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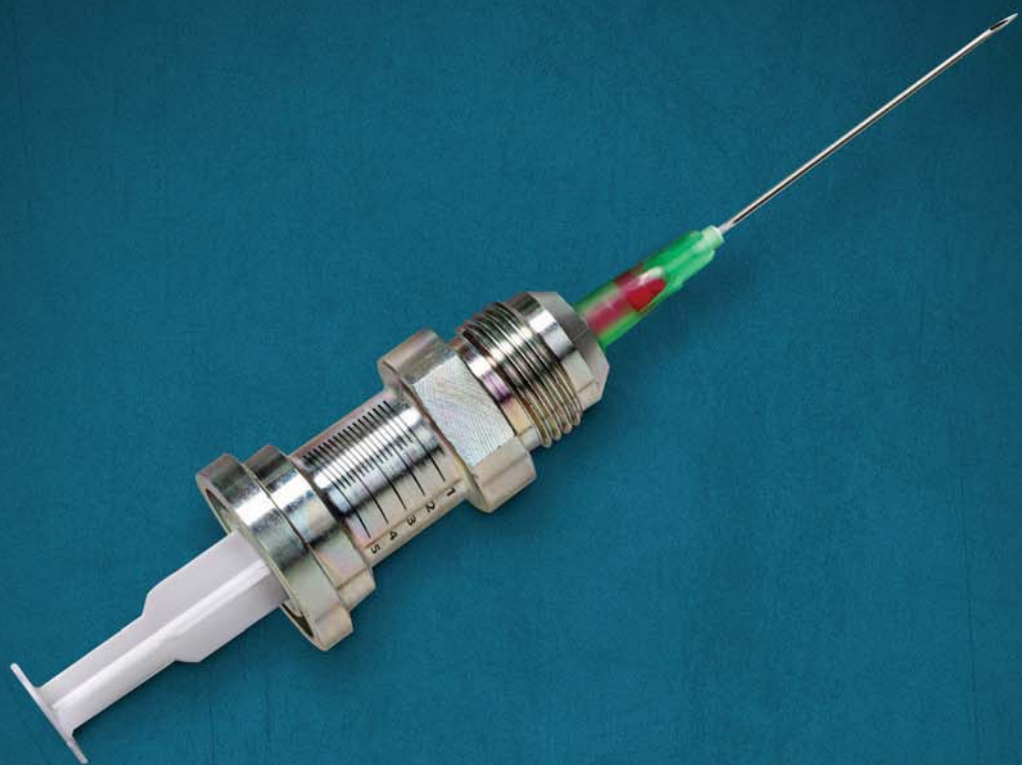
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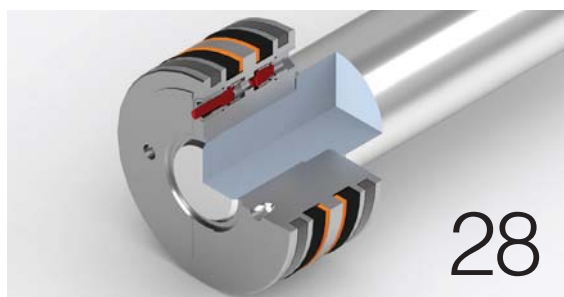
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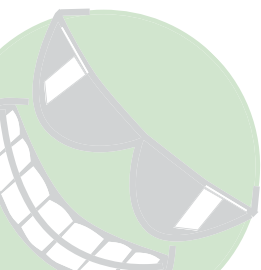
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Editor's Page

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Redesigning the Designer's Role

Spencer Silver is not a name you'd know at first glance, but he was partially responsible for one of the most successful products in global history. Silver died last month at the age of 80, and if you need to make a note to yourself to look up his biography, you might use one of his creations to do it.

A 3M chemist and researcher, Silver invented the glue that gave us Post-It Notes. Silver's unique glue composition could be stuck and unstuck repeatedly without harming the surface or losing adhesion. But while an interesting chemical discovery, there wasn't an obvious use for the glue until another 3M colleague, Art Fry, was looking for an easy way to put up a reminder that didn't require a pin or tape. Fry remembered the glue Silver has created, used it on a small piece of paper, and a product


empire was born.

As in Silver's case, successful design is so often a matter of trial-and-error—and what first may look like an error is in fact a solution in search of a problem. But such an approach is viewed by those outside the design universe as expensive, often unproductive and as a result mostly unprofitable. Speed to market and eliminating the error part of the process have driven much of the innovations of the last few years, the COVID-19 vaccine most recent among them.

Where does this leave the Spencer Silvers of the world? In a different role, but one that is no less crucial to the process. Jesse Coors-Blankenship, senior vice president of Technology for PTC, offered this thought: "These developments will shift the role of the engineer to curating parameters and test

conditions, and then choosing the best design from a range of permutations generated by AI.

"Eventually even the design-selection process will require AI assistance, as the sheer range of generated solutions outpaces the engineer's ability to sort through them," Coors-Blankenship added. "Liberated from the tedious trial and error of refining their designs, engineers can focus on *what* their design needs to accomplish rather than *how* the design will be realized."

Luck can be defined as when opportunity meets preparation. Silver earned 37 patents in his 3M career, so if the temptation is to think of Post-It Notes as lucky, it was luck borne of hard work and talent. If the future of innovation will be better realized by AI, it still will be fueled by innovation that is more intuitive than artificial. 



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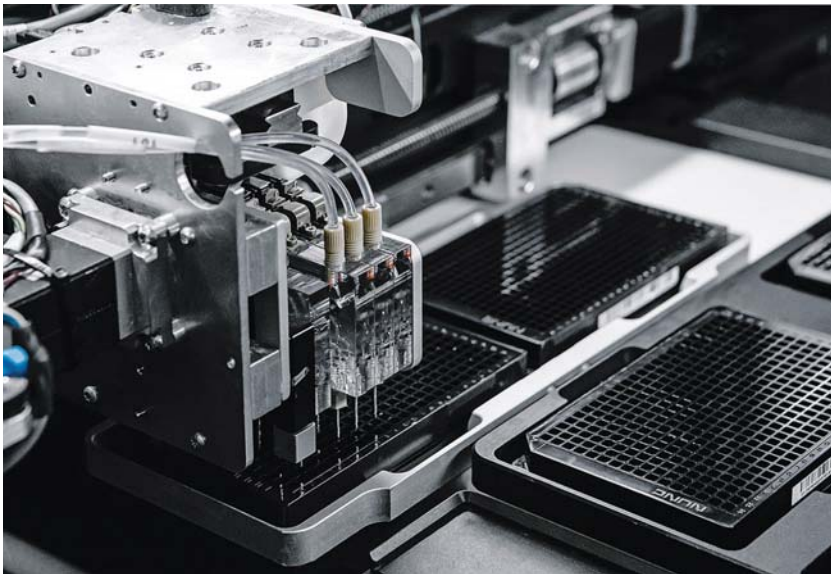


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News

Robotic Analyzer Pinpoints Just the Right Antibiotic for a Patient

by Stephen Mraz



The SeLux NGP machine determines which antibiotics work best against a patient's specific infection and which ones it is resistant to.



Several Festo dosing heads and handling components are used in the NPG machine to speed sample testing.

It typically takes two to four days before doctors can determine the best antibiotic needed to treat a patient's infection. In the meantime, many physicians prescribe broad-spectrum antibiotics for a patient which can cause problems. It raises the risk that some bacteria will evolve and acquire resistance to that powerful antibiotic and render it less helpful for future infections. It also means the patient is not getting the best drug treatment possible, which can forestall or delay the patient's recovery.

A new diagnostic machine from SeLux, the Next Generation Phenotyping (NGP) platform, finds the antibiotic most effective against the exact bacteria that has infected the patient all within 24 hours. This saves time and gets the patient on the best course of drugs sooner.

