifecycles. Solutions that effectively leverage remote monitoring and troubleshooting enable automated maintenance tasks to occur. These tasks reduce the need for and extent of scheduled maintenance periods, while also minimizing required manpower and travel to remote locations.

11. **Explore paired solutions to achieve greater efficiency, reliability, and protection:** Some vendor solutions also offer easy integration with other protective products that ease commissioning while improving protection and extending uptime. For example, a global motor management relay paired with a variable frequency drive enables regenerative energy management. This feature allows the circuit to recognize changes in bus voltage and then store that power to keep the pump motor operating optimally. The drive frequency will dynamically adjust to discharge any added voltage rise on the DC bus.

**Final Thoughts**

By providing insight and opportunity for local engineering and service, quality pump protection products can offer greater stability to operations, while improving uptime and reducing costs. In harsh environments especially, protective devices that offer preventative diagnostics, enhanced stability and control, endurance, and longer life cycles are not only highly advantageous, but also beneficial to the safety of infrastructure, people, and environment.

---

**About the Author**

Jim Rosner has worked as an application engineer in Industrial Controls and Factory Automation for over 41 years. His focus has been on PLC applications, industrial networks and motor control and protection. He has worked with and helped many customers over the years with their application issues and questions.
The San Jacinto College Process Technology Program offers students training on a wide variety of machinery. The LyondellBasell Center for Petrochemical, Energy, & Technology features a Hands-On Trainer (HOT) unit for tech training applications, while the glycol unit mixes manual and automatic functions of newer, more modern equipment.
Calculation of the Arithmetical Mean Values

In Figure 7, the procedure for the two cases 'Q_{opt2900} < 2Q_{opt1450}' (Figure 7a and Figure 7b) and 'Q_{opt2900} > 2Q_{opt1450}' (Figure 7c and Figure 7d) are presented clearly.

A more thorough explanation of Figure 7, when n = 1450 [1/min], is depicted below:

- $Q_{1450M} = 0.5 (Q_{opt1450} + Q_{1450})$, the arithmetical mean value of the Q-values, and $NPSH_{1450M} = 0.5 (NPSH_{opt1450} + NPSH_{1450})$, the arithmetical mean values of the NPSH-values appertaining to $Q_{1450M}$, are to be used for the calculation of the exponent X. Simplifying the equation has been assumed in this case, and it has been determined that the Q-NPSH-curve between $NPSH_{opt1450}$ and $NPSH_{1450}$ is straight. This information is readily admissible because it has been found that $Q_{opt2900}$ is only slightly lower or higher than $2Q_{opt1450}$ in this instance.

The ratio of the arithmetical mean value of the flow rates is equal to that of the speeds, i.e. $Q_{2900M} = 2Q_{1450M}$. These values, along the appertaining NPSH-values, $NPSH_{2900M}$ and $NPSH_{1450M}$, can be put into the equation for the calculation of the exponent X:

\[ X = \frac{\log (NPSH_{2900M} / NPSH_{1450M})}{\log 2} \]
\[ X = \frac{\log (NPSH_{1450M} / NPSH_{2900M})}{\log 0.5} \]

Calculation of exponent X with the arithmetical mean values

With the numerical values of Figure 6, Figure 8 shows the corresponding calculation for the case 'Q_{opt2900} < 2Q_{opt1450}'. Result: the exponent X values are the same.

Results of the Evaluation

To avoid overloading this treatise with all the tables and diagrams made with the evaluation results of all investigated ranges, only two investigations have been presented: Figure 9 and Figure 10.
Figure 9 refers to water pumps in accordance with standard EN 733. It shows the frequency of the exponents X (marked with black points and circles) in the corresponding individual X-regions. Note to avoid misinterpretations: the black points and circles in Figure 9 are not manufacturer-symbols.

Figure 10 refers to chemical pumps in accordance with the ISO 2858 standard. In Figure 10a the NPSH-values at BEP for the two speeds $n = 1450$ [1/min] and $n = 2900$ [1/min] are presented. It shows all 30 sizes (below) and the calculated X-values (above). Figure 10b shows the frequency of the exponents X (marked with black points) in the corresponding individual X-region.

