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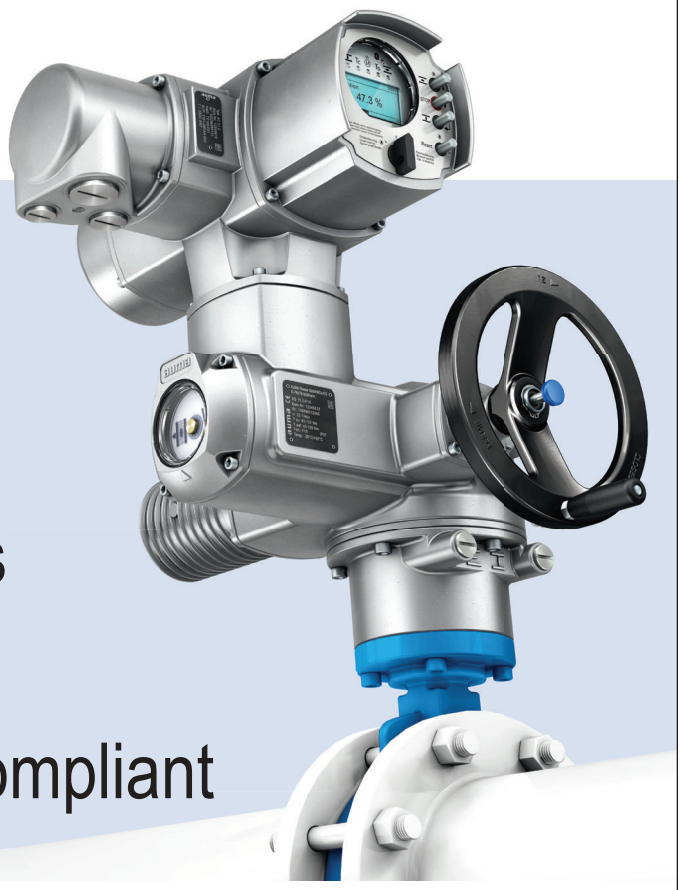

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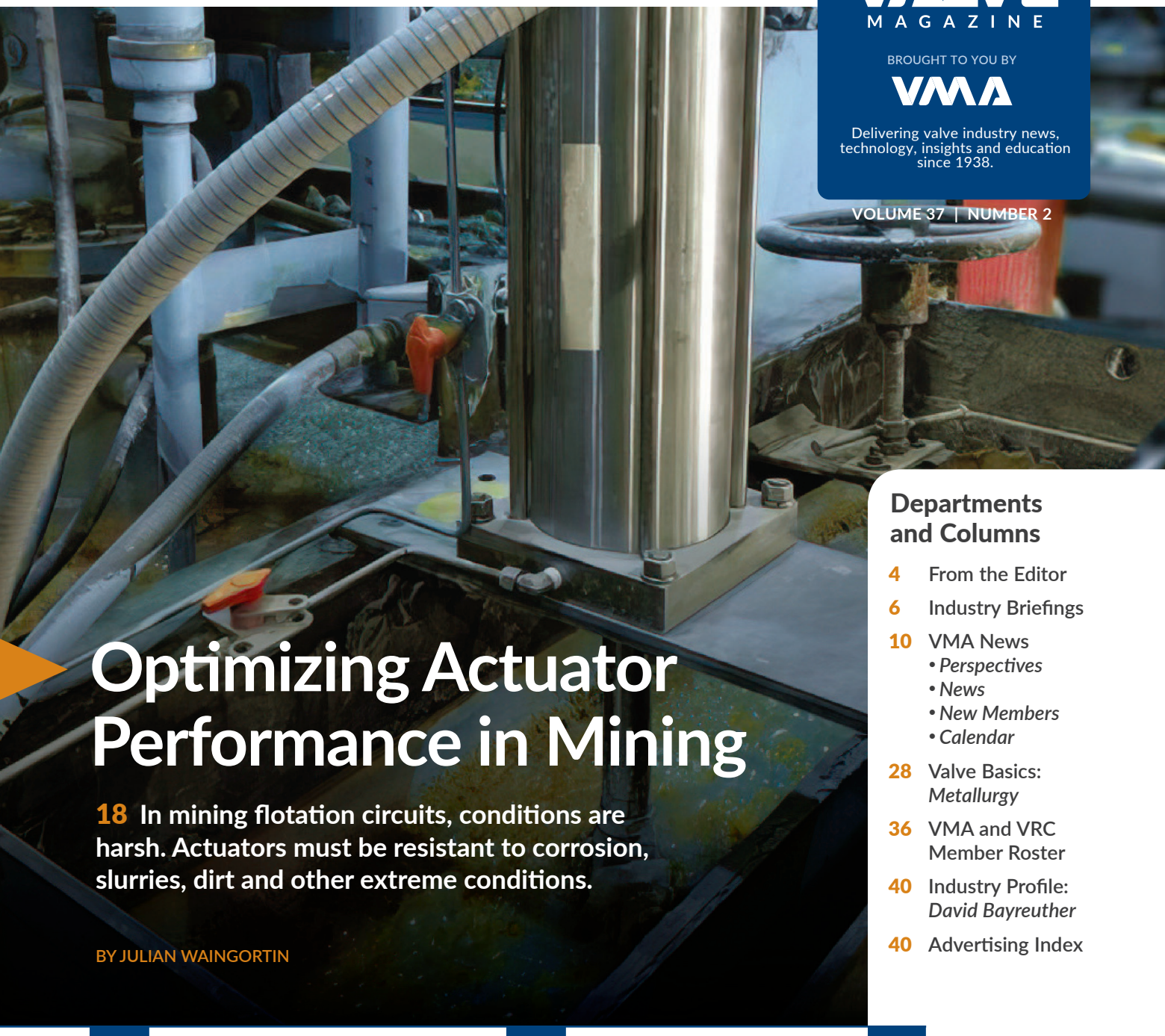

Optimizing Actuator Performance in Mining

18 In mining flotation circuits, conditions are harsh. Actuators must be resistant to corrosion, slurries, dirt and other extreme conditions.

BY JULIAN WAINGORTIN

Departments and Columns

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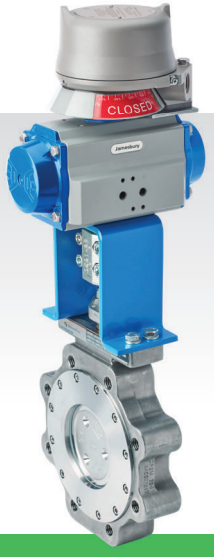

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Valmet FORWARD

Welcome to the Spring 2025 issue of *Valve*.

It's certainly been a busy season so far, with the VMA Hydrogen + Energy Valve Summit and Valve Forum in early April where I met several new people and discussed some exciting editorial opportunities for future issues. From natrium salt reactors to PFAS and plastic seal and packing recycling, there were a few technologies new to me that piqued my interest.

In addition to engaging technical conversations, tariffs were a big topic of discussion as some were announced while we were gathered in Orlando. The uncertainty is the biggest obstacle as manufacturers are looking more closely at their supply chains and trying to adjust and adapt accordingly with strategic inventory management and renegotiating terms with suppliers.

End users are more interested than ever in trying to get as much life out of products as possible through repair or rebuilding valves and actuators to save them time and money and contribute to sustainability efforts. I'm looking forward to the VMA's Valve Repair Seminar in early June to learn more about how manufacturers and end users repair products in the field and in their shops and touring a couple of facilities. Learn more about this event at **VMAEvents.org.**

Many are waiting with bated breath amid a lot of uncertainty for more concrete information to determine if, where and how to make changes in their businesses. In the meantime, the grid still needs to be powered, water needs to be processed, minerals and oil still need to be mined and refined and chips need to be built to power our electronics. So much of what you all do is to maintain the lives and creature comforts for all of us in this country and around the world. You keep showing up and using your expertise to make sure our lives can go on without giving second thought to what goes into all of these utilities, products and processes we take for granted. Thank you for all you do to keep powering our utilities and our world!

In this issue, Dr. Fadila Khelfaoui from Velan explains why metallurgy considerations for valves are dependent on the applications and conditions. Our cover story delves into the specific requirements for actuators in mineral processing. Valve automation for emergency shutdowns is explored, and we talk with VMA Chairman Kirk Wilson about his career, his plans for the year for the Board of Directors and he shares advice for those just entering the business or who have been around for a while.

As always, visit **Valve-Media.com** and subscribe to our biweekly newsletter for the most up-to-date news and products and send us your releases to be featured online and in current issues.

Cheers!

Heather Gaynor, *Editor-in-Chief*
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VALVE MAGAZINE

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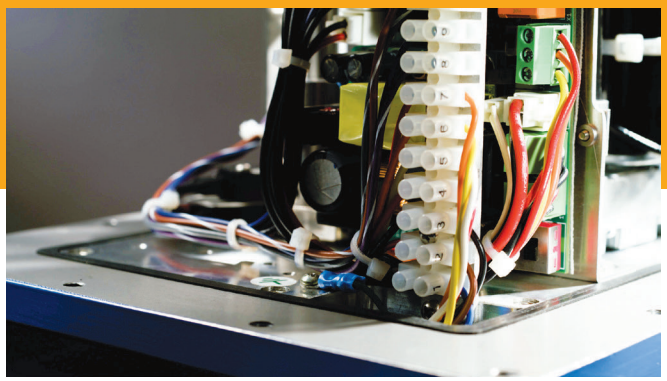

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INDUSTRY NEWS

DoD-Funded Project Announced to Eliminate "Forever Chemicals"

Revive Environmental Technology and Battelle have been selected to participate in a Department of Defense (DoD) Environmental Security Technology Certification Program (ESTCP) project contracted through the Defense Innovation Unit (DIU). The program aims to demonstrate a first-of-its-kind technology, the PFAS Annihilator, capable of destroying toxic "forever chemicals" — scientifically known as per- and polyfluoroalkyl substances (PFAS) — and eliminating the dangers from the environment.

ESTCP is the DoD's technology demonstration and validation program, designed to identify and advance innovative, cost-effective solutions that address critical environmental and mission-related challenges. ESTCP projects are rigorously evaluated in real-world DoD settings to confirm performance, cost-effectiveness and scalability. This demonstration is part of ESTCP's broader mission to support technologies that help reduce environmental risks and improve sustainability across DoD facilities.

Successful application of this prototyping project can result in a success memo, enabling federal government agencies to sole-source contract the PFAS Annihilator to quickly address their PFAS destruction needs.

Unlike traditional methods that merely capture and transfer PFAS to another waste stream, Revive's technology destroys these chemicals at a molecular level. The process uses supercritical water oxidation (SCWO), a high-temperature, high-pressure reaction that breaks down PFAS completely, ensuring they are eliminated rather than relocated. This method works on both short- and long-chain PFAS, operates efficiently without creating harmful byproducts and meets strict environmental discharge requirements.

The upcoming field demonstration, conducted under the ESTCP program, aims to confirm greater than 99.9% PFAS destruction in different waste streams while ensuring compliance with local regulations.

Glenfarne Becomes Majority Owner of Alaska LNG

Glenfarne Alaska, an affiliate of Glenfarne Group, LLC, and the Alaska Gasline Development Corporation (AGDC) signed definitive agreements for Glenfarne to become majority owner of Alaska LNG, the sole federally permitted LNG export project on the U.S. Pacific Coast, and lead its development of construction and operations for the entire project. Alaska LNG is designed to deliver North Slope natural gas to Alaskans and Alaska utilities and export up to 20 million tons of LNG per year (MTPA).

Under the agreement, AGDC is divesting 75% of 8 Star Alaska, a subsidiary AGDC created to hold and manage all Alaska LNG project assets, to Glenfarne. Glenfarne assumes the role of Alaska LNG's lead developer and will lead all remaining development work of Alaska LNG from front-end engineering and design (FEED) through to a final investment decision. AGDC remains a 25% owner of 8 Star Alaska and a key partner to Glenfarne on the project.

Following a successful final investment decision, the State of Alaska will retain a 25% share in 8 Star Alaska and have the option to invest up to 25% in any or all of the three 8 Star Alaska subprojects.

Westinghouse and Chemetics Inc. Sign MoU to Support New-Build Projects

Westinghouse Electric Company and Chemetics Inc. announced the signing of a memorandum of understanding (MoU) to support nuclear new-build projects in Canada and globally. Under the agreement, Chemetics has the potential to design and fabricate alloy or carbon steel vessels and heat exchangers for key AP1000 and AP300 projects.

The Chemetics fabrication facility is located in Pickering, Ontario, Canada, where it provides engineering, procurement and construction (EPC) services, including module fabrication and assembly and field-construction services across western Canada.

Sources said Westinghouse could generate almost $1 billion Canadian dollars in GDP through local suppliers.

Major Global Companies Pledge Support to Triple Nuclear Energy

A cross-industry group of large energy users signed a pledge supporting the goal of at least tripling global nuclear capacity by 2050. This is the first time major businesses beyond the nuclear sector have come together to publicly back an extensive and concerted expansion of nuclear power to meet increasing global energy demand. They also urge other energy users to support the goal of tripling nuclear energy generation.

The collective call, facilitated by World Nuclear Association, brings together global companies recognizing the need for nuclear's clean, stable and abundant energy to power their future growth, while also meeting goals of greater energy resiliency and security. This group of companies acknowledge government support and advocate for equal access to finance for nuclear energy.