In the NGP machine, the patient's blood plasma or other type of sample is placed in up to 384 wells of a microplate. Different types and doses of antibiotics are placed in each sample-filled well. Then each sample is tested and analyzed to see if the antibiotic eliminated the infectious bacteria, and an algorithm checks each antibiotic dilution to see which delivers the best targeted response.

To ensure the Festo VTOE and VTOI heads are properly controlled, a Festo VAEM control is used. For speed and automation, the design relies on Festo's EXCM-30 handling portal to move microplates and its EHMD rotary gripper module to rotate vials, and opens or closes the lids on them.

Under current standards of care, sick

patients are given broad-spectrum antibiotics based primarily on the treating physician's historical experience. Using more targeted antibiotics, which would work better and avoid overprescribing broad-spectrum cures, takes one to four days longer than if the NGP machine is used.

In traditional testing, a blood sample is drawn and sent to be cultured, which can take 16 to 24 hours. If bacterium grows, which verifies the presence of an infection, the bacteria is purified—a process that takes another 24 hours. At this point,

To ensure accuracy and consistency, SeLux decided to use several dosing heads on the NGP to deliver drugs to the samples in precise microliter doses.

a range of antibiotics can finally be tested to find the one that best targets the specific infection, and the first results will take another day. If the patient has an infection resistant to a range of antibiotics, it could take up to five days to pinpoint the best one.

Current machines used in this process are outdated and have not changed since their invention decades ago. For example, current diagnostic machines can only test 12 to 15 antibiotics at a time, even though doctors have more than 35 commercially available antibiotics to choose from. (The NPG machine can handle 384 antibiotics or variations in dilution.) What's more, newly FDA-approved breakthrough antibiotics often don't get tested because current machines can't accommodate them; there isn't enough room to include them on machines already working to capacity testing traditional and well-known antibiotics.



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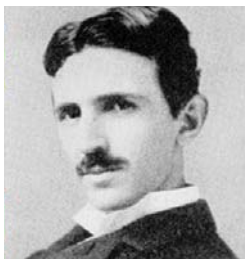
The Tesla Valve: Bringing Back a Forgotten Invention

by Rehana Beggs

Scientists have dusted off the mechanics behind a 100-year-old valve and are reimagining it for use in current and future technology.

The device, originally known as a “valvular conduit,” was invented by Nikola Tesla, who was awarded a patent for the invention on Feb. 3, 1920.

Scientists at New York University’s Courant Institute of Mathematical Sciences have re-engineered replicas of the one-way valve and report that the device is more functional than was previously realized. According to their findings reported in the journal *Nature Communications*, the Tesla Valve could harness the vibrations in engines and other



Nikola Tesla

machinery to pump fuel, coolants, lubricants and other gases and liquids.

“While Tesla is known as a wizard of electric currents and electrical circuits, his lesser-known work to control flows or fluid currents was truly ahead of its time,” said Leif Ristorph, an associate professor and the paper’s senior author.

The re-engineered Tesla Valve has no moving parts, consisting instead of a series of “interconnected teardrop-shaped loops” which allow fluid to pass through in one direction.

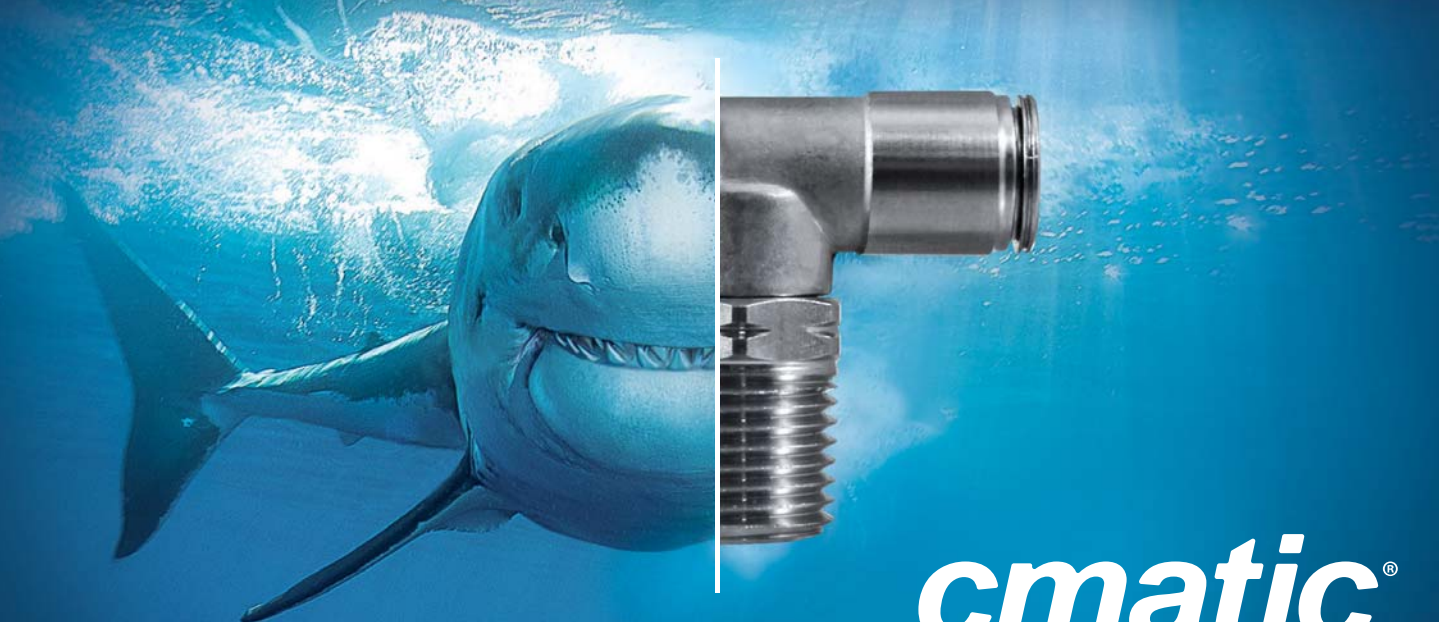
The device provides a clear path for forward flows, but the route is slower for reverse flows, noted the researchers. The slower reverse flow is an unrealized benefit in circumstances when flows need to be controlled rather than unleashed, they added.

In lab tests, the researchers measured the valve’s resistance to passing flow in the two directions. They found:

- At low flow rates there is no difference in resistance for forward and reverse flows.
- Above a certain flow speed, the device abruptly “turns on” and significantly checks or resists reverse flows.

“Crucially, this turn-on comes with the generation of turbulent flows in the reverse direction, which ‘plug’ the pipe with vortices and disrupting currents,” explained Ristorph.

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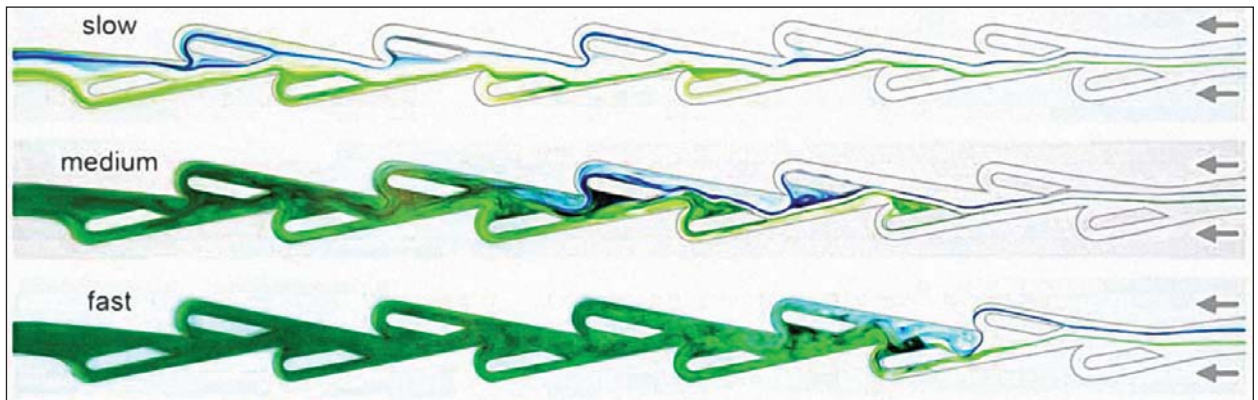
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Comparison of flows in the reverse direction (right to left) at three different speeds. The water current is visualized with green and blue dyes, showing that the flows are increasingly disrupted at higher speeds.

