

VALVE

MAGAZINE

FALL 2021
VOL. 33, NO. 4

2022

MARKET OUTLOOK

**Continued
Growth and
Stability
to Follow
Tumultuous
Times**

*But supply chain woes,
lack of labor, rising inflation
and tariff concerns—
along with changes
brought on by the pandemic—
likely will impact the year ahead.*

- WIRELESS
- TRENDS IN
- SMART
- PNEUMATICS
- HYDROGEN
- VALVE
- TESTING
- STANDARDS
- FOR
- EMISSIONS
- SERVICE
- KNIFE GATE AND
- SLURRY VALVES:
- FIXING FAILURES



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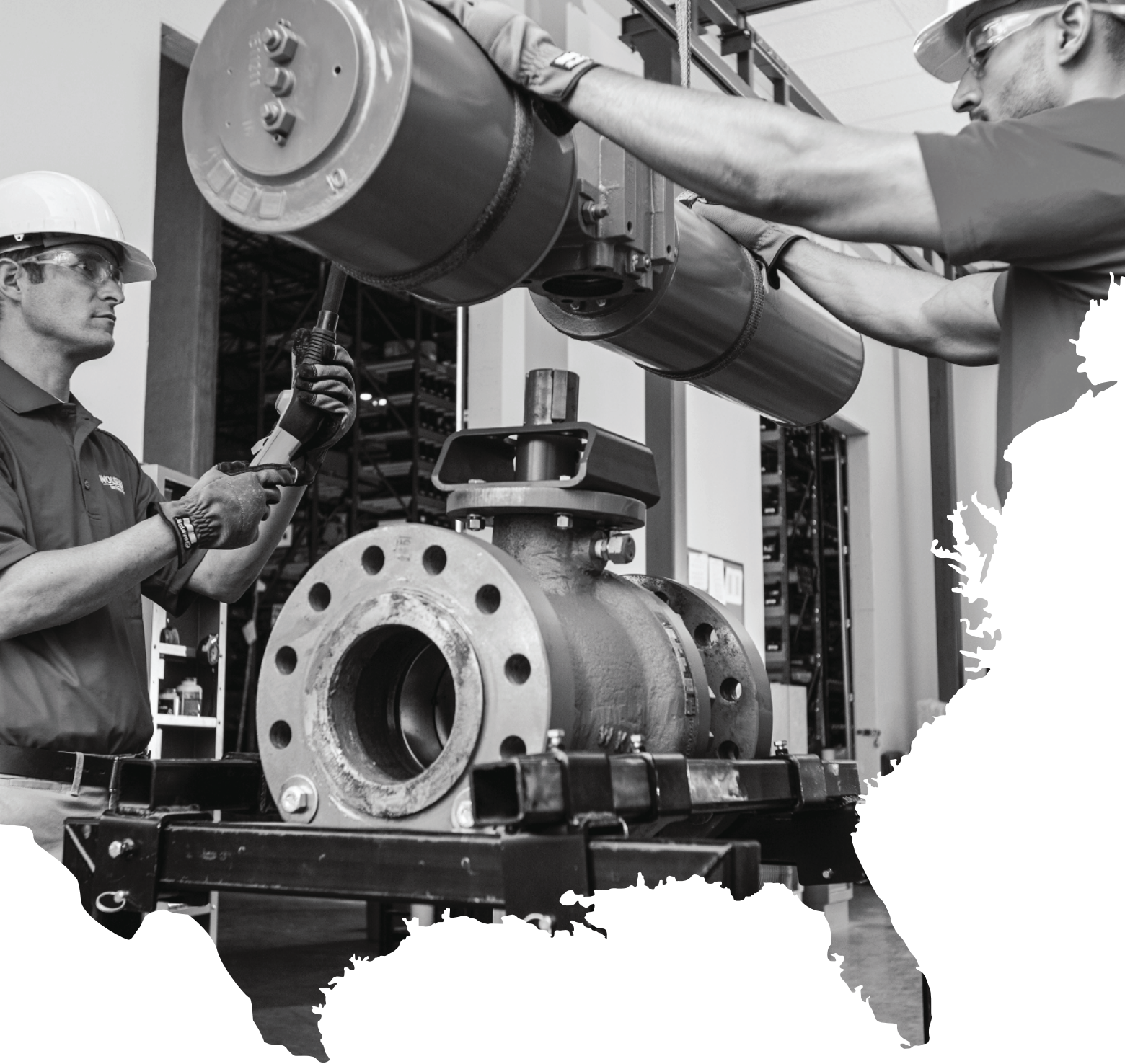
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70
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2022 Market Outlook

The year ahead holds great promise on many fronts as we continue to emerge from the pandemic. Questions remain, however, on how ongoing supply chain and labor challenges, international relations and legislative outcomes will impact how 2022 unfolds. COVER IMAGE BY GETTY IMAGES

BY MARGO ELLIS

22 IN THE AIR: WIRELESS TRENDS IN SMART PNEUMATICS

In today's wireless world it's no surprise that automation and manufacturing spaces have embraced—and sought out—the connectivity and convenience that wireless technologies offer.

BY ADAM GIBSON

26 PROPER CARE OF KNIFE GATE AND SLURRY VALVES

Even the best maintained valves fail—and knife gate and slurry valves are no exception. Often these failures are not easily predictable. However, detailed study and analysis of field failures can give us many pointers to take effective measures to extend service life.

BY DR. S. VIJAYAKRISHNAN

32 AN INTERVIEW WITH VMA'S NEW BOARD CHAIRMAN

At VMA's 83rd Annual Meeting, Ron Warren, president and COO of Bray International, Inc., was elected the board chairman of VMA for the next year. VALVE Magazine caught up with him to discuss his views on the industry and his chairmanship of VMA.

40 Editor's Picks

PRODUCTS



- > Steam-tight control valve
- > Smart hydrant and retrofit kits
- > Software for energy savings
- > IoT wireless monitoring sensor
- > Level transmitter with non-contacting radar device

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More from the 2022 Market Outlook:



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Pivoting to Meet Changing Needs



Pharmaceutical:
Healthy and Growing



Packaging, Tissue and Pulp:
Up and Down



Electricity:
A Flattening Market

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VALVE MAGAZINE

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Long-awaited Return to In-person Industry Events



The fall season brought the return of in-person events for the industrial valve industry. After more than 18 months without a gathering, the industry returned to end-user and customer events like MINExpo, WEFTEC, Offshore Technology Conference, INTERPHEX, and also to industry events like Valve World Americas and VMA's Annual Meeting.

While most of the events were smaller in size than before the pandemic, that did not hinder the enthusiasm for coming together in person to see new innovations, products and of course being able to network and catch up with industry colleagues face to face. If what I witnessed and heard is any indication, the industry is poised to emerge from the pandemic stronger than ever, even given the many challenges facing the industry—supply chain issues, workforce shortages, governmental regulations and United States-China trade relations. The 2022 market outlook report outlined on page 14 also supports this. You will see a few additional markets covered this year, such as hydrogen, mining and pharmaceuticals, as well as traditional markets like water/wastewater, oil and gas, commercial construction and chemicals.

You can find a recap of the VMA/VRC Annual Meeting in the VMA News section of the magazine, and on page 32 we introduce to you to VMA's new Board of Directors Chair, Ron Warren, president and chief operating officer of Bray International Inc., who was elected at the meeting.

In this issue we also explore topics surrounding the valves used in hydrogen production, written by the 2021 VMA Person of the Year Award winner and frequent contributor to VALVE Magazine, Greg Johnson from United Valve. Also check out the information on standards related to fugitive emissions and take a look at the feature on valve automation related to wireless pneumatic controls.

I hope you enjoy the issue, and I look forward to a full recovery of the events in our industry over the next year!

Heather
Heather Rhoderick, CAE
President

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MERGERS AND ACQUISITIONS

Clearlake Capital-backed FloWorks Acquires Genesis Systems

FloWorks, backed by Clearlake Capital Group, L.P., has acquired Genesis Systems, a distributor of control valve, regulator, and valve automation products and systems. FloWorks is a leading MRO-focused specialty valve, rotating equipment and flow control distribution platform differentiated by its specialty products and technical solutions for industrial markets. Founded in 1999, Genesis Systems offers a full suite of valve solutions from the world's leading manu-

facturers, servicing a range of industrial and commercial markets. Headquartered in Garland, TX, the company has an extensive, state-of-the-art valve automation center specializing in the assembly, repair and testing of valves and valve automation equipment. The Genesis Systems management team will continue with the company.

Fairbanks Morse Defense Acquires Hunt Valve Company Inc.

Fairbanks Morse Defense (FMD), a portfolio company of Arcline Investment Management, has acquired Hunt Valve Company Inc., a specialty manufacturer of naval valves and electro-



mechanical actuators. This acquisition expands FMD's capabilities and service solutions for shipyard, defense, and industrial customers – including its support for and offerings to the U.S. Nuclear Navy.

The transaction includes Hunt Valve, the Hunt Valve Actuator Division, MB Valve (Montreal Bronze) and Pima Valve, LLC.

Neles Acquiring Valve and Pump Businesses of Flowrox

Neles has signed an asset purchase agreement to acquire the valve and pump businesses of the Finland-based technology company Flowrox. The acquisition will complement Neles' offering and exposure to the mining and metals industry.

The mining and metals

PEOPLE IN THE NEWS

PROMATION ENGINEERING has hired **Tom Wayer** as national sales manager. Wayer brings extensive knowledge and experience in process and control to ProMation. He has previous national sales and marketing leadership positions in heating ventilation and air conditioning, geothermal installations, high-tech construction and energy recovery systems.



Tom Wayer

EMERSON has recognized **Deepa Malhotra**, director of commercial operations for Emerson's power and water solutions business, with a STEP Ahead Award by The Manufacturing Institute, the workforce development and education partner of the National Association of Manufacturers (NAM).



Deepa Malhotra

Malhotra is being honored alongside more than 100 women who have demonstrated excellence and leadership in their manufacturing careers.

Throughout her 16 years at Emerson, Malhotra has been responsible for marketing, sales and business strategies, project management and customer relations.

CONVAL recently appointed **Glenn Heglund** of Minooka, IL, as Midwest regional sales manager.

Heglund is an experienced valve professional, spending more than 35 years in a variety of operational, sales and

marketing roles at Forum Energy Technologies and MRC Global.

VALVTECHNOLOGIES has named **Juliana Herman** as director of global marketing and **Joseph Miller** as industry director

Herman is responsible for the development and deployment of ValvTechnologies' marketing strategy, product and brand management, marketing programs, communication campaigns, and market analysis on a global basis.

ValvTechnologies has also announced the appointment of **Joseph "Joe" Miller** as industry director for the company's fossil power division. Based in Denver, CO, Joe will have global leadership responsibility for ValvTechnologies' power industry group, with a focus on business growth and customer performance in the severe service marketplace.



Juliana Herman

AIV, LP announced that **Trey Cook** will become the CEO of both AIV and GCM while remaining the president of AIV.

Ryan Loving will now be the CFO of both AIV and GCM, while remaining the president of GCM.

Former CEO Ray Cook II said, "Their hard work and dedication have truly shown through the years, and we know that both companies will continue to be in great hands under their leadership." The day-to-day operations of AIV and GCM will remain unaffected as Trey and Ryan have been operating in this capacity for some time.

market is expected to have strong short- and mid-term growth for the next decade, driven by the increasing demand for metals, ore depletion and underlying investments into more efficient processing.

EGC Holding Company Acquires Slade Inc.

EGC Holding Company LLC has acquired Slade Inc., a Statesville, NC, manufacturer of patented graphite yarn and braided valve and pump packings. The acquisition of Slade will expand EGC's product offering to the valve OEM and MRO markets, which currently includes quick turn VSG graphite pressure seals, engineered graphite die formed rings, die cut gaskets, laminated sheets and graphite roll material. EGC will maintain operations in Chardon, OH, as well as Statesville, NC.

NECI Announces Merger with Northeast Controls

New England Controls Inc. (NECI) and Northeast Controls Inc. (NCI) have agreed to merge their two companies. NECI and NCI are Emerson Impact Partners serving customers in New England and upstate New York.

The combined entity will do business as NECI and bring the broad service offerings NECI has built over the last 20 years to the New York market, allowing plant owners to improve efficiencies, increase throughput, reduce operating costs and extract more value from their plant investment.

Baker Hughes' Subsea Drilling Systems and Akastor's MHWirth Merge

Baker Hughes' Subsea Drilling Systems and Akastor

ASA's MHWirth have merged to form a global offshore drilling equipment company. The new company will be known as HMH, and Baker Hughes and Akastor own equal equity in the company.

HMH is said to combine integrated delivery capabilities, capital, industry expertise and offshore drilling equipment products and packages at scale. HMH aims to support the industry's transition toward more energy-efficient solutions, as well as deploy technologies and service solutions.

HMH is headquartered in Amsterdam, Netherlands, with two major operational centers in Houston, TX, and Kristiansand, Norway. HMH is currently a privately owned company.

CONTRACTS AND PARTNERSHIPS

Eastern Controls and DeZURIK Announce New Partnership

Eastern Controls Inc. (ECI) has officially announced its partnership with Minnesota-based DeZURIK Inc. as the exclusive Industrial representative for the Northern New Jersey and Metro New York industrial markets.

DeZURIK is a global leader in manufacturing valves, actuation and accessories for industrial fluid control applications. "Eastern Controls is proud to announce the addition of DeZURIK to our manufacturer's portfolio," said ECI President, Cliff McLaughlin.

ValvTechnologies Welcomes Quality Controls Inc. as a Distributor

ValvTechnologies, a leading manufacturer of zero-leakage, severe service isolation valve solutions, welcomes Quality Controls Inc. (QCI) as a new distributor. QCI represents ValvTechnologies in Eastern Pennsylvania, Southeastern New York, New Jersey and Delaware for downstream and chemical processing and fossil power products.

Baker Hughes and Primus Line Collaborate on Composites

Baker Hughes, a global energy technology company, has signed a memorandum of understanding with Primus Line to collaborate on non-metallic pipe applications to rehabilitate and repurpose existing pressure pipelines, offering more cost-effective options for pipeline repair and replacement, as well as the repurposing of existing pipeline networks for hydrogen and CO₂ transportation.



Under the agreement, Baker Hughes and Primus Line will collaborate on commercial models and joint customer offerings to drive non-metallic pipeline growth in the pipeline integrity management market.

Emerson and BayoTech Join on Delivery of Hydrogen

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Valve Basics (VMA) Virtual
vma.org/valvebasics

Valve Forum (VMA) Virtual
vma.org/valveforum

JANUARY 2022

26-28 POWERGEN International
Dallas
powergen.com

31 - FEB 2 AHR Expo
Las Vegas
ahrexpo.com

APRIL

6-8 Valve Forum: Conference & Exhibits
San Antonio
vma.org/valveforum

MAY

2-5 OTC (Offshore Technology Conference) 2022
Houston
otcnet.org

AUGUST

3-4 Market Outlook Workshop (VMA) Virtual
vma.org/marketoutlook

SEPTEMBER

7 VMA/VRC Annual Meeting*
Santa Barbara, CA
vma.org/annualmeeting

OTHER VMA EVENTS

Please visit vma.org/calendar for additional programs as they are scheduled.

