VMA PLANS BOTH VIRTUAL AND IN-PERSON EVENTS FOR 2021-22

VALVE

MAGAZINE | SPRING 2021 | VOL. 33, NO.2

The Valve Industry Embraces the Future

- DESIGN AND SELECTION FOR NON-METALLICS
- PRVS IN LNG APPLICATIONS
- WHAT'S TO COME IN FUNCTIONAL SAFETY
- PRESSURE RATINGS AND TEMPERATURES

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14 The Future of Manufacturing is Already Here

Companies that manufacture valves and related products share common traits as they prepare for the future in a rapidly changing landscape: a quest for agility, rapid adaptation of automation and a commitment to digitalization. COVER IMAGE COURTESY B4LLS | ISTOCK

BY SUSAN KEEN FLYNN

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www.VALVEmagazine.com

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VMA VALVE MANUFACTURERS ASSOCIATION OF AMERICA

www.vma.org

Moving Past the Pandemic

A recovery and emergence from the pandemic have begun, with many of the economic indicators of the valve and related industries, as well as manufacturing, providing positive news. I'm hopeful that this, coupled with the roll-out of vaccines, means conversations do not all start with COVID-19 concerns! This issue of VALVE Magazine takes us in that direction by addressing some forward-looking topics.

Manufacturing is the core business of many of the readers of VALVE Magazine. This issue's featured article looks at manufacturing's current and future challenges and explores ways companies are adapting and innovating to meet those challenges. Safety and technology are always important issues, but the topic of our dwindling workforce is top of mind for many. While the pandemic forced flexibility into how many plants and front offices operate, it also had a disproportionate effect on women in the workforce and has likely led to an increase in retirements. The full effect of the pandemic may not have been realized yet, but its impact on the workforce intensified an already challenging environment.

Understanding the array of materials used on valves and related components is consistently a topic of interest to our readers. The article on page 26 covers how to select nonmetal materials for use in the valve industry and includes an interview with a composites industry expert to delve a bit deeper into this material.

I am excited to mention another example of moving past the pandemic with the return of some VMA in-person events! Later this year VMA will host both our Annual Meeting and Valve Basics program with hands-on "petting zoo" component in person. Early next year the Valve Forum Conference and Exhibits will also be an in-person event. Find out more on page 10.

Lastly, VMA and VALVE Magazine are excited to be working with a new partner, Gardner Business Media, to help us publish this magazine and continue to bring you top content and insightful information. Astute readers of the magazine may notice on page 8 a few new names as advertising and production contacts. Please feel free to reach out to me at hrhoderick@vma.org or any of the other individuals who help bring you this magazine with any questions or comments.

Heather

Heather Rhoderick, CAE
President

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CONTRACTS AND PARTNERSHIPS

Flowserve Supporting Pfizer in Vaccine Production

Flowserve Corporation is providing pumps, valves and seals to Pfizer to support production of its COVID-19 vaccine. Through its channel partner, Corrosion Fluid Products, Flowserve is providing Pfizer with a cryogenic valve application to assist in their expanded production capabilities of the COVID-19 vaccine.

The Flowserve Cookeville, TN facility will supply Pfizer with more than 200 Worcester cryogenic ball valves that can handle the rigorous temperature requirements needed for the mass production of the COVID-19 vaccine.

Mueller Awarded Contract for AMI Deployment

The Calaveras County, CA Water District has selected Mueller Systems to deploy an advanced metering infrastructure (AMI) network covering 1,000 square miles with 13,000 AMI endpoints.

The project will replace the majority of the district's meters and add communication capabilities to all meters.

Calaveras County Water District provides water service to over 13,000 municipal, residential and commercial customers in six service areas throughout the county.

Baker Hughes Partners to Lower Carbon Hydrogen for LNG Trains

Baker Hughes and PAO NOVATEK have signed a cooperation agreement aimed at reducing carbon emissions from natural gas and liquefied natural gas (LNG) production. The two companies will cooperate on the development and implementation of innovative compression and power generation technology solutions from Baker Hughes for NOVATEK's LNG projects, supporting NOVATEK's emissions reduction, raising efficiency and supporting long-term sustainability.

The agreement will begin with a pilot program to introduce hydrogen blends into the main process for natural gas liquefaction to reduce carbon dioxide emissions from LNG facilities, including NOVATEK's Yamal LNG complex.

Curtiss-Wright Supplying Eviation with Actuation Technology

Curtiss-Wright's Actuation Division was selected by Eviation Aircraft, manufacturer of Alice, the world's first all-electric commuter aircraft, to provide primary flight control actuation technology. Curtiss-Wright's electromechanical actuators (EMA) provide Eviation with a modular, distributed solution that enables a flexible control architecture.

PEOPLE IN THE NEWS

CURTISS-WRIGHT announced that **Kevin M. Rayment**, formerly president of the commercial/industrial segment, has been named COO following **Thomas P. Quinly's** planned retirement as vice president and COO on April 1, 2021.

Rayment has more than 30 years of experience across the commercial, general industrial, aerospace, nuclear and defense industries. He will report directly to president and CEO **Lynn M. Bamford**.

Robert F. Freda has been named treasurer, succeeding **Harry S. Jakubowitz**, who is retiring after a distinguished 18-year career with the company.

EMERSON'S David N. Farr retired as CEO, effective Feb. 5, 2021. **Lal Karsanbhai**, who served as executive president of the company's Automation Solutions business since 2018, is the new CEO of Emerson and joins the board of directors. Karsanbhai has led Automation Solutions to strong performance, elevating Emerson's software profile and digital transformation business.

Lal Karsanbhai

Farr, who was named CEO in 2000 and chairman of Emerson's board of directors in 2004, will remain as chairman through May 4.

Ram Krishnan, who leads Final Control for Emerson, has been named executive vice president and COO. **Mark Bulanda**, who currently serves as senior vice president of planning and development, becomes the new executive president of Automation Solutions. **Steve Pelch**, who has served as executive vice president and COO since 2018, leaves the organization to pursue other opportunities.

MRC GLOBAL appointed **Rob Saltiel** as president and CEO and as a member of the company's board of directors effective March 2021. He succeeds **Andrew Lane**, who previously announced his retirement plans.

VICTAULIC has a new CEO, **Rick Bucher**. He succeeds **John F. Malloy**. Dr. Bucher was named president of Victaulic in April 2020, following a June 2019 appointment as CEO. Prior to joining Victaulic in 2009 as vice president of engineering, Dr. Bucher worked for 15 years for W.L. Gore, a manufacturer of technologically advanced composite materials.

Southeast Valve Enters New Agreement with BHDT

BHDT has entered into a cooperation agreement with Southeast Valve Inc. (SVI). As a result of this agreement, SVI is now the only authorized repair facility for BHDT products in the U.S. and Canada. SVI will perform the service of BHDT products either with spares supplied by the clients along with the goods or with original spare parts from BHDT.

MERGERS & ACQUISITIONS

Trillium Flow Technologies Acquires Red Point Alloys BV

Red Point Alloys BV has joined Trillium Flow Technologies. Founded in 1987, Red Point specializes in the design, manufacture and quick delivery of exotic material isolation valves for applications in petrochemical, chemical, fertilizer, oil and gas production, LNG and other industrial processes.

"I am excited to expand the Trillium Flow Technologies family and to offer our global and growing customer base a broader range of highly engineered, quick delivery flow control products," said David Paradis, CEO, Trillium Flow Technologies.

Emerson Invests in Fluxa

Emerson has made an equity investment in Fluxa, whose Process & Knowledge Management software manages product and process specifications throughout the drug development lifecycle. The investment will build on Emerson's life sciences capabilities and help Fluxa expand its technology development and commercial pipeline. Fluxa is based in Glendale, CA. The terms of the investment were not disclosed.

The emergence of COVID-19 has sparked innovation in the life sciences manufacturing development process, as a cycle that previously required over eight years was completed in less than 18 months through expedited research and development and automation technologies, including those offered by Emerson.

Baker Hughes Signs Agreement to Acquire ARMS Reliability

Baker Hughes is acquiring ARMS Reliability. The acquisition deepens Baker Hughes' industrial asset performance management (APM) capabilities and will expand the company's industrial asset management offerings. The acquisition is expected to close in the second quarter of 2021.

ARMS Reliability's global customer base has strong adoption in the U.S. and Australia, and the agreement is expected to drive strong growth in APM adoption in other geographic markets.

EnPro Realigns Businesses into Three New Segments

EnPro Industries, Inc. has realigned its reporting segments to enhance transparency and collaboration across the company as part of its ongoing portfolio reshaping strategy. The new Sealing Technologies segment is composed of Garlock, Stemco and Technetics (excluding Semiconductor) businesses.

DeZURIK Acquires Red Valve Company

On Jan. 1, 2021, DeZURIK acquired Red Valve from Hillenbrand, a public company headquartered in Batesville, IN. Red Valve is known for elastomers, pinch valves, check valves and engineered mixing systems. The two main brands in its current portfolio are Red Valve and Tideflex.

"The addition of Red Valve to the DeZURIK portfolio of brands furthers our strategic initiative to advance the human condition by applying exceptional flow control expertise to the development of vital water and industrial infrastructure," said DeZURIK president and CEO Bryan Burns.

A.Y. McDonald Acquires Val-Matic Valve & Mfg. Corp.

A.Y. McDonald acquired Val-Matic Valve & Mfg. Corporation on Dec. 31, 2020. Val-Matic Valve was founded in 1966 by Andrew Nuter and is a manufacturer of 14 valve product lines for the water and wastewater, industrial, commercial building construction and plumbing industries. Each company will continue to operate independently with separate management, market strategies and sales operations.

John V. Ballun, Val-Matic president and CEO, stated, "My management team and I are excited and proud to join the family-owned, historic company A.Y. McDonald. Val-Matic has a similar tradition of serving customers in the water works market for over 50 years with quality products and services."

AWARDS & HONORS

MRC Global Celebrates 100th Anniversary

On Feb. 15, 1921, McJunkin Supply Company was founded in the hills of West

MAY-DECEMBER

Virtual Valve Basics
www.vma.org/valvebasics

Virtual Valve Forum
www. vma.org/valveforum

JUNE

14-17
AWWA's ACE All Virtual
www.awwa.org/ace

AUGUST

5-6
VMA Virtual Market Outlook Workshop with Hydraulic Institute
www.vma.org/marketoutlook

16-19
Offshore Technology Conference 2021
Houston
www.otcnet.org

OCTOBER

6-8
VMA Annual Meeting*
Scottsdale, AZ
www.vma.org/annualmeeting

13-14
Valve World Americas Expo
Houston
www.valveworldexpoamericas.com

16-20
WEF-TEC Conference & Exhibition
Chicago
www.weftec.org

OTHER VMA EVENTS
Please visit www.vma.org for additional programs scheduled this year. All dates subject to change.

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

VALVE MAGAZINE

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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 Judy Tibbs, Editor-in-Chief, at jtibbs@vma.org.

Virginia, and over the next 100 years, companies from around the world would be established and grow into what is now known as MRC Global. Together, these heritage companies built the leading pipe, valve and fitting (PVF) distributor for the global oil and gas industry. MRC Global will celebrate its 100-year anniversary throughout 2021.