“Moreover, the turbulence appears at far lower flow rates than have ever previously been observed for pipes of more standard shapes—up to 20 times lower speed than conventional turbulence in a cylindrical pipe or tube. This shows the power it has to control flows, which could be used in many applications.”

The researchers said that the valve works better when the flow is not steady; when the flow comes in pulses or oscillations, the device converts into smooth and directed output flow. This pumping action mimics the AC-DC converters that

transform alternating current to direct current, they explained.

The Tesla device can be viewed as an alternative to the conventional check valve, noted Ristroph. The valve’s ability to control flows and generate turbulence at low speeds expands the possibilities for Tesla’s invention, he said.

According to Ristroph, the device is very effective at mixing. “[It] could be used to harness the vibrations in engines and machinery to pump fuel, coolant, lubricant or other gases and liquids,” he said.

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Reaching Gender Equity in STEM Professions

by Roberta Rincon

Advocates for gender equity in science, technology, engineering and math (STEM) often focus on one of two areas: recruitment or retention. Those working on recruiting more women into STEM professions may be addressing issues extending as far back as early childhood education. An early introduction to STEM can lead to a developing interest in pursuing a STEM education, greater confidence in math and science ability, and a budding STEM identity.

Recruitment also involves removing systemic barriers along the educational path. This would include increasing the number of STEM role models for young women and combating stereotypes that decision-makers such as teachers and college advisors may have about women that then influences women's decisions to pursue STEM degrees. These stereotypes can also affect how students of all genders interact with female students.

Retention, on the other hand, is really about tackling the systemic barriers that push women out of STEM professions. Don't be fooled: Most of these women are not leaving the workforce to care for children. A study on why women leave STEM, specifically the male-dominated field of engineering, found that almost 70% said they were still working after leaving engineering. The top reasons for leaving? Working conditions and organizational climate. Many women stated that they had lost interest in their work, that they did not like the culture within their organizations and that they did not see a path toward career advancement.

This is not solely experienced by women engineers. A Kelly Services survey of global STEM talent found that 27% of women in the U.S. feel like their careers are stalled, and 32% are likely to leave their STEM job within a year. In Brazil and India, the percentage of women reporting feeling like their careers were stalled was even higher. Women in the study reported experi-

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encing feelings of exclusion, double standards and bias in performance evaluations. Among women who had reached senior-level positions in STEM, many reported pessimistic feelings about women's advancement opportunities within their organizations, stating that women would never get a top position no matter how able or high-performing they are.

What is leading to these feelings of frustration and disillusionment when it comes to career advancement in STEM? McKinsey & Company wrote about the "broken rung" in its 2019 "Women in the Workplace" report, noting that it isn't really a glass ceiling keeping women from top level positions. Rather, it's that first step into management, where fewer women are becoming managers compared to men, that leads to a diminishing pool of female talent from which to draw senior leaders. As stated in the report, "there are simply too few women to advance" into executive positions.

Although the McKinsey report was about women's leadership across all sectors, it helps to explain why women in STEM believe their careers are stalled.

The potential for career advancement is an important factor employees consider when choosing to stay in their chosen profession. A recent survey by the Society of Women Engineers (SWE) found that 24% of women cited growth potential as the primary reason for staying with their current employer. Another 23% indicated it was the empowering work culture at their organizations. Less than 10% said salary was keeping them from leaving.

There are issues that need to be addressed to combat gender inequities in hiring, pay and performance evaluations, but studies like SWE's highlight the need for organizations to pay attention to their process for identifying employees with leadership potential as a way to retain diverse STEM talent.

Researchers at Pinsight note that women are often prevented from accessing professional development opportunities, networking opportunities, executive coaching and special assignments because their leadership potential is overlooked. Women are being held back early in their careers, and over time it results in fewer and fewer women promoted into senior executive levels. To stop this, organizations must honestly look at how they



are identifying the next generation of leaders, and who they are preparing for promotion opportunities.

ROBERTA RINCON is the associate director of research at the Society of Women Engineers. More of her writing and research can be found at <https://research.swe.org/>.



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A Canadian Rig Rolls On—Even in **ROUGH WEATHER**

An energy chain eliminated downtime for a potash mining company.



Workers at AKITA Drilling had seen these conditions before. With temperatures at nearly 40 degrees below zero and winds at 60 miles per hour in Saskatchewan, workers had to shut down potash drilling operations because the company's rig would become inoperable.

"We tried multiple ways to combat the wind messing with the service loop," said Justin Amyotte, a field superintendent with AKITA. "We even went as far to set up the rig in the direction of the predominant winds. We had a worker stationed on the floor watching the service loop at all times during high winds. We shut down if it was too bad."

This time, however, AKITA's workers were not required to suspend operations. An eight-hour retrofit on the previous day included the installation of an energy chain that stood up to the demands of the rough Canadian winter. The energy chain serves as the service loop for the 500,000-lb capacity pad drilling triple rig and is the heart of the unit. This time, the 21.5-meter (nearly 70 ft) energy chain manufactured by igus helped the pulse remain steady throughout the cold Canadian night.

"Continuous operational time and prevention of downtime are paramount for drilling rig operations," said Alan Kwoo of igus, who helped design the energy chain retrofit. "Lost production means lost revenues."

CRITICAL SERVICE LOOPS

Whether the drilling operation is used for oil, gas, potash or any other mineral, service loops power the entire structure.

The energy chain replaces the service loop on the rig and was installed in an eight-hour retrofit. The service loop frequently snagged, and work had to shut down in blizzard-like conditions.

Service loops refer to the supply lines for electricity, hydraulics and pneumatics. A large electrical drilling motor installed in a derrick or mast supplies the torque to drill, which can extend down to depths as far as 10 kilometers.

Electrical service loops serve as the power source between the mast and the top drive. They provide the power to the main motor and auxiliary power for functions such as lighting and cooling fans. They also provide power to capture data and operate the rig.

Most service loops are made with steel. They require regular maintenance, as delaying any repair can result in deadly consequences in dangerous work on a rig. Steel service loops are also susceptible to corrosion and are unreliable in high winds. The AKITA rig cables prior to the retrofit were wrapped, but the wrap wrinkles and snags easily when it comes close to the rig frame. That causes rips or pulls on the cables. The package containing cables and hoses is also costly to replace.

"Sometimes the wind gusts and grabs the service loop and sends it into mast beams," Amyotte said. "Hopefully, the driller sees it and stops and fixes the snag. If he does not see it, the cords get damaged. That results in even longer downtime."

There were also safety concerns. "There was more than one occasion where the service loop became snagged on the top drive, resulting in a dangerous overhead safety incident with high voltage cabling," said Darren Hrynkiw, a senior manager for K+S Potash Canada, the owner of the potash mine. "Multiple engineered safety solutions were explored, but in most cases the solution presented other maintenance or sometimes even new safety concerns."



While in this instance the energy chain was used in mining for potash, the solution can be included on oil rigs and any other mining task.

AN EARLY TEST

AKITA's rig, built in 2015, is 16 ft tall and includes a 136-ft mast. K+S, which has been in operation for 125 years, takes potash crude and further processes it into potassium chloride. Its mine in Bethune, the site of the AKITA rig, is the first greenfield potash mine in Saskatchewan in more than 40 years.

The AKITA rig worked well in normal conditions, but the company considered retrofit options due to the downtime caused by snags on the service line created by the strong winds.

"The only other solution is a rigid chain/track type system," Amyotte said. "These can be bent and damaged from tubulars or on a rig move. It also does not function well with ice. Once it is damaged, the rig would be down trying to

fix it."