* Open to VMA/VRC members only. Visit www.VMA.org to learn if your company qualifies for membership.

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ARTICLE SUBMISSIONS
VALVE Magazine
welcomes articles, proposals, manuscripts, photographs and ideas from our readers. For a copy of the magazine's Author's Guidelines, contact Margo Ellis, Editor-in-Chief,
at mellis@gardnerweb.com

and technology leader Emerson announced a multi-year strategic framework agreement with BayoTech, an innovator in hydrogen solutions, to accelerate the delivery of hydrogen worldwide. Emerson will deliver advanced automation technologies, software and products to enable BayoTech to build hundreds of hydrogen units to produce cleaner, lower-cost hydrogen.

BayoTech's modular hydrogen generation units produce up to 1,000 kg per day, enough to fill as many as 200 hydrogen fuel cell vehicles. BayoTech's patented technology requires less feedstock, which means lower carbon emissions and less cost to produce hydrogen than traditional reformers. Using Emerson's PLC and edge control technologies, remote monitoring and Microsoft Azure IoT Suite, the unmanned, fully autonomous skids will operate and be monitored remotely from BayoTech's Albuquerque, NM, headquarters.

Flow-Tek Signs Agreements with the Macomb Group and Nooney Controls

Flow-Tek announced the Macomb Group (Sterling Heights, MI) has been appointed the M4 Severe Service Ball Valve Master Distributor and Center of Excellence for the Midwest. This follows the recent appointment of Nooney Controls (North Kingston, RI) in the Northeast. The Series M4 is specifically designed for vent, drain and isolation applications for the power industry and are available in sizes 1/2" - 4" NPS, in materials including A105, F22 and F91/92.

ACHIEVEMENTS

Emerson Helps Alaska's Wind Farm Provide Affordable Clean Energy

Emerson announced the completion of a digital transformation project to increase the reliability of clean energy generation at Golden Valley Electric Association's (GVEA) Eva Creek wind farm. The project improves the management of Alaska's largest wind farm.

As the largest electric utility serving northern Alaska, GVEA and its Eva Creek wind farm supply nearly 25MW of reliable, low-cost electricity to customers, while reducing fossil fuel usage.

Champlin, MN Selects Mueller Advanced Metering Infrastructure

The City of Champlin has selected Mueller to replace about 8,000 residential, commercial and irrigation water meters with solid-state ultrasonic water meters and advanced metering infrastructure. The new system will provide two-way radio communication, giving staff access to real-time and historical data when responding to concerns of high consumption, water loss, freezing temperatures or customer account inquiries.

The Mueller solid state meters and two-way transmitters will eliminate the need for a worker to perform monthly drive-by collection of data, providing the city with significant personnel time savings that can be better spent elsewhere.

Emerson Helps Colgate-Palmolive Pursue Net Zero Carbon

Emerson is collaborating with consumer products manufacturer Colgate-Palmolive Company to reduce wasted energy in Colgate's product packaging facilities and contribute to its goal of achieving net zero carbon emissions in operations by 2040. Using data from Emerson's advanced sensor technologies and analytics, Colgate reports it has already seen a 15% reduction in energy usage. The project is part of Colgate's digital transformation program and uses specialized Aventics pneumatic sensors and IIoT-enabled software to precisely monitor compressed air flow in real time to identify leaks, optimize pneumatic processes and improve air flow efficiency. Given the heavy reliance on pneumatics in large-scale consumer goods production, reducing the amount of energy associated with compressed air contributes not only to sustainability efforts, but also to overall equipment health and reliability.

ValvTechnologies Supplies Mining Pipeline Isolation Valves

ValvTechnologies, manufacturer of severe service isolation valve solutions, has been selected by a major metals producer as the leading supplier for pipeline isolation valves in South America. The company's valves have been used on site for many years, showing excellent performance. To streamline operations and improve performance, the customer has decided to maintain AbrasoTech valves exclusively, replacing others on site. VM

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VMA's 83rd Annual Meeting brings members together in person with meaningful programming, networking opportunities and excursions

The 2021 VMA/VRC Annual Meeting in Scottsdale, AZ, welcomed VMA and VRC members back to in-person events. Based on the excitement and energy throughout the event, taking place Oct. 6-8, the meeting focused on essential excellence: motivation, innovation and adaptation—a prevailing theme during the three-day gathering.

Arie Bregman, vice president and general manager at DFT Inc., and outgoing VMA chairman, kicked off the event by welcoming in-person and virtual attendees alike. As the valve industry has adapted to changes driven by the pandemic, there was much to celebrate. Members were dedicated to keeping their employees safe, and we were able to keep our customers operating so they could deliver essential services and products.

SPEAKERS AND QUESTIONS

Annual Meeting attendees heard from several experts during the meeting who talked about topics key to the valve industry.

Keynote speaker Tyson Voelkel, president, Texas A&M Foundation, shared his leadership insights during a candid discussion that focused on uniting purpose and passion, developing talent and trust within teams, and empowering employees to realize their potential—even when they don't fully know their capabilities. Voelkel shared how he used his experience in the Armed Forces to explain how leaders can build relationships and trust with their teams by improving their communication and helping them see past what is dividing them to focus on the bigger picture so they're able to achieve objectives and goals.

Michael Halloran, CFA, associate director of research and senior research analyst at Robert W. Baird, and Simona Mocuta, senior economist at State Street Global Advisors,



provided an overview on how the U.S., Canadian and global economies have been recovering since the start of the pandemic. While the United States continues to be ahead of the pack when it comes to recovery, it won't be long before the European recovery catches up due to its unusual amount of spending—a break from the usual austerity measures it typically adopts in times of economic uncertainty. Canada also continues to recover steadily, but Canadian households have become more indebted than U.S. households due to a steep increase in home prices that could impact its recovery.

Jim Ellis, a 35-year veteran of politics at the state and national levels, along with Dustin Painter, partner at Kelly



Receiving the association's highest honor, Greg Johnson is awarded Person of the Year at the 2021 VMA/VRC Annual Meeting awards dinner in Scottsdale, AZ.

PHOTO CREDIT: HARLEY BONHAM



Drye, shared their analysis on current legislative issues surrounding infrastructure, “Buy America,” tariffs, taxes, U.S. international relations policies and the 2022 mid-term elections.

Steve Goreham, an independent scholar, researcher and futurist in the fields of energy and environmental policy and former business executive, reviewed how current energy topics such as energy transference, renewables, hydrocarbons and alternative vehicles, among others, will impact the valve industry. A few key predictions from Goreham included: the 2050 net-zero goal being unlikely to happen due to the challenges of achieving it; the energy transition will end in shared hydrocarbon/renewable future; high prices for copper, cobalt, lithium and nickel needed for electric vehicles (EVs); and transition issues for consumers as the shift to EVs takes place.

SHARING IN DISCUSSION FORUMS

The program also featured a series of group discussions interspersed with the formal presentations. A combination of in-person and video conferencing discussed diversity and inclusion and the continued effects of COVID-19, which featured Mark Claffey, president, Trillium Flow Technologies; David Loula, director of products and markets, ITT Engineered Valves; David McHugh, vice president of business development, Allied Valve Inc.; and Dave Johnson of Neles. The panel discussed how they have adapted their companies to address various social and environmental issues that have

become more prominent recently and how they’re impacting their communities. The key to successfully addressing issues, whether it be social or environmental, is investing in employees and getting them involved to help create and implement the initiatives that bring about change.

RECOGNIZING VMA'S BEST

Just as it has in previous years, VMA honored individuals during this year’s meeting. Receiving the association’s highest honor, Person of the Year, was Greg Johnson, president of United Valve.



PHOTO CREDIT: HARLEY BONHAM

Ron Warren (left), incoming VMA Board of Directors chair, and Arie Bregman, outgoing chair, mark the coming change as Warren is bestowed the ceremonial gavel.



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Johnson has been influential in many aspects of the association, including serving on the VMA Education and Training Committee, Marketing and Communications Committee, and the VALVE Magazine Editorial Advisory Board. He also is currently on the VRC Board and has been a Service Award and Person of the Year recipient. VMA Chair Arie Bregman commented, “Greg continues to dedicate his time and expertise to better every aspect of the VMA and VRC.”

Also honored at this year’s meeting were Don Bowers of Conval Inc. and John Molloy of Emerson Automation Solutions, both of whom received a VMA Service Award for having gone above and beyond in supporting VMA, contributing to committee efforts and working with committees and staff to deliver value. Bowers was recognized for his role in the VALVE Magazine Editorial Advisory Board as the magazine went through a revamp over the last year. Molloy was recognized for his role in the Education and Training Committee as the association continues to adapt its content to more online education and events due to the pandemic.

There was also much to celebrate with respect to the VMA, including the progress of the newly formed Government Affairs Committee (GAC). The GAC has been busy since inception earlier this year and has been working on a list of legislative issues, with the current three issues foremost:

- **Budget reconciliation bill:** VMA continues to do its part to oppose this bill due to the negative impact of raising taxes on small and large companies.
- **Infrastructure Investment and Jobs Act (the Infrastructure Bill):** Some provisions in this bill still require further guidance, such as the “Buy America” provisions, which VMA will work to address, but overall VMA supports the Infrastructure Bill because we believe that it will create jobs.
- **Vaccine mandates:** VMA is working with both NAM and the U.S. Chamber of Commerce to help bring clarity to this emergency order.

There was also a focus on the long-term direction of the VMA with the approval of the association’s first-ever formal strategic plan. It was developed using a compilation of feed-



PHOTO CREDIT: HARLEY BONHAM

The ability to hold this year’s Annual Meeting in person held special meaning to members as the hope for more normalcy remains high as 2022 approaches. Members enjoyed a beautiful dinner for the final night and capstone awards ceremony to reflect on the accomplishments for the year and also look ahead to a new year for VMA’s initiatives.

back and comments from the Strategic Planning Committee, staff, the VMA Board and member surveys. The strategic plan focuses on five priorities for association:

- **Strategic Priority 1:** Be member driven.
- **Strategic Priority 2:** Encourage industry and member company growth, interaction and innovation.
- **Strategic Priority 3:** Be the unified voice of the industrial valve industry.
- **Strategic Priority 4:** Demonstrate thought leadership and provide industry expertise and education; educate members, end users and the industry to facilitate innovation, efficiencies in production and distribution, increases in health, safety and environmental protection; and to promote the proper use of flow control equipment throughout the world.
- **Strategic Priority 5:** Represent the industry to policymakers, enhance advocacy and influence government activities to create a positive business operating environment and opportunities for industry growth.

The board then discussed the plan and agreed with the vision, mission, core values and priorities that were presented along with some additional changes that were recommended, including increasing the importance of being a more member-driven association in a way that engages members, promotes member value, commits to diversity and demonstrates operational excellence by providing the financial, staff and member resources needed to achieve our priorities.

NEW LEADERS FOR VMA

As part of the association business meeting, Arie Bregman announced the 2021/22 board slate. The following new and returning leaders for VMA were subsequently elected by the membership. Serving on the Executive Committee are:

- Board chair: Ron Warren, presi-

dent and chief operating officer, Bray International Inc.

- Incoming chair/treasurer: Matt Theil, president, AUMA Actuators Incorporated
- Nathan Brunell, product line general manager, Baker Hughes
- Andy Duffy, vice president of sales, Emerson/ASCO
- Immediate past chair: Arie Bregman, vice president and general manager, DFT Inc.

RETURNING AS BOARD OF DIRECTORS MEMBERS:


- Alejandro (Alex) Alcalá, senior vice president, Crane Co.
- Mark Claffey, president, Trillium Valves USA
- Andrew Duffy, vice president of sales, ASCO
- Seth Guterman, CEO, American Valve
- David Loula, director, Global Products and Markets, ITT Engineered Valves
- Kevin McKown, general manager, Curtiss-Wright Nuclear
- Kevin J. Tinsley, senior vice presi-

- Rob Velan, executive vice president, MRO and Aftermarket and vice chairman of the board, Velan Valve Corporation
- Kirk Wilson, president, Flowserve, Flow Control Division
- Brian Wright, president/CEO, A-T Controls

APPROVED AS NEW BOARD OF DIRECTORS MEMBER FOR A THREE-YEAR TERM:

- Danilo Garcia, president, RF Valves Inc., Hanover, MD.

Additionally, the VMA Board of Directors agreed on the need to create up to three ex-officio (non-voting) opportunities on the Board to provide additional diverse viewpoints to board discussions, the opportunity for future leaders to learn more about VMA and provide their input on strategic discussions. VMA welcomes the following individuals:

- Scott Jackson, president and CEO, FloWorks (Distributor)
- Rachel Hollinger, DeZURIK (Manufacturer) 



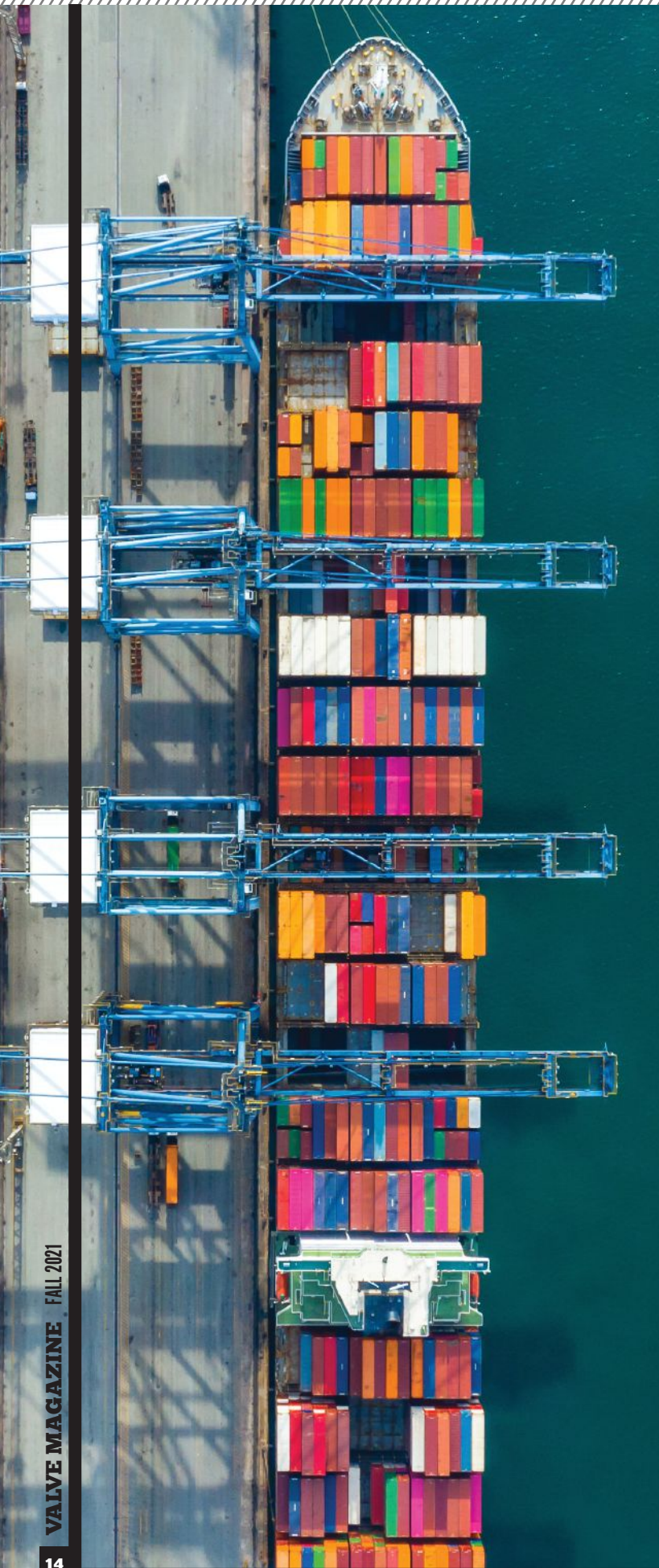
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Market Outlook 2022

Forecasts Stability and Cautious Optimism

VMA's annual Market Outlook Workshop reflects on growth and looks ahead to a stabilizing 2022, although supply chain and labor issues loom large.