Emerson Receives 2021 IoT Breakthrough Award

Emerson has received the IoT Analytics Platform of the Year award for its Plantweb Optics Analytics software. The honor, part of the 5th annual IoT Breakthrough Awards, recognizes Emerson's analytics software that uses artificial intelligence and machine learning to improve reliability, safety and sustainability while optimizing production for industrial manufacturers.

The IoT Breakthrough Awards program recognizes innovators, leaders and visionaries from around the globe in a range of IoT categories. This year's program attracted more than 3,850 nominations from companies all over the world.

NEW FACILITIES

Victaulic Acquires Foundry Manufacturing Facility

Victaulic has purchased a 220,000-square-foot Waupaca manufacturing plant in Lawrenceville, PA. When operating at full capacity, the facility will increase Victaulic's foundry production capacity by 70% in the U.S. and allow for future growth as Victaulic's business demands increase. The facility, including two foundry molding lines, will also enable Victaulic to produce larger scale products.

The MRC team rings the bell at the NYSE as part of its 100th anniversary celebration.

The company is also nearing the completion of an additional 400,000-square-foot light assembly operations facility in Lower Nazareth, PA.

Trillium Flow Technologies Launches STAR Service Center Network

Trillium Flow Technologies launched its global STAR Service Center network serving Sarasin customers with 16 locations across the United States and Mexico – with additional locations joining the network soon. Sarasin Technical Assembler and Repair (STAR) Service Centers from Trillium Flow Technologies will provide pressure relief valve (PRV) OEM aftermarket support for industrial plants. Currently, Trillium has forged partnerships with TEAM, Caliber Valve & Controls and East Coast Valve Services in the U.S. and Vasesa in Mexico.

Emerson Opens Welding and Assembly Technologies HQ

Emerson has opened its new Branson welding and assembly technologies' global headquarters in Brookfield, CT. This opening completes Emerson's $49 million investment announced in April 2019 and supports Branson's plastic joining, ultrasonic metal welding and ultrasonic cleaning technologies for the medical, textile, automotive, food and beverage, packaging and electronics industries.

Formosa Plastics Starts Up Low-Density Polyethylene Unit

Formosa Plastics Corporation, U.S.A. is announcing the start-up of the low-density polyethylene (LDPE) unit at their facility in Point Comfort, TX. The LDPE unit joins the high-density polyethylene (HDPE) and linear-low density polyethylene (LLDPE) units already in operation.

"The LDPE unit significantly expands the portfolio of products we provide to our customers," said Ken Mounger, Formosa's executive vice president. "The range and versatility of our product line is extensive. We're looking forward to continuing to supply high-quality resins and enhancing the value we provide to consumers through our newest line of LDPE products." VM

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VMA Sets Events and Education Program for 2021 and Beyond

As the world continues to emerge from the COVID-19 pandemic, the Valve Manufacturers Association (VMA) is planning for a year of virtual learning and networking opportunities, as well as being prepared to hold in-person opportunities as soon as they are deemed safe.

Here is a look at some of the programs we're gearing up to provide in 2021.

The popular, hands-on portion of the Valve Basics event is scheduled for November.

VALVE BASICS

Valve Basics provides a gateway into the world of valves and actuators and is open to anyone in the global valve industry value chain. Split into two programs, Valve Basics offers an overview of valves, valve actuators and valve automation, and how they are used in various applications.

The Valves 101 program covers the major valve types, including linear, check, quarter-turn and pressure-relief, plus actuation basics. The Valves 201 program is offered for those who want to take the next step in learning about critical flow control products, including actuators, controls, automation and more.

The Basics program is offered virtually throughout the year. Each topic module is available on demand, and there will also be monthly live Q&As on highlighted topics, along with quarterly open topic Q&As, providing attendees an opportunity to meet and have their questions answered by our instructors. Videos demonstrating the workings of each type of valve and actuator are part of the virtual content.

In addition, VMA's intent is to offer a hands-on, petting zoo focused program this fall to supplement the online Valve Basics content and to provide attendees with networking and in-person instruction. Registration for the Virtual Valve Basics program is open now, but attendees can register and take part at any time throughout the year. Find out more: www.vma.org/valvebasics.

VALVE FORUM

The Valve Forum offers solutions, content and business opportunities for the valve, valve actuator and valve automation industry and is open to everyone. Thought leaders will present on manufacturing, technical, repair, marketing, management and other business topics. The event includes abundant business networking opportunities, and industry suppliers, distributors and others will showcase their products and services.

The Valve Forum will be held virtually this year, with new content expected to be released on a monthly basis. Then, take part in the in-person 2022 Valve Forum with exhibits, networking and unsurpassed sessions from experts in the industry. Registration is open now for the virtual program, with the manufacturing track starting in May. Find out more at www.vma.org/valveforum.

MARKET OUTLOOK WORKSHOP

The Valve Manufacturers Association (VMA) is partnering


Conditions permitting, in-person events will resume this fall, and with this comes the opportunity for in-person networking.

again with the Hydraulic Institute (HI) to deliver the valves and pump industries the content, speakers, discussions and knowledge to successfully navigate the economic environment in key valve industry market segments. Now more than ever, each market segment is experiencing its own nuanced recovery, growth and opportunities. Attendees will gain business intelligence and valuable insights from end-user market experts.

As the valve industry adapts to a chaotic operating environment and economic changes, attendees will leave this virtual event equipped with the knowledge they need to plan for the next year. This event is based on past Market Outlook Workshop models but takes place at your desk so you receive all the content and can take part in discussions and networking. The virtual experience allows attendees to save money and time. Save the date for the week of Aug. 2, 2021, and find out more at www.vma.org/marketoutlook.

ANNUAL MEETING

The Annual Meeting will take place in October and will be in person for 2021. This is VMA's premier, members-only event, featuring unsurpassed networking opportunities with company leaders across the industry. Expect a program that continues to address the top concerns of the industry. With presentations, discussions and Q&As, VMA and VRC members will leave with the most current thinking and trends on the industry and what to know for 2022. The Annual Meeting will take place the week of Oct. 4 in Phoenix, AZ. Protocols to address health and safety concerns will be in place. Find out more at www.vma.org/annualmeeting VM

Valve Industry Outlook: Trending Positive

VMA tracks and reports on various valve industry and valve end-user markets, and provides statistical information to its members throughout the year. This year, the data reviewed continues to trend positive for 2021. For example, despite several valve industry end-user markets being down in 2020, ITR Economics, in their quarterly

forecast for VMA members, remained upbeat on the manufacturing sector at the start of the year. This point is supported by data that shows production at U.S. manufacturers increased in December, marking the eighth straight month of gains.

While ITR notes that several markets will also be down in 2021 (most notably chemical and oil and gas), they predict these areas will show growth in 2022. The same is true for non-residential construction, which will be negative all this year with a rise in 2022 and into 2023.

VMA members reported a slight uptick in business performance in November and December of last year, and this has continued through the start of 2021. Both orders booked and shipments were also up at the start of 2021. VMA members should be on the lookout for the 1st quarter 2021 report this spring. VM

VMA's premier event, the members-only Annual Meeting, provides top-notch speakers and plenty of networking.

VMA Board: Renewed Emphasis on Government Affairs, In-person Events to Resume

The VMA Board of Directors met virtually in March to discuss association business, the impact of the COVID-19 pandemic on the valve industry and the association, and ways in which the association can continue to remain relevant and provide support and guidance to the industry and VMA members.

To this end, the Board of Directors agreed to reinstate the Government Affairs Committee to develop relationships with and educate and inform policy makers and members of Congress on issues of importance to the valve industry. The committee will help form the association's relationship building and policy agenda, which is especially timely with the new administration.

The Board also confirmed its intent to offer in-person events as soon as feasible. VMA's Annual Meeting, which is open to VMA and Valve Repair Council (VRC) members only, will meet in person later this year. More information on VMA's other events is explained on page 10.

"I have heard from many of our members and others in the industry that they are eagerly awaiting the return to in-person events. While virtual meetings and events have allowed VMA to continue to provide education and thought leadership over the past year, the networking and business that takes place at in-person events can't be duplicated in an online environment," says Heather Rhoderick, VMA president. "I'm excited to be able to offer in-person events as soon as possible to our membership and the industry at-large."

Other VMA activities offered to members such as the VMA scholarship program, statistics and industry data and information and much more will continue as well. Anyone who works for a VMA or VRC member company is able to take advantage of all that VMA has to offer. If you aren't sure if your company is a member or would like to become a member, visit www.vma.org to learn more. VM

NEW VMA MEMBER: SAMSON CONTROLS INC. - CANADA

VMA welcomes its newest full manufacturing member, **SAMSON Controls, Inc. - Canada**. Serving the Canadian market from its Markham, Ontario head office since 1983, the company offers pre-sales, sales and after-sales support, project engineering, turnkey packaged solutions and other support functions. Parent company SAMSON AG, established in 1907, is a market leader in control valves for industrial process solutions, offering an extensive range of valves, actuators and accessories.

"I've been active in many different associations over the years. **VMA is by far one of the best run and most beneficial** in terms of content, quality and people!"

—Robert Kemple, Jr.,
Former Executive VP, ASCO-Emerson

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TO VALVE, ACTUATOR & CONTROL MANUFACTURERS

✔ **DISTRIBUTORS/CHANNEL PARTNERS**
TO VALVE, ACTUATOR & CONTROL MANUFACTURERS

✔ **OEM MAINTENANCE, REPAIR & SERVICE**
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Once you've applied and your membership approved, you'll be eligible for a wide array of benefits:

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- Access to VMA's Legal Counsel

VMA VALVE MANUFACTURERS ASSOCIATION OF AMERICA
The voice of the flow control industry

To determine if your company meets the criteria for membership, visit VMA.org > Members for information on Qualifications, Benefits and Dues, and then apply Online.

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

The Future of Manufacturing is Already Here

Companies in the valve and control products industry are responding to a confluence of forces that are changing the landscape of manufacturing.

BY SUSAN KEEN FLYNN

Kevin Tinsley shares a commonly held fear in the manufacturing industry. "My nightmare is getting the phone call that somebody got hurt in our facility," said Tinsley, senior vice president of Neles Global Operations. The company recently mitigated some of the risk by combining artificial intelligence (AI) and robotics to perform high-pressure testing of its valves.

"High-pressure testing of valves can be dangerous if there is a casting or design failure," said Tinsley. "We utilize robots equipped with cameras, as well as sniffing devices, to detect valve leakages. They can be programmed to perform this task effectively and—most importantly—safely."

Neles partnered with an outside expert to design and build an explosion-proof enclosure, then purchased an OMRON Collaborative Robot and developed a sniffing program with the industrial automation company for high-pressure testing, such as helium tests. "It's a great advancement in technology," said Tinsley.

New technologies, such as robotics, are changing the face of manufacturing.

In a survey of small and medium-sized manufacturers released in February by The Manufacturing Institute and BKD, more than 77% of respondents indicated they were making technological investments to achieve cost efficiencies in the production process, with 73.4% doing so to improve operational performance. And increasing automation is just one of a wide array of trends shaping the future of manufacturing.