AKITA scheduled to retrofit the rig with the igus energy chains in mid-January. The mine had been scheduled to be temporarily shut down in February before activating again in summer. The teams wanted the new energy chains in place for testing before suspending for the rest of the winter.

The retrofit required just eight hours, and it took only 24 hours for the energy chain to get its first test. A blizzard swept through the region, bringing winds that reached 88 miles per hour along with snow and freezing rain. The storm knocked out power lines, brought six inches of snow and caused numerous power outages. Wind gusts were the highest ever recorded in nearby Regina during the month of January. Temperatures fell to nearly 40 degrees below zero. This

particular storm was no garden-variety blizzard.

The rig, however, with the energy chain serving as the service loop, rolled on: no stoppages, no downtime and no workers standing on the ground watching for a potential calamity.

"Even in those extreme conditions the loop functioned very well," Hrynkiw said. "I am always pleased when an engineered solution can be found to eliminate a safety hazard, as this is far more effective than procedural safeguards. We expect little to no maintenance given its design and there are no productivity impacts with the installation of this protective system."

E-LOOP BENEFITS

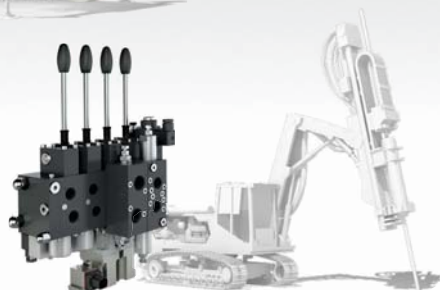
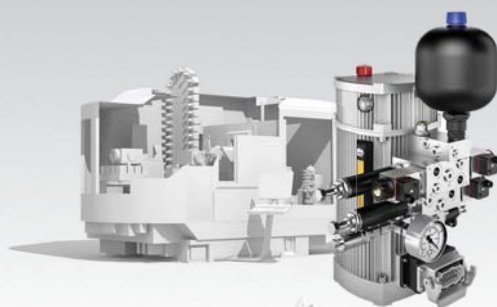


The e-loop energy chain includes several other benefits for drilling rigs. The igus product combines the advantages of a polymer energy chain with a Dyneema rope featuring high tensile strength. The tensile forces are absorbed by the rope and passed through the mounting brackets into the support structure. The design relieves cables of any strain and ensures a defined bend radius of the cables. The modular e-loop also withstands vibrations and shocks.

“Less downtime results in more productivity, and less damage to the rig saves money,” Amyotte said. “There is also an important safety component. There is 600 V AC running through those power cords and up to 600 amps

A rig in Canada used by AKITA Drilling to mine potash was retrofitted with a plastic energy chain that operates in the toughest weather conditions.

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before the breaker trips.”

The e-loop has a bend radius of 500 mm and includes a protective cable guidance system that eliminates service loop cable snags and hang-ups. Its modular design allows easy pre- and post-installation access. The design also makes it safer for repairs. igus, which runs its North American operations out of Providence, R.I., manufactures self-lubricating, long-lasting components that are used in a wide range of applications.

The e-loop is mounted in the middle of the mast, which is a load-bearing structure used to support and position the drill string. The e-loop traverses the 136-ft mast by going 70 ft up and 70 ft down from the center point.

DISHING ON POTASH

While hardly a household name, potash is nonetheless one of the most widely used minerals in the world. Canada is the world’s largest producer and

exporter of potash, and Regina is one of the nation’s regions with the richest potash reserves.

Potash is a group of minerals and chemicals containing potassium, which is a basic nutrient for plants and an important ingredient in fertilizer (where it supports plant growth, increases crop yield and disease resistance, and enhances water preservation). Root vegetables, such as carrots, parsnips, peas, beans and fruit, are products that grow better with potash.

The product is critical to the Canadian economy, especially in Saskatchewan. In 2017, exports of potash from Saskatchewan amounted to more than \$5 billion. Potash production generated direct payments to the provincial government of more than \$308 million CAD in 2017-18.

With those numbers, it is easy to understand why reducing downtime to a minimum is essential for AKITA and

K+S. Potash is critical not only for the world’s food supply chain, but also to keep businesses and investors happy.

While the technology in this application was used for potash, Amyotte said any rig could use the technology. “A drilling rig is a drilling rig,” he said. “What it drills for doesn’t matter. It could be a huge benefit on any drilling rig.”

After years of frustration caused by weather-related downtime, Amyotte now believes he has a solution that will help keep the AKITA rig remain operational despite what Old Man Winter throws at the intrepid Canadian workers.

“We worked out a great solution,” Amyotte said. “This has been a challenge for us for a while, so it’s nice to have something we can depend on.” **hp**

SCOTT PARKER is the igus product manager for energy chain systems in Canada.

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Water-Glycol Hydraulic Fluids: More Than a “GREEN” Solution



Programs based around ISO cleanliness standards ensures costs are low and productivity stays high.

Hydraulic fluid is the lifeblood of industrial machinery and serves many purposes in industry applications. With advances in equipment technology and the ability for hydraulic fluids to provide the necessary protection, it is essential to understand that it is not just another consumable item to be purchased and disposed of as needed.

Many in the industry now recognize that selecting the proper hydraulic fluid can contribute to plant efficiency and ultimately help reduce costs. This insight has driven a great deal of innovation in the hydraulic fluid market.

It has brought more choices to power transmission plants, steel and aluminum mills, and other facilities that rely on hydraulic fluids.

The versatility of the water-glycol hydraulic fluids allows those fluids to be applied in many applications. Today, water-glycol hydraulic fluids can be used in many applications that previously called for mineral oil-based fluids where fire resistance is required. Identifying the need for a fire-resistant fluid and understanding the lubrication requirements is the first step in realizing the benefits that water-glycol hydraulic fluids can bring to various industries.

DEVELOPMENT OF WATER-GLYCOL BASED HYDRAULIC FLUIDS

Water-glycol based hydraulic fluids were first introduced as a solution to onboard fire problems during World War II. The U.S. Navy discovered that mineral oils were not fire-resistant enough to survive the rigors of combat and subsequently initiated a program to create fire-resistant hydraulic fluids.

That program led to the development of water-glycol hydraulic fluids, which proved to be both fire-resistant and were able to meet the rigorous needs of the Navy. Water-glycol hydraulic fluids were commercialized in 1947 and offered vastly improved fire resistance relative to mineral oils in use at the time.

Since 1947, water-glycol based hydraulic fluids have undergone addi-

tional research and formulation changes. Water glycol formulations that extend service life, reduce wear, lower operating costs and are environmentally acceptable are now increasingly available. Water-glycol hydraulic fluids have evolved to the point where they offer reduced operating expenses, safe operating environments and excellent economies of scale.

Many industries utilize water-glycol hydraulic fluids, including power transmission plants; hydraulics systems operating in areas subject to fire hazards (such as those in steel and aluminum mills); molding and metal die casting machinery; welding machines; and foundries. The fluids can also be used in cases that can benefit from fire resistance and extended fluid life while also meeting environmental concerns.

WATER-GLYCOL HYDRAULIC FLUID BASICS

As the name implies, water-glycol fluids consist of a solution of water, ethylene or diethylene glycol, a thickener and an additive package. The additive system contains attributes such as wear protection corrosion resistance, metal passivation, oxidation resistance, antimicrobial properties, and a pink or red dye to aid in identification.

The development of water-glycol hydraulic fluids has been driven by a multitude of changes impacting various industries. A prime example is environmental concerns that have driven industries to look for fluids that are less harmful to the environment, more easily cleaned up and also biodegradable.

Fire safety is another critical area. Water-glycol fluids are fire-resistant, and as industries move to higher operat-



Industries such as steel mills, power transmission plants, hydraulics systems and others use water-glycol hydraulic fluids in areas subject to fire hazards. *Shell Global Solutions U.S.*

ing pressures, the risk of fire increases from ruptured lines. In addition, concerns around equipment life spans, service intervals, and targets focusing on reducing the total cost of ownership are prompting industries to embrace the latest technologies around water-glycol fluids. They are often given strong consideration when facilities are looking to upgrade their hydraulic fluids.