BY MARGO ELLIS

Greek philosopher Heraclitus is quoted to have said, "There is nothing permanent except change." This notion captures this year's Market Outlook Workshop (MOW) that looked ahead to 2022 through the lens of a broadly positive 2021. Unsurprisingly, COVID-19 has had a considerable impact on every market and industry, and as this is written, the Delta variant is adding more contingencies that have yet to be borne out. What was clear, however, is that while uncertainties remain, 2021 has been a year of growth and 2022 is on track to continue that trend, albeit with some predicted slowing. Also inextricably linked to COVID's lasting effects, repeated themes of supply chain issues, labor shortages and inflation dominated much of the experts' presentations.

Marking its second year of the MOW being virtual only, about 150 people participated in the online event that included expert presentations on global and domestic economic outlooks, Wall Street trends, pending congressional infrastructure plans and international trade. Attendees also had a chance to ask questions of the speakers and engage via live question-and-answer sessions throughout the two-day event that is jointly produced by the VMA and the Hydraulic Institute.

IN CONSIDERING WHAT LIES AHEAD FOR END-USER MARKETS IN THE COMING YEAR, THESE THEMES PREVAILED:

- Overall, the news for 2021 was good with soaring consumer demand as the United States and the world balanced vaccination rates with a handful of variants that continue to play a pivotal role in what the future holds. By and large, the belief was that the broader recovery will continue, albeit with drawbacks tied to employment needs, supply shortages, inflationary spending, stimulus monies and the world's collective effort to emerge from and adapt to the COVID-19 pandemic.
- Domestically, much hinges on the massive \$1.2 trillion bipartisan infrastructure package that is in flux at the time of this writing. The bill would include \$55 billion for water and wastewater—a tenfold increase in funds if the legislation is passed. With a related budget reconciliation bill for fiscal year 2022 also hanging in the balance, forthcoming negotiations in congress will have a major impact on associated spending that will affect the valve and pump markets.
- International trade relations with China will remain tense as both countries are concerned with self-interests, decoupling efforts and anti-trust standards, making dealings more difficult and costly in the future. China will continue to be a motor for economic growth—even more than usual.

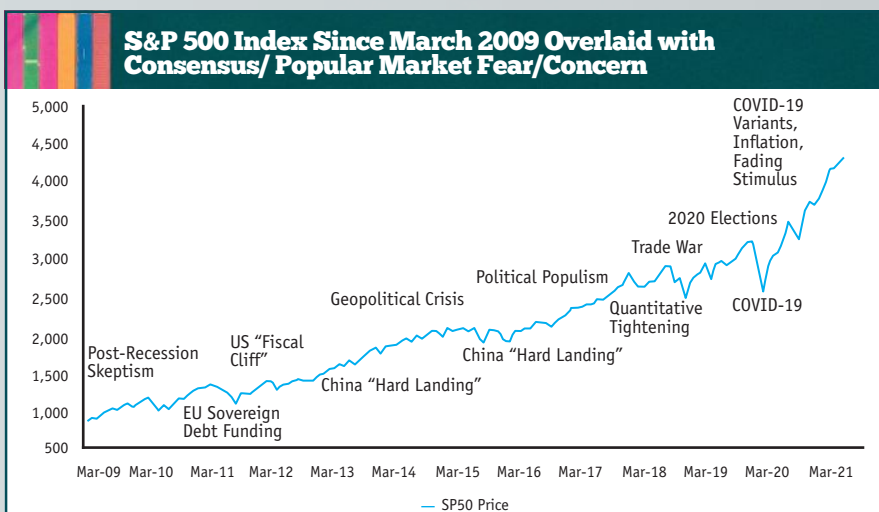
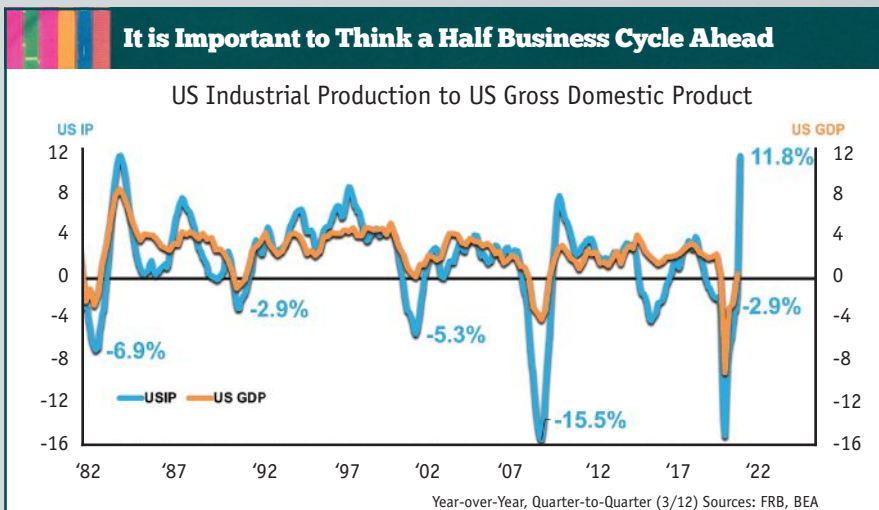
- Many sectors are focused on issues concerning climate change and associated environmental, social and governance (ESG) topics as pressure mounts from investors to make significant steps toward decarbonization and water conservation, particularly in the western U.S.

ECONOMY

As Michael Halloran, CFA, associate director of research, senior research analyst at Baird, aptly commented, "We are in the middle of a staggered recovery and, in many respects, staggering as we continue dealing with all the complications of COVID-19 and recovering from those lows." With 18 months of the pandemic casting a shadow over almost every aspect of our lives and the global economy, Halloran said, and with the looming

uncertainties, a linear recovery should not be expected. "Keep an eye on the big picture: We are likely in front of a very healthy industrial recovery cycle, but short-term volatility will continue in the meantime," he added. The focus will turn to these issues:

- Lingered COVID-19 variants and global responses.
- Sustainability of recovery, transitioning/inflecting end markets.
- Impacts of eventual fading fiscal and monetary stimulus.
- Debate over inflation as to whether it's transitory.
- Global supply chain capacity and the ability to ease bottlenecks.
- Trade tensions remaining elevated.
- Unemployment improvement with fiscal stimulus running out.
- Merger-and-acquisition activity.



In future-looking models, both economic experts, Halloran and Connor Lokar, speaker and senior forecaster, ITR Economics, acknowledged that while the pandemic is an uncertainty driver, they predicted that lockdowns and a second wave of closures are not likely to happen—it can't be altogether ruled out, but it's not probable. This is, of course, critical given that the workforce is greatly impacted if schools and daycare providers were to close again, requiring parents to stay home with their children.

Relatedly, Lokar discussed a tendency toward supply chain panic and the risk of overordering and overloading at the peak of the pricing cycle. For instance, lumber futures have collapsed about 70% since the peak of May 2020 when consumers were home more and spending discretionary money on renovations (and the residential housing market remained extremely robust) instead of vacations and travel. "The supply side of the economy is really trying to make a comeback, but it just doesn't feel like it because demand is so robust and a paradigm shift for 2022 that we're seeing is the supply side finally catching up," he said.

Capturing the overall view of industrial stocks, Holloran said, "The underlying fundamentals of industrials are doing well, and that's what we're focused on. If you have a strong cycle ahead of you where you have earnings power, earnings growth, revenue growth, it tends to be a pretty good leading indicator of why we're bullish on the stocks is because, in part, where the industrial cycle can go from here."

Looking at the valve and pump industries, specifically, their demand is correlated to end-market exposures, capex investment, heavy industry exposure and valve-replacement opportunities with increased MRO as repair needs will likely grow in 2022 and well beyond. Also discussed were research and development technology drivers, diversity of end markets and the types of valve applications that manufacturers focus on as meaningful factors on a long-term basis.

HALLORAN TOUCHED ON A FEW END-USER MARKETS:

- **Engineering and construction**—Backlogs still exist, which suggests a better spending environment and a willingness to undertake large projects. As with last year, cancellations are not materializing for the most part.
- **General industrial projects**—Expect to see very healthy revenue growth as experienced this year continue in 2022, recognizing that the recovery curve will likely have "stops and starts" given global challenges that center around ongoing supply chain problems.
- **Oil and gas upstream and midstream**—Oil pricing recovered in 2021 as economic and mobility conditions have improved, although prices have been volatile. Baird expects oil pricing to remain, and now-stable levels determined by OPEC that are corresponding with increasing demand associated with a choppy but generally positive emergence from pandemic-related restrictions and closures.
- **Oil and gas late-cycle**—Downstream processes in oil and gas and chemicals short-cycle work have started to move, Halloran said, but again expect a rather bumpy progression as some projects continue to lag but to expect an overall upward trajectory.
- **Traditional and legacy power generation**—"I think traditional power gen is fading and we'll see far more replacement-oriented investment, regional variability and some of the more mature markets going far more to alternative investments," explained Halloran, and then added, "I will tell you that the companies I have exposure to that have traditional legacy exposure or oil and gas exposure are all figuring out how they can pivot toward higher-growth, more sustainable areas of investment." However, in this context he went on to clarify that sustainable doesn't necessarily

mean ESG; it means sustainable for their own enterprise and business platform. This process of transitioning will last a long time, he predicted.

OIL AND GAS

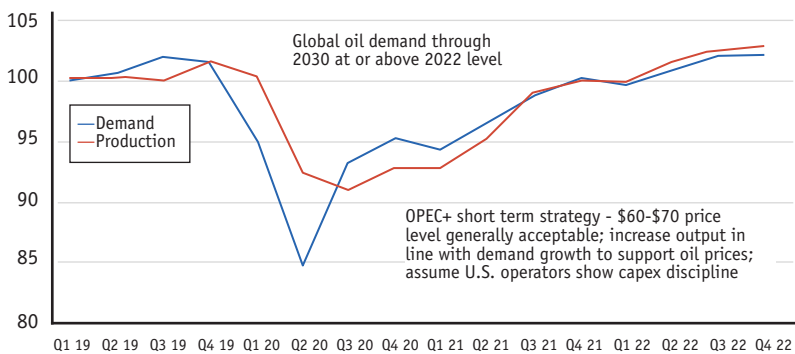
On the heels of 2020 and its unprecedented decline where the U.S. rig count had fallen below its 80-year low point, activity has doubled in the past 12 months, due in large part to behavioral changes associated with the pandemic. John Spears of Spears & Associates, making his regular annual presentation to VMA and HI audiences, reflected on many aspects and ups and downs seen in these turbulent times for the industry but said the sense overall for better days ahead is palpable.

In terms of fundamentals and where the global demand and supply is headed, Spears drew on 2019 numbers, explaining that it's informative to see that, on a global basis, demand is sharply improving and will soon be back to pre-pandemic levels. Estimates show that oil demand has averaged 98 million barrels per day (bpd) in 2021, a 5.9% increase and is expected to climb another 3.7% to 101 million bpd in 2022.

Pursuing a strategy since the latter part of 2020 of targeting oil prices in the \$60-\$70 range, Spears explained that OPEC+ (larger group formed in 2016 to have more control of the global crude oil market) members and other producers are restricting their production so that the supply doesn't grow faster than the recovery that is seen in demand. The thinking seems to be that if they undershoot the demand recovery it's acceptable because that means global inventories will begin to shrink, which will help to stabilize oil prices and he's predicting that this approach will continue into next year.

Spears forecasted that prices will gradually decline slightly to about \$65 per barrel—down from the peaks of \$75 per barrel seen in late June and early July of this year. He also said U.S. oil production will likely average 11 million bpd, up from 10 million bpd currently, both of which are lower than the 13 bpd being produced at the of

Global Oil Demand and Supply (mil bpd)



Source: EIA

Global oil demand to average 97.7 million bpd in 2021, up 5.9% and 101.3 million bpd in 2022, up 3.7%.

2019 when prices bottomed out at \$30 per barrel.

Gas production is following a similar and related trend as oil and is expected, per Spears' analysis, to rebound after its low point in 2020 and subsequent COVID-related decline. Spot gas prices look to be tracking at an average of \$3.20 per mmbtu, up from about \$2.00 per mmbtu at this time last year—an increase of 60%.

One key factor that Spears mentioned in looking at the long-term picture is energy transition and the global shift to combat climate change, entailing an increased use of electric vehicles and renewables as the effort to phase out fossil fuel production in the U.S., Europe and other parts of the world. Spears stipulated, "In examining the numbers, it suggests to us that global oil consumption will remain at or above this 2022 level for the balance of this decade and perhaps longer." So while changes are certainly afoot with a push toward reducing our carbon footprint, he said that over the next five to ten years, demand is expected to remain very strong, sustain higher prices and activity levels will continue to remain higher over time.

However, in what Spears described as an ongoing story regarding greenhouse gas initiatives, he finished up by asking what the future holds for this industry. "We've been in business as a company for over 50 years and I've been doing my work in oil field research for 40 years and, in probably the last

six months, I've had more discussions about the 10- and 20-year outlook for the industry than I've had in all those previous 39 years of working in this job, so clearly a lot of companies in this sector are asking themselves what kind of future might we expect for this business and beyond the issue of recovery in 2021 and 2022 from last year's decline," he stated, "and firms are clearly thinking about improving profitability while lowering their carbon footprint to mitigate their impact on the environment."

MINING

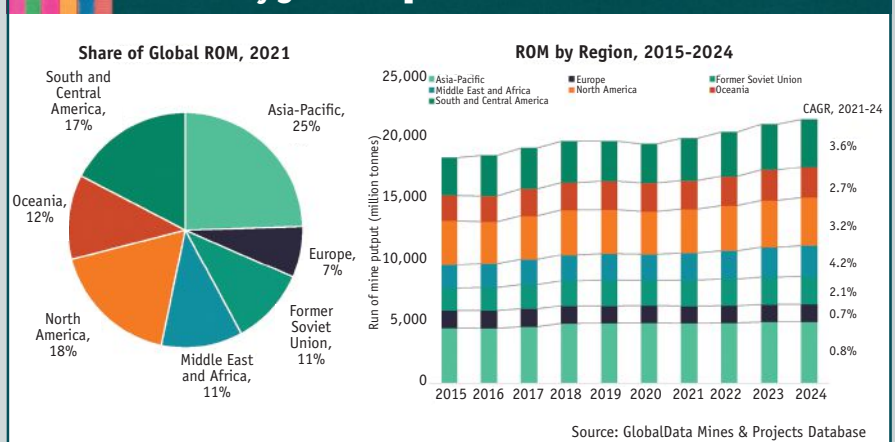
With a first-time appearance at the workshop, David Kurtz, director, Research & Analysis at GlobalData,

touched on myriad topics in the mining sector and its relevance in the marketplace for valves and pumps along with an overall discussion centered around timely ESG issues, particularly with declining grades and related effects on the environment.