Founding companies who signed the pledge include: Amazon, Google, Meta, Dow, Occidental, Allseas, OSGE and IHI. The pledge is expected to gain more support over the coming months, reflecting growing interest in nuclear power from industries as diverse as maritime, aviation and oil and gas.

Chemours and Energy Fuels Forming Strategic Alliance for US Critical Minerals

The need for critical and rare earth minerals continues to grow globally. In response, the Chemours Company and Energy Fuels Inc. announced they are forming a strategic alliance to expand the companies' existing relationship to enhance U.S. domestic rare earth and critical mineral supply chains to meet increasing demand.

The alliance will capitalize on both companies' geographic and operational synergies. Energy Fuels, a U.S. producer of rare earth elements, is currently developing new heavy mineral sands projects in Madagascar, Brazil and Australia, expected to produce world-scale quantities of rare earth, titanium ilmenite and zircon minerals in the coming years. Chemours mines and separates heavy mineral sands from its mines in Florida and Georgia.

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Ecovyst Acquires Sulfuric Acid Operations from Cornerstone

Cornerstone Chemical Company, operator of the Cornerstone Energy Park, announced the sale of its sulfuric acid operations to Ecovyst, a global provider of advanced materials, specialty catalysts, sulfuric acid and regeneration services.

Ecovyst's business struture includes two core business units: Advanced Materials and Catalysts (AM&C) and Ecoservices. Headquartered in Malvern, Pennsylvania, Ecovyst employs more than 900 people across 12 facilities in locations worldwide. The Ecoservices segment of Ecovyst is a provider of virgin sulfuric acid and sulfuric acid regeneration services.

"Cornerstone looks forward to a smooth transition from the sulfuric acid business to Ecovyst, and we are confident in the long-term success of that business and its employees," says Matthew Sokol, Cornerstone's president and chief executive officer.

Located along the Mississippi River in Waggaman, Louisiana, and established in 1952, the Energy Park is home to several state-of-the-art chemical manufacturing facilities, including site owner Cornerstone Chemical Company, LLC. With approximately 400 employees, Cornerstone is a manufacturer of high-quality, intermediate chemicals used for a variety of end-market applications.

Executive Leadership Changes at Victaulic

Victaulic announced that Gary Moore, executive vice president and chief revenue officer, retired at the end of April after 37 years of service with the company. Mark Gilbert, currently vice president and general manager for Europe, Middle East and Africa, as well as vice president in the U.S., succeeds Moore as vice president of sales effective May 1, 2025.

"Gary Moore has had as much to do with Victaulic's growth over the last 20 years as anyone," says Victaulic Chairman John Malloy. "His greatest legacies are the Victaulic sales organization as it stands today, the leadership of this organization and the careers Gary has created for such a talented group of individuals."

Gary Moore, retiring EVP and CRO.
Source: Victaulic

"It has been the privilege of my professional life to serve Victaulic for nearly four decades," Moore says. "I'm incredibly proud of what our team has accomplished in expanding our global presence and developing innovative solutions that have transformed the construction industry. I look forward to seeing Victaulic's continued success in this next chapter."

Gilbert brings over 30 years of Victaulic experience to his new role. After graduating from Purdue University, he joined Victaulic as a sales representative in the Washington, D.C. area. His career has included positions as regional manager, west coast division manager, director for the Middle East region in Dubai, and vice president of Europe, Middle East, Africa and India in Belgium, and for the last two years, vice president in the U.S.

Mark Gilbert, new EVP of sales.
Source: Victaulic

"Mark's extensive knowledge of our business, coupled with his proven ability to work cross-functionally, positions him well to continue our tradition of excellence while forging new paths to market leadership," says Richard A. Bucher, president and CEO of Victaulic. "We are confident in his ability to build upon the strong foundation that Gary has established."

Cyclic Materials to Invest in First US Commercial Facility

Cyclic Materials, the advanced recycling company working to create a circular supply chain for rare earth elements (REE) and other critical materials, announced a new state-of-the-art facility. Located in Mesa, AZ, the facility will focus on the separation of permanent magnets from end-of-life products previously not recovered.

As part of its commitment, Cyclic Materials is establishing a feedstock supply network that will serve the entire U.S.

"We are excited to begin commercial operations in the U.S. in early 2026," says CEO and cofounder of Cyclic Materials, Ahmad Ghahreman. "We have chosen our first global site to be close to feedstock that will support our mission to address the global supply-demand imbalance for rare earth materials. By developing circular supply chains, we can reduce dependence on overseas sources and secure a more stable REE supply for the future."

Val-Matic Announces New President

Jason Maciejewski has been named president of Val-Matic. Jason has been with the company for 14 years and in that time progressed through the sales department in various roles to his most recent role as senior vice president of sales.

"Jason has established himself at Val-Matic, A.Y. McDonald Industries and across the water and wastewater industry as a professional with great knowledge of our products and their applications in the field," says Rob McDonald, CEO of A.Y. McDonald Industries, parent company of Val-Matic. "He has been a successful leader in the company his entire career so I'm confident in Jason's ability to promote both a people and customer-focused environment."

US Energy Development Corporation Expands Permian Footprint

U.S. Energy Development Corporation (USEDC), a Fort Worth-based oil and gas exploration and production company, has acquired 20,000 net acres in the Permian Basin in Texas.

"This transaction greatly enhances the overall quality and resilience of our portfolio, supplementing our reserves with additional proven producing assets, adding years of multibench drilling inventory and expanding our operated economies of scale," says Jordan Jayson, CEO and chairman of USEDC.

USEDC plans to run a dedicated drilling rig on the acquired acreage, making this acquisition a key component of USEDC's 2025 plan to invest up to $1 billion in U.S. oil and gas properties. In 2024, the firm deployed about $850 million in operated and nonoperated oil and gas projects in the basin, and the firm's team continues to evaluate opportunities.

1950 – 2025

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Strength Through Community and Collaboration

In the last issue, I reflected on the importance of agility in today's business environment. The events of the first months of 2025 — from rapid regulatory changes to shifting legislative and executive office priorities — have only reinforced that need. Yet as I've traveled and met with VMA members this year, another essential truth has become clear: community, collaboration and strong networks are equally vital to long-term success.

At VMA, we strive to convene the right people, lead critical conversations and deliver the insights and resources our members need to thrive. Our goal is to help companies manage today's challenges and ensure they are prepared to seize tomorrow's opportunities. While that may seem lofty, I believe that our members, together, can solve larger, more complex challenges than any one company could tackle alone, and that VMA can be a true strategic partner in that journey.

We saw this firsthand at the recent Energy Summit held alongside our Valve Forum. Every attendee left with a renewed sense of the magnitude of energy demand in the years ahead. While many of us know this instinctively, the data and insights shared by our speakers underscored the urgency — and the opportunity. Valves are essential at every stage of the energy landscape: production, storage and distribution. Creating and hosting discussions around these shifts ensures our members are positioned to meet the evolving needs of the market.

Another example of collective impact is VMA's advocacy work around potential PFAS bans. By partnering with larger coalitions, we've helped educate policymakers on the critical role of fluoropolymers in industrial applications. In April, New Mexico passed broad PFAS legislation — but with important carveouts for key sectors and an exemption for fluoropolymers. It's a significant win and a model we will advocate for so other states do the same.

Additionally, several VMA Board of Directors' members recently traveled to Capitol Hill to meet with congressional offices, advocating for tax reforms, trade consistency and a PFAS definition excluding fluoropolymers. Doing this together, we demonstrate that these issues affect the entire industry, not just select companies or sectors. Educating policymakers about the valve industry's essential role across energy, oil and gas, water, food, construction, chemicals and more is central to VMA's mission.

Finally, we continue to help members navigate trade and tariff issues, providing regular updates, analysis and hosting webinars to help companies understand evolving policies and their implications. By providing accessible and expert information on the trade policy, it provides more time for employees to understand and craft responses to the tariffs and other tax implications to their businesses in a way that makes the most sense for their business and company.

By working together, we are raising the profile of the industrial valve industry, strengthening our business environment and providing foresight on emerging trends. This enables our members to focus on what they do best: innovating, serving customers and building resilient businesses.

I encourage you to be part of this journey. Stay engaged with VMA's programs and share your insights with us. Whether by attending events, joining committees or reaching out to me, your involvement strengthens our community. Together, we will navigate the road ahead and ensure a vibrant, innovative future for the valve industry.

Please connect with me to learn more! *hrhoderick@vma.org*

Heather

Heather Rhoderick, CAE
President

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VMA NEWS

VMA is dedicated to driving growth and innovation of the U.S. and Canadian valve industry globally. Through collaboration, education and advocacy, we work to create an environment where manufacturers, distributors and service providers of valves, actuators and controls can thrive. The VMA News section of Valve Magazine *highlights key initiatives, industry developments and opportunities we're championing. To learn more or explore membership with VMA or VRC, contact VMA President Heather Rhoderick at hrhoderick@vma.org.*

VMA Board of Directors Energized Around Key Topics

Led by Board Chairman Kirk Wilson of Flowserve, VMA's Board of Directors held its first meeting of 2025 this April. Government affairs discussions focused on successes, due in part to VMA's efforts, on slowing down the barrage of PFAS bans being considered by local, national and global governments. Tools and resources needed to help Members understand the changing trade policy and impact on their businesses were discussed. Members can expect further updates on tariff impacts, with webinars planned to coincide with upcoming dates when new announcements are expected.

The Board also discussed strategic planning activities taking place this year, which will culminate with a refreshed Strategic Plan to present at the Annual Meeting later this fall. To support this effort, members will soon receive a survey to help the Board understand how members view the current activities and their value, as well as emerging industry trends. Additionally, the Board reaffirmed the importance of partnerships with other organizations aligned with the flow control industry.

VMA Members Work to Protect Member Interests with Capitol Hill Visits

Working together with our members, VMA amplifies our members and the voice of the manufacturing industry on legislative and regulatory issues. VMA's government affairs activities work to shape a business environment that supports growth, competitiveness and compliance, and educating policymakers on the vital role of our industry is an important part of the work VMA does for its members.

In April, VMA met with the offices of Representatives Wesley Hunt (TX- 38), Brian Babin (TX-36), Tim Moore (NC-14), Randy Feenstra (IA-4) and Tom Emmer (MN-06) to discuss the importance of reinstating 2017 tax provisions and consistent trade policy, and the need for a definition of PFAS substances that excludes fluoropolymers.

Zachry Brown, Nick Buccheri, Matt Thiel, Kevin McKown and Scott Lustyk from the VMA Board of Directors.

Progress Seen in Stopping the PFAS Bans

Since the start of the year, VMA has joined forces with other groups to help to educate state lawmakers on the importance of fluoropolymers in industrial uses. This has included four letters sent to state and federal officials, one of which was to the legislature in New Mexico. On April 8, 2025, New Mexico became the third state in the country with a broad ban on PFAS (following Maine and Minnesota). However, important to the valve industry are various carve outs for HVAC, semiconductor and other industries, and even more importantly — an exemption for fluoropolymers. This is a great precedent to have in place for our industry, and an approach we hope other states follow.

VMA is currently developing comments to the state of Minnesota on their recent proposed rules around reports on products containing PFAS due to the state at the end of the year, and to the state of Maine on their recent notices which outline how currently unavoidable use (CUU) designations can be obtained. These efforts run parallel to our message on the importance of excluding fluoropolymers from any broad PFAS ban. Tools and resources to help VMA members comply with requirements are also being developed.

Valve Basics Program Supports Company Training Programs

VMA's Valve Basics Program brings together presenters with a combined 150+ years of flow control knowledge and shares this expert knowledge in a virtual format that allows individuals to complete it on their own schedule, at their own pace. The program content includes "101" and "201" levels that flow control industry professionals can use as an introduction to valves, and to also to enhance their knowledge on various types of valves, applications, actuators and other related components and topics.

The program is perfect for those new to the industry or those who want to refresh their industrial valve knowledge — especially end users, specifiers, manufacturers, distributors and suppliers. The modules are available for purchase by an individual, or companies can buy a license for a group of employees. Member companies receive significant discounts and many companies use it to quickly bring new employees or employees in marketing or non-technical functions up to speed.

Bonus! VMA members can access the "Introduction to the Valve Industry" module as part of their membership — a great overview for all employees.

New modules are being added to the program this year and as needed in the future. For more information, contact Abby Brown at abrown@vma.org or visit vma.org/VirtualBasics

Come Visit VMA at Valve World Americas

VMA and the Valve Repair Council are excited to be attending Valve World Americas this year, taking place June 4-5, 2025, at the George R. Brown Convention Center in Houston. Visit us in Booth 1745 to learn more about some of the key issues affecting the industry today — from tariffs and trade, PFAS bans, energy expansion, global relations, workforce and more — and what activities and resources are available for members to help them navigate the current business environment. You'll also be able to test your valve industry and product knowledge for a chance to win a free registration to one of our events! Whether you are a current member or just want to learn more, VMA is your resource. To set up a specific time to meet, please contact Heather Rhoderick at hrhoderick@vma.org. We look forward to meeting you at Valve World Americas!

Source: KCI

Tariff Response Center Launched for VMA Members

While each company will determine its own approach to address changes in trade policies, VMA has launched a Tariff Response Center for members to provide summaries of current policies and potential implications to the industrial valve industry. In this Center, members will find webinars to watch, links to customs and other guidance, timelines of announcements, and importantly, what the current status is of various tariffs. This is available in the Member Resource Library.

2025 Save the Dates

Visit vmaevents.org for more information and to register for all events.