FORCES OF CHANGE

"I see several forces driving changes in manufacturing," said Tony Scacchitti, operations manager for AUMA Actuators Inc. "One obvious one is advancements in technology, but another is customer expectations. People want things more quickly, and they have quality and cost expectations. From year-to-year, those three expectations vary depending on the market. But they drive change."

Another factor that affects manufacturing is the role of federal, state and local government. "Government intervention is forcing more sourcing of local content to meet new regulations and avoid costly tariffs," said Tinsley. "Countries are looking to create manufacturing jobs and driving legislation to block pure imports."

Manufacturing jobs—and finding qualified people to fill them—are also at the forefront of conversations about the industry's future. "The demographics of our workforce are contributing to change," said Bill Metz, vice president of operations and engineering for Richards Industrials. "We have a lot of people looking at retirement in the next four to 10 years and not enough young people coming into the business."

Workforce challenges, technological advancements, customer demands, the regulatory landscape and more are leading manufacturers in the valve and control products industry to adapt. In this article, we'll take a closer look at movements in three main areas: agile manufacturing, automation and digitalization.

A QUEST FOR AGILITY

Manufacturers are increasingly embracing agile manufacturing to enhance their operations. Encompassing a broad range of strategies and tools, agile manufacturing is a methodology that stresses the importance of responding quickly to customer needs and unexpected changes in the marketplace. Agility is becoming a hallmark of successful manufacturing facilities and will continue to do so in the future.

When Scacchitti joined AUMA Actuators nearly a decade ago, the standard lead time for orders was six to eight weeks. When the company expanded into the oil and gas market, it had to make changes to meet that niche's two- to three-week delivery expectations.

"We wholeheartedly embraced a made-to-order system and eliminated all batch processes in assembly areas," said Scacchitti. "We had to realign our shop floor, move equipment and change our product and process flow." Among the changes AUMA made recently was to eliminate the purchase of pre-assembled motors from its parent company in Germany and bring the assembly inhouse to turn products around faster.

By using a made-to-order system, Scacchitti said the company has decreased its lead times up to 270%. AUMA has also reduced waste. "With batch processing, you're making components ahead of time. Materials may

A robotic arm at Neles Global Operations is configured to rotate around a valve holding a spectrometer sniffing device to capture leaking helium from the valve and provide data to determine if the leakage rate meets customer specifications.

Finding personnel with the skills needed to perform in today's manufacturing environment remains a significant challenge. Here, Richards Industrials employee Mike Fischer reviews a FORCAM report.

become obsolete or get recalled, so you end up with a lot of wasted products you can't use," he said.

A focus on cross-training helps Richards Industrials remain agile. "Almost all of our employees can do multiple tasks on multiple machines," said Metz. "You can move them where the work is rather than moving the work to where they are. We have that flexibility throughout our machining and assembly areas."

At Neles, shortened lead times are often driven by customers who are completing engineering work at the same time the supplier of flow control solutions is processing the purchase order. "This requires us to react quickly to changes to their purchase order and still try to keep their original promise date," said Tinsley. One of the ways the company stays on track is by using a workflow system that records, tracks and reminds individuals of their to-do lists and due dates. A second tactic is the delayed differentiation strategy, which occurs on the production side.

"For certain industry segments, we produce a family of products that can later be differentiated into a specific end product, thereby reducing lead times," said Tinsley. "We use a variety of strategies, from subassemblies stocked on the shelf to components that can be transformed into many different end-use items."

ADVANCES IN AUTOMATION

A record 2.7 million industrial robots work in factories around the world, according to the International Federation of Robotics' World Robotics Report 2020. That represents a worldwide increase of approximately 85% between 2014 and 2019. Despite the jump, the move to robotics and other automated systems isn't a simple decision—or undertaking.

While Richards Industrials is investing in automation, Metz admits it's challenging for the company because it has a high mix of products that it produces in low volumes. "Automation can help us, but it's much more difficult to do compared to a high-volume, low-mix environment," he said. One area where automation makes sense is machining to help minimize changeover and setup.

In addition to using robotic arms for high-pressure testing, Neles also relies on them for measuring and data mining of critical valve dimensions. Advancements have moved the task from coordinated measuring machines housed in a control area to robotic measuring

The Workforce Dilemma

Finding and retaining a skilled workforce tops the list of concerns for many manufacturing firms. A survey released earlier this year by The Manufacturing Institute and BKD noted that more than 77% of small and medium-sized companies expect to continue struggling to attract workers in 2021 and beyond. In addition, the No. 1 way that companies indicated they plan to address unfilled positions was by handing their existing employees more work and responsibilities.

That strategy seems untenable. While greater efficiencies on the shop floor can reduce the number of employees, they don't negate the need for a qualified talent pool. "We have plenty of jobs open, but we can't find people," admitted Kevin Tinsley, senior vice president of Neles Global Operations. The company partners with nearby Worchester Technical High School, providing the vocational school machines for student training and offering a work-study program. "We try to create as many connections with kids as possible to help negate the stigma of working in a factory and attract them to advanced manufacturing," said Tinsley.

Bill Metz, vice president of operations and engineering at Richards Industrials, said his company also struggles to backfill positions left open when skilled employees retire or leave the firm. Richards Industrials is involved with the machining program at two local high schools. It also pays for interested employees in the stock room or assembly area to earn a certificate in manufacturing machine operation at Cincinnati State Technical and Community College.

"We hire for attitude and train for aptitude," said Metz. "It takes a little longer, but you typically get better long-term results."

arm equipment on the manufacturing floor. The company has several Hexagon Romer Absolute Arms in its Massachusetts facility to validate critical parts.

"In the past, measuring all these parts was so time-consuming. We had almost a 'hope strategy'—build it, take it apart, try something new, repeat," said Tinsley. "Now we are trying to be more scientific. Collected data is compared to our drawing and historical data. We then run 3D models to see if we could have a stack-up dimension issue. This eliminates wasted valve assembly capacity, rework and damaging essential parts."

Neles also developed a machine for lifting and turning large valves—some the size of cars—that Tinsley said resembles a PAC-MAN character. "We stick the valves in the jaws of the PAC-MAN, squeeze it down, and the machine turns it over," he said. "So we avoid using chains and cranes and lifting with people underneath the valves." It's a win-win, increasing both efficiency and safety.

A COMMITMENT TO DIGITALIZATION

Like agile manufacturing and automation, digitalization can take on many forms. Simply put, it refers to the use of digital technologies to change business processes and models. Two of the tools gaining buzz recently throughout manufacturing are virtual/augmented reality and digital twinning, which means to create a virtual representation of a component, product or process to run simulations before it's deployed. But they aren't the only digital technologies impacting industry.

Last year, Richards Industrials won the Manufacturing Leadership Award from the National Association of Manufacturers for innovating the company's shop floor with FORCAM's manufacturing execution systems (MES) software. MES packages collect and analyze data on the status of equipment and tools, personnel availability, material buffer and batch and more.

"We're using FORCAM to look at what things are preventing our machines from running efficiently," said Metz. Richards Industrials receives daily, weekly and monthly reports that point to potential bottlenecks, such as tool changes or equipment downtime due to delays in receiving materials. The company uses the information to "dig a little deeper and find opportunities to make changes in the process," said Metz.

AUMA Actuators has completely digitized all functional testing requirements for its products, which are configured to meet each customer's specific needs for movement, speed, torque and other requirements. The company digitized data from nearly 3 million customer drawings. The data now runs through a computer system, and products are tested on custom-built testing stations. "You plug in the electrical actuator, pick the job number and the system pulls up pre-digitized functional testing for that order," said Scacchitti. "You push a button, and when the testing is done it tells you what's working or what's wrong."

Neles has invested in advanced planning software to connect supply and demand data from all its factories, which helps resolve one of the key supply management issues in the valve industry—part forecasting. The large number of markets, applications and variants in product lines creates erratic demand patterns month-to-month, said Tinsley. "[With the software] our production facility planners see customer demand in real time and allocate supplies to necessary work sites, which minimizes forecasting and the potential for inventory buildup on site while having shortages in another facility," he said.

PLANNING FOR CHANGE

It's a challenge for manufacturing companies to keep an eye on daily business while also forecasting where the industry is headed. To remain up to date, Neles Global Operations relies on internal talent, help from its parent company and collaborations with external experts.

"The valve industry is a small niche. It isn't as lucrative for technology developers as other industries," said Tinsley. "Most of our ideas for new technologies come from in-house, then we go out, search for a partner and get them interested. It takes a lot of internal development, then strategic partnerships with others."

New technologies are just the tip of the iceberg. Companies must make decisions about offshoring versus onshoring, supply chain management, fulfillment strategies, material advancements—the list goes on and on.

"Change is inevitable," said Scacchitti. "And in manufacturing, change is necessary to remain competitive." VM

☐ Test specialist Jim Manni from AUMA Actuators verifies controller operation using an automated test system.

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The Next Step in Functional Safety

Efforts are underway to further enhance safety by developing new recommended practices targeted specifically at remote actuated valve assemblies.

BY LOREN STEWART AND SHAWN STATHAM

The main goal of functional safety is to prevent accidents. When people think of functional safety, key words such as failure rates and safety integrity level (SIL), come to mind. However, these words only scratch the surface of understanding functional safety. Plant engineers and end users know the use of IEC 61508 certified devices alone does not guarantee a safe design, especially with a final element assembly. For example, analyzed field failure reports for remote actuated valve assemblies show that the root cause for many of these failures is application mismatch, insufficient lifetime torque matching and assembly errors. A study done in the UK supports this as well (Figure 1). The realization is that these automated valve assemblies do not always provide the anticipated safety.

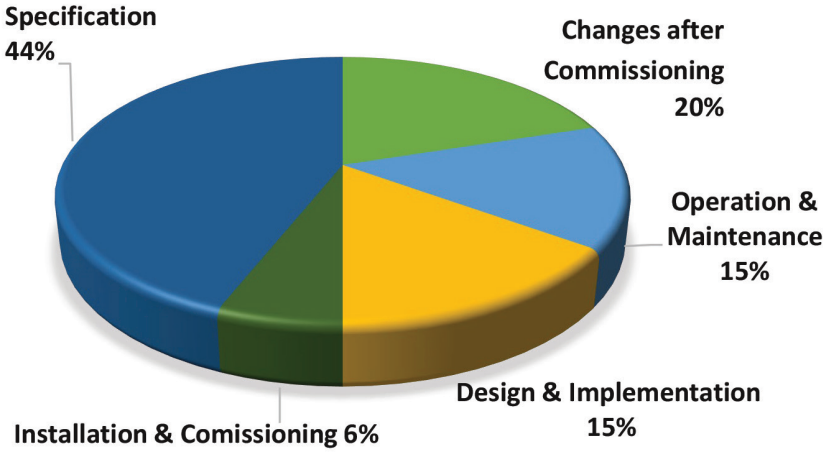
Organizations and committees are now undertaking efforts to address these challenges and developing new recommended practices targeted specifically at remote actuated valve assemblies (RAVA). These practices increase the rigor associated with the engineering, design and testing of completed final element assemblies and have become the path forward.