Globally, mining generates about \$1.5 trillion per year and accounts for 1.8% of GDP. Like many sectors, said Kurtz, mining saw a production and revenue decline in 2020 due to COVID-19, but with commodity prices surging since May 2020 and production back on track since that time, 2021 is expected to finish strong and 2022 will show moderate growth. Within these figures, Kurtz noted that iron ore showed its resilience and has risen sharply in the ensuing months following the start of the pandemic, and backed by demand from the Chinese government's infrastructure spending, iron ore prices have doubled from their position in March 2020 when it was \$88 per ton and is now more than \$200 per ton. Similarly, copper has doubled in value since mid-2020 and also hit an all-time high of \$10,000 per ton in 2021.

"With a rise in commodity prices and commodity demand, miners are committing higher investments in 2021. After falling by approximately 6% in 2020, the capital expenditure of the top 20 miners is expected to rise by about 23% in 2021, which is the highest point since 2015," said Kurtz. And in keeping

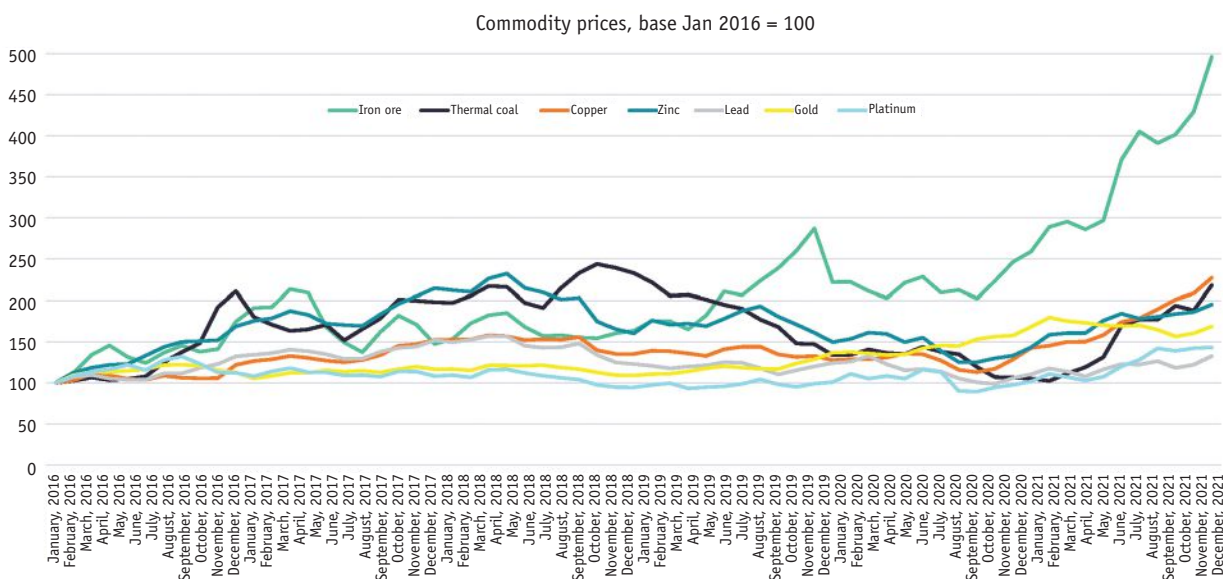
North America represents 18% of global mining activity, with steady growth expected



Source: GlobalData Mines & Projects Database

Highest growth in mining output, as measured by Run of Mine, forecast in Africa & the Middle East, followed by South & Central America.

After dipping in early 2020, commodity prices have surged



Source: GlobalData Mines & Projects Database

Prices of iron ore and copper are hitting all-time highs after brief COVID-19 slump.

with the broader ESG focus on renewables, he said it's expected that spending will be directed more toward those commodities that will support a transition to carbon reduction and EVs, such as copper, nickel, cobalt and lithium as opposed to thermal coal, for example.

In developing new projects, Kurtz spoke about challenges that miners face—namely that as good deposits of minerals have become scarcer on the surface, mining is forced to go underground, increasing costs significantly. Currently, among all operating mines, 25% are underground, but Kurtz said that's due to change with sites that are under construction or in development requiring increasing numbers of underground mines as part of a surface-underground hybrid site. These changes, he said, will lead to a greater need for pumps and valves in the more extreme environment of mining underground.

In wrapping up his presentation, Kurtz reiterated sustainability as a key initiative and emphasis for the industry with the goal of reaching net-zero emissions by 2050. He outlined a wide range of activities like community engagement prior to a mine's construction all the way through to rehabilitation at the end and said, "Miners

need to be environmentally sound and socially responsible in whatever they do."

HYDROGEN

In the evolving energy space, another newcomer to the MOW included the Fuel Cell and Hydrogen Energy Association (FCHEA). Director of External Affairs Connor Dolan presented on their members (and other outside groups) that have formed a coalition of major oil and gas, power, automotive, fuel cell and hydrogen companies, like Chevron, Shell, Microsoft, utility companies and several auto manufacturers, to develop a road map for hydrogen in the United States to expand the use of hydrogen by scaling up activity in the renewable energy system.

Dolan began by explaining the five uses of hydrogen, including power generation and grid balancing (hydrogen as an energy carrier and storage medium), fuel for industry, feedstock for industry, fuel for residential and commercial buildings and transportation fuel—all emerging markets as the United States moves toward decarbonization. One of the largest uses, Dolan said, is material-handling equipment like forklifts and lift trucks that are powering distri-

bution warehouses across the country. "Over the pandemic, more than 25% of all groceries in supermarkets in our country went through a warehouse or distribution center that used hydrogen-powered forklifts with 40,000 in operation today at companies such as Amazon, Walmart, The Home Depot, FedEx and others."

Dolan discussed and shared a Department of Energy map of the United States detailing hydrogen electrolyzer locations and capacity. In looking ahead, as demand increases, Dolan said, "We will need a lot of electrolyzers and energy-storage capabilities of taking electricity, running it through water and passing electric current through it and get zero-emissions fuel from that hydrogen."

Speaking specifically about the intersection of the hydrogen economy with pumps and valves, "Basically anything that moves or stores hydrogen needs a valve. Valves are very integral to our industry and important. Most hydrogen being generated today is using gaseous applications, but we are seeing a number of emerging production methods of liquid hydrogen and we have a number of members that are producing large-scale liquified hydro-

gen,” Dolan said. Relatedly, he went on to explain that hydrogen is typically moved using pipelines, of which there are only about 3,000 miles in the United States, mostly around the gulf coast and refining operations. A majority of the distribution network, however, is currently through trucking, which uses either compressed hydrogen trucks or liquefied hydrogen trucks, and any refueling station is going to need pumps and valves, as well as large-scale storage vessels and tanks.

WATER AND WASTEWATER

With clever framing of his presentation around movie series he binged during the pandemic (Star Wars, Star Trek, The Lord of the Rings, Harry Potter), Thomas Decker, of his eponymous consulting firm, provided a thorough and nuanced background on the state of this industry where valves and pumps are widely used.

Faring better than expected, 2020 wrapped up with just under 6% growth for water and wastewater (W/WW) as an industry. This is due to several factors, Decker explained, including W/WW markets being deemed essential construction during the pandemic; utility reserves; state and local revenues stayed high or increased due to property taxes; people working from home resulted in higher water use across the board; remote workers in the industry had success performing duties; RFPs going out to engineering firms continued; and the Paycheck Protection

Plan (PPP) funds kept many operations afloat.

Through April 2021, construction put in place has held steady and Decker expects the year to follow much like 2020 did where water use grew 9%, making up 44% of the mix, while wastewater grew 3% to account for the remaining 56% of the W/WW combination.

In addressing the Star Wars-themed topic of “the force awakens,” Decker dove into the numerous and somewhat revived (compared to the past eight years) legislative issues: pandemic relief, development of the infrastructure plan/bill and two or three regulations that will have some impact on the industry.

The first part of pandemic relief was the December 2020 omnibus package, Decker described, that contained the Low Income Household Water Assistance Program (LIHWAP), which helped cover payments owed to water utilities that had accumulated during the first several months of COVID-19 when a moratorium was placed on utilities shutting off customers’ water. The second part of pandemic relief he discussed is the Biden administration’s American Rescue Plan passed in March 2021; it included \$350 billion in aid to state and local governments—with W/WW being specifically mentioned—to be spread out in 2021 and 2022.

The other legislative component Decker discussed was the bipartisan infrastructure plan: President Biden’s

American Jobs Plan that came out in March of this year and is still in a state of flux. He did say, however, that he feels positive about needed funding coming out of all this legislation; it’s just a matter of what it will be in the end.

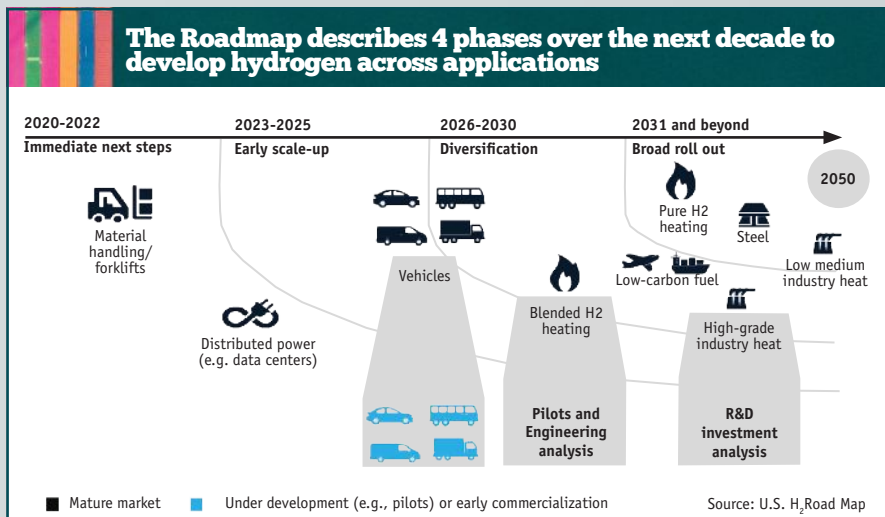
Onto the portion of his presentation that focused on drivers and restrainers, respectively as Star Wars: a New Hope and Star Trek: Nemesis, Decker detailed drivers as: aging/deteriorating infrastructure, drought, digitization, energy efficiency and public support and he listed the restrainers as: materials cost, worker shortage and labor cost, population growth and affordability. Of the various statistics and figures, a memorable one that reflects the need for improved infrastructure is the 9 trillion gallons of treated, pumped and distributed water annually that is wasted and does not reach customers.

The drought in the American West continues to pose significant problems for the W/WW industry in ways Decker understatedly labeled as challenging. The figures he presented (California reservoirs at 50%, Lake Mead at 37%, temporary and permanent desalination plants increasing and the Colorado River shortage declaration) revealed a harsh reality from an environmental standpoint, but these issues will drive work for the W/WW industry.

A final and interesting factor Decker brought up, with the census having just occurred in 2020, was that the United States had just 7% growth, which is the second-lowest rate ever recorded since the census began in the mid-18th century. A growing population is, of course, a driver for the W/WW industry.

CHEMICAL PROCESSING

Dually presented by Shaheen Chohan, vice president of Global Analytics and Trey Hamblet, vice president of Chemical Processing, both of Industrial Info Resources, the global chemical processing industry, like practically every market in the workshop has experienced a mix of headwinds and tailwinds in 2021, and 2022 still will show signs of uncertainty in the midst of the world’s tentative and choppy reopening as COVID-19 cases continue to fluctuate.



And also akin to other industries, the pervasive energy transition story will play a key role, as Chohan proposed that the pandemic as a disruptor may be a catalyst for longer-term and sweeping energy changes toward a lower-carbon future.

"The chemical industry is actually one of the most intense energy users of all manufacturing industries," Chohan said. 2021 has been vastly better with 6% growth, Hamblet explained, but uncertainty still prevails even as

production and manufacturing activity are up.

Current projects for 2022 show moderate growth of about 4.4% and delivery of 2021 fiscal support and infrastructure spending programs will be key to maintaining growth. "The reality of it is that chemical-derived end products have vast end-use applications, and in most instances plastics and rubber are very hard to replace with another product, so the long-term demand outlook continues to remain intact and look


very robust," Chohan said. A rather interesting dilemma the chemical sector finds itself in is, he added, "On the one hand we have strong demand with little product displacement, which is somewhat jarring against a societal awareness and shift away from plastics."

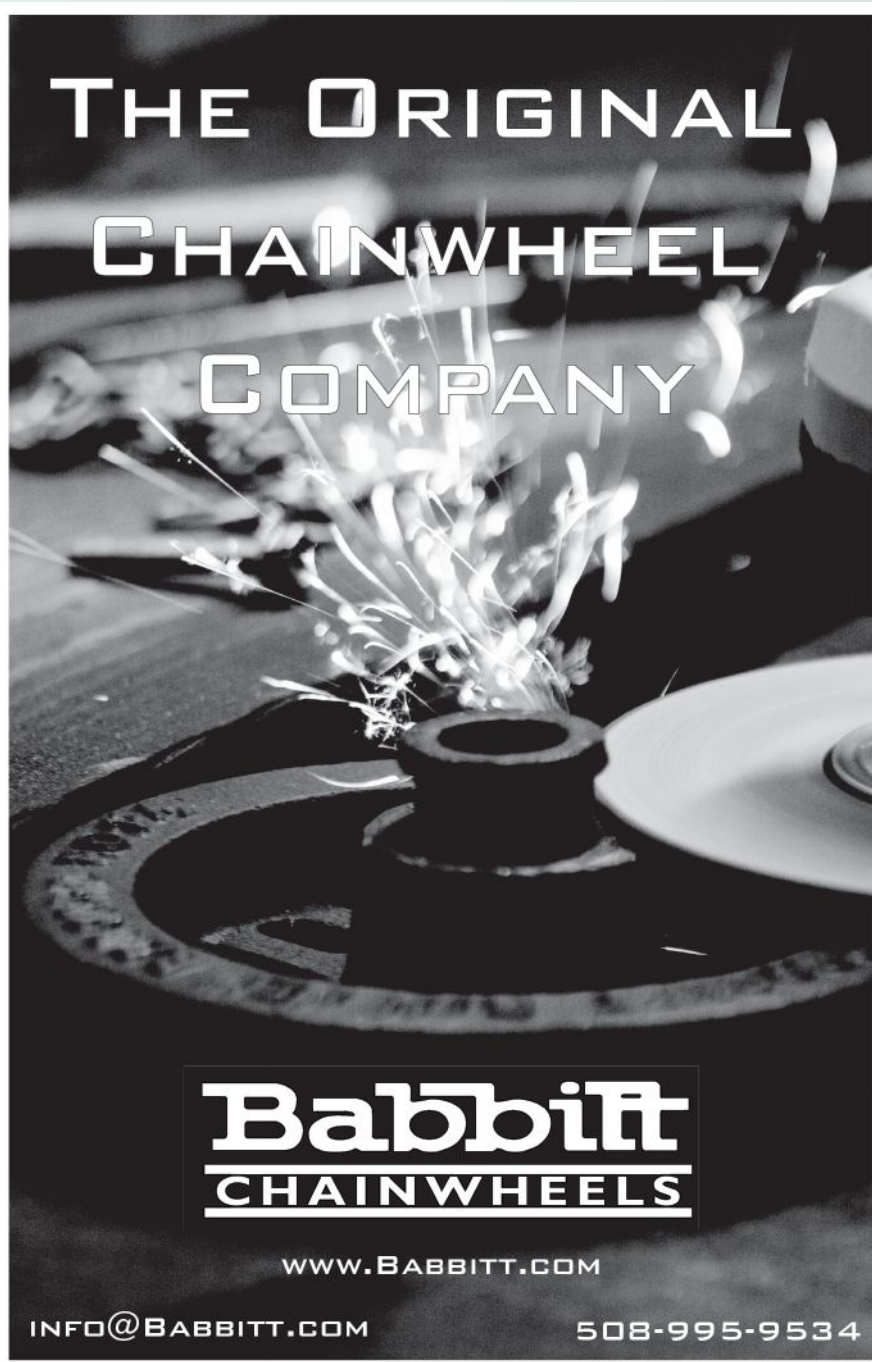
"If you look at the very significant changes in the consumer habits and spending specific to plastics over the past 18 months, and if you think back prior to the pandemic, the world had already moved away from single-use packaging everywhere it was possible and curb consumers' use of these plastics. We've now gone in the complete opposite direction; people want things individually packaged for health and safety, personal protection equipment, increase in deliveries at home or curbside all require an immense amount of plastic," Hamblet said. These abrupt changes will play a part in a long-term trend.