May 12:
Webinar | 1:00 p.m. EDT
PFAS Interest Group *(Exclusive to VMA/VRC Members)*

May 14:
Webinar | 2:00 p.m. EDT
Tariff Response *(Exclusive to VMA/VRC Members)*

May 15:
Webinar | 1:00 p.m. EDT
Heroes MAKE America: Connecting the Military Community with the Manufacturing Industry

June 2-3:
Valve Repair Seminar | Pasadena, TX

June 26:
Webinar | 3:00 p.m. EDT
HVOF Coatings for Severe Service Ball Valves

July 15:
Webinar | 2:00 p.m. EDT
Tariff Response *(Exclusive to VMA/VRC Members)*

October 13-15:
VMA/VRC Annual Meeting | Naples, FL
(Exclusive to VMA/VRC Members)

A Successful Hydrogen + Energy Valve Summit and Valve Forum

The Valve Manufacturers Association (VMA) recently hosted its Hydrogen + Energy Valve Summit and annual Valve Forum: Conference & Exhibits in Orlando, Florida. More than 100 professionals — manufacturers, distributors, suppliers and end users — gathered to connect and explore the latest in flow control technology.

The three-day, dual event opened on Tuesday, April 8, 2025, with the Hydrogen + Energy Valve Summit. Attendees engaged in forward-looking sessions covering topics such as the energy industry outlook, evolving energy policy and the role of nuclear and hydrogen in future energy systems. The day wrapped up with a thought-provoking panel moderated by VMA President Heather Rhoderick, emphasizing the importance of diversified energy strategies and the interplay between economic factors and policy. The Summit provided attendees with a view of the energy landscape and information to help companies ensure their products and services are ready to meet the increased energy demand.

VMA President Heather Rhoderick wraps up the day with Energy Summit speakers Neil Mendes, Greg Boerschig, Aaron Lang, Amy Stein and Marc Albert.

Valve Forum keynote speaker Mitch Anderson from Bray spoke about sustainability.

The Hydrogen + Energy Valve Summit was sponsored by ASCO, AUMA Actuators and Valve Media.

The Valve Forum followed on April 9–10, offering four specialized tracks: Manufacturing & Repair, Technical, Business Management and Valve Fundamentals. The conference began with a keynote by Mitchell Anderson of Bray International Inc., the 2024 VMA Service Award recipient, who highlighted

Attendees at Toho Water Authority's North Bermuda treatment plant.

Attendees discuss top-of-mind issues during roundtables.

Attendees network with exhibitors at Valve Forum.

the industry's role in advancing sustainability throughout the valve sector's value chain, as well as approaches companies could take in their facilities to strengthen sustainability efforts.

With in-depth sessions across all tracks, participants engaged in lively discussions on industry trends, challenges and solutions. Attendees valued the dynamic content and meaningful networking opportunities, including the roundtable discussions on tariff impacts, PFAS and artificial intelligence. The exhibit display area provided opportunities for discovering products and services, as well as some fun with a hands-on test of valve knowledge!

On the final day, attendees toured Toho Water Authority's cutting-edge North Bermuda treatment facility. The tour showcased how valves and actuators play a vital role in treating and distributing millions of gallons of clean water each day.

VMA thanks all the exhibitors and the sponsors who made this event possible. Sponsors of the Valve Forum included A&B Stainless, EFCO USA, Precision Spray & Coatings and Setpoint Integrated Solutions.

Stay tuned for an announcement later this summer with the date and location for the 2026 Valve Forum: Conference & Exhibits.

Valve Repair Seminar

The Valve Repair Seminar takes place June 2-3, 2025, in Pasadena, Texas, and offers a day-and-a-half of educational programming, two facility tours, multiple networking opportunities and tabletop exhibits. Hosted at the San Jacinto College Center for Petrochemical Energy & Technology (CPET), it is produced by the Valve Repair Council (VRC) and is open to everyone in the industry. This event is unique in that it focuses on issues specific to repairing valve assemblies and keeping them operating at peak efficiency, as well as addressing high-level concerns about what is happening in the industry, what pressures it faces and where it is headed.

This year's event includes facility tours of both United Valve and the San Jacinto College's CPET laboratories, giving participants a firsthand look at both operational and educational environments shaping the industry's next generation. The conference program delves into a range of timely topics, such as:

- Motor-operated valve (MOV) repair best practices
- Repair in the field
- Fugitive emissions compliance and regulatory updates
- Welding processes and defects
- OSHA safety protocols
- Updates from the National Board
- CNC machining

Attendees may earn up to nine professional development hours (PDH), reinforcing the seminar's commitment to both technical enrichment and career advancement.

Complementing the sessions is a tabletop exhibit area featuring industry suppliers showcasing tools, technologies and services relevant to valve repair professionals. These exhibits offer not just product overviews but also a space for candid dialogue and shared troubleshooting.

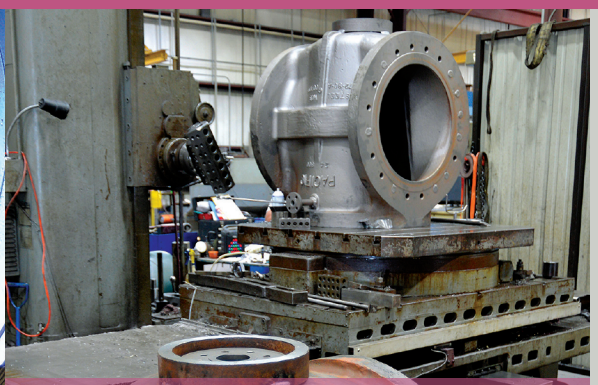
For more information and to register, visit: **vmaevents.org/valve-repair.**

VRC Welcomes New Member

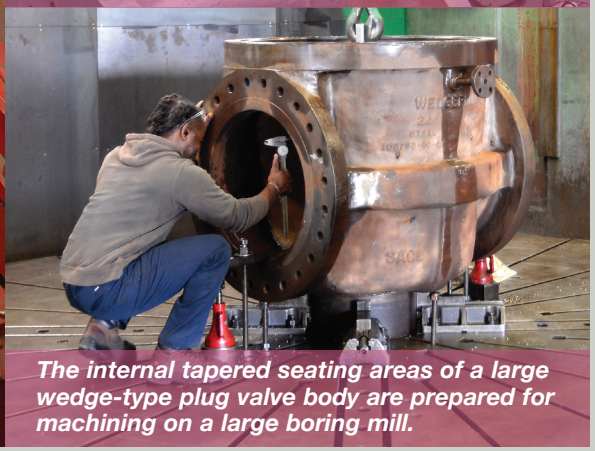
The VRC welcomes Scallon Controls as a member! For almost 50 years, Scallon Controls has been serving the "Golden Triangle" and adjacent counties throughout east and southeast Texas. Through history and experience, they leverage local knowledge and apply technical acumen to complete every project correctly, the first time. Scallon Controls is an authorized OEM repair provider for multiple valve manufacturers and is an Emerson Impact Partner. Find out more at **scalloncontrols.com**.

Rising-Rotating Plug Valve Repair & Service

The seating areas of a DN 30, wedge-type plug valve are weld-repaired, prior to machining and grinding.



The raised faces of a DN 24 wedge-type plug valve are machined on a horizontal boring mill.



The internal tapered seating areas of a large wedge-type plug valve body are prepared for machining on a large boring mill.

United Valve is fully equipped to handle repairs and modifications on all types and brands of rising-rotating metallic plug valves. These valves are mainstays of Coker-valve block service as well as many other critical fluid control applications, such as overhead vapor lines and ethylene cracking units. We offer in-shop or field-service repair on these valves and their associated actuators.

The largest boring mills in our machine tool inventory can machine plug valve components of any size or material, while our grinding machinery is capable of handling valves of up to NPS 24 for both internal and external grinding. The machining department features 20-ton cranes, while the adjacent assembly area is served by a 40-ton crane.

Weld repairs are often required on these plug-type metallic valves. The United Valve welding department is led by our in-house welding engineer and features both manual and mechanical welding processes. All of our 200+ welding procedures are created and qualified in accordance with ASME Section IX, as well as approved by many, even stricter end-user specifications.

United Valve

The Valve Service Specialists

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FEATURED ARTICLE

Optimizing Actuator Performance in Harsh Mining Environments

How to overcome maintenance challenges and improve precision control in flotation applications for better performance and increased profitability.

BY: JULIAN WAINGORTIN, *Business Development Manager*
COMPANY: COWAN DYNAMICS

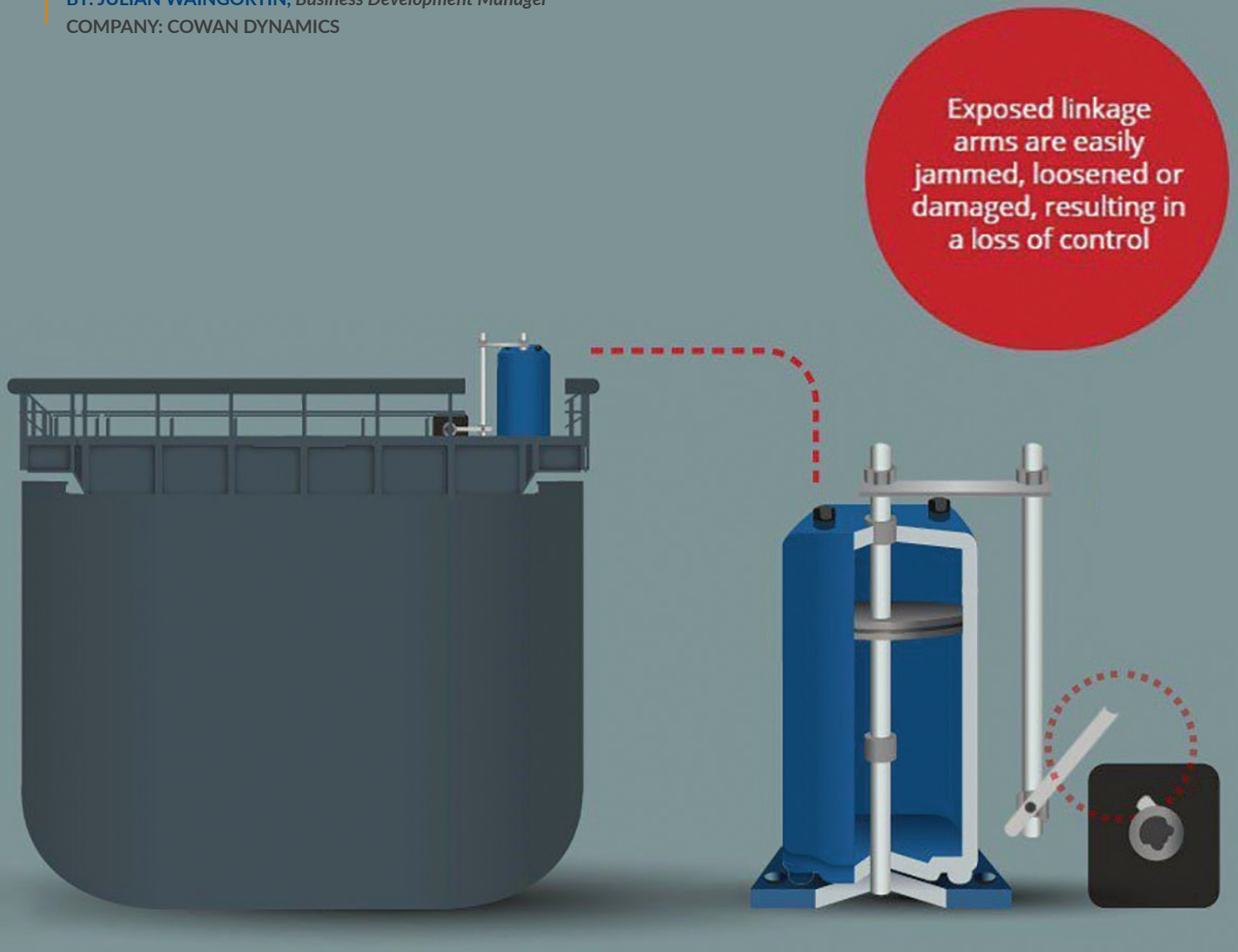


Figure 1: Linkage arm positioner in traditional actuators for dart valves in froth flotation cells.

Mineral processing plants present a particular combination of challenges that require attention, and flotation is one of the critical processes in these operations. Actuators are critical to froth flotation operations, as they can make the difference between a high recovery or a loss of metal. Rusty, old linkage arms causing actuators to overshoot, slow responses from control loops causing them to undershoot, unplanned downtime … sometimes it can seem like any minor disturbance can cause a loss of productivity.

The challenges faced with actuators directly impact mineral recovery, concentrate grade and ultimately, the plant's bottom line. In this article, we will share some insights on the two most pressing issues encountered and the practical solutions that can be implemented, starting with the challenges, as individual solutions usually cover more than one problem.