THE BENEFITS OF WATER-GLYCOL HYDRAULIC FLUIDS

Water-based hydraulic systems have been traditionally used in underground mining applications and in steel mills and foundries, where the obvious advantage offered were fire resistance. Further development of the fluids led to use by the Navy in other hydraulic systems, where the importance of fire resistance had been stressed even more. However, pure or deionized water was not suitable for many use cases since corrosion and wear protection become an additional concern.

As new formulations were introduced, with the inclusion of glycol and additive packages, anti-wear and anti-corrosion capabilities were incorporated into the fluid. The creation of non-toxic, biodegradable formulas also helps create an environmentally acceptable hydraulic fluid. Water-glycol hydraulic fluids bring many advantages to the industry. Some that may not be readily apparent include:

Lower clean-up costs. Water-based hydraulic systems hold the potential for tremendous cost savings at the plant and applicant site due to lower associated clean-up costs.

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Excellent fire resistance coupled with reasonable cost and performance makes water-glycol fluids a good choice for many industrial applications.

Safety. Many water-glycols are certified as FM Approved for fire resistance. Water-glycol hydraulic fluids are classified as HFC fire-resistant fluids and can reduce fire hazards in storage, handling and use.

Wear protection. Water-glycol hydraulic fluids can have higher viscosity indices than any other fire-resistant fluids for a given viscosity grade providing excellent hydrodynamic lubrication in a wider operating temperature window. Together with advanced additive technology, wear protection is amply provided over the entire lubrication regime.

Rust and corrosion protection. Water-glycol hydraulic fluids

can be formulated with several corrosion inhibitors, including liquid phase rust protection, vapor phase rust protection and liquid phase yellow metal passivation. For example, Shell Water-Glycol hydraulic fluids pass the rust corrosion test ASTM D 665 A (freshwater) and D665 B (saltwater) at 24-hour duration and ASTM D 130 copper corrosion test strip with ratings of 1a or 1b.

Predictable service life. Water-glycol hydraulic fluid formulations can be readily tested and monitored to measure fluid life, giving operators insight into when a replacement may be needed.

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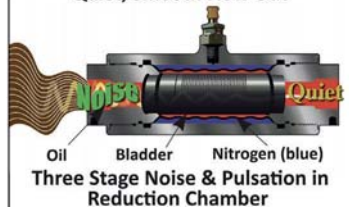
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Excellent fire resistance coupled with reasonable cost and performance makes water-glycol fluids a good choice for many industrial applications.

CONSIDERATIONS AND RECOMMENDATIONS

Interest in water-based fluids has been driven both by HSE and economic considerations. However, different rules apply to water-based hydraulic systems. Care should be taken when converting from a mineral oil to a water-based or synthetic anhydrous fluid.

Operators cannot simply drain a mineral oil-based hydraulic system and replace the fluid with a water-glycol formulation. Water-glycol formulations are not compatible with mineral oil formulations and mixing the two might result in deposits that may be difficult to remove. Follow change out guidelines provided by your lubricant supplier.

Other issues to evaluate when considering switching to water-glycol hydraulic fluids include temperature sensitivity and possible evaporation. Since water-glycols contain water, higher system temperatures may cause water to evaporate from the fluid. This can impact the heat transfer properties of the fluids as well as the lubrication. Your lubricant supplier can provide guidance on how to measure the water content (generally by viscosity measurement or with a handheld refractometer) and advise on adding deionized water to restore the fluid to the correct concentration.

Special consideration should also be given to seals, gaskets and connectors to make sure they are compatible with the formulation and will not deteriorate. Certain metals such as zinc and cadmium may be especially sensitive to water glycol formulations, and exposure to such formulations might result in rapid fluid deterioration.

Water-glycol hydraulic fluids are emerging as the first choice in

hydraulic fluid for many industries. Although existing systems may require retrofitting, the long-term savings offered by water-glycol hydraulic fluids could help reduce the total cost of ownership and can bring forth a measurable return on investment in extended service life, reduced

environmental costs and an overall reduction in operating costs. **hp**

ROBERT PROFILET, Ph.D. is technical manager, Iris Song, Ph.D. is an engineer and Sameer Sathaye, Ph.D. is project leader for industrial oils, all with Shell Global Solutions U.S.



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Quickly Filling the Need

An HVAC contractor and AutomationDirect partner to deliver automated machines for COVID-19 sanitizing products.

In the summer of 2020 in the midst of the pandemic, a manufacturer looked to utilize unused factory space and produce sanitizing wipe pails to help combat COVID-19. They turned to longtime partner Rock Hill Mechanical Corporation (RHMC) to quickly develop a system to fill pails and containers with sanitary wipes and disinfectant solution. Based in St. Louis, RHMC is focused on HVAC, building automation and other related facility projects, executing a variety of design-build work.

Partnering with AutomationDirect, the RHMC team developed an instrumentation and controls solution to get the manufacturing online and get the vital products distributed more quickly.

INTEGRATING PIECES AND PARTS

The project's success relied on using available equipment to get the critical COVID-19 products quickly to market. Automation was needed to not only start production but to provide greater production capacity as needed.

The client sourced preowned equipment used for filling water jugs. Their vision was to repurpose this equipment to add disinfectant into pails and tubes containing the wipes. Two machines were available, but both were in disrepair.

The first machine needed extensive rehabilitation. RHMC removed the old PLC and added switches, relays, timers and pneumatics to get a functional but largely manual filling process.

More automation was needed on the second machine. The RHMC team salvaged usage parts and procured additional automation and fittings, including a PLC,

from AutomationDirect.

Based on these two successes, RHMC was commissioned to build to build three new filler machines. Taking what had been learned from the first two projects, assemblies were added to each machine for conveyors, box/tub handling, a supply manifold and movable filler heads.

The RHMC team had not previously created a new project specifically using industrial PLCs. Its HVAC knowledge and experience with sensors, electronic logic controllers and input/output devices was a good foundation for understanding that a PLC was needed for this new project.

The team settled on the CLICK controllers, which offered free programming software. It also reviewed many of the YouTube videos produced by AutomationDirect.

It was important to build and fabricate the machines as quickly as possible, so work was done on the plant floor. Mechanical fabrication incorporated all the lessons learned from the first two machines, and the use of all new parts and PLC automation provided much-needed flexibility. Using this approach, the third machine was quickly put into operation, built exactly to meet the client needs.

The first machine was installed in August 2020, and the subsequent four machines each went online about one per month later.

For each machine, RHMC was able to make mechanical and automation improvements while quickly responding to client requests. For example, the




initial machines filled pails individually and required operators to load the pails into cases. Later machines were updated to accept cases with the pails already in them and to fill those pails while they were in the case, speeding up throughput and making handling easier for the operators. Another machine filled bulk refill wipe rolls in a bag.

Once the PLC-based machine was in operation, it was easier to revise the automation. Any improvements such as streamlined logic or better safety measures were added back into any of the other machines that had a PLC.

A CLEAN PATH FORWARD

RHMC taught the client some basic automation skills, such as changing PLC timer settings, so the client could develop a cost-effective training module that doubled as a way to troubleshoot problems.

The client wasn't the only beneficiary of the partnership. Working with AutomationDirect enabled RHMC to support its customer for this time-critical project, as well as to expand expertise with industrial automation so it can grow its business. 

JOSH STEFANIAK and Blake Young are journeymen service pipefitters at Rock Hill Mechanical Corporation. Stefaniak is a lead technician for automation and electrical tasks required with systems. Young's specialty is welding and fabrication.

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Getting the Right PERMANENT SEALS for HYDRAULICS

Here are five critical issues that must be addressed to get the best permanent expansion plug or seal for your hydraulic application.