Many manufacturers have started to adopt these new practices, which allow the complete assembly to be engineered, designed and tested as an integrated product. This added rigor has created a new form of functional safety certification with the potential to significantly reduce systematic failures resulting in a safer design and product.

SAFETY INSTRUMENTED FUNCTION ANALYSIS

Statistical analysis of over 80,000 Safety Instrumented Function (SIF) designs shows that nearly 70% of the average probability of failure on demand (PFDavg) comes from the Final Element (Figure 2). The PFDavg metric represents the chance that the automatic protection will not work when needed. An objective of engineers who design these automatic protection systems is to lower the PFDavg as well as reduce the false trip rate. The false trip

Figure 1. Detailed analysis of which phases contribute to failures



SOURCE: *"OUT OF CONTROL: WHY CONTROL SYSTEMS GO WRONG AND HOW TO PREVENT FAILURE,"* U.K.: SHEFFIELD, HEALTH AND SAFETY EXECUTIVE, 1995 (ED 2, 2003)

rate and PFDavg are based on several variables including the failure rate of all devices used for each SIF. These devices are classified into three groups: the sensor assembly, which detects a dangerous condition; the logic solver, which determines when to initiate the protection; and the final element, which does the protection work. The final element is often a remote actuated valve that opens or closes.

End users are looking for help from manufacturers to reduce this percentage and make their plants safer.

CONTRIBUTING FACTORS

Numerous field failure reports show root cause due to inadequate lifetime torque matching, insufficient assembly testing, manufacturing errors or application mismatch. These automated valve assemblies do not always provide the anticipated and necessary safety. Often, the requirements for the final element are not specified with sufficient clarity and detail to facilitate a well-designed and verifiable subsystem. Combine this with the natural engineering process that focuses on getting things to work and rarely considers what happens when devices fail. A delivered RAVA is impacted by device manufacturers, distributors, engineering contractors, integrators, third-party suppliers, etc. Many opportunities for misunderstandings and design issues exist, and more needs to be done to apply the lifecycle engineering rigor required by IEC 61508 to the entire RAVA supply chain.

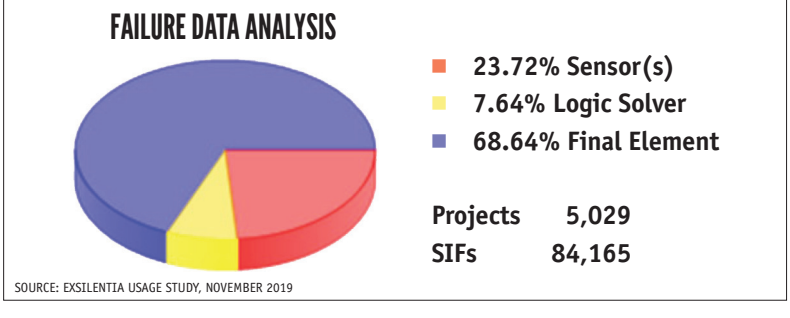
INDIVIDUAL PIECES VS. PRE-ENGINEERED FINAL ELEMENT ASSEMBLIES

Typically, a safety function design engineer will choose devices for a RAVA that meet process specifications. Often, IEC 61508 certified devices will be chosen. Then the assembly is designed, and the devices are assembled by an integrator. How could this process be improved?

When a device (like an actuator or a valve) goes through a functional safety certification, numerous audit and assessment steps are done. One of the essential steps is an FMEA (failure modes and effects analysis) followed by a more detailed FMEDA (failure modes effects and diagnostic analysis). Each component failure mode is reviewed, then the impact on the entire device is identified and evaluated. This focus on what happens when failures occur identifies potential solutions to make devices better. The design engineering process is also carefully audited and must provide sufficient design analysis and testing. This is a proven method that is well established for the individual devices, however, can this approach work with a RAVA to provide verification and structure?

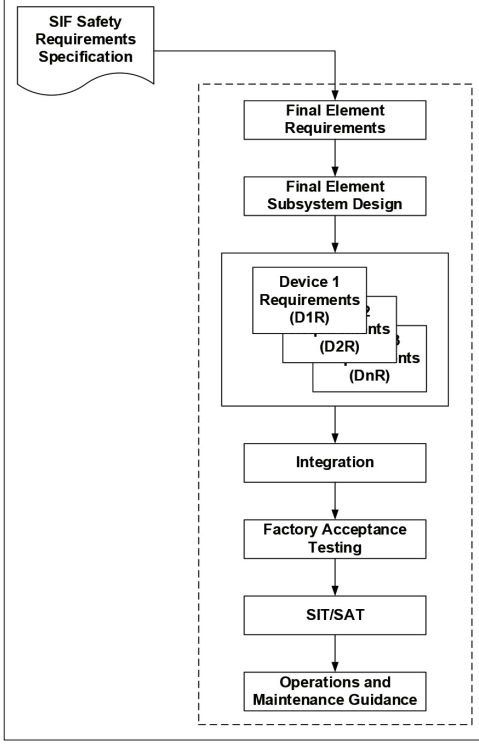
The answer is yes. The certification assessment approach works well on the entire RAVA (Figure 3). Several documents have been leveraged to obtain

Figure 2. Average PFD contribution results from over 80,000 SIF designs



SOURCE: EXSILENTIA USAGE STUDY, NOVEMBER 2019

Figure 3. RAVA -pre-engineered final element assembly approach



requirements for RAVA certification from organizations such as the Process Automation Users' Association (WIB), International Organization for Standardization (ISO), Instrument Society of America (ISA), American Petroleum Institute (API) and American Society of Mechanical Engineers (ASME). The resulting requirements from these relevant standards/recommended practices define a certification scheme that will reduce engineering errors and omissions, characterize lifetime torque and match actuator output, provide complete design testing, and verify manufacturing quality. The program also requires a user document called a "safety manual" where safety design data, including application limitations, predicted failure rates, maintenance procedures and effective proof test procedures, are provided. The objective of the RAVA program is to achieve fewer false trips and higher safety by reducing engineering errors, reducing communication errors, finding and addressing problems in a design and reducing operational/maintenance complexity.

The RAVA certification scheme does not just ensure that the assembly was designed as a whole, but also includes a detailed review of the design parameters to accurately estimate design strength. When a manufacturer has innovative designs with special coatings, surface finishes and strong strength margins, credit is given. When an end-user application review is part of the assembly engineering process, the number of application mismatches is reduced, and credit is also given. What does this really mean? Our chances of failure are getting increasingly smaller.

Figure 4. SIF analysis

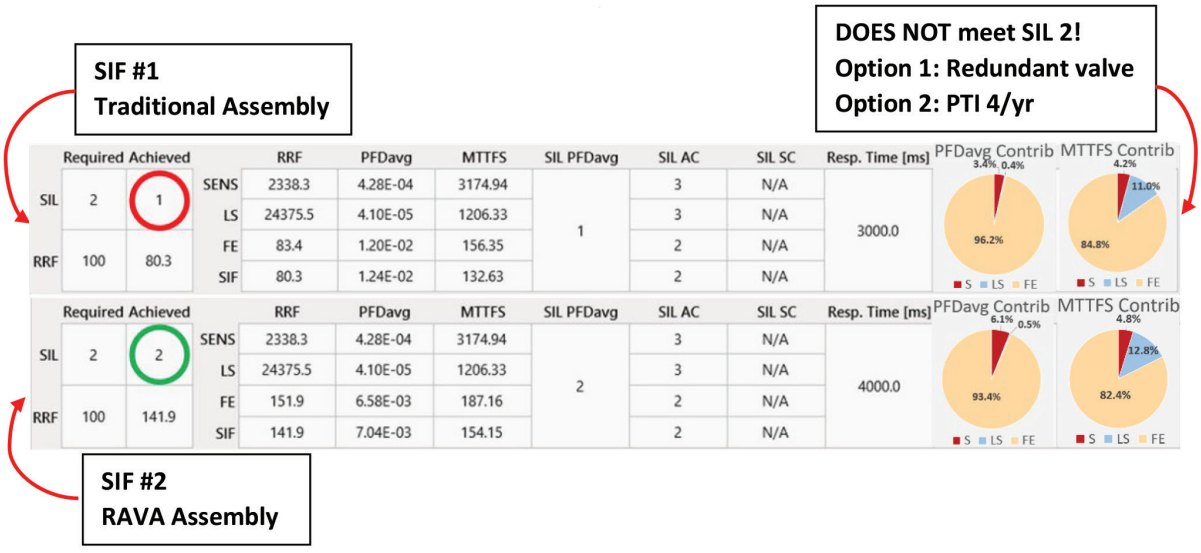


Figure 5. Lifecycle cost comparison of SIF #1 and SIF #2

		Cost	Total SIF Cost Over Plant Life
SIF #1 Traditional Assembly	Total Design and Implementation	$6,300.00	$597,790.97
	Annual Operation and Maintenance	$12,656.37	
	Net Present Value of Annual	$373,664.13	
		Cost	Total SIF Cost Over Plant Life
SIF #2 eRAVA Assembly	Total Design and Implementation	$1,200.00	$331,994.32
	Annual Operation and Maintenance	$4,449.81	
	Net Present Value of Annual	$131,375.37	

Lifecycle Savings **$265,796.65**

IMPACT ON SIF DESIGN VERIFICATION RESULTS

The RAVA products that have completed certification have shown low false trip rates and better safety resulting in a significant reduction in overall SIF lifecycle cost.

To demonstrate this, we utilized an engineering tool to perform a SIF analysis (Figure 4) containing a sensor, logic solver and final element assembly including a solenoid, actuator and valves attempting to achieve a SIL 2 SIF. Both SIFs have the same devices and assumptions have been maintained for both SIF #1 & SIF #2. The PFDavg contribution of the RAVA has been modeled for both SIF #1 (traditional assembly with individually certified devices) and SIF #2 (RAVA certified assembly). In this analysis we see SIF #1 achieves a SIL 1 level, which does not meet the target of SIL 2. SIF #2 RAVA achieves a SIL 2 level.

There are still two options that can be considered here to bring SIF #1 up to our SIL 2 target. In option #1, we can add an additional redundant Final Element assembly (making it a 1oo2 assembly). Or with option #2, we can decrease the proof test interval (PTI) to 3 months. Both of these options will add significant cost to both designing the SIF and its operational lifetime.

Evaluating the two SIF options in a lifecycle cost analysis tool (Figure 5) demonstrates a significant savings when using the SIF #2 RAVA certified final element assembly. In this example, a savings of 45% was achieved for an overall lifecycle cost reduction of $265,797.

SUMMARY

Even though devices used in remote actuated valves typically have IEC 61508 certification, it was recognized that more could be done. The IEC 61508 concepts could be applied to the entire assembly instead of only the pieces individually.