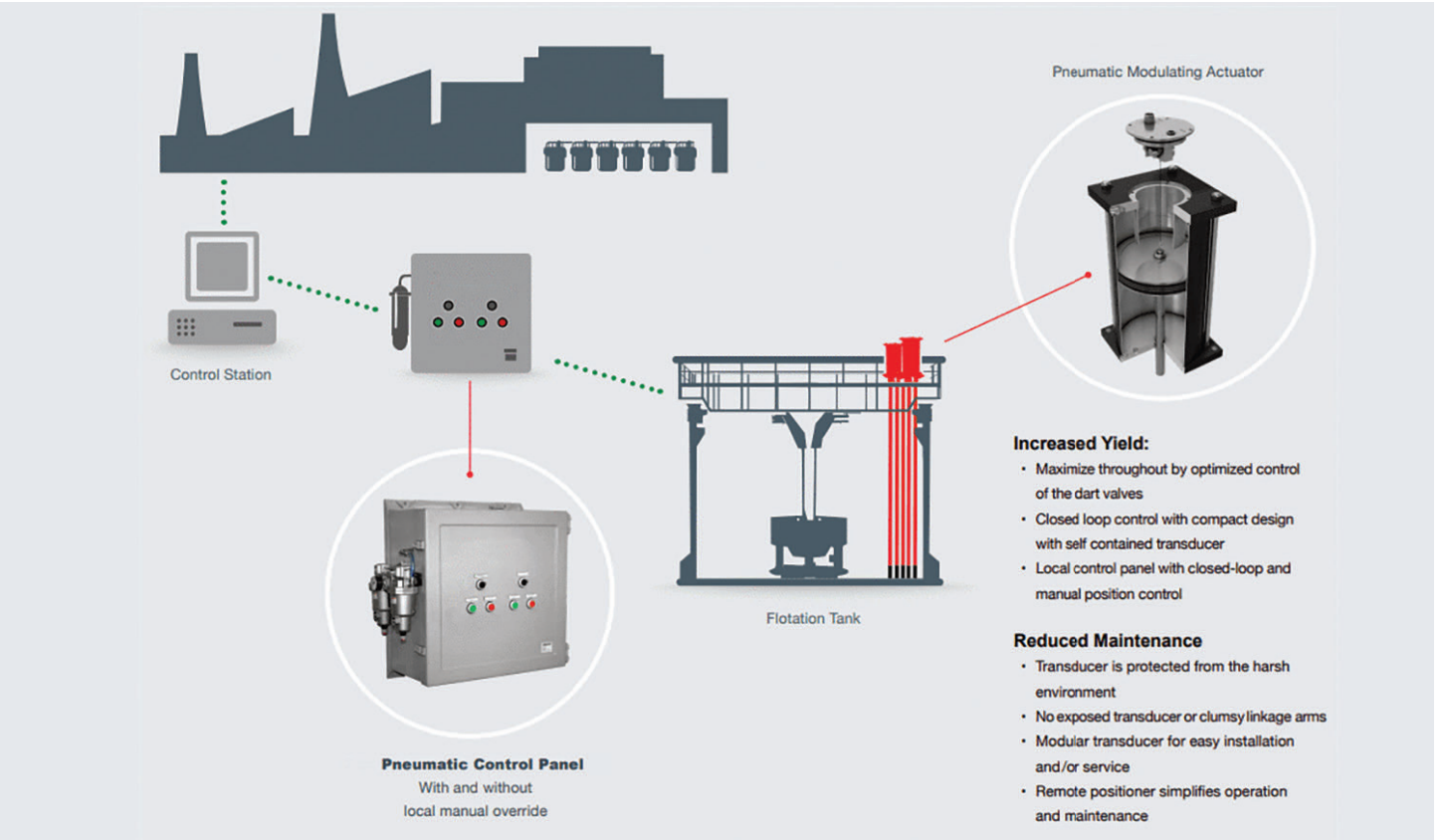
Maintenance and reliability challenges

In flotation circuits, valve actuators operate in one of the most demanding environments in mining. Operators deal with equipment's constant exposure to corrosive reagents, mineral slurries, dirt and often extreme ambient conditions. Sometimes, what an operator observes as an issue or effect is due to compounding causes, so it is important to understand the core issues before determining a solution. Here are some examples we have observed as the primary challenges operators face.

- **Component wear and degradation:** From our experience in flotation plants, actuator wear is accelerated by exposure to dust and reagent splashing around conditioning tanks. Depending on the operation, it can often be lime or sulfuric acid, though other reagents are also used. Additionally, high humidity environments around flotation cells contribute to internal corrosion, which compounded with vibrations from motors, agitators and rotors, can seriously shorten the life of actuators. Tropical regions or areas with high sun radiation can be punishing, causing heat damage to the electrical components.

  Some operations, like alumina, work with ultrafine particle sizes, which can infiltrate seals, particularly around launders and concentrate pumps. Temperature variations, especially in plants operating in extreme climates, can also contribute to shortened life of actuators.
- **Pneumatic system complications:** In flotation circuits, we have found that pneumatic actuators face additional complications, arising from the very nature of compressed air operations, such as moisture build-up and reagent mist contaminating air lines, or fluctuating air pressure due to competing demands from spargers. In cases where the air lines are contaminated (generally in acidic or alkaline environments), infiltrations in the cylinders or air lines can cause accelerated corrosion. In other cases, exposure to xanthates and other reagents can degrade seals faster than in typical applications.

Figure 2: Schematic of where dart valves are used in froth flotation cell.



- **PFAS in actuators:** At this point we must add some words about PFAS (per- and polyfluoroalkyl substances), the main components of many seals. These are those critical yet often overlooked parts of an actuator that make it work as it should. PTFE (polytetrafluoroethylene) and Viton are PFAS that are under intense scrutiny these days. They are the seals of choice for high-temperature applications. Any alternatives available today will offer reduced performance or will require increased maintenance. (*Ed note: Learn more about what the VMA is doing to help members understand the impacts of impending and existing legislation and regulations on the VMA website.*)
- **Control and positioning accuracy**: Keeping all of the above in mind, control and positioning accuracy add another layer of complication. Limited accuracy can mean the loss of valuable mineral or the dilution of concentrate, whereas high accuracy can rapidly increase the CAPEX and OPEX. This aspect might trigger a negotiation between the metallurgist (the custodian of recovery and throughput) demanding higher accuracy, and the maintenance functions operating under a mandate to reduce costs.

Precision challenges

Other challenges in these operations may include the items below, ranging from equipment issues to the inherent challenges of working in mining operations due to the size and scale of operations and equipment required.

Linkage arms: Older models of actuators used to have a linkage arm, which was exposed to the environment and therefore was vulnerable to dirt, splashing and corrosion. Over time linkage arms become loose, causing a defective level control of the flotation cell by an overshoot or undershoot of the actuator response. At some point unplanned maintenance interventions become more frequent due to the accelerated wear.

In addition to this, linkage arms had a nonlinear response to the signal and therefore the process control was inaccurate in the best of times, or unstable at worst.

A variety of other problems, including interference of magnetic fields generated by large agitator drives, calibration drift due to vibration and more have also been observed. Fortunately, the following are some of the solutions available in the industry today that accommodate for these issues.

Feedback devices: The first solution was the introduction of protected feedback devices, such as advanced position transducers and controllers. These have linear or proportional response, are expected to withstand vibration and can be shielded from the magnetic fields in the surroundings.

Confined installation of transducers: The second solution arrived when some manufacturers started installing position transducers inside the pneumatic cylinder. This is a simple yet effective configuration where the transducers are shielded from the surroundings and exposed to instrument air only. This is especially effective in corrosive environments. Maintaining these products requires opening the pneumatic cylinder, but the need for maintenance is greatly reduced with this configuration, making it worth the effort relative to previous versions of this product.

Selecting the right transducer: There has also been significant improvement in the design and manufacturing of position tranducers. Most popular models are built around magnetic sensors, which offer a linear response signal of 4-20 mA, as is the industry standard, though digital signals are also becoming adopted. Other systems offer a passive resistive response, generally 0-10 kOhm, which can be installed with any communication protocol. These devices offer the additional advantage that they can be installed in explosion-proof applications controlled by remote panels in safe zones. The high resolution available in these types of systems, though slightly less than in a magnetic position transducer, is still more than enough to prevent an overshooting or undershooting response.

Figure 3: 150 psi pneumatic actuator with integrated position transducer. The position transducer is fully enclosed and protected from the corrosive surroundings in a flotation unit in a potash mine in Canada.

One contentious issue here is the speed of response. The controllers must be carefully designed to provide the required actuator speed. A delayed action could cause process instability and lower metallurgical performance. In some of the biggest flotation cells it is often necessary to install volume boosters to provide the required response.

Fail-safe add-on systems: A simple solution with increased acceptance is the installation of air spring, fail-safe systems. As an energy reservoir, these systems can provide a tight shutoff and allow for several actuation strokes in the event of an electricity outage or loss of air pressure.

Quality of compressed air: The availability of unlimited, constant pressure, clean and moisture-free air supply is a key underlying assumption in all the above considered issues.

Solutions and trade-off assessments for compressed air systems are outside of the scope of this article. Just remember that the presence of moisture, acids or alkaline

substances within the compressed air represent a dormant issue that frequently has a significant impact on the performance of any related equipment, not just actuators. For this reason, most suppliers of pneumatic actuators and automation require the additional of filters to ensure the absence of moisture, acids or alkaline substances within the compressed air. Also, variations in air pressure will affect the speed of response or might cause leaks in an otherwise tight shutoff.

The installation of desiccant air dryers, dedicated air supply systems and additional filtration are options that could be considered. When adequate air quality is not possible, electric actuators might be a viable option, but again, there are pros and cons with them as well.

Special seals: Adding specialty seals can go a long way in keeping contaminants away from an actuator's air chambers. Rod scrapers in particular are a valuable addition to the actuator as they have been shown to be highly effective in restricting the ingress of particulate material or extraneous liquids into the pneumatic actuators.

Rod scrapers and multistep seals are generally more effective than rod boots, especially in the presence of ultrafine particulates like alumina or in acidic or alkaline environments.

Conclusion

Before making big investments, or postponing them indefinitely, the criticality of the valve must be assessed against the related metallurgical performance. A fair evaluation of the cost impact of valve-related process disruptions must include the lost production, lost recovery and higher environmental costs such as excessive tailings disposal and containment, as well as higher cost of water treatment.

For this reason, a good approach is always to test any solutions in pilot areas of reduced impact on the processing plant and the overall process stability.

Remember, in froth flotation, valve actuator performance isn't just about mechanical reliability — it directly impacts your metallurgical results and ultimately, your bottom line. The solutions we have outlined here come from real-world experience and have proven effective in maintaining stable and effective flotation circuit operation in many mines around the world.

ABOUT THE AUTHOR

Julian Waingortin has been involved in business development in a variety of aspects of the mining industry for the past 18 years. He obtained his BA at the University of Buenos Aires in chemical engineering and his MBA at McGill University in Canada, and he is a member of the Order of Engineers of Quebec. Mr. Waingortin is currently the Business Development Manager for the Americas at Cowan Dynamics.

FEATURED ARTICLE

The Evolution of Valve Automation for Emergency Shutdowns

Valve failures happen, but having a well-planned and tested emergency shutdown system can limit lost time and expenses.

BY: JASON MOOREHEAD, ENGINEERING MANAGER
COMPANY: WESTLOCK CONTROLS

Valve failure. It's an aspect of the fluid handling industry that no operator wants to experience, yet it happens. As the final control element of a safety-instrumented system, or SIS, emergency shutdown (ESD) valves are depended on when called upon. Yet they are often seen as the weakest link of an SIS, contributing to more than 50% of statistical failure data, and for an understandable reason. Remaining static or dormant for long periods of time, these valves slowly accumulate media buildup and corrosion, until the day they are suddenly required to operate. ESD valve failure can also be connected to systemic issues related to the valve automation package. Therefore, a consistent, quality valve monitoring process must be implemented into the SIS program to increase the reliability of the installed ESD valves.

Though there are several different options from which an operator can choose, partial stroke testing (PST) has evolved to offer more safety and cost-saving benefits when combined with the latest technology available. Thanks to continual advancement in smart technology, digital position control transmitters have emerged as the most comprehensive PST solution for ESD applications, offering a broader diagnostic ability, an easier implementation and a more cost-effective maintenance program than could be achieved by traditional PST methods. The system's automated diagnostics have the ability to eliminate the need for human dependency on critical areas of the plant, as well as the need for costly offline testing.

A review of partial stroke testing

Partial stroke testing allows processing plants to test the installed base of valves without having to close the valve and shut down the plant, as is the case with full stroke testing (FST). Since its inception, traditional PST methods have offered multiple advantages over other methods. For example, utilizing PST reduces the control element's probability of failure significantly. Not only does it help to determine whether the safety function will operate on demand, it also exercises the isolation valve, decreasing the likelihood of valve sticking. From a financial perspective, PST is useful when there is a high-cost burden to close an ESD valve: it can extend the interval between full stroke tests it enables operators to plan inventory for maintenance turnarounds, and in some cases, it may reduce the need for redundant valve solutions. However, despite all of these benefits, the traditional PST method does have some drawbacks, including its potential for spurious trips. Also, it may not be an appropriate testing method for all final control elements because of the disturbance it may create.

Prior to the introduction of digital control transmitters, there were different PST techniques available, each offering a different set of these benefits and disadvantages. The most common still in use today are mechanical jammers and discrete valve controls (smart positioners).

The mechanical jammer is the simplest and least expensive option. It is a device that is fixed between the actuator and the valve or integrated into the actuator. When in test mode, a piece of the jammer locks the movement when the valve experiences 10-15% of travel. They are highly reliable because of their ability to resist vibration, but they are also the most manual option, requiring the device to be physically inserted into the valve assembly to prevent it from closing completely, subjecting the entire process to human error. Also, the safety function of the valve is unavailable during the test, posing a problem should an ESD occur during the process.

