

VALVE

MAGAZINE
SPRING 2020
VOL. 32, NO. 2

Fixing the Water Infrastructure Problem

- : VALVES IN
 - : HF ACID
 - : SERVICE
 - : .
 - : .
- : VALVE
 - : ASSEMBLY
 - : GUIDELINES
 - : .
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14 WATER INFRASTRUCTURE: GETTING LONG OVERDUE ATTENTION

North America's water systems are aging and getting many headlines because of leaks and other issues. Some federal funding, a healthy bond market and new technology may be able to help.

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Valve Performance Management

A comprehensive approach to valve performance management gives access to available data about valves' condition and function. It also allows staff to anticipate failures before they occur, extend valve life, minimize unplanned downtime and focus maintenance resources where they can do the most good.

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- » Hydrogen's Role in Reducing Industrial Carbon Emissions
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Moving Forward During the Crisis



It has been said that in times of crisis, true colors shine through. From my vantage point, this is certainly true for our industry and VMA member companies. In mid-March, when it became clear that COVID-19 was unlike anything experienced in our time, our members and VMA quickly reacted.

In addition to holding webinars and providing curated information on state and federal actions, regulatory and industry response, one of the first actions we took was to demonstrate to government leaders the essential and critical nature of our industry so that our members could stay operational and serve their customers.

This issue's cover story is just one piece of evidence of how essential our industry is. Having clean and safe drinking water is typically taken for granted in this country, but if you are located in an area like where I live, which has periodic breaks in water pipelines leading to water outages, it quickly becomes clear how badly we need to update our decades old infrastructure. These days, valves do more than just stop the water flow in the event of a pipeline break—they detect leaks, provide information on the chemical levels that ensure our water is safe to drink and more.

As the industry works to ensure that water, as well as energy, medicine, food and more keep moving, VMA is committed to offering education, networking, business intelligence and industry representation to support our members—just as we did before COVID-19 hit. The last meeting VMA held before all this began, the Leadership Forum, provided excellent information on leadership, manufacturing and management approaches, as well as new contacts and inspiration. If you weren't able to attend, check out a recap on VALVEmagazine.com and see what ideas you can draw on to manage yourself, staff or company during this time. And be assured we have many more such valuable meetings coming your way in the future—in person and virtually.

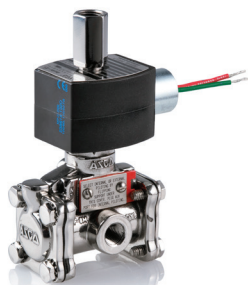
The world may look different in the wake of COVID-19, but after witnessing how the industry has responded thus far, I have no doubt that we'll continue to be resilient and return stronger than before to serve customers even better. VM

Heather
Heather Rhoderick, CAE
President



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NEW CONTRACTS

Baker Hughes Supplying Valves for BAPCO Project

Baker Hughes will supply the severe service, control and safety relief valve contracts for the Bahrain Petroleum Company (BAPCO) modernization project. This expansion project will modernize BAPCO's refinery to increase production, while increasing yield and efficiency.

Baker Hughes will supply products from its valve manufacturing sites in Coimbatore, India; Conde, France; and Jacksonville, FL, with raw components sourced from various suppliers to comply with a "no-China" material specification.

Emerson Partners with Brewery Research Group

Emerson is partnering with Ghent University and Uni-

versity College Ghent in Belgium to revamp, automate and modernize a pilot brewery, including providing equipment and support services. The two institutions share the Laboratory for Brewing and Fermentation Science and Technology, which offers hands-on training using digital automation technologies to educate the next-generation workforce, close skills gaps and enable digital transformation throughout the region's brewing industry.

Curtiss-Wright Signs Agreement with APS

Curtiss-Wright signed an exclusive agreement with the Arizona Public Service Company (APS) to commercialize APS's equipment anomaly detection (EAD) technology.

EAD technology uses machine learning to detect

anomalies in plant equipment and systems, allowing operators to improve performance and prevent failures. The technology can identify potential issues in important components so they can be addressed before a problem arises.

Curtiss-Wright will add the EAD technology to its suite of thermal plant performance and condition monitoring platforms.