Other changes and increases in demand Hamblet described revolved around the segments of transportation (EVs, hydrogen-power vehicles, lighter, more efficient vehicles, coatings), green initiatives (solar and wind farms, batteries) and traditional growth (housing, agriculture, population). A relatively new and emerging concept Hamlet introduced to viewers is power-to-X, which in short is "taking renewable energy and producing this X commodity, which can be green hydrogen, green ammonia or green methanol, but it all starts with capturing that energy in a dedicated format to be processed in an electrolyzer to produce the green hydrogen be put toward end uses such as maritime fuel, power generation and mass transit fuel."

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Questions about VMA? Contact VMA President Heather Rhoderick (hrhoderick@vma.org).
Questions about VRC? Contact Marc Pasternak (mpasternak@vma.org).

In the Air: Wireless Trends in Smart Pneumatics

In today's wireless world it's no surprise that automation and manufacturing spaces have embraced—and sought out—the connectivity and convenience that wireless technologies offer.

BY ADAM GIBSON

Pneumatics is one technology where the demand for and innovation of wireless tools is growing. The latest wireless pneumatic devices remotely connect operators to pneumatic components such as valves—and often use phones, tablets and laptops to do it. Their new capabilities and direct, wireless access provide end-users with valuable benefits that can reduce downtime while improving convenience and efficiency.

IMPROVE EQUIPMENT EFFECTIVENESS

Pneumatics is one of the most widely used and effective technologies in today's automation systems. Pneumatic systems are ideal because they are proven to provide long operational life, as well as a low-cost and effective way to add various motion to equipment. As technology suppliers add intelligence to these widely used devices, OEMs and manufacturers have opportunities to build more sophisticated, smarter automation systems.

Pneumatic valve technology plays a critical role in today's high-speed automation machines and platforms. New wireless technology is now being introduced to enable easy valve system commissioning and configuration, as well as real-time access to pneumatic component diagnostics.



As sensing technology has advanced, it is now easier to monitor pneumatic actuators and valves and get actionable data without being cost-prohibitive. Pneumatics now ties in with the overall automation system to provide comprehensive, actionable performance data that can improve overall equipment effectiveness (OEE).

Reliable wireless communication interfaces now network large installations of widely distributed sensors, freeing facilities from the time and costs required to physically connect devices and freeing personnel from the need to physically check assets that could be out of easy reach.

These smart pneumatic technologies deliver actionable data, in real time, that machine operators and plant engineers use in two critical ways: to immediately respond to problems and issues with pneumatic components and to correct them before they cause significant problems or lead to significant downtime for automation systems.

Robust, high-performance pneumatic systems with real-time sensor data also provide the basis for data-driven, preventative maintenance programs. Data on valve performance, and whether pneumatic function is falling outside of established thresholds, now provides the basis for more predictive maintenance programs, helping to prevent unscheduled downtime by planning for component servicing and replacement in the most efficient manner possible.

SIMPLIFY VALVE COMMISSIONING AND CONFIGURATION

Even if it's planned, any downtime on the plant floor is money lost. This includes installation time. Easy commissioning and configuration get valve systems in service—and machines running—more quickly.

An advanced, modular fieldbus valve system interface helps simplify commissioning, installation and integration of pneumatic valves into the overall automation system. Such fieldbus valve systems enable faster start-ups and enhanced diagnostics that help identify

problems earlier and faster, contributing to increased equipment uptime and greater productivity.

A pneumatic fieldbus valve system connects to sensors incorporated with an automation system's pneumatic components. The system then captures and manages the data that sensors collect to provide operators access to valve status and diagnostics through a web browser dashboard. These fieldbus valve systems replace conventional hardwired solutions and integrate communication interfaces and input/output (I/O) capabilities to pneumatic valve manifolds.

When choosing a fieldbus system, it's important to select one with a full range of automation communications protocols, including EtherCAT, EtherNet/IP and ProfiNet. This enables PLCs to turn valves on and off more efficiently and to channel I/O data from sensors, lights, relays, individual valves or other I/O devices via various industrial networks.

The modularity of fieldbus valve systems often invite innovation that can amplify their capabilities. For example, there's now a wireless automatic recovery module that can easily be added as a "clip" into compatible, existing fieldbus platforms. The module provides real-time, wireless access to pneumatic component diagnostics, as well as supports easy valve system commissioning and configuration.

Sensor data from pneumatic devices networked through the fieldbus platform are sent via secured Wi-Fi connection to a web-based dashboard that can be accessed by any smartphone, tablet or laptop. Using the wireless automatic recovery module allows the valve manifolds to be fully commissioned and monitored prior to machine start-up; this includes setting operational thresholds and alarm settings.

It's an example of how wireless interfaces can more easily support a fieldbus platform's diagnostic and commissioning capabilities via an internal Wi-Fi access point. This wireless access can improve operational convenience and efficiency, especially in machine set-

tings where the valve system is located inside the machine or on the ceiling.

This web interface can also be used to commission all the features of the fieldbus module when it is first integrated into the overall automated production system. Operators using a wireless laptop or tablet can commission networking features such as IP address, subnet mask and gateway addresses for the fieldbus module, as well as valve manifold settings such as baud rates.

EFFICIENTLY DIAGNOSE COMPONENT ISSUES

Like drawn-out commissioning and configuration, endless troubleshooting can also eat away at productivity. A wireless automated recovery module clipped into a fieldbus platform can provide operators with convenient, wireless access to diagnostics that help identify potential issues quickly and efficiently.

Devices ranging from pneumatic cylinders and valve manifolds to pressure sensors and air preparation units are constantly generating performance data. This is essential information that operators need so they understand how all the pneumatic devices connected through the fieldbus communication interface are performing and can be diagnosed when problems occur during production.

Once an automated system has been commissioned, configured and is up and running, the fieldbus valve system can send error notifications for alarms, voltage levels, short circuits, module errors, open load errors and distribution errors to the web-based dashboard. To address issues in near-real time, operators can configure the system to send alert notifications to appropriate laptops or smartphones if critical thresholds threaten to be exceeded.

Machine operators can use these alarms for detailed guidance about precisely which device or valve component may be approaching failure thresholds, providing the kind of actionable data needed to support the servicing of a device during the next scheduled downtime for machine maintenance.

Performance and diagnostic data that is aggregated to the website dashboard is, obviously, pneumatic-specific. However, the end user can combine that data with other data from the machine's PLC and other sensors to conduct more sophisticated analytics about overall automation performance. Using this real-time data develops deeper insights into machine productivity and energy efficiency.

One example of an application that

benefits from such prolific and detailed real-time performance and diagnostic data is the engine test stand. Engine test stands are just what they sound like. They're used to run vehicle engines, often to their limits, to monitor the engine's overall performance. Pressure sensors are key measurement components found throughout these testing systems. By integrating a fieldbus valve system interface and wireless automatic recovery module,

manufacturers can add a user-friendly way to capture and manage sensor data and access real-time pneumatic component diagnostics. The solution also integrates communication interfaces and I/O capabilities to the test stand's pneumatic valve manifolds.

QUICKLY RESTORE FUNCTIONALITY AFTER FAILURES

Power spikes and other critical events can damage the modules of a fieldbus system. If they are not backed up in

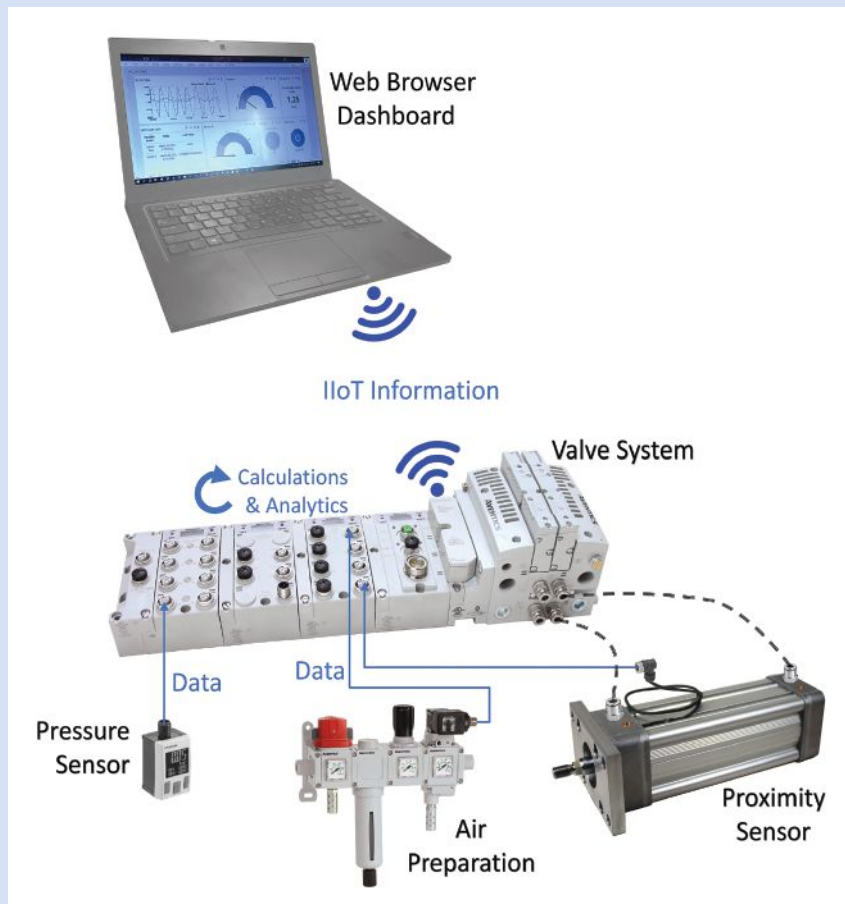
Cyberattacks and Ransomware: How to Keep Wireless Communications Secure

While wireless technologies provide great value to many applications, they are also susceptible to cyber-crime. Cyberattacks and ransomware can initially appear harmless, but these dangerous strikes can completely devastate businesses of all sizes. Reliable wireless security is critical to keeping networks and valuable data safe.

Facilities can ensure successful, secure deployment of field instrumentation and plant applications by integrating wireless security technologies that are proven to protect process performance and data. Two types include field network security and plant network security.

Field network security solutions protect sensor and field device applications and are provided through advanced, standards-based encryption, as well as authentication, verification and key management techniques. This solution prompts users to set network keys that automatically rotate or change. When implemented with the WirelessHART standard, users can also add session keys that allow and safeguard communication between two devices.

Plant network security protects plant and business data using multi-layered protection, such as RF security, WLAN intrusion prevention and location, network access control (NAC) and encryption. Some engineered solutions feature threat-control capabilities and network admis-



Shown here, an example of the type of technology discussed in this article: The Wireless ARM is a modular "clip" that interfaces with an electronic fieldbus valve system, Emerson's Aventics Series 3. Performance data from pneumatic devices connected to this platform can be transferred via Wi-Fi to a dedicated web-based dashboard, accessible via smartphone, tablet or laptop computer.

sion control that helps enforce security policies and limits access to specific devices.

When choosing a solution, it's important to look for reliable, robust turnkey technology that meets and

complies with industry certification requirements. Some manufacturers even offer solutions with added benefits, including improved process monitoring, increased productivity and lower operating costs.

any way, a controls engineer must recover and reprogram valve system functionality through a PLC or laptop. This incurs downtime and pulls experts away from other important work.

As its name suggests, the wireless automatic recovery module provides an automated recovery capability in addition to wireless access to commissioning and diagnostics. Each time the fieldbus manifold is powered up, its configuration and parameter settings are saved into the wireless automatic recovery module's nonvolatile memory.

If a critical event damages any of the modules of the fieldbus system, the wireless automatic recovery module will automatically reconfigure any replacement modules without the need for a laptop or user commissioning. The module automatically saves all the configuration data, avoiding valuable time loss and allowing the valve manifold to quickly get back into service.

This kind of backup intelligence, based on the use of smart digital technology, is a key requirement for many automation end users: Instead of requiring a controls engineer for system recovery and reprogramming, a service technician or machine operator can easily perform the replacement to restore the valve function with minimal effort and without using any special tools or software.

STREAMLINE DIGITAL TRANSFORMATION

The latest wireless pneumatic devices demonstrate a key IoT principle: using advanced digital technology to maximize the uptime and productivity of complex automation systems. Wireless interfaces can simplify and streamline how plant floor personnel or maintenance technicians access diagnostics from pneumatic valve systems. There's no need to gain access to the machine's network or download a special app—the real-time, actionable data is safely available via a standard web browser.

The wireless automatic recovery module is not meant to replace high-speed, wired automation networks like EtherNet/IP or ProfiNet for valve control. Rather, it provides a simple wireless diagnostic interface into smart pneumatic valve systems platforms and represents a key addition to the expanding range of smart digital technologies being integrated into today's pneumatics.

It is also an example of how pneumatics technology providers continue to invest in innovation and advanced thinking about ways to leverage proven technologies like wireless connectivity. As a result, manufacturers can reduce production downtime and simplify valve system commissioning. In addition, these developments are designed to create a path for using diagnostics and pneumatic device performance data for analytics and further expanding IIoT functionality. ■

ADAM GIBSON, application engineering manager, is responsible for managing advanced customer support of all fluid power components and systems at Emerson. Gibson has over 25 years of experience in the pneumatics industry. He provides expert guidance and input into the development of new components and systems, with emphasis on industrial communication and related technologies.