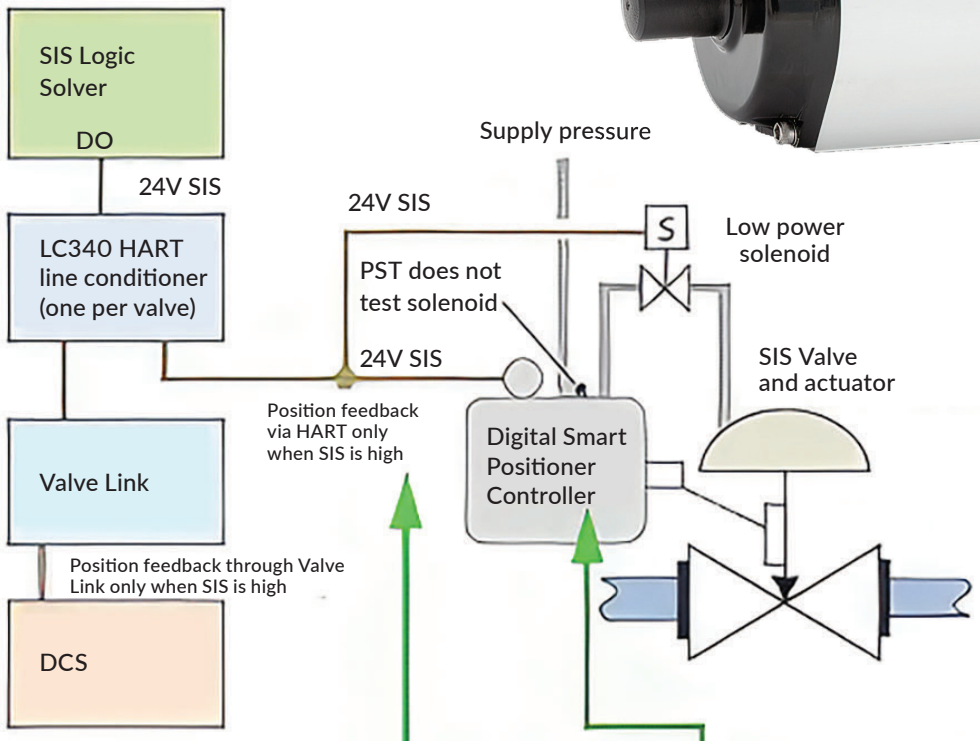
Smart positioners offer a more innovative technique that utilizes modern technology to automatically generate the PST function, either locally or remotely. They monitor valve movement proportionally, measuring the speed of its response and position. Additionally, smart positioners do have the ability to capture diagnostic data for use in maintenance, unlike mechanical jammers. However, smart positioners are the more expensive option. Also, smart positioners perform PST by bleeding air from the system via a pneumatic relay. By performing in this manner, the solenoid valve (SOV) remains untested by the positioner's PST function. To test the solenoid valve, an additional test is required from the SIS system to "pulse" the signal to the SIS solenoid valve. With this method, there is no safeguard to prevent over-travel, which creates an increased chance for an unintended spurious trip.

The latest technology

The digital position control transmitter represents an evolution in PST technology with an enhanced design based on

Example of a digital transmitter.
All images courtesy of Westlock Controls.

Positioner Safety Instrumented System Installation



CON: Positioner needs a line conditioner to communicate HART on the DO wires increasing overall cost.

CON: In an ESD event, the positioner becomes unpowered and cannot provide confirmation of valve closure and requires the addition of limit switches for feedback.

CON: Positioner is an extra piece of equipment interjected into the pneumatic system, greatly increasing the chance of spurious trips.

CON: Positioners perform PST by bleeding air from the system via its own pneumatic relay. By performing in this manner, the solenoid valve remains untested by the positioner's PST function. In order to test the solenoid valve, an additional test is required from the SIS system to "pulse" the signal to the SIS solenoid valve. With this method, there is no safeguard to prevent against over-travel and creates an increased chance for an unintended spurious trip.

SOV technology. It is a device that electronically measures a valve's position and creates a feedback signal of its actual position, using analog and/or bus technology which is then used as an input separate from the SIS output, reporting a valve's true position to the plant's control system.

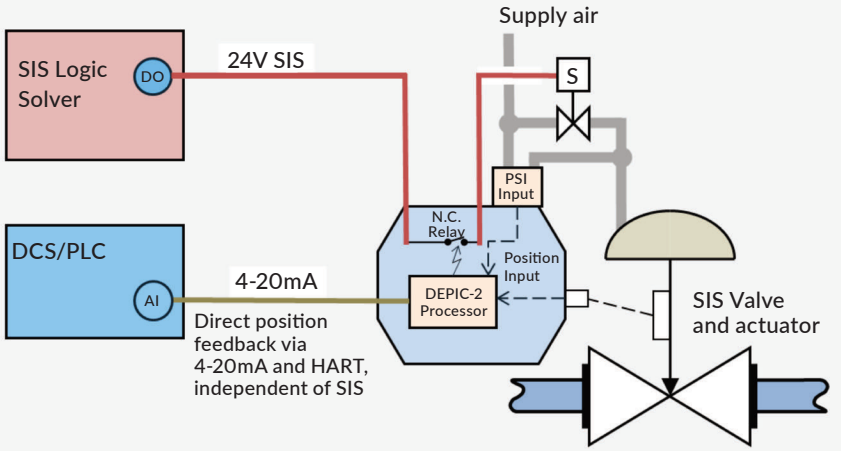
Unlike mechanical jammers and smart positioners, a digital control transmitter can capture diagnostic information during FST, as well as during an ESD event without the need for limit switches, as it directly operates the SOV when executing the PST. Also, while expensive smart positioners may need a line-conditioner to communicate HART on the DO wires, which further increases the overall cost, digital control transmitters do not require this. Through the device, PST can be initiated in multiple ways: remotely via a maintenance PC with HART Protocol or discrete output; locally via dry contact push button or selector switch; or, on a dedicated schedule.

When monitoring the ESD event, digital control transmitters monitor the SIS signal to know when the ESD event occurred and document the event, providing 4 to 20mA feedback and HART so the user can validate the information received and be confident that the valve not only shifted, but went to the fully closed, tight shut-off position.

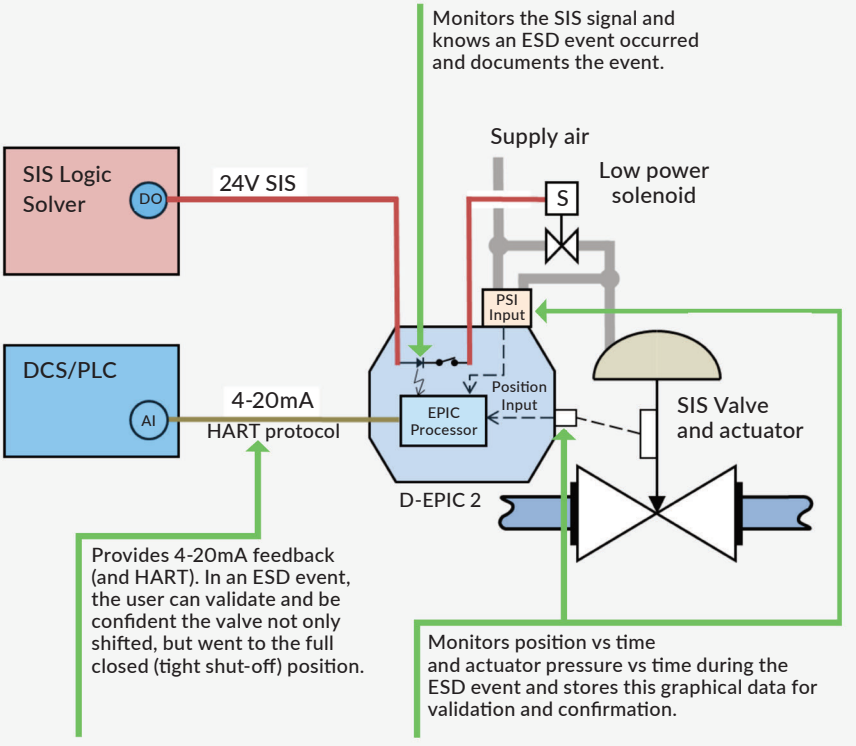
In addition to gathering useful predictive data, digital control monitors have the added ability to mitigate spurious trips that were historically caused by traditional PST methods. A spurious trip is the accidental activation of the safety system due to process disturbance which could be caused if the PST moved the valve past the intended partial travel setting. Because PST is controlled by the digital control monitor, it utilizes a fast processor so that even on small, fast-moving valves, the position can be captured accurately and PST position will not be exceeded. The system measures overshoot in a baseline test and compensates by that amount in the maintenance PST. If supply pressure is out of range for the actuator, low supply pressure can prevent the actuator from being able to bring the valve back to the fully open position. The digital control monitor measures supply pressure and will not allow initiation of PST if out of range.

Digital Position Transmitter

Method of Operation: As a Platform for PST and FST



Monitoring the ESD Event



The science behind the data

The introduction of the smart technology present in digital

position control transmitters allows operators to use the collected data for predictive diagnostics, rather than in hindsight. These transmitters focus on securing the data that provides the best insight on the probability of failure, for example break pressure to close or break pressure to partial stroke setpoint time. They then use that data to determine which automated/discrete valves are healthy and which are not during plant turnaround, before an emergency shutdown event occurs, saving the user from expensive and unnecessary service. In cases where an emergency shutdown event does occur, critical data is collected to analyze what happened and the historical graph is available for documentation and evaluation of valve performance. Additionally, critical data, such as break pressure and travel time, is analyzed and compared to previous baseline data to determine if automated valve system health is acceptable for reinstatement into service.

When providing diagnostics of online valve performance, some digital control transmitters have the ability to store up to seven full stroke tests in nonvolatile memory. Of the seven tests, five are for diagnostics, including baseline tests, dynamic baseline tests and maintenance tests which retain the four most recent valve travels. The remaining two tests are used to document history: the integrator test, which documents the function of the valve assembly as manufactured by the automation supplier or OEM; and the installer test, which documents the function of the valve assembly after being installed in the field by the contractor.

Conclusion

Partial stroke testing has come a long way from relying on mechanical jammers. Though the traditional methods still exist, the availability of smart technology has completely changed the way data can be gathered and used in the prevention of emergency shutdowns. The evolution of this technology has resulted in the reversal of how valve data is used, bringing advanced predictive diagnostics to the multitude of discrete automated valves in the plant. The data generated by digital control transmitters provides plant operators with valuable information that can help prevent unplanned shutdowns, organize maintenance resources for planned turnarounds and reduce inventory. Just as every other industry is and has been benefitting from the introduction of smart technology, so too is fluid handling with the introduction of digital position control transmitters.

ABOUT THE AUTHOR

Jason Moorehead serves as the Engineering Manager at Westlock Controls, bringing over 22 years of expertise in valve technology. Known for his passion for innovation and engineering excellence, he leads a dedicated team in designing advanced valve monitoring and control systems that set industry standards.

FEATURED ARTICLE

Meet the Chairman: Kirk Wilson

Wilson tells us about his goals for his tenure as chairman and what he thinks the biggest challenges and opportunities valve manufacturers and the industry are facing today.

EDITED BY: HEATHER GAYNOR, EDITOR-IN-CHIEF, *VALVE MAGAZINE*

We recently spoke with VMA's Chairman Kirk Wilson, president of the Flow Control Division at Flowserve, to learn more about him and his experience in the industry, his vision for VMA and what he does in his not frequent enough downtime!

Tell us about your background. Where did you study, and how did you get involved in this industry?

I graduated from Texas A&M University with a degree in mechanical engineering. I started my career in the pump industry as an application engineer for Ingersoll-Rand and basically never left the company. Over the years, the industry consolidated, and I ultimately ended up in Flowserve, serving in various leadership roles on the rotating equipment side of our business. In 2019, I transitioned into the valve side of our business as President of the Flow Control Division. So, I have been in the flow control equipment industry for 38 years, but focused on the valve industry for the last six years. I have enjoyed learning and contributing to Flowserve's valve business and engaging with our valve industry peers as a board member of the VMA.

Sustainability, energy expansion, government regulations and legislation on PFAS, taxes and tariffs are all hot topics right now. What other pressing issues do you think that the industry and VMA need to focus on in the coming year?

These topics are the areas where we believe VMA is currently creating the most value for our membership and the industry, and we'll continue to advocate for our member companies on these and other issues as they arise. Other areas of opportunity that I see for the VMA in the future are:

Kirk Wilson, VMA Chairman. Source: Flowserve

- Workforce staffing and development: While the pandemic brought this to light and while it has improved some, the industry still needs more workers at all levels. This is especially true in the U.S.
- Automation and AI: With fewer workers, our industry and the broader manufacturing industry need to find ways to do more with less. AI will be a big part of this, so understanding the opportunities for our industry and capitalizing on those will become a differentiator for companies.
- Navigating geopolitical shifts: The global political and business ground rules of the past 50+ years are changing and as businesses we need to understand what these changes are and the possible implications to us to manage our operations to meet demand. We need to be more agile and decisive, and we need to spend time on foresight and developing contingency plans for scenarios which may or may not ever come to fruition.

What do you see as the biggest challenges we face in the industry today? What about the greatest opportunities?

As far as opportunities, I think there are favorable, long-term macro trends including energy expansion, electrification, digitization and automation.

For challenges, geopolitical uncertainty, end-market stability, aging workforce, knowledge retention and attracting and developing talent are all top of mind for me.

How do you see VMA serving and advancing the industry?

VMA provides a community that supports the North American valve industry and creates value for our membership. As a collective group, we provide insights to our membership and respond to common challenges.