When considering the entire final element assembly, RAVA certification does just that. It is a credible assessment and certification process that can verify, validate and document improved remote actuated valve assemblies. Perhaps the result will be that remote actuated valves will no longer win the first place of safety reduction. And more importantly, end users will enjoy better products that significantly improve safety, reduce false trips and reduce overall lifecycle costs. VM

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Enhanced Safety in LNG Applications

Modulating pilot-operated safety valves can be designed for cryogenic services and offer numerous advantages for efficient and reliable pressure protection of liquid natural gas (LNG) installations.

BY JEAN-PAUL BOYER

For more than 40 years, the safety record of the global LNG industry has been excellent, due to attention to detail in engineering, construction and operations. While the safety of processing and handling LNG has always been paramount, it is now even more important to retain this excellent record as LNG installations are getting smaller, therefore multiplying and being constructed closer to populous areas. The reliability and dependability of pressure safety valves (PSVs) protecting these installations is more critical than ever.

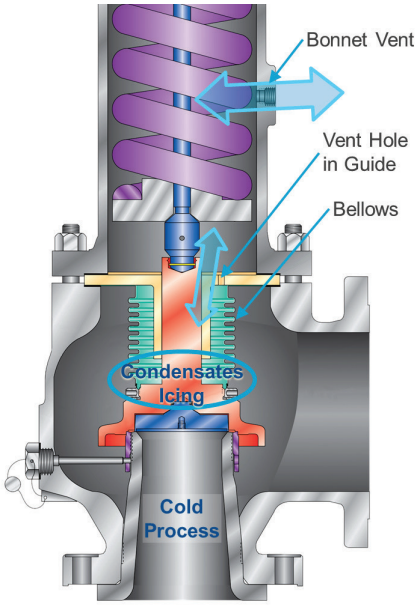
PRESSURE SAFETY VALVES

For the obvious reason of safety and environment protection, most safety valves on an LNG installation discharge to a closed piping system and to a dry flare. Without any moisture in the piping system, the dangerous freezing risks at the seat of the valve are eliminated. Many other valves and equipment also discharge into this same header system so that the pressure in the header is always fluctuating. This variable backpressure is imposed on the PSV and will act directly on its disc, adding itself to the original setpoint (opening pressure) of the valve. This is not acceptable. Most of the pressure vessel codes in the world accept a tolerance of +/-3% on the set pressure of a safety valve so it is not higher than the design pressure of the equipment it protects. If the pressure in the dry flare header exceeds 3%, then obviously the safety valve connected to it will open at a pressure higher than what it should, leading to a very hazardous situation: The equipment is no longer safely protected.

To avoid this danger, balanced bellows safety valves are commonly used across all industries. A metallic bellows is mounted on top of the disc of the valve to protect it from the header backpressure, so the safety valve opens at the correct pressure, whatever the variations of the header pressure.

For this to work properly, the volume inside the bellows, connected to the bonnet of the valve, must be freely vented to the atmosphere, which is accomplished via a vent in the bonnet. As a result, only atmospheric pressure acts on the bellows, on top of the disc and around the spindle and guide. As these parts cool down with the process temperature—which can be as low as -260°F (-162°C) on LNG processes—the air moisture will condense and freeze at the lowest point: inside the bellows on top of the disc (Figure 1). This is dangerous—and invisible. As the ice builds up slowly, the disc will be blocked from opening, without this being visible from the outside, thus, the equipment is no longer protected.

Figure 1. Balanced bellows safety valve



Many standards refer to this situation. For example, API Standard 520 part 1, clause 4.2.1.3.9 reads: "[…] the bonnet of a balanced PRV shall be vented to atmosphere at all times. The user should be cautioned of the potential for freezing of atmospheric moisture inside the bonnet."

CRYOGENIC PILOT-OPERATED SAFETY VALVES

This is why, since the late 1960s, pilot-operated safety valves (POSV) have been used extensively on LNG installations onshore as well as on LNG tanker ships.

POSVs use the system pressure as a closing force so that the seat tightness is at its maximum close to the set pressure—completely opposite from a spring-loaded valve. With the addition of a properly engineered soft seat, the tightness on cold or cryogenic service will be reinforced to avoid any leakage or even icing risk, while reducing maintenance costs.

Instead of a disk, a piston closes on the nozzle. This piston makes the POSV inherently balanced against backpres-

POSV during cryogenic flow test on liquid nitrogen

sure, by design, without any additional accessory.

There are several factors to consider when installing a POSV on a cold or cryogenic application. The valve and its pilot must be specifically designed to perform in these demanding cryogenic applications: Use of a standard design with all parts in austenitic stainless steel is obviously not sufficient.

Particularly, the pilot must be relatively isolated from the cryogenic temperatures. There are many proven ways of achieving this. One way, which must not be overlooked on site, is that while the main valve can usually be insulated like its associated piping, the pilot and tubing must be kept out of the insulation, in the open air.

The pilot should be non-flowing to limit the input of cryogenic media through it. A non-flowing pilot will still flow a little but only to reclose the valve: It does not flow while the main valve is opened and flowing. To reclose the main valve, the non-flowing pilot will then send process fluid into the dome of the main valve—the volume on top of the main valve piston. By re-pressurizing the dome, the piston moves down and re-closes the valve. So, the non-flowing pilot will flow only the dome volume at each open-close cycle.

But a flowing pilot will flow as long as the main valve itself is opened. With such a large amount of cryogenic fluid passing through, the pilot may freeze and lock open and not be able to reclose the main valve after an event.

Until 20 years ago, the only suitable pilot technology for these applications was the snap-acting pilot, which has only two discrete positions: fully closed or fully opened. In a similar way to spring-loaded safety valves, the POSV with a snap-acting pilot will discharge its full capacity every time it opens, whatever the real needs of the protected system, leading to unnecessary heavy losses of products to flaring.

Furthermore, the snap-acting pilot itself cannot be balanced against backpressure, so any release of natural gas from the pilot must be to the atmosphere, which is dangerous and harmful.

This changed 20 years ago, when the first LNG site started operations with modulating pilot-operated safety valves.

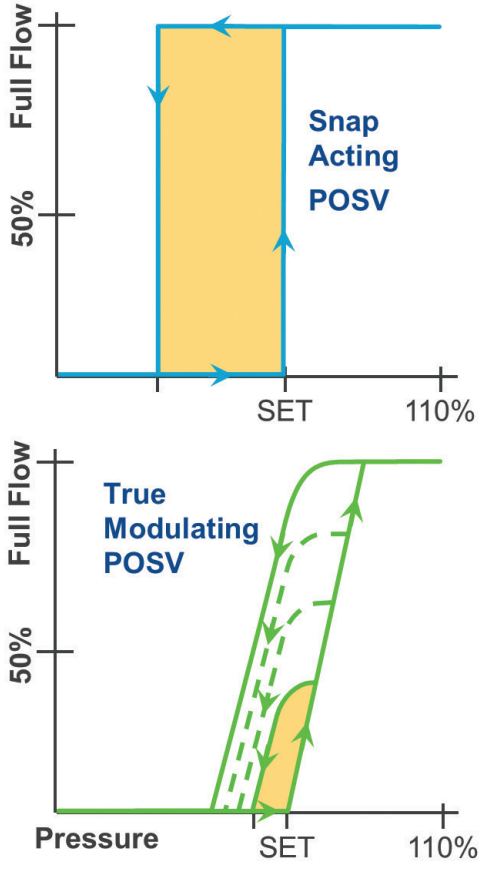
TRUE MODULATING POSVS

True modulating pilots are fully balanced against backpressure, so any necessary exhaust from the pilot can be conveniently piped to the main valve outlet, to the flare: no release to atmosphere.

Being truly modulating they also control the valve opening exactly in proportion to the needs of the system: important reduction of emissions as the valve will release only the strict amount of gas necessary to keep the pressure within safe limits. At the same time, this obviously eliminates the risk of oversizing and the dangerous PSV instability it can bring (Figure 2).

These pilots will also be non-flowing to reduce the amount of cryogenic fluid

Figure 2. Flow diagrams of the two types of POSV



passing through. As the opening of the main valve is always proportional to the needs of the protected system, they typically will never need to open fully, reducing even further the volume of process fluid needed to reclose the valve at each cycle.

On liquefied gas processes, most safety valves applications will develop a mixed-phase flow as the liquefied gas flashes into vapor across the nozzle of the valve. Mixed-phase applications like these are very demanding on PSVs, causing a high amount of backpressure, additional instability on the valve and difficult reclosing. True modulating pilots have shown to be a reliable, safety valve technology for mixed-phase flows, keeping the main valve stable, even with this high level of backpressure and whatever the flashing mix; they are able to reclose the valve within the usual limits as such pilots react only on static pressure.

True modulating pilot-operated safety valves, with dedicated design and configuration for cryogenic services, offer numerous advantages for efficient and reliable pressure protection of LNG installations.

While conventional spring-loaded safety valves can provide an acceptable level of protection—particularly when fitted with a soft seat of proven design—the balanced bellows spring-loaded valves represent the potential for highly hazardous situations and should be avoided on cold or cryogenic services.

Pressure safety valves act as safeguards to protect the integrity of expensive equipment, and doing so, the lives of people and the environment. Because LNG installations are safely designed and operated, most will probably never experience the opening of a safety valve. However, it is important the design and configuration of such safety valves is correctly adapted to the process conditions.

As the supply of LNG to retail market grows, it is imperative the level of care and custody that the historical LNG industry has provided be maintained by all retail LNG market participants. Industry knowledge, and the collective lessons learned of the broader LNG industry, need to be shared with new entries. VM

[1]US Department of Energy, *Liquefied Natural Gas: Understanding the Basic Facts*, Aug 2005

[2]American Petroleum Institute, *API 520: Sizing, Selection, and Installation of Pressure-relieving Devices - Part 1: Sizing and Selection*, 10th edition, October 2020

[3]GIIGNL, *Retail LNG Handbook*, 1st edition, 2015

Jean-Paul Boyer is process director PRV, Europe, for Emerson Automation Solutions. Boyer is a former merchant marine engineer officer and has worked with safety valves for more than 30 years. His main areas of expertise are the use of safety valves for cryogenic services and mixed phase flows. Reach him at jeanpaul.boyer@emerson.com.

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Selecting Non-metal Materials for Valve Components and Coatings

BY MITCHELL ANDERSON

Non-metallic materials are commonly used for valve components. The selection of non-metallic materials for valve design and for application-specific conditions is critical to ensuring product reliability. Like metallic materials used in valve designs, to meet reliability target selection of non-metallic materials is important to fulfill the design function of the component in the intended applications. In this article, we address some key areas to aid in the design and selection of non-metallic materials.

INCORPORATING NON-METALLICS INTO VALVE DESIGN

From a design/manufacturing standpoint, when selecting a material you need to be clear on the function of the intended part. Is it a dynamic seal? Is it a static seal? Is it pressure boundary or pressure controlling component?

With respect to pressure boundary components in industrial valves, non-metallic materials are not as common as metallic materials. One reason we don't see non-metallics utilized broadly in industrial valves is due to the lack of codes or standards providing acceptance and guidance for their use. Several industries will use non-metallic pressure boundary materials (such as fiberglass reinforced plastic composites) because these materials are better suited than metallic materials with respect to chemical compatibility. Composite materials can

provide superior chemical compatibility in many acid services thus selecting the right material for the service can provide overall product reliability.