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Proper Care of Knife Gate and Slurry Valves

How to resolve—and avoid—field failures of knife gate and slurry valves

BY S. VIJAYAKRISHNAN

Like any mechanical equipment, even the best-maintained valves fail—and knife gate and slurry valves are no exception. In fact, being valves that generally handle tough media, they tend to fail more frequently than conventional valves due to a variety of reasons, often not easily predictable. However, detailed study and analysis of field failures can give us many pointers to take effective measures to extend service life. This article discusses some of these aspects.

NORMAL LIFE

Applications for which this family of valves are used vary widely in severity. Therefore, we will need to agree on what is the typical life expected of

them in different applications. While it is almost impossible to collect and present accurate data on this, the figures shown in Table 1 could be used as broad, ballpark guidelines for this discussion.

We can now look at the way they fail prematurely and why. Before discussing failure modes, let's examine some contributing factors specific to these valves by their design.

PRODUCT HANDICAPS

Every valve has some limitations that arise from its design, and

some of them may contribute to field failures too. Here are a few of these for knife gate and slurry valves.

Valve stroke and closed position indication. Unlike many other designs,

Table 1

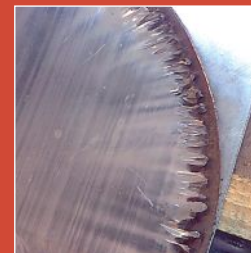
Service	Typical media	Typical life (months)
General purpose, light duty	Raw water, sludges, pulp stock	120-240
Medium duty, abrasive media	Process slurry, chemicals	30-60
Highly abrasive, slurry handling	Ore, tailings, tar sands pipeline	12-36
High cycle, highly abrasive	Pneumatic conveying, fly ash	6-12



Incomplete closure caused major damage of perimeter seal and body



Uni-directional valve with deflection cone subjected to reverse slurry flow



Gate eroded by abrasive media (cement) leaking at high velocity



Push-through seal valve seat damaged by sharp debris pushed through while closing



Slurry deposition by dewatering and hardening in valve body and pipeline



Particles stick between gate and perimeter seal in valve, preventing closure

Figure 1. Examples from user sites

these valves have little tolerance in the stroke required to achieve full closure. For example, a knife gate valve with a rated stroke of 400 mm that travels only 399 mm could cause excessive passing. In contrast, a ball valve with a rated travel of 90 degrees may still be shut at 89 or even 88 degrees. Complete sealing occurs only at the final closure point and no over-travel is feasible; this makes precise valve travel mandatory to avoid leakage. Further, a small deviation from a fully closed position is difficult to note but can cause significant wear of the sealing area as the media leaking at high velocity is often an abrasive slurry or powder.

Operating torque. Most valve designs have operating thrust variation from open to close position with a distinct increase near the fully closed position. This assists the operator in detecting the fully closed point and prompts the use of sufficient force to effect proper closure. However, few designs of slurry valves (e.g., perimeter seal valves) have high operating forces spread over a large part of the stroke and that makes detecting the fully closed point difficult for the operator. This may cause the operator to inadvertently leave the valve slightly open with a leak path.

OS&Y design. These valves feature a gate that comes out of the body when the valve is opened. This warrants a large rectangular packing that is more difficult to seal compared to round stem packings. Most of these valves do not have a bonnet, and gate and stem are exposed to the often-dirty environment. While bellows cover is provided for protecting the stem in some designs, the gate surface in an open valve is still likely to collect debris. This may, in turn, affect packing integrity over time.

FAILURE MODES AND CAUSES

Functional failures can manifest in different ways—leakage, excessive torque, jamming and wear are all possibilities. Following are some of the causes as they relate to knife gate and slurry valves. The images shown in Figures 1 and 3 depict some of these issues.

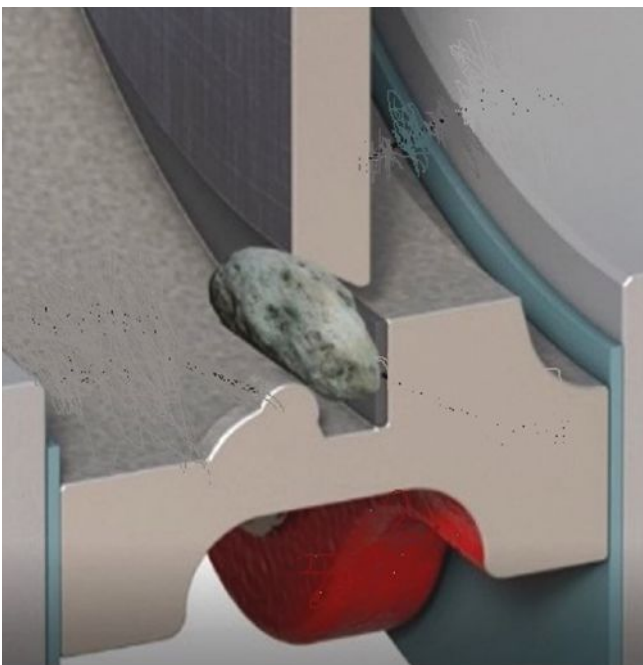


Figure 2. Hard debris in gate paths can cause electric actuators to trip before closure.

LEAKAGE

Leakage to the atmosphere. The large gland area of these valves is susceptible to loosening due to vibrations. In dirty environments, a gate traveling out of the body can attract deposits that deteriorate gland sealing. Unlike round stem gland packings, it is not easy to uniformly compress the rectangular, square section packing. Live loading by springs or Belleville washers is sometimes used but only marginally effective. Periodic checks and tightening of gland packing to arrest any observed leakage are recommended.

Leakage downstream (passing).

Passing can be created by seat wear of metal seats, damage and/or deterioration of elastomer seats due to abrasive or sharp particles in media. Incomplete closing of the valve is another common cause; this could be due to actuation issues or debris preventing closure. Damage due to pitting corrosion of the seating area is yet another cause in metal-seated valves.

OPERATIONAL ISSUES

Increased torque. These valve types are long stroke valves, and stems tend to bend if lateral movement of the gate (which happens in knife gate valves during seating) is not isolated from the stem. Some valves use a rigid stem-to-

gate connection (such as a slotted end stem) that provides no play, and it may cause stem bending. When a bent stem engages with the drive nut, operational torque increases. Designs with a stem-to-gate clevis that allows for little play is preferable.

Scaling, solidification and debris on stem threads caused by debris from the environment is another factor that increases operating torque. This is likely to occur considering the dirty environment in which most of these valves operate. Stem bellows and cover provide protection to the stem in such applications.

Most of these valves are designed to work well with minimal routine stem lubrication; however, total lack of lubrication may also make operation difficult.

Actuation issues. Insufficient air pressure to pneumatic actuators (due to air-line leaks, for example) can cause reduction in thrust for proper operation of the valve. Figure 2 shows a bi-directional perimeter seal slurry valve damaged by incomplete closure. In this case, it was caused by air supply to the actuator going low. Extensive damage is caused to the perimeter elastomer seal and the body by the abrasive slurry leaking at high velocity.

Some designs, like uni-directional



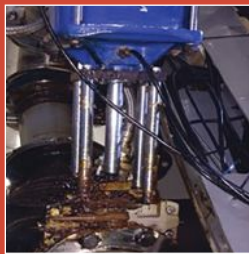
Hard scaling in body of a perimeter seal valve used in nickel slurry



Erosive wear on valve body caused by abrasive slurry



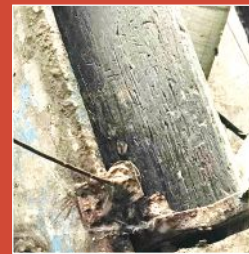
Push-through seal valve seat damaged in face area by elastomer deterioration



Gland leakage in a valve in hot molasses line



Corrosion of stem nut may increase operating torque



Gate surface marked by hard debris in recycle pulp

Figure 3. Examples from user sites

valves with electrical actuators, are set to trip when a certain torque is exceeded, which happens when the valve is fully closed. However, a hard, large particle in the media coming in the way of the gate while the valve is closing could create a false torque trigger and cause the electric motor to stop, leaving the valve partly open.

Jamming. A variety of situations can cause these valves to jam and prevent proper operation and/or closing. Hard debris in a dead pocket in the body that does not allow the gate to close fully is a common problem. Scale formation on elastomer seal surface in perimeter seals can harden and prevent easy movement of the gate and/or create damage to the seal when forced.

Dewatering and media settlement or solidification in the body cavity also can cause jamming. Hard scaling, which is not easily dislodged on any mating parts (gate surface, stem threads, piston rod, seat, packing) creates the potential for jamming. Overtightening of the packing gland to arrest leakage can also cause the valves to jam.

INCREASED WEAR

Erosion in sealing areas. Partial closing and high velocity seat leakage of abrasive media through the narrow leak paths can highly accelerate wear of the sealing area and parts involved.

In some situations, the valve could be made totally unserviceable within weeks or days. Usually for such applications, the recommended valve models will have the sealing parts hard faced or made of harder metals that can withstand the wear, even with the envisioned leakage.

Body wear due to erosion is relatively less common. Most of these valves are full port designs that offer little resistance to flow from exposed body parts. However, seat leakage with abrasive media could also erode adjacent body parts, often drastically.

Improper selection/usage. Some erroneous usage causing field failures can be traced to deficiencies in the user's knowledge of specific capabilities of these valve designs.

Using a uni-directional valve incorrectly with reverse pressure is rare, but when done can cause serious damage. Figure 1 (p. 26/top middle photo) shows a uni-directional valve with a deflection cone that was accidentally subjected to reverse pressure in an abrasive slurry application. The slurry passed through the narrow gap between the gate and the cone causing damage to the gate in a circular area.

Use of a light-duty design in a demanding application that requires a heavy-duty model is quite common. Though done with a view to lower costs,

this could lead to enhanced wear and/or premature failure, eventually resulting in higher costs.

RECOMMENDATIONS

Based on the details outlined above, here are some broad guidelines for improving operational ease and service life of these valves:

- *Always* ensure complete closure—possibly the most important recommendation.
- Close the valve while the media is flowing and not after the pump/flow is shut down. This avoids incomplete closure due to any sedimentation/settlement obstructing gate movement; also it allows for a self-cleaning action of the seating areas as the fluid flows at high velocity when the valve is nearing full closure. Avoid laying pipeline that can create low-lying, stagnant sections near the valve; on vertical pipelines, flow should be ideally upwards.
- Check gate surface for scales and deposits and then clean the surface if observed to be dirty. On horizontally mounted valves, gate protection covers are useful to keep the gate clean. Material deposited on the gate can damage packing, perimeter seat,

- push-through seats, etc., and create packing leakage.
- Do not use the valve to throttle flow or keep the valve partly open to set flowrates. These valves are suitable only for on/off duty, except for a few special types with V-orifice or pentagon ports.
- Regularly flush or drain the body cavity of push-through seat valves (and similar designs) as recommended by the manufacturer. Also check that the drain lines are not clogged.
- Do not subject uni-directional designs to reverse pressure/flow. With clean media or soft sludges such operation will only produce excessive passing; however, with abrasive media, serious and costly damage will occur to the valve.
- In silo/hopper isolation applications, do not close the valve against the stagnant powder column (except O-port valves). Such usage could bend the gate and/or stem. Also look for locations where another valve (or equipment such as a screw feeder) exists downstream and if so, ensure it is open when the top valve is being closed.
- Wherever feasible, partially cycle valves that are very infrequently operated (for example, once every few months).

- In certain situations, such as providing an auxiliary valve, take additional precautions. Consider a very tall slurry tank in a mine site with a single bottom discharge valve. If there is any operational issue with this valve, attending to it may require draining the tank. Providing a secondary valve (kept open during normal operation) in the same line, ahead of the operating valve, may be advisable despite the extra cost.
- In certain situations, providing an auxiliary valve should solve potential issues. One interesting possibility involves the use of a valve with a seat cartridge that can be replaced online without removing the valve from the line. In this design the valve that is mounted on the pipeline works like a shell for the replaceable seat cartridge (Figure 4).

Knife gate and slurry valves, in general, are more expensive and less widely stocked compared to general purpose valves. Proper care of these valves in line with their anticipated failure modes and expected life can greatly reduce both inventory and plant shut-down costs. **VM**

ACKNOWLEDGEMENT

The images in this article are used to illustrate typical valve failure instances; we acknowledge these images are from multiple sources who own them. The failures indicated are not restricted to the specific makes of valves in the photos. Identical failures can be found in similar designs from all manufacturers.

Dr. S. Vijayakrishnan spent most of his career with manufacturers of knife gate and slurry valves in application engineering, marketing and operations. In a career spanning 30+ years, he worked for DeZURIK and VAAS in their Indian operations and retired as the business unit head; post retirement, he worked for Bray as global product manager for knife gate valves. He has authored several articles on these products in international magazines. Reach him at vijaykrishnan@gmail.com.

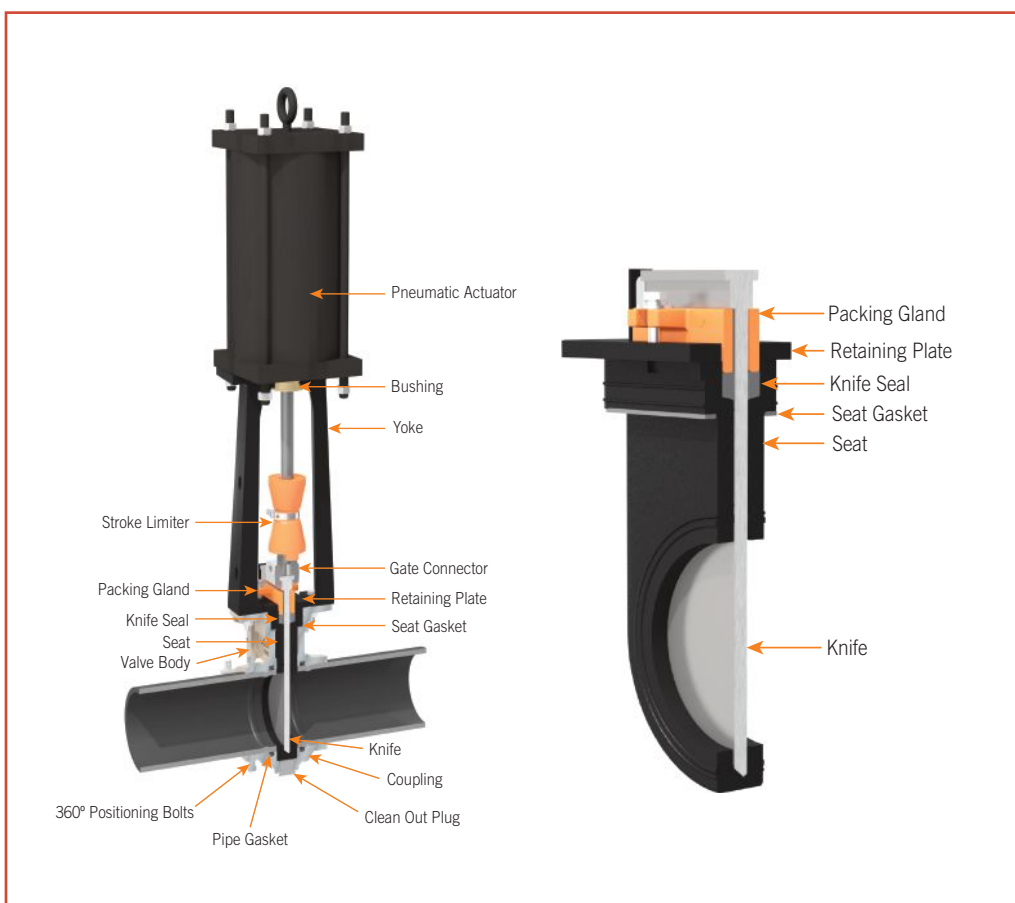


Figure 4. Cutaways of a slurry valve (left) and knife gate valve

Weight-loaded, Low-pressure Protection Devices 101

BY STUART PRESTRIDGE

In the world of low-pressure and low-vacuum relief valves—defined for this article as valves with settings less than 15 psig—there are several different common valve configurations. These configurations include spring-loaded valves, pilot-operated valves and weight-loaded valves.