We continue to develop common platforms, tools and

guidance for members and the industry as a whole, especially for industry sustainability, legislative and regulatory topics. While each company always needs to make its own business decisions, VMA can provide leadership on best practices and benchmarks, particularly on areas that all members are addressing.

Promoting our industry and member value to policy makers, the various markets we serve and the current and future workforce remains a key set of activities for us. We continue to invest in educational topics and technical training for our membership and the broader industry.

VMA acts as leadership for the industry on the global stage. North America remains one of the strongest markets for our industry, and as the U.S. and Canadian industry trade association, VMA can help the global industry coalesce around key topics.

What will your focus be as a leader in the VMA?

- Refreshing our strategic plan to create more value for our membership.
- Engaging current members and expanding our reach to new members.
- Ensuring our committee structure supports VMA's key focus areas and aligns with the Board of Directors and act efficiently and effectively.
- Continuing to create sustainability and governance management processes for VMA.

What advice do you have for someone considering joining VMA?

Being a VMA member offers companies a community and network at all levels for the organization, helping companies to benchmark and pool resources and knowledge to solve issues affecting us all. Membership also demonstrates your company's leadership in the industry.

Membership and participation in VMA events both in person and online is what you make it — get involved! Join a committee or create content for an article, conference session or webinar. The industry and the VMA benefit from your expertise and experience.

What advice would you have for those entering the industry either as a new graduate or mid-career professional?

There are unlimited opportunities for professional and career development in our industry. Find an area that ignites your passion in a company that has a culture where you can thrive. Commit to delivering value to the organization in your current role before looking for the next opportunity.

Remain flexible and open when presented with new roles and opportunities, even if they differ from your preconceived career path. In my career, I gained significant development while in roles that did not initially seem attractive to me.

Tell us a little about what you do outside of work.

When I'm not working, I enjoy spending time with my family and friends. My hobbies include outdoor activities, community support, theater, travel and Texas A&M athletics.

VALVE Basics

Understanding Metallurgy for Valve Applications

BY: FADILA KHELFAOUI, *Corporate Engineer*
COMPANY: VELAN

Material selection for valves is a complex process that must consider temperature, pressure, corrosion and wear. A comprehensive understanding of metallurgical principles enables engineers and manufacturers to make informed decisions, ensuring valves perform reliably in demanding environments while reducing operational costs and improving safety.

What is metallurgy?

Metallurgy is the science and engineering of metals, focusing on their extraction, processing and transformation into functional components. It examines how composition, structure and processing methods affect mechanical and chemical properties such as strength, toughness, corrosion resistance and thermal stability (see an example in Figure 1).

Figure 1A : Fractured cast iron yoke stem bushing made of D-2C material. All Photos: Velan Inc. (unless otherwise noted)

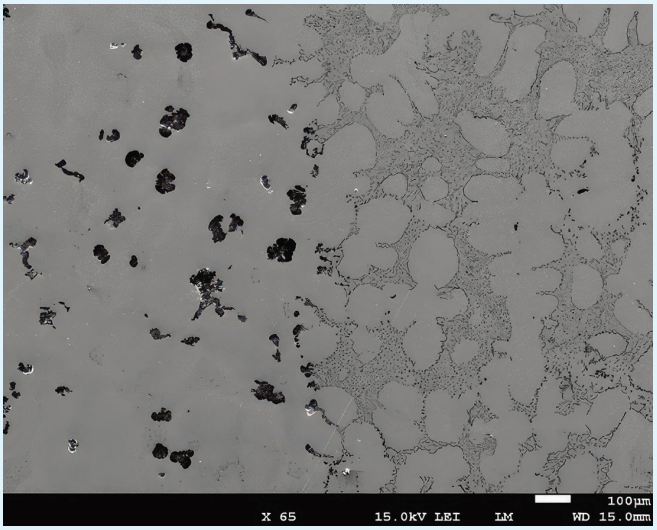
In valve applications, industry standards such as ASME, API and ASTM define material requirements, pressure ratings and temperature limits to ensure safety and reliability. Metallurgy directly influences these ratings through alloy composition, heat treatment and microstructural control.

Role of heat treatment and crystal structures

Heat treatment processes refine material microstructures to enhance strength, hardness, toughness and corrosion resistance, ensuring optimal performance in industrial applications. The table on p. 31 summarizes key heat treatment processes. Each process is crucial in modifying the material's phase and structure to achieve specific characteristics. Solution annealing and precipitation hardening, for instance, are used to optimize corrosion resistance and strength in specific alloys like austenitic stainless steels and nickel-based alloys. By controlling the heat treatment parameters, engineers can tailor materials to meet the demands of high-stress and corrosive environments.

Heat treatments and crystal structures define material performance. Martensitic steels, formed through rapid cooling, develop a body-centered tetragonal (BCT) structure and offer high hardness and wear resistance, ideal for valve trim and seats. Austenitic steels, with a face-centered cubic (FCC) structure, provide superior ductility, toughness and corrosion resistance, making them suitable for valve bodies and chemical processing. Ferritic steels, featuring a body-centered cubic (BCC) structure, deliver moderate strength and oxidation resistance for cost-effective industrial valves (Figure 2). Duplex stainless steels combine dual FCC and BCC phases (Figure 3) for high strength and corrosion resistance, requiring careful heat treatment to prevent sigma phase formation.

Figure 1B: Microstructural analysis of a fractured cast iron yoke stem bushing made of D-2C materials revealed a mix of nodular graphite and filamentary structures due to insufficient magnesium content, resulting in poor nodularity during manufacturing. This deviation from ASTM standards compromised the mechanical properties, ultimately leading to bushing failure.



Heat Treatment Process	Material Type	Microstructure Phase/Formed	Effect on Material Properties
Austenitization	Carbon and alloy steels	Austenitic phase (FCC)	Prepare for hardening, enhances ductility
Quenching	Austenitized steel	Martensite (BCT)	High hardness, but increased brittleness due to trapped carbon
Tempering	Martensite	Refined martensite (BCT)	Reduces brittleness while maintaining hardness
Normalizing	Carbon and low-alloy steels	Fine-grained (BBC)	Improves strength and ductility, refines grain structure
Solution annealing	Austenitic stainless steel and nickel-based alloys	Stabilized austenitic phase (FCC)	Dissolves carbides and precipitates, enhances corrosion resistance
Precipitation hardening	Nickel-based alloys and certain stainless steels (e.g.,17-4PH)	Fine precipitates in FCC/BCT matrix	Strengthens by obstructing dislocation movement, improving mechanical properties
Stabilization heat treatment	Austenitic stainless steels (e.g., 321, 347)	Austenitic phase (FCC)	Prevents chromium carbide precipitation, preserves corrosion resistance

Table 1: Examples of heat treatment and the effects on materials

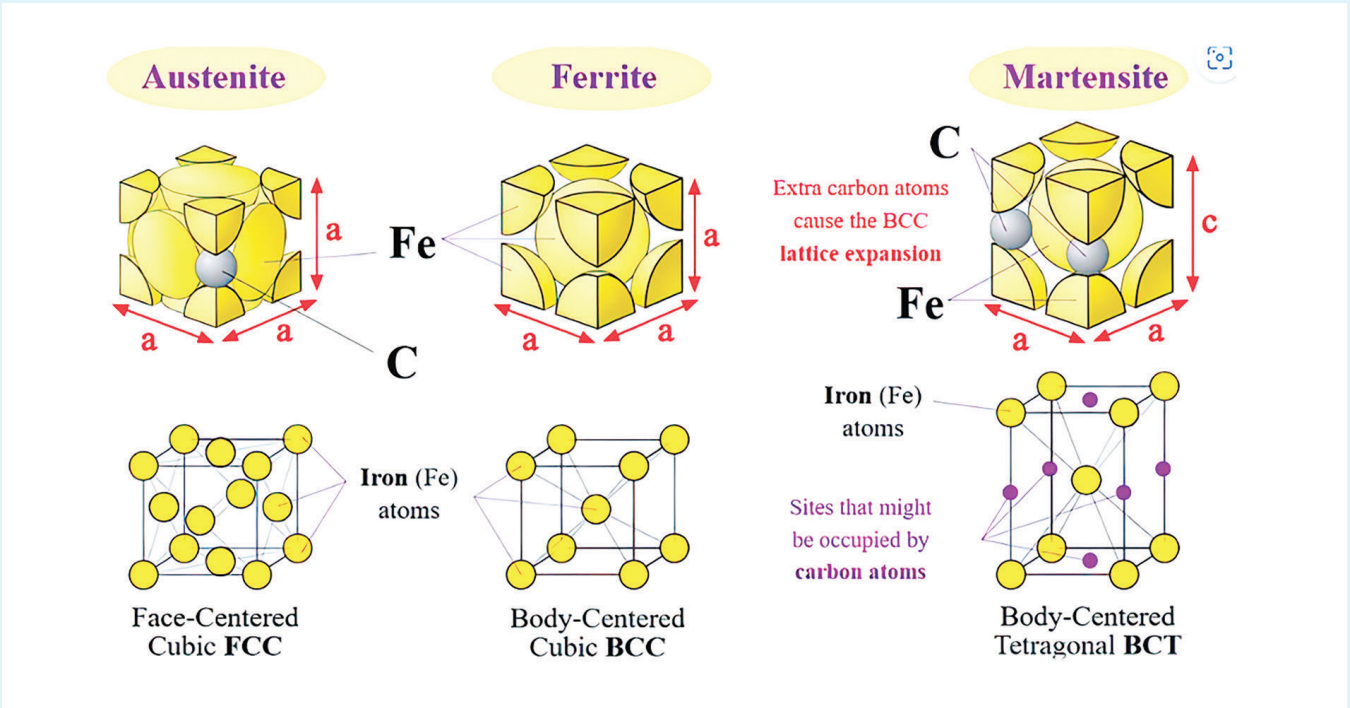
Nickel-based alloys, such as Inconel and Hastelloy, leverage their FCC structure to maintain oxidation and corrosion resistance under extreme conditions, making them essential for high-temperature, high-pressure valves. Cobalt-based alloys like Stellite provide outstanding wear and galling resistance, commonly used for hardfacing valve components. Titanium alloys, with a hexagonal close-packed (HCP) structure, offer an excellent strength-to-weight ratio and corrosion resistance, valuable in seawater and aerospace applications.

Understanding heat treatments and crystal structures allows engineers to optimize valve performance and ensure reliability in demanding applications.

Metallurgy matters

Selecting the appropriate materials for valves is a complex process requiring careful consideration, not only of the material group, but also specific grades, heat treatment conditions and compliance with industry standards like NACE (National Association of Corrosion Engineers) for sour service applications. In this application, compliance

Figure 2: Molecular structure of common valve steels. Source: Metallurgical Engineering.



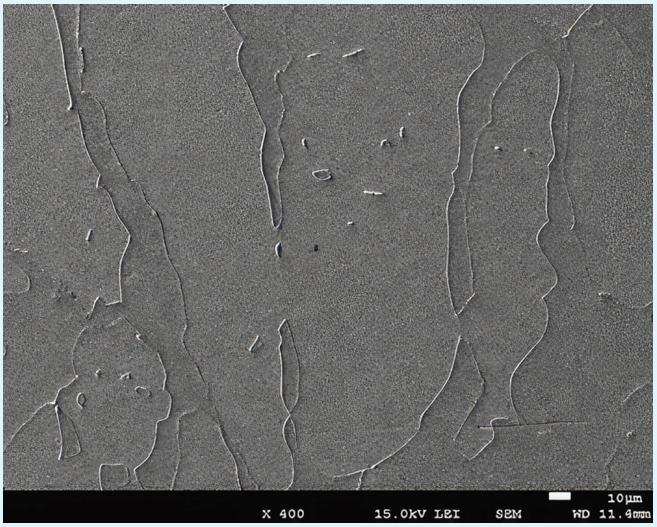
Material	Key Benefits	Limitations	Typical Applications
17-4 PH	High strength, corrosion resistance	Susceptible to SCC in H900 conditions	Valve stems, trim components
Inconel 718	High strength, oxidation resistance	Lower mechanical properties above 1200°F (650°C)	High-temperature valves
Inconel 625	Superior corrosion and oxidation resistance	Lower strength compared to Inconel 718	Higher temperature applications, oxygen service
Carbon steel (WCB)	Good mechanical properties, easy to manufacture	Brittle at low temperatures; suitable up to 800°F (425°C)	General-purpose valve bodies
LCC/LCB	Enhanced toughness for cryogenic use	Not suitable for high temperatures	LNG, cryogenic processing
321/347 SS	Stabilized for high temperatures, resists sensitization	Carbide precipitation risk at improper heat treatment	Refinery, high-temperature applications
Duplex SS (2205, 2507)	High strength, corrosion resistance	Formation of sigma phase if overheated	Offshore, chemical processing
Grade 91 (9Cr-1Mo steel)	Superior creep strength, long-term stability	Cast version has lower creep resistance	Power plants, high-temperature refining
Titanium (grades 1-4, Ti-6Al-4V, Grade 12)	Exceptional corrosion resistance, lightweight	Lower strength in pure form	Seawater, aerospace, mining
Monel (400, K-500)	Outstanding seawater and acid resistance	Higher cost than stainless steel	Marine, desalination, chemical plants, oxygen service
Stellite 6	Superior wear resistance, withstands high temperatures	High hardness reduces ductility	Valve seats, high-wear parts
Stellite 21	Improved toughness, corrosion resistance	Lower hardness than Stellite 6	Stems, guide surfaces

Table 2: A comparison of commonly used materials.

ensures resistance to hydrogen sulfide (HS)-induced failures such as sulfide stress cracking (SSC), stress corrosion cracking (SCC) and hydrogen embrittlement, which are common failure mechanisms in oil and gas environments. To mitigate these risks, NACE imposes strict hardness limits to balance toughness and mechanical strength, enhancing durability.