In addition, consider:

- Chemical resistance and physical properties
- Flex modulus and creep resistance
- Processing method for making the non-metal part: What expertise is required and what is the cost of the equipment?

From an application standpoint, pay attention to the conditions the valve will encounter:

- Chemical composition of the flow medium (critically important)
- Elastomer liners must withstand chemical attack and swelling
- Temperature limits of the material
- Solids content of the flow, if any (is there risk of abrasion?)
- Flow rates or velocity

PROPERTIES OF NON-METALLIC MATERIALS USED IN VALVES

Understanding material properties is critical for selecting the right material for the valve design function and compatibility for application. Both chemical and physical properties of the materials of construction should be understood to utilize a particular material.

The chemical properties of a material determine whether it can be used within a particular application include:

- Chemical compatibility/corrosion resistance/chemical resistance
- Crystallinity
- Permeation
- Electrical conductivity
- Food safety

The physical properties of the material need to be taken into account to ensure functional performance, including under a full range of operating conditions:

- Strength: tensile, yield, compressive
- Elongation
- Flexural modulus
- Compression set
- Deformation under load
- Hardness (Shore durometer)
- Volume change: swelling, especially due to the flow medium
- Abrasion resistance
- Extrusion resistance
- Temperature rating: performance within given temperature range (Figure 1 shows examples)

It also is important to know that no two materials of the same type may have the same properties. Here are two examples:

Elastomer properties are highly reliant on the "recipe" and "ingredient brand," so changes to the brand of ingredient can result in unexpected material property changes.

Polymer mechanical properties are highly reliant on the processing (recipe) of the materials; material properties can be directly related to crystallinity of the material, which is dictated by the heat treatment. Any change in heat treatment will correlate to a change in mechanical properties.

COMPATIBILITY IS CRITICAL

Material manufacturers know their products well and provide chemical compatibility information, often in charts like the one shown in Figure 2.

Notice in the second column that FEP/TFE/PFA (fluoropolymer) material is shown as excellent for use with all the chemicals listed. That said, this type of material isn't necessarily good with everything; an extremely challenging flow such as molten sulfur could cause it problems.

In a similar guide for rubber materials, instead of having corrosion rates as for metal, you'll see swelling rates or degradation rates. Look for a material that's going to be compatible with whatever is going to flow through that pipe.

Examples of incorrectly applied materials:

- PEEK dissolves completely in concentrated sulfuric acid at room temperature.
- EPDM elastomer swells and decomposes when hydrocarbons are present, even in trace amounts. Use nitrile or Viton instead, depending on the manufacturer's recommendations.
- Polypropylene is excellent for

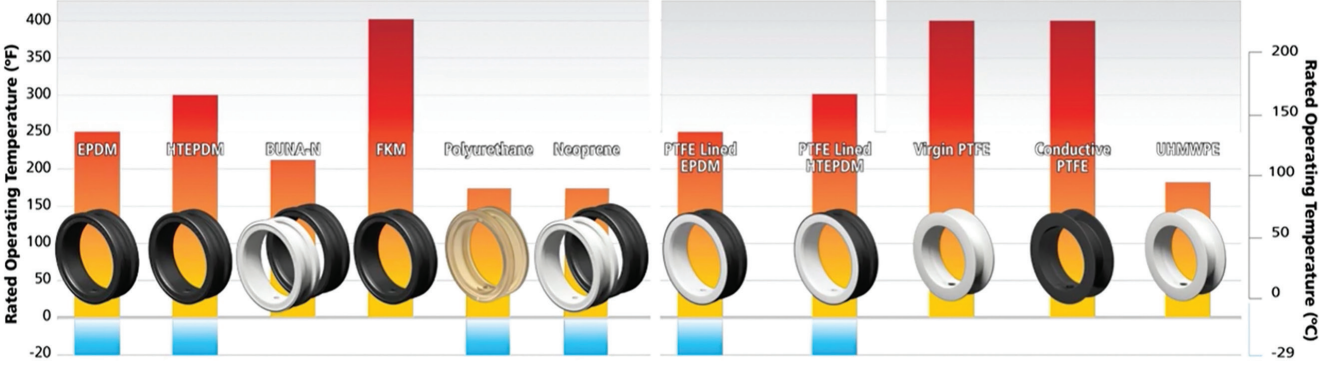


Figure 1. Temperature ratings for non-metallic seat materials used for resilient seated butterfly valves

Considering Composites

To learn more about how composites can work for the valve industry, VALVE Magazine asked Mitchell Anderson, author of the accompanying article, to interview John P. Busel, F.ACI, HoF.ACMA. He has 27 years experience on the subject of composites and is considered a leading authority on the subject. Busel works with the American Composites Manufacturers Association (ACMA) and serves as vice president of ACMA's Composites Growth Initiative.

Mitchell Anderson: For those not familiar with composite materials, could you provide a short primer?

John Busel: Composites are materials that, when combined with other materials, are stronger than they are individually. The materials include reinforcement fiber, such as glass or carbon, and then a type of resin. The selection of those materials, along with the manufacturing process, then determines the specific properties of each composite material. The results include materials that are high-strength, lightweight, corrosion-resistant and very durable.

Composites are used to make a variety of different types of valves, such as ball, butterfly and plug. Some companies make composites for pressure-relief and other flow control valves.

One important benefit in the valve industry is that composites can be specifically tailored to almost any application or service environment. However, this can also be a deterrent because of the lack of a specific standard or formulation.

MA: Let's focus on standards and specifying with composite materials. In some cases where composites piping or storage tanks are used, composite valves are also used. But in other areas where steel traditionally has been used, are there standards to point to or ways in which engineers can learn about composites?

JB: One of the first factors to understand with composites is how important the service environment is. Service is the key to using the right materials, which means it's important for customers and composites or materials engineers to discuss the specific properties for the valve. These properties will be based on both the materials used and the manufacturing process.

John Busel

MA: Are there standards commonly used in the composites industry?

JB: Some standards exist, but they typically are product based, so you won't find a universal standard for something such as fiber-reinforced polymer (FRP) because of all the different "recipes" for making that material. This is partly because of use. For example, making a boat from FRP is different than making FRP rebar. For valves, as with other composite products, educating and building trust with the customer about the product and material use is vital, as is explaining the benefits and reasons why a composite valve should be chosen. It can take a very long time for a standard to be developed, which is another key reason why educating

Selecting Valve Materials – Chemical Compatibility Guides

Color Guide

- **E** — 30 Days of constant exposure causes no damage. Plastic may tolerate for years.
- **G** — Little or no damage after 30 days of constant exposure to the reagent.
- **F** — Some effect after 7 days of constant exposure to the reagent. The effect may be crazing, cracking, loss of strength or discoloration.
- **N** — Not recommended for continuous use. Immediate damage may occur. Depending on the plastic, the effect may be severe crazing, cracking, loss of strength, discoloration deformation, dissolution or permeation loss.

	ETFE	FEP/ TFE / PFA	FLPE	FLPP	HDPE	LDPE	PC	PETG	PP	PVC	TPE***
Acids, dilute or weak	E	E	E	E	E	E	E	G	E	E	G
Acids,** strong / concentrated	E	E	G	G	G	G	G	N	G	G	F
Alcohols, aliphatic	E	E	E	E	E	E	G	G	E	G	E
Aldehydes	E	E	G	G	G	G	G	G	G	G	G
Bases/Alkali	E	E	F	E	E	E	N	N	E	E	F
Esters	G	E	G	G	G	G	N	G	G	N	N
Hydrocarbons, aliphatic	E	E	E	G	G	F	G	G	G	G	E
Hydrocarbons, aromatic	G	E	E	N	N	N	N	N	N	N	N
Hydrocarbons, halogenated	G	E	G	F	N	N	N	N	N	N	F
Ketones, aromatic	G	E	G	G	N	N	N	N	N	F	N
Oxidizing Agents, strong	E	E	F	F	F	F	F	F	F	G	N

*not for tubing chemical resistance (except pvc)
**except for oxiding acids (see Oxidizing Agents, strong)
*** TPE gaskets

Figure 2. Examples of a polymer chemical compatibility guide

and developing trust with the customer to truly understand the service environment is important.

MA: What are some of the reasons for material use?

JB: As you said, using a composite valve with composite piping and tanks makes sense intuitively because of the service environment. In this case, a very corrosive environment may exist that requires a composite valve. Other reasons such as strength, weight or size requirements are also factors. Because composites can be joined with other materials, they could be used alongside metal piping, for example. And of course, cost also plays a role.

Many times, the composite material may be a better choice, but the fear of the unknown, perceived cost or lack of a standard may preclude it from selection. Currently, composite valves seem to be selected when there is a specific and obvious need, or when the service environment is so severe that other options don't make sense.

Composites are often selected when there is a specific need, such as in a severe environment, but they also can be used in other applications.

MA: Since you began working with composite materials until the present, have you seen any industry trends or technology improvements that will further expand their use in valves?

JB: Yes, there are a number of developments, and a few that are relatively new innovations. One example is graphene. This material can be added to resin. Doing so really intensifies the properties of the resin, creating what I'll call a resin on steroids. For example, the thickness of the material could be reduced substantially, without changing any of the other properties such as strength.

Smaller changes and innovations are a constant process, whether a new formula is developed or a change in manufacturing processes is created. Any of these could expand the use or market for composite materials beyond some traditional ones such as chemical processing or high pressure relief.

MA: Any last suggestions you have in helping to educate others on specifying composites materials in valves over steel?

JB: Because, as I've stressed, education and awareness are key in composites, I thank you and VALVE Magazine for the opportunity to explain about composites. I also want to point out how important collaborating with the customer to understand the service environment is in helping reduce the perceived anxiety or risk of change, and in building trust in these "new" materials.

Interested in learning more about composites? Visit www.discovercomposites.com or contact John Busel at jbusel@acmanet.org to request a copy of his presentation, Composites 101.

dilute and concentrated mineral acids and bases, but chlorinated hydrocarbons cause it to swell and soften.

- EPDM elastomer can swell when steam is present.
- Swelling in an O-ring or flat gasket may actually improve static sealing, but in a dynamic seal of a butterfly valve liner, for example, swelling of the liner could result in tearing when the valve cycles.

TAILORED TO THE APPLICATION

From an application perspective, it is critically important to know the composition of the flow medium, temperature and pressure of the service. Information gathering may not be as simple as readying a valve data sheet. Often a conversation between the valve manufacturer and the end user is required to understand all possible conditions to ensure compatibility throughout the process requirements. Say you're looking to put a rubber-lined valve in a certain service that has five different chemicals. The rubber lining material has to be good with all those chemicals. Even trace amounts of incompatible chemicals can cause problems, particularly swelling with elastomers.

What type of chemical resistance do you need for this valve? How long is this valve going to last? How many cycles?

Does the flow medium contain solids that make it abrasive? What is the flow rate? 20 to 25 ft/s (6.1 to 7.6 m/s) has been a common design velocity. Some manufacturers go to 30 ft/s (9.1 m/s) with a clean liquid (no solids) and with a gas you can go to sonic velocity.