These valves can be set up in a variety of configurations with all sorts of different bells and whistles based on customer preference and tank-specific needs. In this article, however, we are going to focus on the most basic: the weight-loaded relief valve.

HOW WEIGHT-LOADED VALVES WORK

The weight-loaded valve is king in low pressure applications due to its simplicity. There is very little to go wrong with a weight-loaded valve because the technology is based upon the ever-constant force of gravity. If installed correctly and properly maintained, it will work every time. The biggest drawback with the weight-loaded valve is the weight itself. A large valve can get very heavy very fast as the valve set pressure is increased. For this reason, most weight-loaded valves have set pres-

ures less than one psig. The science behind weight-loaded valves should sound familiar; you were likely first introduced to the concept of pressure in junior high. To calculate how much weight is required to reach your desired valve set pressure, use the following formula:

$P \times A = F$, where desired set Pressure multiplied by the effective Area of the pallet/disc (the area that the pressure acts upon while the pallet is closed) equals the amount of Force (weight) required to hold the pallet closed (until reaching the set pressure).

DEFINITIONS:

Set pressure: The pressure at which a valve is calibrated to crack open

Effective area: r^2 (in this case r is the effective radius shown in Figure 2)

Force: Total dead weight of the pallet assembly

One of the keys to success with a weight-loaded valve is the tank nozzle is level prior to mounting the valve. If the tank nozzle is not level, the normal forces (gravity) of the weight can cause the valve pallet to interact with the valve seat in an uneven fashion.

This typically manifests itself in lower than calculated set pressures and/or inconsistent set pressures. Valve leak rates will also be negatively impacted which results in an increase of fugitive emissions being released.

Valve soft goods maintenance is also a key contributor to a weight-loaded valve's performance. Soft goods wear out over the course of time during normal operation. Therefore, it is important to follow the manufacturer's maintenance recommendations to ensure the best performance from your weight-loaded valve.

WHY WEIGHT-LOADED VALVES ARE NECESSARY

Weight-loaded relief valves are available in pressure only, vacuum only or with both pressure and vacuum relief capabilities. These devices are typically used to vent storage tanks to protect against overpressure and/or excessive vacuum conditions during normal operations. Storage tanks need to be able to breathe to stay within a tank's maximum allowable working pressure (MAWP) and maximum allowable working vacuum (MAWV). Pressure or vacuum conditions outside of the

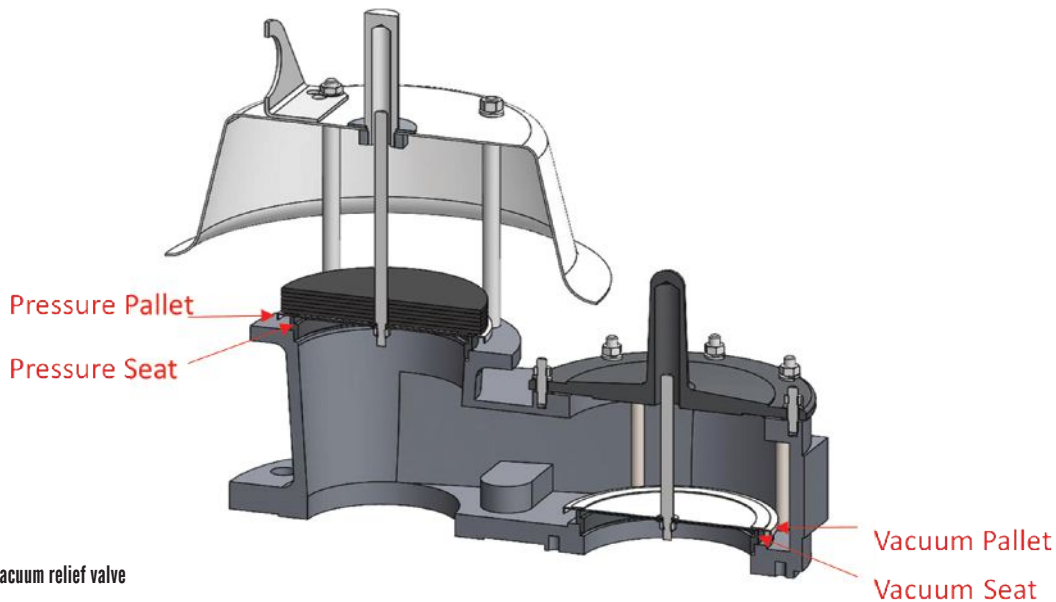


Figure 1. Pressure and vacuum relief valve

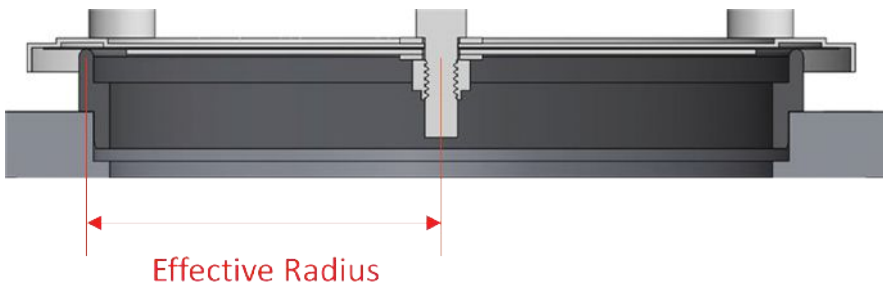


Figure 2. Effective area

MAWP and MAWV limits can result in structural failure of the storage tank, and possibly much worse depending on what media is stored inside the tank. The most common reasons a tank may need to breathe under normal operation include the following:

- Moving media into or out of a storage tank
- Weather changes (temperature change or atmospheric pressure change)

Weight-loaded relief valves also provide venting capacity during emergen-

cy events but should be used in addition to emergency relief valves. They are typically not designed or sized to be the only emergency relief for a tank.

WHERE WEIGHT-LOADED VALVES ARE USED

Weight-loaded relief valves are most commonly used on thin-walled storage tanks with relatively low MAWP and MAWV ranges. These types of tanks are common in the upstream oil production industry, the downstream petrochemical industry and other industrial liquid storage applications.

CODES AND STANDARDS

API 2000: *Venting of Atmospheric and Low-Pressure Storage Tanks*, 7th Edition and ISO 28300: *Petroleum, Petrochemical and Natural Gas Industries—Venting of Atmospheric and Low Pressure Storage Tanks*, are the current design standards that govern the design of venting devices for low-pressure tanks such as weight-loaded relief valves (as well as the other types of emergency and relief valves). These standards are intended for tanks containing petroleum and petroleum products but are also commonly applied on tanks containing other liquids. **VM**

STUART PRESTRIDGE With 31 years in the industrial sector, Prestridge has worked primarily in oil and gas/petroleum refining. Twenty years was spent in industrial construction management. He has worked the past 11 years for Setpoint Integrated Solutions Inc., serving in several leadership roles across the organization. Prestridge's role as corporate director of sales focuses his time and energy on building out OEM partner relationships, evaluating potential additions to product offerings, as well as the identification and evaluation of M&A targets for expansion and growth.

Manufacturers
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MSS Appointed as New U.S. TAG Administrator

The Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry has been approved as the new U.S. Technical Advisory Group (TAG) Administrator to International Standardization Organization (ISO) Technical Committee (TC) 153, Valves.

This new position helps to maintain U.S. involvement in TC 153 and elevates our support for, and engagement within, the national advisory process and the international standardization community.

American National Standards Institute (ANSI) is the U.S. voting member to ISO and will coordinate directly with MSS staff, as the U.S. TAG administrator, for the ISO valve committee.

About MSS

The Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. is a non-profit technical association organized for development and improvement of industry, national and international codes and standards for Valves, Valve Actuators, Valve Modifications, Actuator Mounting Kits, Pipe or Tube Fittings, Flanges, Pipe or Tube Hangers and Supports, and Associated Seals, Springs, Spring Washers, and Fasteners. Since its establishment in 1924, MSS has been dedicated to developing voluntary standards for national and global application, in cooperation with other standardizing bodies and regulatory authorities. **MSS is an ANSI-accredited standards developer.**



New Board Chairman Ron Warren

At VMA's 83rd Annual Meeting, Ron Warren, President and COO of Bray International, Inc., was elected the board chairman of VMA for the next year. *VALVE Magazine* caught up with him to discuss his views on the industry and his chairmanship of VMA.

VALVE Magazine: Can you give us a little background on your education and how you became involved in the industry?

Ron Warren: Many years ago, I earned a BS degree from Michigan State University with an emphasis in economics and psychology. Shortly thereafter, I earned an MBA degree with an emphasis in marketing from Loyola of Chicago.

When I finished my MBA, I worked for a major power, architectural and engineering firm in Chicago, leading a group in the Mechanical, Analytical Department. Our focus was writing specifications for equipment in power plants. I determined at the time that if I was going to get into sales and marketing, it would be an opportune time to do so. As I enjoyed learning about and working with equipment going into power plants, it was a natural segue to join a valve company when an opportunity presented itself.

At that point, I had an opportunity to work for Keystone Valve as a salesman in Chicago and since then, I have been in and out of the industry working with other flow control companies and products such as pumps and mechanical seals. I have spent the last 14 ½ years at Bray International Inc.

VM: What are some current opportunities in the industry? What about challenges?

RW: Our industry has not appealed as we should have to younger professionals in the past and we need to change that quickly. The valve and flow control industry is enormous on a global basis. Virtually everything we use or touch in life is impacted by the valve industry. It is a very diverse, stable and growing

industry that is and will continue to be an essential part of making people's lives better. There are all types of companies—from public, private, Fortune 500 and small—many careers including sales, service, engineering, accounting, finance, manufacturing, legal, logistics and more. Many current company leaders are aging, providing a great opportunity for new talent and leaders to take the helm.

As the industry grows, so will the technology and processes used to support it. The industrial valve industry is also positioned for knowledge transfer from other industries such as automotive, software and electronics, to drive innovation. It is a diverse, exciting, innovative industry with enormous opportunity for anyone working in it—or for those looking for an industry to be a part of.

It is not difficult to mention the challenges that have been brought about due to the pandemic: supply chain issues, logistics problems, taxes, tariffs and inflation of our material and labor costs. Anyone in the industry currently doing business in China or relying on Chinese suppliers must be concerned about the socio-political challenges currently existing between China and the U.S. Additionally, learning how to operate most effectively and efficiently in the post-COVID era will be one of the biggest challenges each of our organizations will face. As we optimistic managers look at challenges as opportunities, this will be a chance for us all to build stronger companies and a better flow control industry.

VM: Did the pandemic bring on any shifts or changes to the industry you think may stay?

RW: Post-pandemic times will present an opportunity for us to change the way we do business for the better. Most companies will employ some mode of flexible working arrangement. Because of the effectiveness of virtual meetings, I think you will see a drastic change



Ron Warren, President/COO, Bray International

in companies' travel activities going forward. Individually, we are already starting to see a mental reset. Many are considering, "What was I doing prior to the pandemic, what did I do during the pandemic, and what do I want to do for the remainder of my career?" The choices that our employees make on these questions will greatly affect our companies in many ways.

VM: Taking into account valve industry issues you mentioned, how do you plan to focus your efforts as the VMA Board Chair?

RW: I like the way your question uses the valve industry's moniker. That may be a better way to think of our group than just valve manufacturers. We are part of a huge flow control industry made up of suppliers, A&E firms, channel partners, OEMs and end users. Our job is to work together to grow the industry and, as VMA members, we must be more inclusive in growing our membership and be more effective in how we use our united industry voice. We have always emphatically stated that we are not a lobbyist organization, but this may be a topic to be revisited.

During his term as Chairman, Bryan Burns of DeZURIK was instrumental in establishing a Government Affairs Committee within the VMA. This committee has been working on bills such as a budget, reconciliation, infrastructure, Investment and Jobs Act as well as vaccine mandate issues.

VMA, just like most of our companies, managed well through these challenging times. Heather Rhoderick joined VMA as president just as the pandemic was starting and has done a magnificent job since she arrived. Bryan Burns of DeZURIK served during the challenging first part of the pandemic as chairman and Arie Bregman of DFT has done a great job during the remainder of the pandemic. Nathan Burnell of Baker Hughes worked closely with our VMA president and members of the Strategic Planning Committee to write a detailed, three-year strategic plan. Because of the work of these members and our Board of Directors, I believe the organization is stronger, better organized and on the precipice of great growth going forward.

I believe our responsibility for the coming year should be to enact the newly adopted strategic plan and move it forward as quickly as possible.

To me, the core principles of the plan are the following:

- Be the unified voice of the industrial valve industry. Represent the valve industry as a sector of manufacturing that is vibrant, attractive, innovative and responsible. We as a collective industry need more people participating and serving in the VMA to drive a continuing evolution.
- Demonstrate thought leadership and provide industry expertise and education. Educate members, end users and the industry to facilitate innovation, efficiencies of reduction and distribution, increase in health and safety and environmental protection, and promote proper use of flow con-

trol equipment throughout the world.

- Represent the industry to policymakers. Enhance advocacy and influence government activities to create a positive business operating environment and opportunities for industry growth. Do not become a lobbyist organization, but certainly become more like one.

VM: On a more personal note, what do you do when you're not wearing your business hat?

RW: We certainly must bifurcate that question between pre-COVID environment and our last 20 months of a vastly different COVID life. Pre-COVID, I spent basically every week traveling, so the personal time was largely confined to weekends. As I have been on an extended golf hiatus, my weekend time

is spent with family endeavors. My wife Cassandra and I are fortunate to have two grown children with five grandchildren. Our daughter and family live near us in the Chicago suburbs, and we are geographically challenged with our son and his family in New Mexico. We try to spend as much time as possible with both of them. During the summer, my wife and I enjoy traveling internationally and I look forward to that returning.

VM: What piece of advice would you have for those entering the valve industry—either as a recent graduate or a mid-career professional?

RW: Hurry. We need you. The industry is stable, it is growing, and we are offering high-paying career positions with great benefits. It should be a destination industry for people as they plan their business careers. VM

VMA VALVE FORUM



2021: Offered virtually,
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Testing of Hydrogen Valves

BY GREG JOHNSON

With the excitement and optimism over clean and green hydrogen fuel cells, multiple industries are working to make hydrogen a key in future energy planning. Almost all the processes to accomplish this goal involve piping and valves operating at high pressure and in most cases high temperatures.