Table 2 (above) provides a comparison of commonly used valve materials, highlighting their key benefits, limitations and typical applications.

Figure 3: Ferrite and austenite typical duplex microstructure.



For example, 17-4 PH stainless steel in the H900 condition offers high strength but is prone to SCC, making it unsuitable for NACE applications. In contrast, the H1150D condition improves toughness and corrosion resistance at the cost of some strength, making it a better choice for impact-resistant applications. Choosing the wrong heat treatment condition for 17-4 PH can lead to failure (Figure 4).

Additionally, 17-4 PH is limited to operating temperatures below 480°F (250°C) as its copper-rich strengthening precipitates coarsen (over time, larger precipitates grow at the expense of smaller ones in a material) and dissolve at higher temperature, reducing mechanical properties. For higher temperature applications, Inconel 718 or Inconel 625 are preferred. Similarly, Inconel 718 undergoes aging treatments to optimize strength but loses mechanical integrity above 1,202°F (650°C) due to detrimental phase formation. Inconel 625, more stable at higher temperatures, is available in Class 1 (annealed, high corrosion resistance) and Class 2 (precipitation-hardened, higher strength) is preferred.

Carbon steels such as WCB, LCB and LCC are widely used in valve bodies, but performance varies with temperature. Standard WCB becomes brittle in cryogenic conditions, requiring low-carbon variants like LCB and LCC for improved impact resistance. Conversely, for high-temperature applications, WC6 and WC9 provide superior oxidation resistance and creep strength.

Stabilized stainless steels, such as 321 and 347, are designed for high-temperature applications where resistance to sensitization is critical to prevent chromium carbide precipitation at high temperature using titanium (321) or niobium (347) stabilizers. While thermal stabilization treatments are not always ►

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Figure 4: Brittle fracture of a17-4 PH stem in H1100 condition, likely caused by inconsistent heat treatment and exposure to a sour environment.

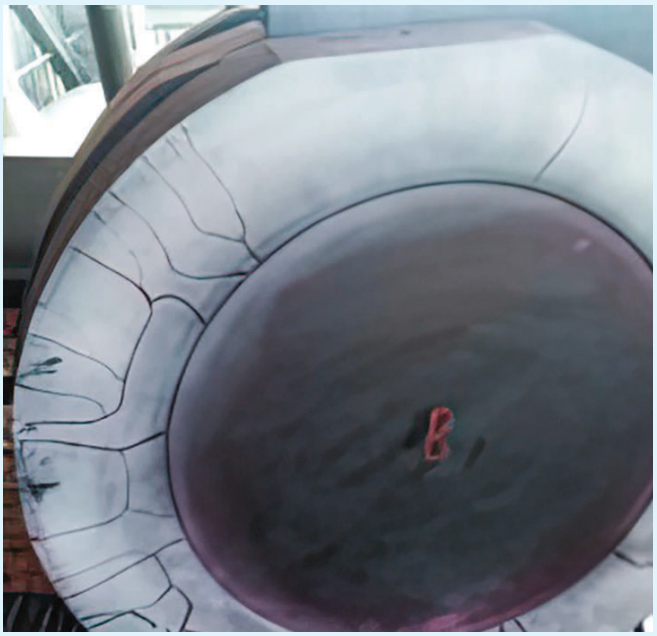

Figure 5: Transversal cracking of Stellite 6 seat hardfacing in combined cycle power plant.

required, they are recommended for prolonged high-temperature applications like ebullated bed process valves.

Duplex stainless steels (2205, superduplex 2507) offer high strength and corrosion resistance but require precise heat treatment to prevent intermetallic phase formation, such as sigma phase, which reduces toughness and corrosion resistance (Figure 6).

Grade 91 (modified 9Cr-1Mo), a creep-strength-enhanced ferritic (CSEF) steel widely used in power plants and refineries has two types: Type 1 (normalized and tempered) and Type 2 (with stricter tramp element control such as tin and antimony, for better long-term creep performance). Cast Grade 91 lacks these classifications and has lower creep resistance than wrought versions.

Commercially pure titanium (Grades 1–4) excels in seawater and chemical processing but lacks strength for high-pressure use. Ti-6Al-4V offers higher strength, while Grade 12 (Ti-0.3Mo-0.8Ni) resists crevice corrosion in chemical processing and mining applications.

Like titanium, Monel alloys, primarily nickel-copper, are also extensively used in marine environments due to their outstanding resistance to seawater corrosion and hydrofluoric acid. Monel 400 is common in offshore and ►

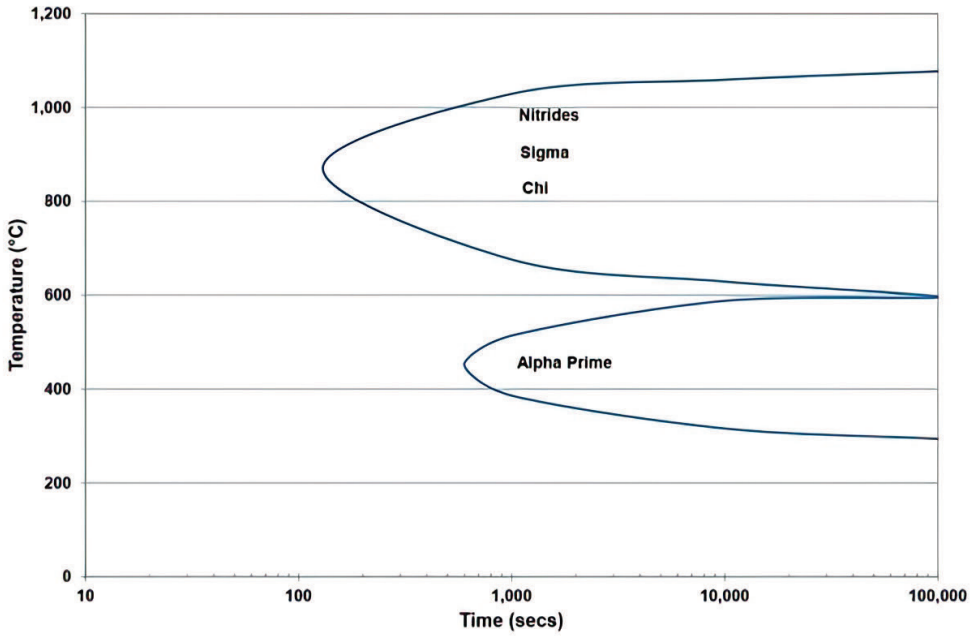

Figure 6: Typical phase transformations of super duplex stainless steels during continuous cooling [R. Francis, et al., Corrosion, 2016].

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Figure 7: Piping supports are deformed from improper piping design failing to accommodate thermal expansion under large cyclic loads.

marine valves, while K-500, precipitation-hardened for higher strength, is ideal for marine and oil and gas high-performance valves. A key difference between titanium and Monel is that titanium is much lighter, making it advantageous for weight-sensitive applications such as naval components. However, Monel has a lower risk of galling, making it a better choice for sliding components. Proper design prevents galvanic corrosion when pairing these materials.

Stellite 6 and Stellite 21 are cobalt-based alloys used for wear and corrosion resistance. Stellite 6, with tungsten, excels in galling resistance but is harder and prone to cracking under thermal cycling (Figure 5). It performs well up to 1112°F (600°C), becoming brittle at higher temperatures. Stellite 21, with lower carbon and added molybdenum, offers improved toughness and corrosion resistance. Stellite 6 is preferred for high-wear components like valve seats, while Stellite 21 is good for stems and guide surfaces requiring improved galling resistance and thermal stability.

Challenges in material compatibility

In addition to selecting individual materials, understanding how their combination influences performance is equally important. When different metals are combined through welding, cladding or bimetallic assemblies, their interactions can impact mechanical integrity and corrosion resistance, leading to premature failure. Key considerations include:

- Thermal expansion mismatches: In valve components, differential thermal expansion between materials can cause significant issues. This mismatch can result in stress, leakage and sealing failure (Figure 7). Specifically, when base materials and coatings are used together, the differences in thermal expansion may lead to cracking, disbonding or leakage, particularly in high-temperature applications. These stresses can compromise the integrity of the valve, reducing its reliability and lifespan. In Fig. 7, deformation of the piping support was caused by improperly designed piping to accommodate thermal expansion under large cyclic loads. This led to excessive stresses within the piping system, contributing to valve leakage at the body/body end flange in ebullated bed unit.
- Galvanic coupling: Combining dissimilar metals having different electrochemical potentials, such as stainless steel and carbon steel, in corrosive environments can accelerate galvanic corrosion and cause rapid material degradation.
- Phase transformations: When materials are exposed to specific operating conditions over time, such as elevated temperatures or mechanical stress, phase transformations can occur. These changes may significantly alter mechanical properties like hardness, strength and ductility. In valve applications, exceeding the material's initial metallurgical limits — especially under prolonged high-temperature or high-pressure service — can trigger these transformations. If not properly accounted for, they can cause brittleness, fatigue or reduced corrosion resistance, compromising valve integrity. For example, hardfacing CSEF steels with cobalt-chrome-based alloys can result in delamination due to the formation of brittle intermetallic phases at operating temperatures above 1000°F (538°C) (Figure 8).

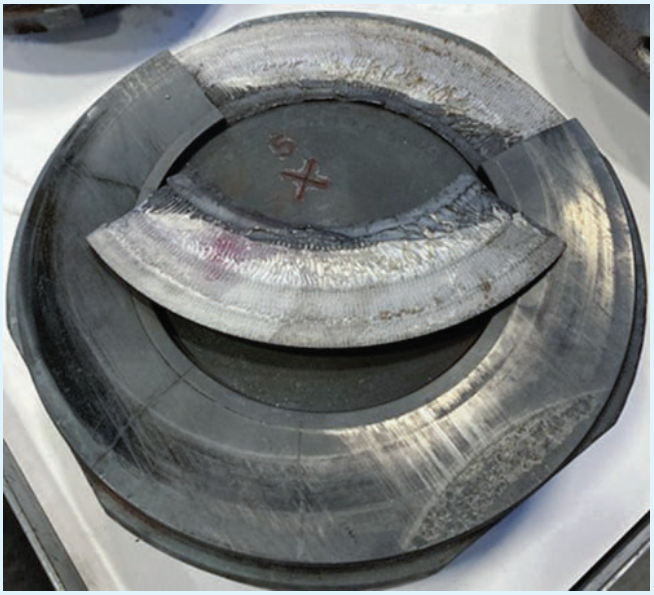

Figure 8A: Hardfacing delamination.

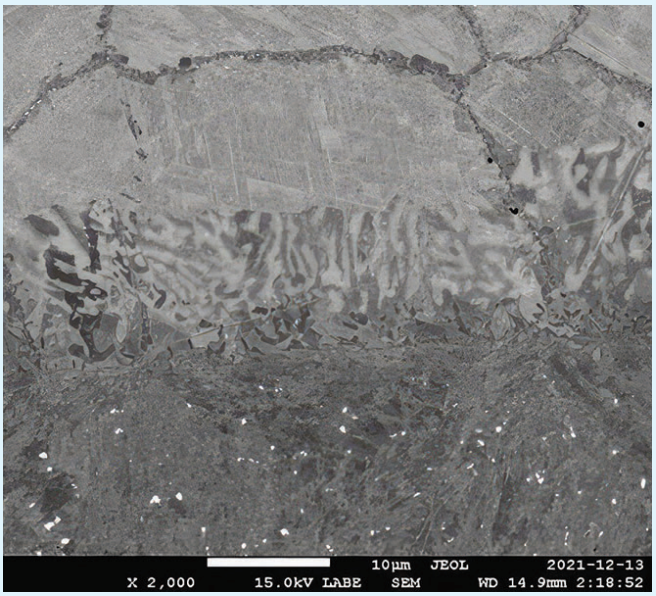

Figure 8B: Microscopy of failed disc shown in image (above, 8A) reveals an intermixed zone at the interface between Grade 91 and Stellite 21, indicating the formation of hard and brittle sigma phase.

The future of metallurgy

The future of metallurgy in valve applications will be shaped by advanced materials, sustainability and regulatory challenges. Functionally graded materials (FGM), which gradually transition in composition and microstructure, offer enhanced thermal resistance and mechanical performance. Additive manufacturing (3D printing) allows for complex geometries and tailored material properties, enabling next-generation valve solutions.

Despite these innovations, regulatory requirements can slow adoption. Certifications from ASME, API and ASTM ensure safety but also create barriers to new material integration. To overcome this, industries must work closely with regulatory bodies, demonstrating long-term benefits through rigorous testing.

Sustainability is becoming a priority, with an increasing focus on environmentally friendly alloys, energy-efficient production techniques and the recycling of high-performance metals. Advanced coatings that extend component lifespan further contribute to sustainability efforts.

By balancing innovation with regulatory compliance, metallurgy will continue to evolve, driving improvements in valve technology while ensuring safety, performance and sustainability for future applications.