Figure 11 is the most important table of this investigation. It presents the sums of the frequencies of the exponents X of all ranges in the corresponding 26 individual exponent X-regions. Figure 11 shows peak values of the frequency for the exponents X with values between $X = 1,000$ and $X = 1,099$ as well as $X = 1,500$ and $X = 1,599$. Furthermore, it can be seen that more exponents X are in the exponent X-region from $X = 0,800$ up to $X = 1,499$ than in the region from $X = 1,500$ up to $X = 1,999$.

If a Gaussian frequency distribution curve was also drawn into Figure 11, its peak would be between $X=1,200$ and $X=1,399$ of the exponent X-region. As the position of this frequency distribution curve takes into account the exponents with values between $X=0,500$ and $X=0,999$, it is justified to move it to the right. This is indicated by the broken line on the graph, and therefore has peak values between $X=1,400$ and $X=1,599$ of the exponent X-region.

The lowest calculated values of the exponent X are in the exponent X-region of 0,100 to 0,199 and the highest ones in the exponent X-region of 2,100 to 2,199. This demonstrates clearly that a general valid exponent $X = 2$ is far away from the results of this investigation.
Test result

Figure 12 shows an interesting diagram from reference 5. It clearly shows that the conversion of NPSH$_{1450}$ into NPSH$_{2900}$ with the exponent ‘2’ results in NPSH$_{2900}$-values (upper dash-dotted line) that are too high.

If referring to the BEPs, it can be seen that the NPSH$_{2900}$ (middle test curve) corresponds to $X = 1.46$. Based on this result, it could be concluded that ‘1.5’ could perhaps be an acceptable value for the exponent $X$ for the NPSH-conversion.

Figure 12: Extract from [5], translation of the German caption: NPSH-test-values at 1450 and 2900/min. The test values (drawn with full lines), which led at $Q_{opt}$ to a conversion exponent of 1,46 are compared with the theoretical values with exponent 2 (dash-dotted line). Translation of the words inside the diagram: Messung = measurement, Umrechnung auf… mit… = Conversion to… with...

For comparison purposes this calculation can be made:

The conversion of NPSH$_{1450}$ = 5.4 [m] at BEP with the exponent $X = 2$ leads to NPSH$_{2900}$ = 1.35 [m] at BEP (red drawn into Figure 12); this is a clear deviation from the test curve.

Figure 13: Distribution of the frequency of $X$ in the regions $X = 1.400$ to 1,599 and 1,900 to 2,099 dependent on the manufacturers A to H.

With regard to the exponent $X = 1.46$ determined in reference 5, the question arises: how are the various $X$-values, presented in Figure 11, in the exponent $X$-regions: $X = 1.400$ to 1,499 and $X = 1.500$ to 1,599 as well as $X = 1.900$ to $X = 1.999$ and $X = 2.000$ to 2,099, distributed to the manufacturers A to H? This can be seen in the coloured bar chart, Figure 13.

Final word

Using scientific tests above, it was proved that the NPSH-conversion to another speed with the exponent $X = 2$ leads to NPSH-values which are not in accordance with the test results. (5)

This leads to the answer of the original question, is NPSH-conversion to another speed quadratic or not?

Without any doubt the results of this investigation show clearly that a general valid exponent could not be confirmed for $X = 2$ nor for $X = 1.5$! The only statement which can therefore be given is: NPSH-conversions with the exponent $X = 2$ lead to incorrect results and because of that it is recommendable, if ever possible, to avoid NPSH-conversions and determine NPSH at the required speed to get reliable results.

To read Part 1 of this article look to the April 2021 issue of Pump Engineer.

References

1. ISO 2548-1973 Centrifugal, mixed flow and axial pumps Code for acceptance test Class C.
2. ISO 5555-1997 Centrifugal, mixed flow and axial pumps Code for acceptance tests Class B.
6. Rütschi, Karl, Dr.-Ing. h.c. NPSH-Messungen an Kreiselpumpen NPSH-Measurements at centrifugal pumps, Schweizer Ingenieur und Architekt 48/85.
10. ISO 2858: 1975 End-suction centrifugal pumps (ratings 16 bar) -Designation, nominal duty point and dimensions.
12. Technical documentation of eight pump manufacturers.