Any time you have a lot of solids in the line, the slower the velocity the better. However, where the flow is 100% solids, as in bulk-solids hopper applications, valves can last a long time.

Finally, you have to be cognizant of the temperature limits of the material.

The bottom line is you really need to consult the material manufacturer to get their recommendations for your particular application. With the right material in the right place, a valve can operate reliably over a long life, even when fulfilling a challenging application. VM

Mitchell Anderson is director – ball valve and triple offset valve engineering at Bray International, Inc. He is a member of the VMA Education & Training Committee and regularly presents on the subject of materials. Reach him at mitchell.anderson@bray.com.

Virtual Work and the Workplace

BY BARBARA DONOHUE

The coronavirus pandemic is "the opportunity we never asked for," said Victor Reyes, managing director at Deloitte, in a recent webinar and virtual panel presented for VMA members. Reyes reviewed trends in work and the workplace. Kevin Kemerer, owner of Precision Pump & Valve Service and a member of the Valve Repair Council, and Roderick Stanley, CEO of VMA member Fetterolf Corporation, joined the discussion.

Three in five workers who have been working remotely during the pandemic say they would prefer to continue working at home after the pandemic. Fifty percent of workers believe they are as productive at home as they are at the office.

Among corporate CEOs, 32% expect one-third of their workforce to be remote in January 2022 and 76% of CEOs expect to require less office space than before the pandemic.

The effects of working at home have been perhaps surprising. Of the companies surveyed, 69% said their employees' productivity at home was the same (30%) or higher (39%). As for innovation, 63% said it was the same (23%) or higher (40%) among employees at home than it had been in the office. Among employees, 64% said their satisfaction with their work-life balance was the same (14%) or higher (50%) working at home instead of on site.

Among the businesses Deloitte surveyed, attitudes toward this new way of working covered the whole spectrum, from regarding remote work as a temporary phenomenon to reinventing how the office is used to planning to abandon office space entirely.

In the next year or so, Reyes said, the challenges will continue to be how to give workers what they need to work effectively from home and maintain their well-being and empowerment. This will develop the company's culture and sustainable productivity.

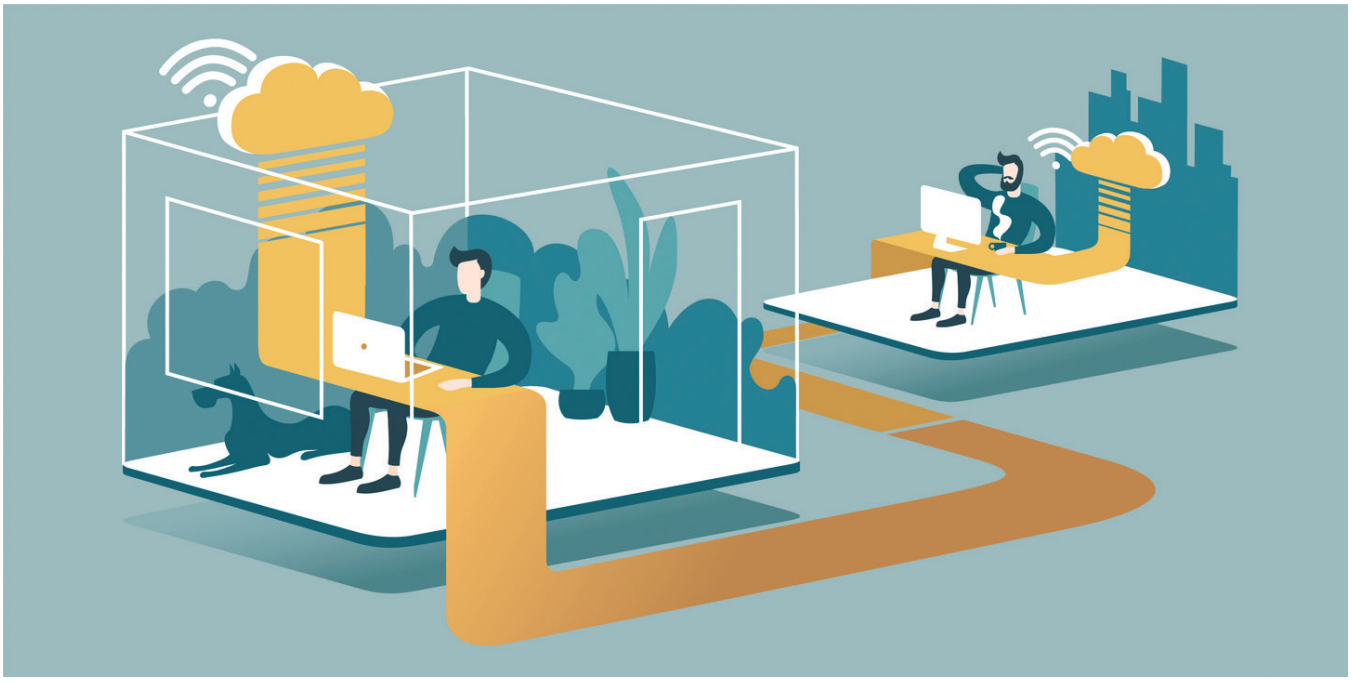
- Clear and frequent communication between management and employees (in both directions)
- Identification of high-value work and how to execute it effectively
- Simplification of decision-making processes
- Recognizing individual work preferences and schedules
- Use of collaboration tools to enable work across personal schedules and time zones
- Fostering employee growth by providing mentorship and learning experiences

Looking forward into 2022 and beyond, companies will likely rethink what the work is, where it is done and who does it, Reyes said.

MAKING IT WORK

About half our staff who were in the office are now at home, Stanley said. "We have found that the design engineers who know exactly which part or subassembly they are designing work very well from home. Not only that, but their productivity has gone up by 10 to 15%." Interestingly, half those people don't want to stay at home, he said.

Even before the pandemic, Kemerer said, sales staff worked remotely and technicians worked at job sites. "We already had people in the field who



work virtually, so maybe we're ahead [of the trend] and didn't even know it."

Kemerer told about a safety meeting that took place during the pandemic. "It's hard to get 90 people together at the hub." With a virtual meeting, everyone could attend and people in the field could save hours of travel time.

> **"The challenges will continue to be how to give workers what they need to work effectively from home and maintain their well-being and empowerment.**

To keep up communications with employees, Kemerer said, he delivered a video state-of-the-company talk and does monthly video communications to provide clarity and reassurance. "Though it's not face to face, it's more frequent, he said. "I think that better communication helps us retain talent."

AT HOME VS. IN THE PLANT

In this sort of situation, disconnects or hard feelings could occur between the staff who can work from home and the people on the shop floor who are essential workers and have to come to work every day. Reyes asked the panelists what they had seen.

"People understand. There aren't hard feelings," said Stanley. "It's not that people aren't working. They are at home, working."

Kemerer agreed that people understand. "I don't know for how long. It could be a challenge for management. We need to work on communication and culture. I think some of my remote people would love to come in every day and not have the dogs barking in the background of their calls. There are challenges on both sides."

At first, Stanley said, his company thought that people older than, say, 40, would not want to stay at home. "It's turning out that they are much more comfortable at home." The younger workers seem to need more communication. In the industry it generally takes six months to get someone up to speed or as long as two years for a valve engineer, he said. People on that learning curve need people with whom they can interact, talk about technical issues and bounce ideas around.

STAFFING

When Stanley talks with other folks in the valve industry, they say their most pressing issue is finding and retaining good staff, particularly in the workshop, but also, to a certain degree, in the office. If the technologies enabling remote work give an advantage in finding and keeping staff, it would be a massive improvement, he said.

It is both easier and harder to find talent "We did a Zoom video interview with someone in California last week," Kemerer said. Since his company is in a rural area, the option for virtual recruiting and working opens up welcome possibilities. "If we can be on the forefront instead of resisting, it can give us a competitive advantage."

LOOKING AHEAD

The advantages of virtual work are many, Reyes said. The benefits to companies include real estate and labor savings, access to a wider range of talent and increased employee engagement. On the workforce side, the benefits include flexibility to travel while working, cost savings and increased well-being.

A trend toward remote and hybrid work has been growing for the past 15 years, according to Reyes. The pandemic suddenly accelerated it. Time will tell whether and how much virtual work will become the new normal. VM

Barbara Donohue is a freelance technical journalist and former Web editor of VALVE Magazine. Reach her at info@the-engineer-who-writes.com

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What's Your Temperature?

Re-examining refinery valve pressure/temperature ratings in light of FE containment requirements

BY GREG JOHNSON

For decades, valve manufacturers have provided the maximum recommended working pressures and temperatures for their products, based on the materials used in the pressure-containing parts. Since the 1930s, these pressure/temperature (P/T) ratings have been denoted in standards specifications as well. But in today's world of fugitive emissions (FE) containment, the effective temperature range of the FE-capable seals (packing and gasket) is just as important as the temperature capability of the metallic components of a valve.

Until the demise of asbestos and the advent of asbestos-free graphite-based packings in the late 1980s, the listed maximum operating temperature requirement for packing and gaskets, as stated in the 1973 8th edition of the American Petroleum Institute (API) API 600 gate valve standard (the primary refinery valve standards document), was 750°F (399°C). This maximum temperature rating covered about 75% of the valves in refinery service, a percentage that is still close today.

Since the theoretical, non-oxidizing operating temperature for graphite is closer to 2000°F (1093°C), the refinery valve standards developers felt comfortable in raising the operating temperature of these packings and gaskets to 1000°F (538°C) in the 1991 9th edition of API 600. The 1000°F (538°C) packing and gasket requirement was mostly an afterthought until recently when the physics of low-emissions packings began to be extensively discussed in industry meetings and forums. For the past several years, most in the valve community ignored the fact that polytetrafluoroethylene (PTFE), or another lower melting point organic compound, was the key ingredient in graphite packings that made them seal fugitive emissions so effectively. PTFE

Acknowledging and defining the differential temperature between the fluid and the packing could lead to fundamental changes to refinery valve standards.

serves an important role in binding the graphite fibers or flakes together, plus providing some valuable lubricity to the packing. The elephant in the room was the fact that PTFE starts to deteriorate at around 550°F (288°C). Burning the PTFE or any other organic material results in a weight loss that corresponds to a volume loss and subsequently, a packing load loss. Which means that if a packing set is exposed to a temperature above the melting point of the PTFE, its ability to seal effectively is severely compromised.

The issue with stating that today's valve packings must be able to seal effectively up to 1000°F (538°C) is that they cannot repeatably contain fugitive emissions at an EPA and industry-accepted rate of less than 100 PPM at that temperature. As a result, we have a multitude of refinery valve standards in use today that require unattainable performance from the packing.

Although most refinery processes are well below the PTFE melting point, the question becomes whether the valve standards should drop their maximum packing temperature requirement to an effective or realistic 500°F (260°C)? That is not likely to happen, as there are some applications in a refinery where temperatures go much higher than 550°F (288°C), although 500°F (260°C) does match the test temperature of API valve fugitive emissions testing standards RP624 and RP641. So, we are stuck with a major incongruency: The valve packing temperature requirement in the valve standards is unrealistic because today's state-of-the-art fugitive emissions packing will not seal either effectively or repeatably, at the currently mandated higher packing temperatures.