Whether industrial hydraulics, automotive, oil and gas, medical, aerospace or other industries, choosing the best permanent sealing solution is mission-critical. Failure is not an option. Here are five critical components that must be considered to ensure the proper selection of permanent seals.

BASE MATERIALS

Expansion sealing plugs permanently seal holes using one of two different ways, depending on the hardness of the base material the plug is being installed in. If the base is harder than the plug's material, the plug depends on the surface finish requirement of the base material (typically 10-30 Rz). Then, during installation, the plug expands radially and its material flows into the roughness of the base material to secure it in place.

If, however, the plug is harder than the base, then serrations on the plug "bite" or "dig" into the hole when it radially expands to secure it. In either case, the expansion plugs make a 100% leak-free permanent seal.

Knowing the base material is also impor-

tant for reducing corrosion. It lets engineers choose plugs made out of materials that will not establish a galvanic cell when in contact with the base material.

PRESSURE REQUIREMENTS

Pressure performance is simply the psi/bar requirement of the permanent seal, and all plugs have pressure ratings as well as safety ratings. Understanding this lets designers determine which type of plugs best meets the pressure performance requirements of the application at hand.

MACHINING CAPABILITIES

Companies need to know what their machining and designing capabilities are when choosing plugs. They need to know if they can machine the proper holes needed for the expansion plug they choose. Fortunately, expansion plugs will work in range of variety of holes with range of tolerances for the diameter, roundness, wall thicknesses, proximity to another hole or exterior edge, and the desired depth of installation. They can also be installed in tapered, counter-bored and straight holes.

Standard plugs come in English sizes from 0.093 to 0.875 in. and metric sizes from 3 mm to 22 mm. There are also several plugs that can produced in larger sizes.

INSTALLATION

A significant factor in deciding on the best expansion plug depends on how it will be installed. Plugs can require fully automated or manual installation. Some are best for low-volume applications, while others can be installed by the millions annually. Some plugs are installed using fixtures and a press, some require handheld hammers and set tools, and others call for hydro-pneumatic installation tools.

There are some plugs that need to be installed up to 90 mm deep in the hole, but most are installed near the surface. And some plugs take longer than others to install. All of this needs to be considered when selecting expansion plugs.

OVERALL COSTS

Companies should not choose an expansion plug based solely on the per piece price as that is not the overall cost of using an expansion plug. It is often advisable to consult with a sealing expert, such as a supplier or a company that makes expansion plugs, and let them assesses the overall cost.

They understand the costs created by various combinations of base materials, pressure performance requirements, and a company's machining needs and capabilities, as well as the preferred installation method. Experienced sealing experts understand the overall costs associated with expansion plugs and can offer options. **hp**

BRIAN KRIEGER is North American vice president of sales and global marketing manager for Engineered Inserts & Systems Inc., a company based in Connecticut that makes sealing and flow control products.



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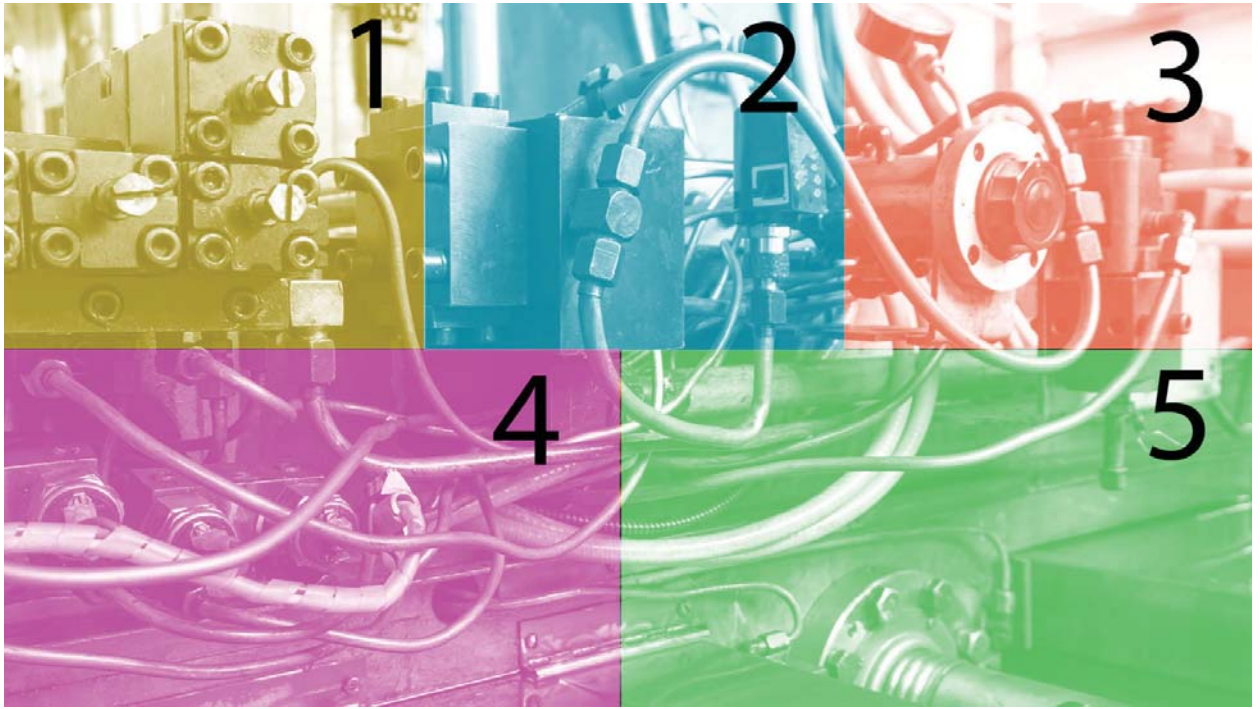
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5 Filtration Technologies for HYDRAULIC SYSTEMS



Regardless of the system used, reduced downtime is the benefit.

Even the smallest contaminants can cause major problems in a hydraulic system. Whether maintenance simply needs to be performed more frequently or particles make their way into the system, causing damage to the machinery, significant downtime could result from contaminated fluid.

With the proper filtration technology for your industry's application, you can ensure that contaminants are removed from your hydraulic system well before they can cause damage and shutdowns. Regardless how contaminants enter the hydraulic system, the right filtration solution can address the issue.

REDUCING CONTAMINANTS

Because clean fluids are essential to the functionality of a hydraulic system, finding and reducing contaminants is a critical part of hydraulic maintenance. When contamination isn't minimized, significant and often unplanned downtime is the result.

So how do contaminants make their way into hydraulic systems to begin with? Some unwanted particles may be remnants of the manufacturing process. It's common for things like pieces of rubber or even metal debris from machinery to make their way down the line, causing potential damage.

One way to avoid this issue is to perform a complete system flush before initial use.

Some contamination may also be caused during normal operations. Frequent rotation of pumps, for example, may lead to eventual wear on the system, causing unwanted particles to form.

Although these guidelines are basic, they often can get overlooked:

- Use quality filters in the hydraulic system, and have filters cleaned on a regular basis. Follow manufacturer guidelines on how often to change out the filters and fluids.
- Imperfect seals and openings in the hydraulic components, like breather caps, may also contribute to contamination in the system. The area around the system should be clean,

and using high-quality breather caps is also an important consideration.

- When hydraulic hoses come loose, or seals begin to leak, repair them as soon as possible so contaminants do not make their way into the machinery and through the hydraulic line.
- One of the leading causes of unwanted particles within the hydraulic system is the fluid that is added to the system. Even new oil is not considered contaminant-free, and it should be filtered to the correct specifications before use.

Conducting periodic fluid analysis can identify additional contamination sources.

BASKET STRAINERS

Many filtration options require filters that need to be replaced frequently. Basket strainers conduct a high level of filtration, but instead of replacing the filter each time it becomes full, a basket strainer can simply be cleaned and returned to the hydraulic system, making it a cost-effective option.