About the Author

Dipl.-Ing. Jürgen H. Timcke

studied mechanical engineering at the University of Applied Sciences in Karlsruhe. He has 40 years’ experience in the field of centrifugal pumps and has gained a thorough understanding of the pump industry. In the last 30 years, he has been a Manager of the Development, Design and Testing at a number of international and well-known pump companies. In addition to his professional activities he was also a regular lecturer at the University of Applied Sciences in Konstanz. As an expert in his field he was elected a member of the AMERICAN SOCIETY OF NAVAL ENGINEERS. Other articles by Timcke can be found at: www.juergen-h-timcke.ch
KNOW-HOW AND EXPERIENCE FOR FUTURE PUMP TECHNOLOGIES

The international renowned ANDRITZ Group has been building pumps since almost 170 years. Our profound experience, our quality and high-efficiency products as well as our understanding of customer requirements have made us a preferred partner for pumping solutions worldwide. We offer innovative and targeted solutions with pumps and complete pumping stations for water management, the pulp and paper industry as well as numerous other industrial applications and areas. ANDRITZ offers everything from a single source – from development work, model tests, engineering design, manufacture and project management, to after-sales service and training. Our declared goal is your complete satisfaction. See for yourself!
Climate change, population growth, and water scarcity are creating new challenges, and desalination is becoming an important alternative to traditional freshwater resources.

SAER is ready to face these new scenarios with a strong and fast answer: a full range of high efficiency end suction, close coupled, high pressure, split casing and submersible pumps and motors in DUPLEX and SUPER DUPLEX, available with one of the best delivery time on the market, thanks to the Italian production.

Let’s improve the water management in civil, industrial, marine and agricultural water services and rest assured with SAER quality. #saerready
SAER.Elettropompe
SAerelettropompe
Saer Elettropompe
+39 0522 830941
info@saer.it
saerelettropompe.com

Climate change, population\nbecoming an important\nand desalination is\nare creating new challenges,\n
Let's improve the water management in civil, industrial, marine and\nitalian\nproduction.\nbest delivery time\navailable with one of the\non the market, thanks to the\n,

to face these new scenarios with a strong and fast answer: a

#saerready

Centrifugal pump, vertical, horizontal & self-priming pumps delivered in half the\ntypical lead time!

Argal Pumps
Via Labirinto, 159 – 25125 Brescia Italy\ntel:+39 030 350 7015\ninfo@argal.it\nwww.argalpumps.com
Pump manufacturer since\n1975 Centrifugal and\npneumatic pumps\nThermoplastic, metallic and\nFRP pumps

Debem Srl
Via del Bosco 41 21052 Italy\ntel: +39 0331 074 034
fax: +39 0331 074 036
info@debem.it
www.debem.it/

Argal Pumps
Via Labirinto, 159 – 25125 Brescia Italy\ntel:+39 030 350 7015
info@argal.it
www.argalpumps.com
Pump manufacturer since\n1975 Centrifugal, pneumatic,\nthermoplastic, metallic and\nFRP pumps.

Debem Srl
Via del Bosco 41 21052 Italy\ntel: +39 0331 074 034
fax: +39 0331 074 036
info@debem.it
www.debem.it/

Messe Düsseldorf GmbH
P.O. Box 10 10 06, 40001\nDüsseldorf\nGermany\ntel:+49-221-2969-6\ninfo@mundus.de
www.mundus.de

Technosub
1156 Avenue Lariviere\nQuébec JX9 4K8\nCanada\ntel: +1-819-797-3300
fax: +1-819-797-3060
rheaultp@technosub.net
www.technosub.net

Messe Düsseldorf GmbH
P.O. Box 10 10 06, 40001\nDüsseldorf\nGermany\ntel:+49-211-4560 01
fax:+49 211 4560 668
info@messe-duesseldorf.de
http://www.messe-\nduesseldorf.de/

Resolute Research B.V.
Lovinklaan 1\nNL-6821 HX Arnhem\nThe Netherlands\ntel: +31-26-205-1515
info@resolutereach.com
www.resolutereach.com

Pump market Report\nPump Supplier Database\nPump Product Database\nCustom-made Research