ABOUT THE AUTHOR

Fadila Khelfaoui is a corporate engineer, metallurgy, at Velan, with 27 years of experience in materials engineering and metallurgy. She has led numerous R&D initiatives aimed at optimizing material selection and developing protective coating technologies for valve components. Fadila holds a Ph.D. in Materials Science and Engineering and is a licensed metallurgical engineer in Quebec.

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Chicago, IL
alliedvalveinc.com

AVP Valve Inc.
Lakeland, FL
avpvalve.com

AWC Inc.
Corpus Christi, TX
awc-inc.com

Caltrol Inc.
Las Vegas, NV
caltrol.com

John H. Carter Co.
Baton Rouge, LA
johnhcarter.com

Classic Controls Inc.
Lakeland, FL
classiccontrols.com

Control Southern Inc.
Suwanee, GA
controlsouthern.com

Curtiss-Wright Industrial Division
Brecksville, OH
cw-industrial.com

Dowco Valve Co.
Hastings, MN
dowcovalve.com

Eastern Controls Inc.
Philadelphia, PA
easterncontrols.com

Emerson
Corporate HQs, St. Louis, MO
emerson.com/FinalControl

Flotech Inc.
Jacksonville, FL
flotechinc.com

Formosa Plastics USA
Point Comfort, TX
fpcusa.com

Gulf Coast Modification, LP
Houston, TX
gulfcoastmod.com

J~S Machine and Valve Inc.
Nowata, OK
jsvalve.com

Kirksey Machine
Houston, TX
kirkseymachine.com

Midwest Valve Services Inc.
Minooka, IL
mwvalve.com

Pioneer Industrial Corp.
St. Louis, MO
pioneerindustrial.com

Precision Fitting and Gauge
Tulsa, OK
pfandg.com

Precision Pump & Valve Service
Charleston, WV
ppvs.com

Precision Valve Group
Monroe, NC
precisionvalvegroup.com

Puffer-Sweiven
Houston, TX
puffer.com

R.E. Mason
Charlotte, NC
remason.com

Riggio Valve
Bayonne, NJ
riggiovalve.com

Scallon Controls
Beaumont, TX
scalloncontrols.com

Score (Canada) Limited
Edmonton, AB, Canada
score-group.com

Setpoint Integrated Solutions
Baton Rouge, LA
setpointIS.com

Southern Valve Service Inc.
Baton Rouge, LA
southernvalve.com

TEAM Industrial Services
Houston, TX
teaminc.com

United Valve
South Houston, TX
unitedvalve.com

Universe Machine Corp.
Edmonton, AB, Canada
umcorp.com

Valmet
Shrewsbury, MA
valmet.com

Valve Reconditioning Service Co.
Melvindale, MI
vrsinc.net

ValvTechnologies
Houston, TX
valv.com

VRC ASSOCIATE MEMBERS

EFCO
Charlotte, NC
efcousa.com

Quality Valve
Mobile, AL
qualityvalves.com

LATEST LAUNCHES

Emerson Rolls Out Next Version of DeltaV

Emerson has announced the release of version 6.LTS of its DeltaV Mimic dynamic simulation software. The software has been enhanced to support performance and collaboration across the enterprise, helping eliminate silos of data that limit visibility into operator performance and providing tools to create digital twin simulations that deliver continuous value far beyond project execution.

In the new DeltaV Mimic version 6.LTS, users will find a focus on enterprise connectivity and parallel long-term support (LTS) lifecycle strategy for the DeltaV Distributed Control System (DCS) and DeltaV Mimic. Streamlined model tuning and support for virtual controllers and larger simulations will help companies more easily accomplish their goal of implementing these holistic simulation solutions. **emerson.com**

Sensaphone Introduces New Predictive Maintenance System

Sensaphone's Sentinel Pro remote monitoring system aids facility managers seeking to enhance their maintenance plans through predictive and preventative maintenance. The system's advanced capabilities enable personnel to detect changes in the operational environment and potential equipment issues before they lead to costly failures, helping to ensure continuous uptime and reducing disruptions.

For predictive maintenance the Sentinel PRO system's real-time monitoring and alert features detect early warning signs of equipment malfunctions. The system also identifies changes in conditions like temperature and humidity. By analyzing data trends and detecting anomalies, facility managers can address minor issues before they escalate into major problems, reducing repair costs and extending equipment lifespan.

The Sentinel Pro remote monitoring system also supports preventative maintenance, a scheduled approach in which facility personnel perform regular inspections and servicing at predetermined intervals to prevent unexpected failures. The system provides continuous remote monitoring of critical parameters, allowing teams to verify the condition of their equipment and confirm that scheduled maintenance is effectively preventing breakdowns. **sensaphone.com/sentinels**

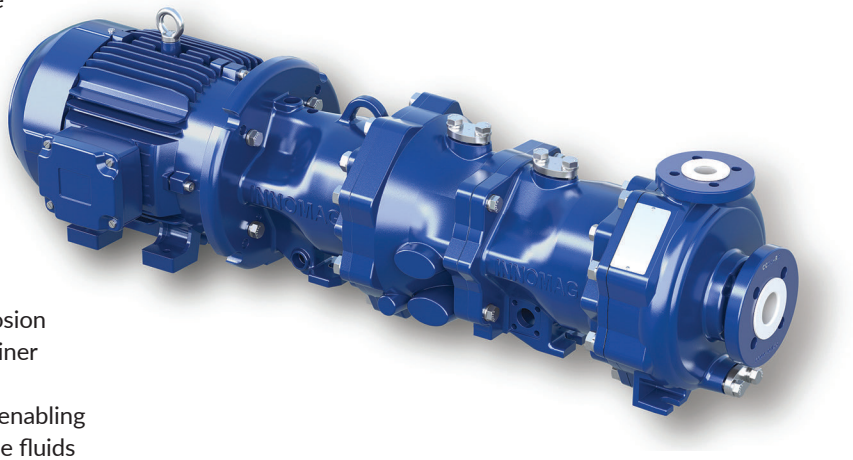
Norstat Sensor Offers More Data

The new F.Core flow sensor from Norstat offers flow measurement, temperature, pressure and energy consumption — offering up a wide range of applications for machines, systems and compressed air applications. The sensor also collects energy consumption data to help operators optimize and increase production efficiency.

The F.Core electronic flow sensor uses a combination of calorimetric and piezoresistive measuring principles to measure flow, pressure and temperature with high accuracy. The sensors feature a rotatable OLED display and are suitable for various operating media including compressed air, helium, argon, nitrogen and carbon dioxide. The sensors are rated to IP65 and IP67 protection and can be integrated into most automation systems. **norstat.com**

Flowserve Launches Sealless Pump with Secondary Containment

The Innomag TB-Mag Dual-Drive Pump is a magnetic drive pump that is double hermetically sealed and features a secondary independent containment system to reduce impact from failures.



The Innomag TB-Mag Dual-Drive now makes sealless pumps a safe alternative to CMPs and other sealless pumps with dual-control systems because the liquid and drive sections of the pump are both sealed airtight, providing a secondary layer of protection in the pump. By containing the liquid in the pump, the motor remains liquid-free and operational — the most common downfall from CMP failures. The pump also has an additional layer of corrosion resistance for handling chemicals with a non-metallic liner which coats the pump internally.

These features help ensure the elimination of leaks, enabling a significant safety net for operators who process these fluids daily. **flowserve.com**

INDUSTRY

PROFILE

David Bayreuther

David Bayreuther leads product management for Valmet Flow Control and is President of the Board of Directors of the Manufacturers Standardization Society (MSS).

What inspired you to pursue a career in the world of valves and actuators?

My career started as a valve engineer at General Dynamics Electric Boat Division designing and developing valves and actuators for nuclear submarines. I can't say that I chose to pursue a career in valves, but like many in this industry, I sort of fell into it. One responsibility for my first role was developing valves for the U.S. Navy. One of my mentors in the group would frequently say, "Valves make the world go around." As my knowledge of valves and awareness of their widespread use in industries increased, I learned to appreciate why he said this.

Why did you decide to get involved with VMA?

Shortly after I started at Neles-Jamesbury, my manager started planning for retirement. He was a member of the VMA Technical Committee and asked me to take over his role. At my first VMA event, I offered to buy the chairman of the committee a beer. He agreed and immediately offered me the position of vice chair. Shortly after, I enjoyed several terms as chairman of the Technical Committee.

Tell us about your work with MSS and how it overlaps with VMA.

The scope and purpose of VMA and MSS are different. MSS develops and publishes industry standards for valves and actuators, as well as flanges, fittings, pipe hangers, packing, seals and other components. MSS was founded over 100 years ago, and our slogan is "The technical voice of the industry." This is where some overlap occurs. MSS has over 120 member companies, many of whom are also VMA members and frequent presenters at VMA events.

Are there any exciting projects or initiatives you are working on that you'd like to highlight to our readers?

It is essential for MSS to maintain our current portfolio of standards and keep them up-to-date for our members and the industry. To remain healthy and grow, MSS also needs to continue to develop new standards, and we are expanding the scope of that work to include product standards for challenging industry applications. T

How do you stay abreast with changes in the valve/actuator industry?

I read a lot of materials every day including industry magazines, trade association news, social media, industrial valve news updates, various websites and reports from patent applications.

Any emerging trends or technologies that you are particularly excited about?

There are always emerging trends piquing the interest of our industry and currently AI and digitalization are key topics. Valves for hydrogen and additive manufacturing (3D metal printing) is being discussed more. Personally, digitalization to extract more information from valves is something that I believe will develop in the future.

What do you enjoy doing outside of work?

My wife and I enjoy skiing in the winter, and golf and sailing in the summer. We are starting to get the boat ready to be back in the water by May so we can enjoy the summer sailing around New England.

Read the full interview: VALVE-MEDIA.com/articles/industry-profile-David-Bayreuther

VALVE MAGAZINE

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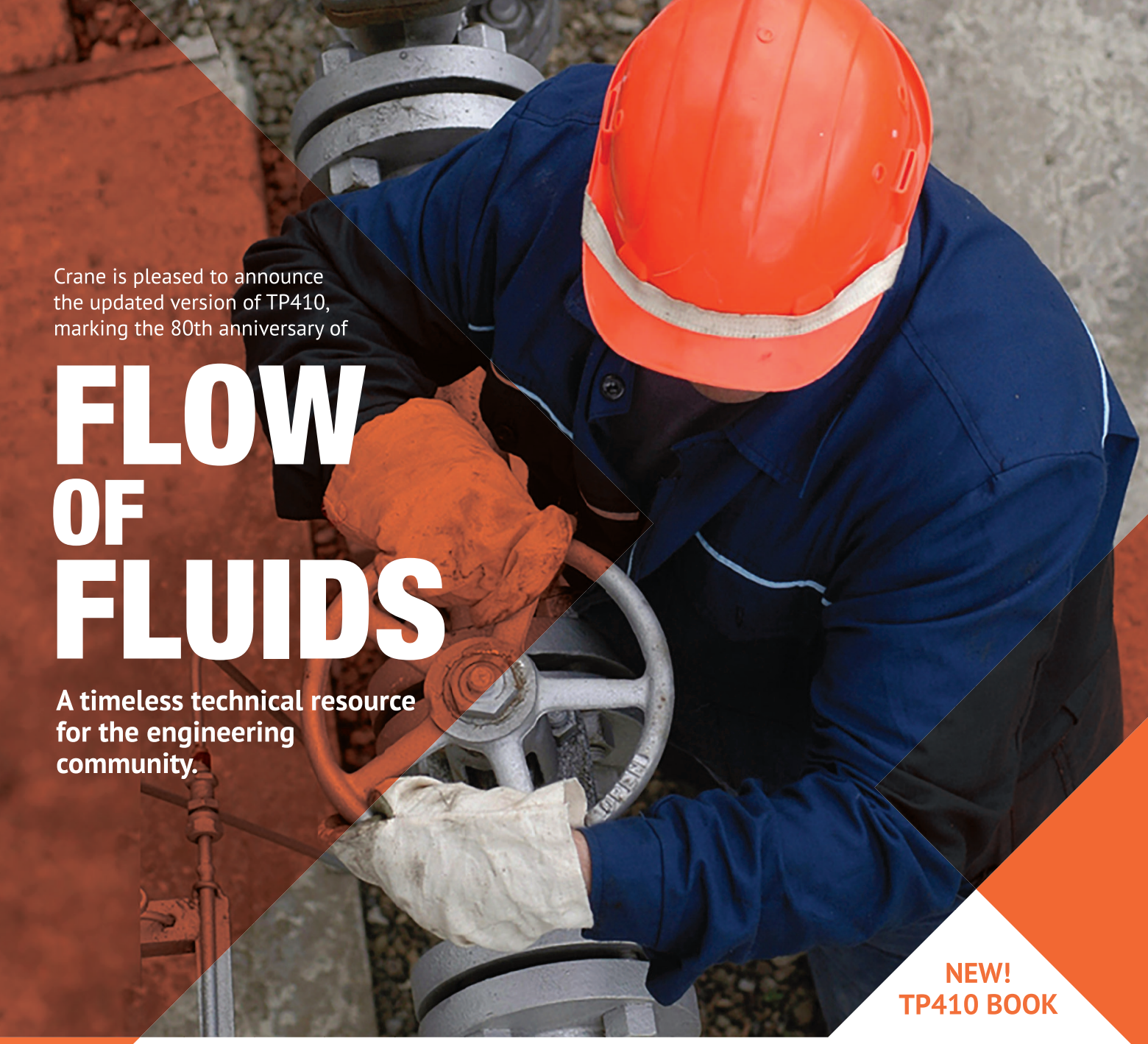

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