One type of basket strainer is the simplex strainer. It's a single basket, typically made of stainless steel or cast iron, and can be used in both low- and high-pressure applications. They are frequently installed as return line filters, inline filters and suction filters. While they are versatile, the downside to simplex filters is that the system will need to be shut down briefly when the filter needs to be cleaned.

Duplex filters offer the same advantages as simplex filters, but they do not require a system shutdown for cleaning. The filter is equipped with two baskets. When one needs to be cleaned, simply switch the hydraulic system to the other basket, with no downtime required. Whether choosing simplex or duplex for your hydraulic system, it is important to select a basket strainer with no leakage.

Like basket filters, bag filters are another cost-effective option for removing contaminants from hydraulic fluid.

These filters employ a cloth bag to filter out unwanted particles as they pass through the line. The size of the pores on the bag determines the amount of filtration that can be achieved. Large pores, for instance, will only filter out larger particulates, while smaller pores will provide a finer filtration. Bag fil-

Downtime is more than just a hassle. From the impact on productivity to the employee time needed for repairs, the bottom line is always affected.

ters are commonly used in a variety of hydraulic systems associated with food and chemical processing, water treatment and more.

CARTRIDGE FILTRATION SYSTEMS

The round, pleated filters in cartridge filtration are designed to remove small particles and contaminants that could cause damage to the machinery in the hydraulic system. While they are extremely effective at removing unwanted materials from hydraulic fluid, they do require some minimal downtime for cleaning or replacement. However, they are the preferred filtration choice for many industries, including pharmaceutical and petroleum.

SELF-CLEANING FILTERS AND STRAINERS

Occasionally, regular maintenance and system downtime of any kind may not be ideal, especially in applications where hazardous chemicals are present or flow rates and pressure are high. Self-cleaning filters provide the same level of contamination filtration as other filtration technologies, without the need


to shut the system down for regular filter cleaning or replacement. This is due to the complex design, where continuous backwash at the output allows the filter mesh to remain clean. Cooling towers and tubular backwashing filters use self-cleaning filtration technology.

REVERSE OSMOSIS SYSTEMS

When water is the primary fluid in a hydraulic system, reverse osmosis, or RO, systems may be the best option. During the reverse osmosis process, water is forced through a semi-permeable membrane, where particles of all sizes are removed and purification is achieved. Industries that utilize RO systems include water purification facilities, food processing plants and even oil refineries.

REDUCING HYDRAULIC SYSTEM DOWNTIME

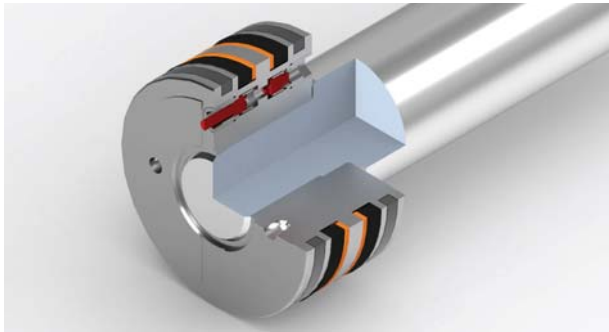
Downtime is more than just a hassle. From the impact on productivity to the employee time needed for repairs, the bottom line is always affected. To reduce downtime in your hydraulic system, you must first reduce the contamination in the hydraulic fluids. While contamination is caused by a variety of factors, including manufacturing, environment and general wear-and-tear of equipment, unfiltered fluid may be the leading cause.

Fortunately, the solution is simple: Implement a high-quality filtration system. Once installed, your filtration system will work to remove unwanted particles from hydraulic fluid, resulting in systems that run at peak performance, with very little need for downtime. 

MARK LIGON is the marketing manager at Commercial Filtration Supply, a distributor/supplier of industrial filtration products, including self-cleaning strainers, bag filtration, cartridge filtration and replacement parts.

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Recirculating Cylinder

THE PATENT-PENDING ARC (Automatic Recirculating Cylinder) Technology is designed to increase cylinder life by 25% or more and is available on selected rod and bore combinations of the H-Series (3,000 psi) hydraulic family of cylinders. The technology that allows the piston to be bypassed when the piston reaches the end-of-stroke on the side where ARC is installed. When not at the end-of-stroke, ARC closes, allowing the cylinder to achieve full force and speed. Benefits include Increasing

cylinder life by removing stagnant oil, better hydraulic performance by removing trapped air, and allowing operation of cylinders in higher temperature environments by creating an end-of-stroke recirculation of cool oil.

MILWAUKEE CYLINDER, www.milwaukeeecylinder.com

Transport Control

THE MECHATRONIC EXTENDED Transport System (XTS) now includes an application-specific HMI control for visualization of dynamic product transport. The XTS technology already supported collision-free motion with movers working independently or in groups and delivering dynamic, high-precision positioning on customer-specific track geometries. The new HMI software extension generates matching visualizations from an existing XTS track configuration with just one mouse click. The generated XTS HMI Control is automatically linked with all necessary parameters from the user's application and can directly display the current positions of all movers within the system. The solution consists of three levels and readily combines with other HMI Controls, or even with animated images, as required. This means that users can create highly realistic representations of complete systems with minimal effort.

BECKHOFF AUTOMATION LLC, www.beckhoff.com



Safety Laser Scanners

SAFETY LASER SCANNERS offer an ingenious, cost-effective way to protect an entire area. This can be a static application such as a robot cell or the area surrounding a moving device such as an AGV. They are ideal for providing safe access to potentially dangerous locations or areas. These laser area scanners are configurable and feature a 275-deg. viewing window that allows for several user-defined zones of protection. I/O and dust filtering are other options configurable through the unit.

AUTOMATIONDIRECT, www.automationdirect.com/safety-laser-scanners



Ethernet Switch

THE SX5E-HU085B 8-PORT unmanaged industrial Ethernet switch provides many managed switch features to support the rapidly expanding quantity of Ethernet, IoT and IIoT devices used in critical and challenging commercial and industrial locations. No software configuration is needed, and flexible installation options make this an economical yet high-performance solution. This switch operates at 10 and 100 Mb/s, with auto negotiation of speed and full or half duplex mode, and every port automatically detects and adjusts for straight-through or crossover cable connections.

IDEC CORPORATION, Us.idec.com/SX5E-8port

Linear Motion Bearings

SLIDE WAYS ARE non-recirculating linear motion bearings used primarily in optical and measurement equipment where high-precision movement is required. The SV style consists of two roller cages with precision rollers in a cross arrangement and four rails with V-shaped raceways. The SVW has one rail with V-shaped grooves on both sides and 2 SV rails. The catalog contains all dimensions, drawings and ratings necessary for specific applications. 3D CAD is available.

NB CORPORATION OF AMERICA, www.nbcorporation.com



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New Products



Industrial Robots

THE 6-AXIS IRB 1300 industrial robot includes new protection elements that enable it to be used in tough industrial applications and contamination-free production processes, opening new opportunities for increased productivity, improved product quality and reduced cycle times in a variety of industries including electronics assembly, automotive and metals fabrication. Originally launched in 2020, the IRB 1300 is now available in IP67, Foundry Plus 2 and cleanroom ISO 4 versions. This will expand its use in tough environments, with high levels of liquids and dust. This is achieved by preventing intrusion by sealing all electrical components, which enables a variety of processes in multiple industries.

ABB ROBOTICS & DISCRETE AUTOMATION, go.abb/robotics

Hydraulic Hoses



The MEGASys MXT with XtraTuff Plus cover (MXT-XTP) is a universally applicable hydraulic hose featuring patent-pending wire-braid technology. MXT-XTP offers compact size, light weight, flexibility and high performance

with added durability from the XtraTuff Plus (XTP) cover. MXT-XTP is suitable for the most demanding fluid power challenges across a broad array of industries and applications, including construction and mining, material handling, machining and metal processing, injection molding and other stationary machinery, agriculture and forestry, aerial lifts, and more.