The challenge is controlling the flow of these tiniest of molecules without perceptible leakage. Substantial leakage of hydrogen can be a dangerous situation, because hydrogen in conjunction with oxygen and ignition source burns very aggressively, witnessed by heavier-than-air, hydrogen-filled dirigible disasters, such as the Hindenburg at Lakehurst, NJ, in 1937.

Leakage in any valve is characterized in one of two ways: leakage across the closure members (seats, disc, gate, etc.) or fugitive leakage through the pressure-retaining shell, around gaskets, or through the packing, if so equipped. Leakage from either method is even harder to mitigate when dealing with hydrogen's tiny molecular size.

Any hydrogen-service valve user expects the valves they purchase to perform as required. The expectation is that leakage will be zero. Another challenge with valves designed for a gas like hydrogen is proving they don't leak before they leave the factory.

HELIUM TESTING

In the industrial valve sector, the most stringent leak-testing techniques involve safe-to-use helium as a test medium. Helium tests can be monitored via visual cues such as bubbles or with leak detectors such as mass spectrometers. Helium testing is a mature test method and has traditionally been used to verify the performance and leakage rates in valves carrying more viscous fluids or needing tighter scrutiny. The thought being that if it will hold helium (with its very small molecule size), then it will surely hold the fluid that will be passing through



□ Body-bonnet connections must be assembled correctly and gaskets selected and sized properly to ensure that small-molecule-sized gases are contained during helium testing and in hydrogen service.

the valve while in service. However, in the case of hydrogen, there is no smaller-molecule-fluid to use as a tougher-to-seal test fluid.

Another issue with utilizing micro-molecule gases for testing is their permeability through materials such as seals and gaskets. A gasket or packing that may hold pressure easily with a liquid or a gas such as nitrogen may allow hydrogen to pass easily through its cross-section.

Decades of valve experience in the petroleum sector with valves in high temperature and high-pressure hydrogen applications have proven that valves in that service often need tougher than normal pressure tests and sometimes even additional volumetric inspections such as radiography to ensure their soundness.

METAL-SEATED BALL VALVES

A popular valve design for high-temperature, high-pressure hydrogen service, such as encountered in hydrogen separation facilities or fuel cell

charging stations, is the metal-seated ball valve. The standard design test for this type of valve designed and manufactured in accordance with American Petroleum Institute (API) 608, *Metal Ball Valves—Flanged, Threaded and Welding Ends*, requires testing per API 598, *Valve Inspection and Testing*. This



□ The primary test gas utilized for testing valves in hydrogen service is helium. Even at low pressures, helium gas can find the smallest of leak paths.

calls for a required seat test at 90 psi using inert gas. Optionally, a water test at 110% of the rated working pressure may be called for as well. Neither of these prescribed and optional closure tests are much good at verifying the sealing integrity in hydrogen service. As an alternate, the test fluid may be changed to an inert gas for these tests.

By changing the test fluid to helium, the test comes closer to emulating the containment of hydrogen. However, the consensus from many in the industry is that the prescribed testing times at the API 598 test pressures may not be stringent enough. The only options at this point, if requiring zero leakage, are to increase the pressure holding time and/or utilize a much more precise leak detection method, such as a helium mass spectrometer.

The Manufacturers Standardization Society (MSS) created a standard practice designed to provide a more sensitive test method for valves in critical services such as hydrogen. Standard Practice (SP) 158, *Supplemental High-Pressure Gas Test Procedures for Valves*, provides procedures, including holding times, much greater than those prescribed in API 598.



□ Fugitive-emissions leakage through the packing or between the stem and packing can be cause for concern. Sealing helium or hydrogen is tougher because of the tiny molecule size, so stem straightness and smoothness is critical during helium testing and in hydrogen service.

The second issue involves testing of the entire pressure envelope of the valve, including the packing and gasket. In the case of the API 608 designed metal-seated ball valve, this test is normally performed at 150% of the rated working pressure with water, although inert gas may be specified. For hydrogen, helium is again the best choice. An extended duration high-pressure gas test procedure for verifying the integrity of the valve pressure envelope is also detailed in MSS SP-158.

Fugitive emissions testing per se is not required of valves in hydrogen service. Although hydrogen is not a greenhouse gas, it has the energy potential and volatility to blow up green-houses, out-houses or high rises.

Because of the permeability of the helium into non-metals, care must be taken when taking readings of stem seals or non-metallic gaskets with a helium mass spectrometer, as helium gas can enter these materials and affect the instrument's readings for a substantial period of time after the initial pressure charge.

HYDROGEN PIPELINE VALVES

One of the initial issues within the growing hydrogen energy sector is the transportation of hydrogen gas and pipelines are the most logical mode of transport. There are pipeline compa-

nies currently transporting pure hydrogen in newer dedicated hydrogen pipelines as well as pipeliners blending hydrogen with natural gas in existing pipelines. The added flammability and danger of this activity has caused some users to invoke the tougher options present in the current API 6D, *Pipeline Valves*, design and testing document. These additional tests include the use of inert gas, combined with the already longer API 6D holding times.

Currently no hydrogen-specific valve design or testing standards exist in North America. With the increasing interest in the hydrogen and carbon capture and seques-

tration (CC&S) industry, various groups outside the valve industry realm are hinting at creating valve and valve-testing standards for these green and growing energy sectors. It behooves the valve standards development organizations to take the lead and create these specifications based upon their extensive valve knowledge and experience, rather than let a group of bureaucrats or scientists dream them up.

The future of hydrogen energy use and the design and construction of hydrogen-specific piping systems is bright. The opportunity for valve manufacturers is also excellent. Since we are still near the embryonic stage of the venture, it is important that the end users, manufacturers and regulating agencies work together and get the details right. While testing procedures are not the center of the discussion, agreement on testing protocols could go a long way in ensuring the budding industry's long and especially safe future. ❧

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□ To adequately test valves for hydrogen service, the use of helium gas as a test fluid and extended pressure holding times may be required.

Valve Packing Sealing for Emissions Service

BY RON FRISARD AND WARREN MONTGOMERY

Methane (CH_4) is the second-largest greenhouse gas emitted in the United States. In 2019, CH_4 accounted for approximately 10% of all U.S. greenhouse gas emissions from human activities. Methane's lifetime in the atmosphere is much shorter than carbon dioxide (CO_2), however, it is significantly more efficient at trapping radiation. Pound for pound, the comparative impact of CH_4 on climate change is 25 times greater than CO_2 over a 100-year period.

One area that is responsible for the increase in CH_4 is leaking equipment in the refinery sector. The largest component that accounts for this leakage are valves that leak CH_4 (and sub derivatives called volatile organic compounds) from the valve packing gland. Over the last 30 years, governmental agencies have worked with industry to address these leaks by increasing the implementation of new technology. This focus on new technology has pressured packing manufacturers to ramp up research and development of new materials. State and federal agencies have also tightened standards for

maximum leak rate measurements of VOC valves from 10,000 PPM 20 years ago to 100 PPM in most places in the U.S. today. As a comparison, that is like changing the CAFE limits for MPG of cars from 1990 levels of 27.5 to 2,750 MPG today. That is going from New York to Los Angeles on one gallon of gas!

NO UNIFIED STANDARD

One of the main challenges that needed to be overcome was the lack of a unified testing standard. Twenty-five years ago it was similar to the Wild West with many refineries and packing manufacturers using their own testing standards with varying media (nitrogen, helium or methane at different concentrations), temperature ranges, and thermal cycles. This made it very hard to compare the effectiveness between low emissions valve packings. A few standards organizations created tests for valve emissions to start to tackle this issue. The American Petrochemical Institute (API) has specifically focused on a detailed testing procedure for packing performance in methane. This standard, API 622, has

become a benchmark for packing performance here in the United States for a variety of reasons, including the EPA statement that packing performance testing needs to be conducted in methane instead of other gases. This standard became the bullseye for research and development working toward the goal of a <100PPM valve packing.

The API 622 requires five thermal cycles from ambient temperature to 260°C (500°F), 1,510 mechanical cycles, and methane as the test gas. Thermal cycles are done once per day, and are divided into 300 mechanical cycles (150 at ambient and 150 at 260°C), with a final 10 mechanical cycles at ambient temperature where the final leakage measurement is taken. This test has an extreme amount of mechanical and thermal cycles and is designed to challenge packing manufacturers to improve development. Without setting such a high bar it is hard to believe the industry could have achieved the technical changes we have seen.

One important point is that API 622 is NOT a valve test but a packing test, so it would be a mistake to assume that all valves will have the same performance with the same packing. This is because all valves have their own design considerations that affect overall sealing, primarily tolerances and unique valve design. With this in mind, the API turned their attention toward creating a testing protocol that focused on emissions capability by each valve design by manufacturer, API 624. One important factor in API standards



□ Correct packing sizing is essential for emissions service.

is that they dovetail into each other by complementing and building on work previously done. In the case of API 624, one of the requirements is that the packing used has already been tested to the API 622 standard. This is one reason API 624 has fewer thermal cycles and stem actuations than API 622. (The 624 test procedure requires 310 mechanical cycles and three thermal cycles to 260°C [500°F].)

LESSONS LEARNED

Some of the lessons learned with API 624 have focused on the machining tolerances of components. Methane molecules are small and leak rapidly through small gaps compared to steam and other media. With this knowledge, you can't use standard gland to valve dimensioning for steam service in emissions service. The main areas of concern are stem and box size tolerance, the packing gland tolerance to the stuffing box and stem, and the stem to the ID of the bottom of the stuffing box. All of these dimensions are critical to successful emissions sealing.

Another sometimes overlooked area of concern that has shown to be extremely important in sealing methane is the bolting on the valve. One of the most important issues that came out of testing is getting an accurate gland load on the packing, and the condition of the bolts plays a big part in that. Lubrication is critical and the use of new bolts compared to used bolts can drastically affect how the valve seals. This is because, in most cases,

the applied gland load is estimated based on torque—a measurement not of tension but of force over the threads and nut. When using unlubricated used bolts compared to new bolts the same torque will result in a much lower tension, and therefore an under-loaded gland. One way to mitigate this is to use a load indicator, such as disc spring height, that measures specific tension on the connection.

The combination of the work the refinery industry, regulatory agencies, packing manufacturers, and the valve industry have completed has served to reduce methane emissions. The development of new packing materials, new testing standards, and valve design improvements has allowed the refinery industry to lower its environmental footprint by lowering the emissions of greenhouse gases. **WM**

This article is sourced from Frisard's and Montgomery's VMA Virtual Valve Forum technical track in September



□ Emissions packing training is critical for meeting Low-E requirements.

2021 and is one of many presentations that can be accessed by registering for the Virtual Valve Forum, which features tracks on technical, manufacturing, marketing and valve repair topics.

Ron Frisard is global training manager for A.W. Chesterton, where he has spent 30 years as a technical expert in Mechanical Packing and Industrial Gasketing. He manages the design, development, analysis and execution of training for the company. He is also chair of the Gasketing Division for the Fluid Sealing Association. Frisard graduated from Northeastern University in Boston with a degree in Mechanical Engineering Technology.

Warren Montgomery joined A.W. Chesterton Company in 1994, and for the last 25 years he has focused on the packing product line. Warren has held positions as a mechanical engineer for the packing engineering department, senior application engineer, and currently is global product line manager for the mechanical packing and gasketing product line.

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For more information on joining the Valve Repair Council, contact Marc Pasternak at 202.331.0104 (mpasternak@vma.org).

EDITOR'S PRODUCT PICKS

Spirax Sarco has expanded its product line to include the new Spira-trol Steam-Tight control valve, helping maximize output, minimize down-time and improve product quality. It has a full peak class VI shutoff double-life seat, increasing the life span of the steam plant, simplifying plant maintenance throughout the life cycle of operation and driving down the total cost of ownership for customers in the food, beverage, oil, gas, chemical and healthcare industries. The Spira-trol Steam-Tight control valve has a low impact on maintenance because the valve is not required to be removed from the line and requires no special tools. This new product solution is available in sizes .5 to 4 in. and comes in SG iron, carbon steel and stainless steel. It's suitable for steam pressures to 275 psig, steam temperatures to 428°F and comes with a three-year warranty.



Mueller has expanded the capabilities of the Sentryx software-enabled Super Centurion smart hydrant and retrofit kits. New capabilities include bury depths of 3 to 7 ft., open left and open right, 5.25-in. and 4.5-in. main valve opening sizes. Retrofit kits are compatible in both the 5.25-in. and 4.5-in. Centurion hydrants that have been manufactured since 1975 without changing components.



Neles has announced the latest version of Neles Expertune PlantTriage software to continually monitor and diagnose issues and help find the root cause, prioritize according to economic and technical factors and provide a complete set of analysis tools to resolve the problem at its source. The software update also includes enhanced cybersecurity, as well as new capabilities for improving sustainability, tuning control loops and simplifying remote license management. The latest sustainability improvements are focused on energy efficiency. The new "Energy Saver" diagnostic report pinpoints controllers and valves that are

contributing to loss of efficiency. The corresponding dashboard shows users how to make the improvements to save energy.

Chesterton Connect released its IoT wireless monitoring product line that is certified for use on equipment and structures in most hazardous environments dealing with high pressures, high temperatures and flammable liquids. Rated for Class 1/Division 1 (gas, vapor environments) and Class 2/Division 1 (dust environments) and IP66 for outdoor use, the new Chesterton Connect Sensor can be used in operators' most critical applications for equipment vibration, equipment surface temperature, process pressure and process temperature. It monitors process fluid conditions that impact mechanical seals that are often the first component to exhibit signs of imminent equipment downtime.



Emerson has developed the Rosemount 1408H Level Transmitter, the world's first non-contacting radar device designed specifically for the food and beverage industry. Features include a hygienic compact design, fast sweep technology, exceptional radar beam focusing and IO-Link communications, helping manufacturers to optimize the efficiency of their operations, reduce product losses and ensure food safety. Non-contacting radar is an ideal level measurement technology for applications that require stringent hygienic facilities and equipment. It is virtually maintenance-free, which helps it to ensure long-term reliability, in sharp contrast to legacy technologies. It



has a top-down installation that reduces the risk of product loss through leakage, and it is unaffected by process conditions such as density, viscosity, temperature and pH. It received the 2021 Red Dot Award for product design.

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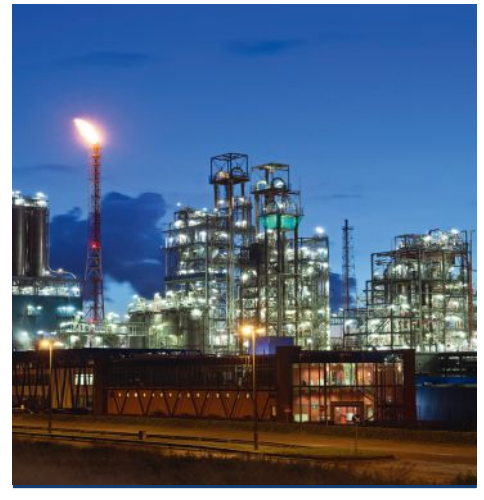


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