INOXSYDA
4-8, rue Etienne Dolet\n76140 Petit Quevilly\nFrance\ntel: +33 (0) 285 67 78 50
fax: +33 (0) 285 72 99 99
contact@inoxysyda.fr
http://www.inoxyda.co.uk
Aluminium bronze sand casting Sand Castings up to 300t Continuous casting to diam. 430 mm Centrifugal\nCasting up to diam 6m a member of LBI Foundries: http://www.lbi-foundries.com

V. Solis at\nmarketingdist@chesterton.com
www.Chesterton.com

A.W. Chesterton Company\n860 Salem Street,\nGroveland, MA 01834\nUSA\ntel: +1 781 438 7000
fax: +1 978 469 6785
marketingdist@chesterton.com
www.Chesterton.com

Gebr. Steimel GmbH & Co.\Maschinenfabrik\Johann-Steimel-Platz 1\D-53773 Hennen\nGermany\ntel: +49-2242-8809-0
fax: +49-2242-8809-160
info@steimel.com
www.steimel.com

Grundfos GmbH
Schlüterstraße 33\n40699 Erkrath\nGermany\ntel: +49-211-2969-6
info@grundfos.de
www.grundfos.de

SANDVIK MATERIALS\Technology\SE-811 81 Sandviken\nSweden\ntel: +46-26-263873
christechtorson@sandviken.com
www.smt.sandvik.com

Tytco Alloy Industries\(Hong Kong) Co., Ltd.\Level 13, Tower 2,\Kowloon Commerce Centre,\51 Kwai Cheong Road\Kwai Chung, Hong Kong\ntel:+852 2497 3300
fax:+852 2435 1162
enquiry@tyconalloy.com
http://www.tyconalloy.com

INNOXYDA\4-8, rue Etienne Dolet\76140 Petit Quevilly\France\ntel: +33 (0) 285 67 78 50
fax: +33 (0) 285 72 99 99
contact@inoxysyda.fr
http://www.inoxyda.co.uk
Aluminium bronze sand casting Sand Castings up to 300t Continuous casting to diam. 430 mm Centrifugal\nCasting up to diam 6m a member of LBI Foundries: http://www.lbi-foundries.com

Tytco Alloy Industries\(Hong Kong) Co., Ltd.\Level 13, Tower 2,\Kowloon Commerce Centre,\51 Kwai Cheong Road\Kwai Chung, Hong Kong\ntel:+852 2497 3300
fax:+852 2435 1162
enquiry@tyconalloy.com
http://www.tyconalloy.com

INNOXYDA\4-8, rue Etienne Dolet\76140 Petit Quevilly\France\ntel: +33 (0) 285 67 78 50
fax: +33 (0) 285 72 99 99
contact@inoxysyda.fr
http://www.inoxyda.co.uk
Aluminium bronze sand casting Sand Castings up to 300t Continuous casting to diam. 430 mm Centrifugal\nCasting up to diam 6m a member of LBI Foundries: http://www.lbi-foundries.com

Tytco Alloy Industries\(Hong Kong) Co., Ltd.\Level 13, Tower 2,\Kowloon Commerce Centre,\51 Kwai Cheong Road\Kwai Chung, Hong Kong\ntel:+852 2497 3300
fax:+852 2435 1162
enquiry@tyconalloy.com
http://www.tyconalloy.com
Casting Engineering Solutions

Casting For A Better Tomorrow …

Capitalizing on our own Lean Manufacturing Foundry in China with state-of-the-art technological practices and internationally accredited quality assurance, that further interplaying with our competent human resources with modern management proficiency, we have been rendering high value Casting Engineering Solutions for our customers who are themselves market leaders in their own fields, around the globe.

… Together our synergy will lift you UP Where You Belong

One Stop Services in Precision & Sand Casting, Machining, Engineering, Fabrication & Logistics;


Norsok M650 Approved by Customer
STANDARD WITH EXTRAS

TRY OUR CHEMICAL STANDARD PUMPS

- **Standardised** – dimensions and performance according to ISO 2858
- **Versatile** – large selection of materials, seals and seal-less options
- **Low-maintenance** – few spare parts, quick and easy maintenance, long service life
- **Efficient** – optimised flows, highly efficient
- **Special** – taylor-made solutions for you

Boschring 3 • D-91161 • Hilpoltstein • Germany
+49-9174-97708-0 • info@strobl-pumpen.de
www.strobl-pumpen.de