GATES, www.gates.com/mxt



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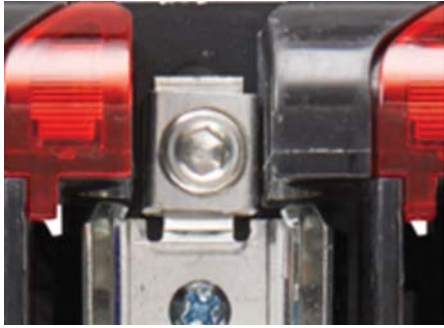
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Fuse Block Hex Screws

HEX-SCREW HEAD OPTIONS for the 60-A LFR and LFT series of fuse blocks are ideal for manufacturing automation, helping OEMs simplify the tightening process for their components to reduce assembly errors. The hex-screw 60-A fuse blocks accommodate a wide range of existing mounting configurations and feature a snap-to-release DIN-rail mounting for easier installations, as well as reinforced fuse clips for increased reliability.

LITTELFUSE, Littelfuse.com/FuseBlocks

On/Off Current Sensor

THE EISH SERIES of On/Off current sensors can detect current as low as 200 mA AC and up to 60 Amps AC, making it optimal for applications in a variety of markets including HVAC, water treatment, data centers, tunnel/airport lighting and other areas of critical infrastructure. The EISH Series features a space-saving and versatile housing which can be either DIN rail- or panel-mounted. It has a built-in current transformer with a solid state normally open output. A 12 mm through hole easily accepts insulated wire. The EISH Series is self-powered from the input current, making it simple and cost-effective.

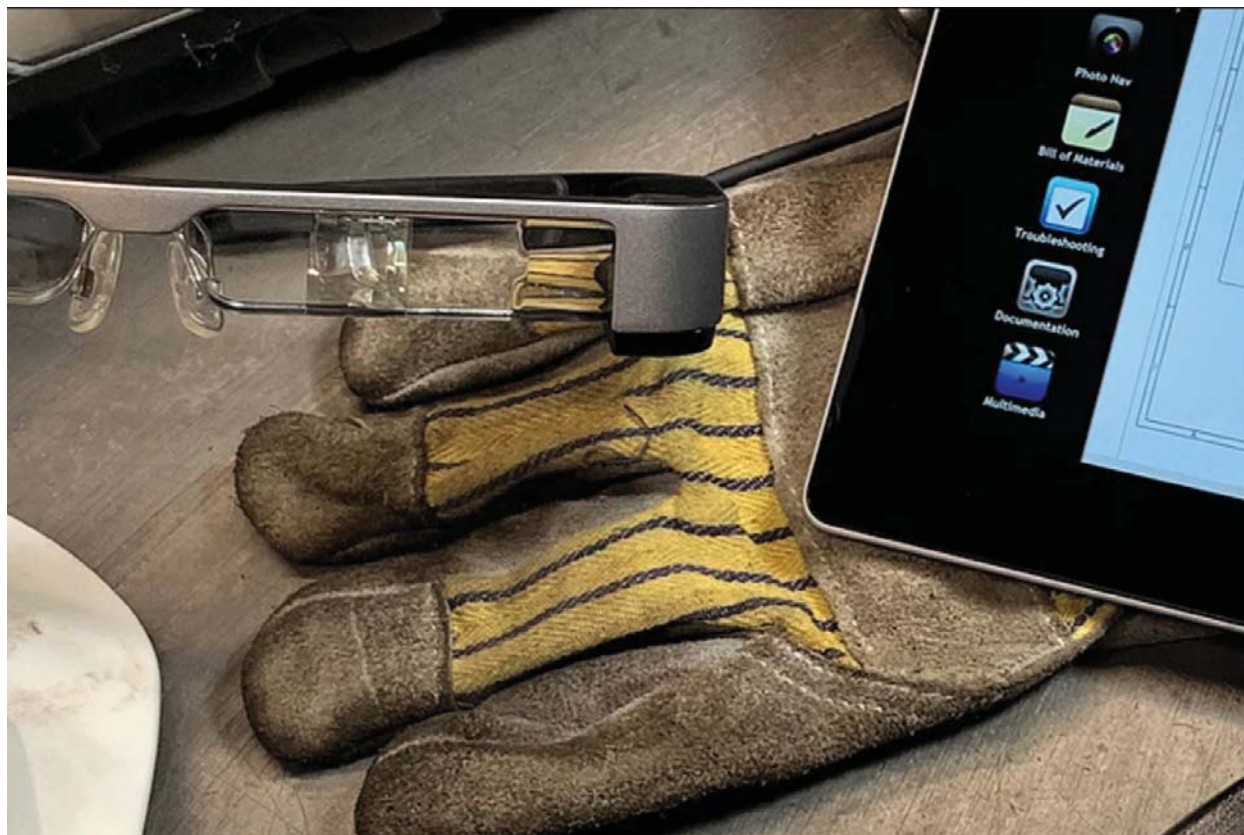
CARLO GAVAZZI, www.GavazziOnline.com



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CLAMPING CYLINDER is Running Slow and Weak



Despite having redundant pumps, the hydraulic clamp was not performing up to par—plus the oil was overheating.

A company had a problem with a coating and slitting line. The clamp function was slow and weak. The hydraulic power unit had two circuits, each with its own pump, and the pumps were identical. One pump could handle the load if the other one failed. The two circuits were not cycled at the same time. There was also an overheating problem with the oil.

The company tried shutting down the clamp pump and opening the ball valve connecting the shear pump as its back-up. Pressure remained low and the closing speed on the clamp dropped.

Any idea what the problem(s) could be?

Bob Sheaf is the founder of CFC Industrial Training, Fairfield, Ohio. He and his company have been involved in troubleshooting, training and consulting internationally for more than 30 years. For more information, call (513) 874-3225, or visit cfcindustrialtraining.com.

Find the Solution

Think you know the answer to this month's problem? Submit your solution to smraz@endeavorb2b.com, with "July Aug Hydraulic Solution" in the subject line.

All correct answers submitted by Sept. 15, 2021 will be entered into a random drawing. The winner will be notified and their name will be printed in a future issue.



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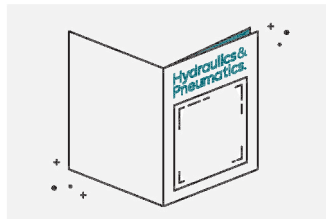
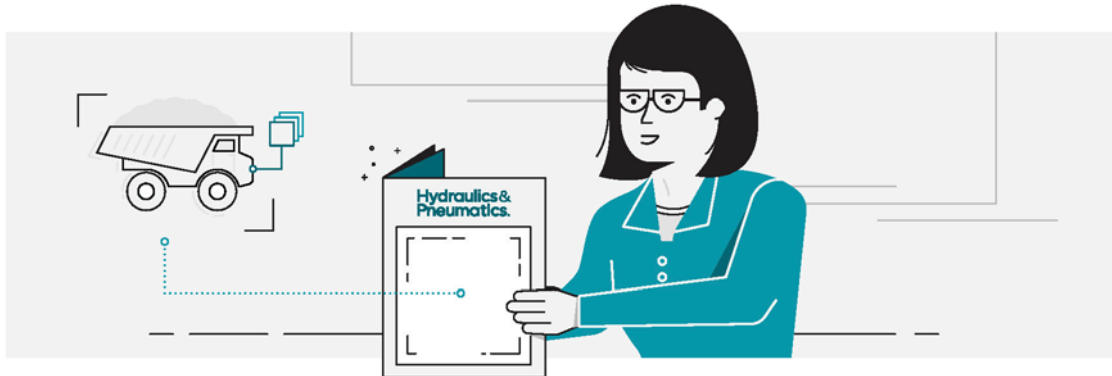
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Bob Vavra

Senior Content Director, *Hydraulics & Pneumatics*



After a long career in the newspaper industry, Bob has been an editorial team leader for more than 20 years. During that time, he covered the global transition of the plant floor and its systems and managed several international automation conferences. Bob is also a sought-after Webcast moderator and event emcee, and has presided over events in the U.S., Germany and China.

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