There is one other factor that is not clearly defined in either the valve or FE testing standards: *Does the packing really see the same temperature as the fluid?* The answer is: that depends. There are many factors that affect the transfer of heat from the fluid area of the valve up to the center of the packing area. These factors include:

- Insulation around the valve
- Ambient temperature
- Design of the packing chamber bonnet/yoke area
- Valve orientation—is it in the open or closed position most of the time?
- Presence of a double packing set with a lantern ring
- Ceramic spacers below the packing
- Frequency of operation of the valve
- Fluid type
- Velocity of the fluid through the valve
- Fluid state—liquid, gas, or multi-phase
- External heat sources near the packing area

Acknowledging and defining the differential temperature between the fluid and the packing could result in fundamental changes to refinery valve standards, as the valve packing temperature requirement could be lowered from the process fluid temperature.

Some initial testing to determine the actual packing temperature, compared to the fluid temperature has been performed by refinery end-users using non-contact temperature measuring devices. These tests so far are inconclusive, as there are too many variables preventing the accumulation of highly accurate data.

As mentioned earlier, the test temperature for the API valve FE testing standards is 500°F (260°C). The issue of test temperature is being considered as part of the current revision of these standards. An optional high-temperature FE test at 750°F (399°C) has been discussed by the revision workgroups. In conjunction with this revision work, three testing facilities are performing 750°F (399°C) fugitive emissions tests on several similar sample valves. The goal of these tests is to try and determine the viability of a higher test temperature along with the procedure and acceptance standards for such a test.

The results of this testing will hopefully be presented at the next API meeting, April 2021. At that time, the decision to consider lowering the 1000°F (538°C) packing requirement that is resident in several API valve standards and possibly increasing the FE testing temperature to 750°F (399°C), either as a requirement or as an optional test, will be discussed.

It is important that packing manufacturers not only work towards creating packings that pass the API laboratory testing requirements but provide the best high temperature (>550°F [>288°C]) sealing possible. However, the consequences of higher temperature FE leakage might be so insignificant, and not a major real-world issue, that trying to create a new "super" packing to handle this leakage may not be cost-effective or necessary.

Significant thought and discussion are required in considering a change in either the requirements of the testing specifications or the valve design documents, as these documents tend to become de facto "law" and can affect end-user specifications and more importantly governmental regulations for years to come. VM

Greg Johnson is president of United Valve (www.unitedvalve.com). He is a contributing editor to VALVE Magazine and a current Valve Repair Council board member. He also serves as chairman of the VALVE Magazine Advisory Board, is former chairman of the VMA Marketing & Communications Committee, and is a founding member of the VMA Education & Training Committee. He is past president of the Manufacturers Standardization Society. Reach him at greg1950@unitedvalve.com.

Differences Between Double Block and Bleed and Double Isolation

BY NICK CRALL AND ANDREU TORRE PUJOL

Double block and bleed valves are used for primary and secondary isolation where bleeding the valve's cavity is required. To properly understand double block and bleed valves, one must first understand the definitions established by API regarding double block and bleed (DBB) vs. double isolation and bleed valves (DIB).

Double block and bleed as defined by API 6D is a "single valve with two seating surfaces that, in the closed position, provides a seal against pressure from both ends of the valve with a means of venting/bleeding the cavity between the seating surfaces." API 6D defines double isolation and bleed valves as a "single valve with two seating surfaces, each of which, in the closed position, provides a seal against pressure from a single source, with a means of venting/bleeding the cavity between the seating surfaces."

There is an important distinction between DBB and DIB as they often fall under the same category and are used interchangeably within the industry. DIB valves can isolate either side of the valve regardless of the presence of upstream or downstream pressures. And often, DIB valves are referred to as "double block and bleed valves." For further clarification and explanation, customers should consult the factory on product specifications and intended use.

WHAT AND WHY?

In various ball, gate, globe and needle valve configurations, a double block and bleed valve is like having three valves in one. In the closed position, it provides sealing against both ends of the valve (block) with a mechanism to relieve the pressure within the chamber between the seating surfaces (bleed). DBB valves are flexible in their design and offered in varying orientations, bores and end connections to meet design requirements and customer needs.

Once both block valves are sealed, the flow to downstream devices will stop. The residual media and pressure can be vented allowing for maintenance and repairs to begin without impacting the rest of the system. Using double block and bleed valves replaces the need for using three separate valves to perform the same function. This provides three major benefits: reducing the size and weight of the piping system, which lowers the amount of stress acting on pipes; reducing installation time and reducing the number of leak paths.

Figure 1 depicts a conventional, primary isolation double block and bleed pressure tap. It has a total of eight potential leak points, a cumbersome design and requires significant time to install as well as to maintain.

Figure 2 displays a flanged valve with self-operated needle valves performing the same function as Figure 1. Two of the needle valves are used for isolation and one of the needle valves is used for venting to an integral pipe tap.

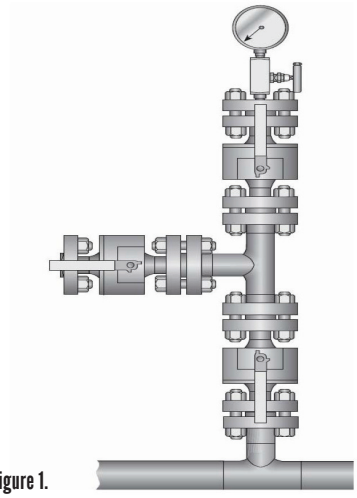

Figure 1.

WHERE CAN I FIND DOUBLE BLOCK AND BLEED VALVES?

DBBs are commonly used in the oil and gas industry but can be employed in other industries where piping isolation is critical, and leakage must not occur. These demands are often required when dealing with high-pressure

While double block and bleed valves are most often used in the oil and gas industry, they also are employed in other industries, particularly when piping isolation is essential and leakage must not occur.

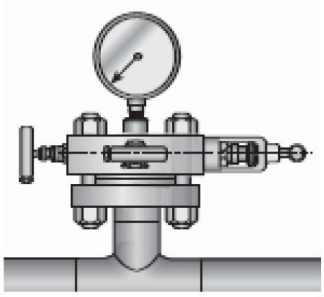

Figure 2.

systems, toxic or hazardous media, and where isolation for maintenance and calibration is required while keeping the rest of the piping system running. Many applications can be found on upstream and downstream offshore/onshore oil and petrochemical production, transmission and storage and industrial processing of natural gas.

More specifically, DBB applications often consist of bypass loops for instrumentation, such as a flowmeter or pressure gauges, where calibration is required at prescribed intervals. Isolating upstream pressure, providing a backup seal, and venting captured pressure allows for removal or work to begin on an unpressurized downstream. A second seal is desirable due to the nature of the applications. Viscous and aggressive media can increase clogging and/or seal failure. Having a second isolation valve allows for increased safety during these routine maintenance operations. This is an important example of understanding the API definition as well as a manufacturer's intended purpose for their products. The above application should be satisfied by using a DIB valve, whereas a DBB valve, such as a common trunnion ball valve with self-venting seals, has the potential of the first seal leaking and the vent valve becoming clogged. This could result in the upstream pressure overcoming the spring creating the second seal, ultimately compromising the second seal. A popular solution would be using an independently operated ball, needle or globe valves with a vent valve located in between.

In conclusion, it is imperative to fully understand the definitions used to prescribe types of valves, especially when dealing with the isolation of pressure. The proper use of the large array of double block bleed valves (DBB & DIB) allows for safer, more cost-effective piping systems. VM

Nick Crall is a project engineer for Richards Industrials currently tasked with New Product Development for the product line Steriflow Valve. He graduated from the University of Cincinnati with a Bachelor's of Science degree in Mechanical Engineering Technology. Originally working on the product lines of Hex Valve and Bestobell Steam, Nick gained industry experience in industrial steam as well as oil and gas applications.

Andreu Torre Pujol is a project engineer for Richards Industrials. He grew up in Spain where he graduated from the URV (Tarragona) with a Bachelors in Mechanical Engineering, and went on to receive his MBA and MEng in Mechanical Engineering from the University of Cincinnati. Andreu is the chief engineer responsible for Hex Valve, Bestobell Steam and the recently acquired line of sanitary diaphragm valves.

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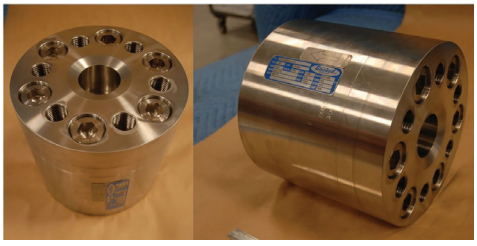
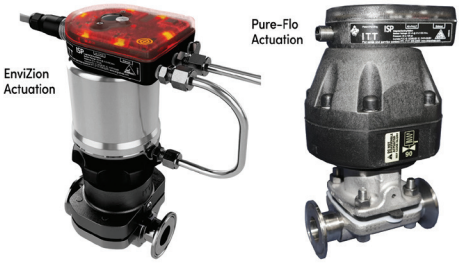
For more information on joining the Valve Repair Council, contact Marc Pasternak at 202.331.0104 (mpasternak@vma.org).

DeZURIK has launched a new knife gate valve with an innovative metal cutting design. Based on the company's KGC series knife gate valves, the new KGC-MC metal cutting cast stainless-steel knife gate valves are designed to provide long service life in applications requiring shearing capabilities. Wires, staples, glass or plastic are cleanly cut, crushed and cleared from the seating area.

Conval recently introduced a new in-line, axial check valve for urea and ammonia service. The new axial check valve complements the company's extensive urea service product line, which includes Clampseal Y-, T- and angle-pattern globe valves, Swivl-disc gate valves and Camseal top entry ball valves in ASME Class 900 to 2500 ratings. Standard sizes range from 1/2" to 6" with flanged, butt weld, hub, lens ring or custom connections.

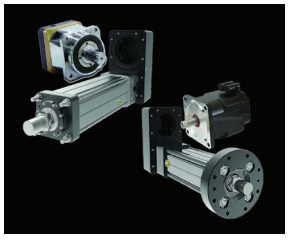


ITT Engineered Valves new Integrated Sensing Platform (ISP) delivers valve sensing technology with intelligent design to control and monitor diaphragm valves. By combining their knowledge of valve design with valve position feedback and network communications, the ISP delivers reliable sensing technology for EnviZion and Pure-Flo hygienic diaphragm valves.



Emerson has released its ASCO 141 Series Advanced Redundant Control System (ARCS) to provide a redundant solution for a variety of emergency shutdown valve applications, such as those found in the chemical, power, oil and gas industries. Available globally, it includes various redundant solenoid configurations to enhance the reliability of the process and meet specific safety or reliability requirements in automation processes.

Curtiss-Wright has released its new ASSIGN (Any Servo, Stepper, Integrated, Geared or NEMA) motor program for Exlar FTX and FTP Series actuators. These high-force/duty cycle, electric, rod-style actuators now provide the ability to support the mounting of almost any motor.



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