AWARDS & MILESTONES

Victaulic Named to Top 20 List

The latest version of Victaulic Tools for Revit 2019 came in at No. 8 on Plumbing & Mechanical magazine's Top Products of 2019. The magazine receives thousands of plumbing, heating and radiant & hydronics product releases from industry manufacturers every year. Readers choose the top 20 products.

Neles Involved in 250 Major Shutdowns during 2019

Customers in various process industries used Neles Corporation to secure about 250 major shutdowns globally in 2019. Neles offers valve services through 40 service locations around the world.

It currently uses

diagnostic data, performance data and historical maintenance data to determine which valves need to be maintained during a shutdown.

VMA Members Highlighted in Readers' Choice Awards

Control Global magazine recently came out with its annual list of winners for its Readers' Choice Awards. Over a thousand respondents weighed in with their choices. Emerson Automation Solutions was a significant winner, finishing in the top 5 in countless categories. Other VMA members on the list of winners were Metso, Flowserve and AUMA Actuators.

ValvTechnologies Recognized as Fittest Houston Company

ValvTechnologies, Inc. took first place overall in the medium division of The Fit Company Challenge, presented by Fit Company Institute. The bi-annual competition is designed to encourage employees to be active in the office and on the field.

Challengers from companies in the Houston area exhibited mental and physical stamina by competing against each other in a three-course fitness event designed to test strength, agility and endurance.

THREE NEW MEMBERS

VMA welcomes two new associate members into the fold.

MRC Global (MRCglobal.com) joined as a distribution/channel partner. MRC Global has provided automated valves for more than 20 years, evolving from a bolt-up, quarter-turn shop into an advanced, fully integrated quarter-turn, multi-turn and linear automation provider with facilities worldwide. The company serves the upstream, midstream and downstream sectors of the oil and gas industry as well as the chemical and gas distribution market worldwide.

Rayson Company (www.raysoncompany.com) became VMA's newest supplier member. Located in North Houston, the company focuses on providing valve components to the global oil & gas industry as well as a variety of services including sawing, welding, turning, milling, CNC and assembly.

The Valve Repair Council (VRC) added **Custom Valve Solutions** (customvalvesolutions.com) to its roster. This is the first new VRC member of 2020. Based out of Vallejo, CA, Custom Valve Solutions provides complete field services including preventative maintenance, turn-around services and emergency call-outs.

ValvTechnologies was recognized as the fittest company in Houston.





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For a copy of the magazine's
Author's Guidelines, contact
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tor, at gparente@vma.org.

**Spirax Sarco Celebrates 30
Years of Accreditation**

Spirax Sarco is celebrating three decades of course-accreditation from City & Guilds Group. The relationship was born in 1989 out of a decision by The Dairy Trade Federation and City & Guilds to introduce a skills-testing scheme for the validation and accreditation of maintenance engineers in the dairy industry. This led to the introduction of a nationally recognized certificate in the U.K.

**Emerson Named IIoT
Company of the Year for Third
Consecutive Time**

Emerson has been named the "Industrial IIoT Company of the Year" by IIoT Breakthrough for the third year in a row. The honor recognizes Emerson's commitment to helping customers in industries such as chemical, life sciences, power, and oil and gas define and execute a practical and successful path to digital transformation.

**Baker Hughes to Go 100%
Renewable at 170 Texas
Facilities**

Baker Hughes entered into an agreement to purchase 100% of its Texas electricity from renewable sources. Designed in collaboration with Energy Edge Consulting and EDF Energy Services, the agreement combines renewable energy from the Texas-based White Mesa Wind project, owned and developed by Apex Clean Energy, and the Talitha solar project, owned and developed by 7X Energy. The combination of wind and solar assets creates an energy production profile that aligns with Baker

Hughes' electricity use patterns around the clock.

**Emerson Named to Food
Logistics' Annual List**

Food Logistics named Emerson to its 2019 FL100+ Top Software and Technology Providers list. The annual list serves as a resource guide of software and technology providers whose products and services are critical for companies in the global food and beverage supply chain.

NEW FACILITIES

**DistributionNOW Odessa
Company Moving to New
Headquarters**

Odessa Pumps, a DistributionNOW company, is consolidating its three current Odessa, TX locations into a new, larger headquarters, which will expand product and service capabilities for its customer base.

The facility will total 60,000 square feet and include machine shop space, warehouse inventory, office space and a classroom for customer and employee product training.

The move aims to create synergy with all Odessa employees under one roof. It gives the company room to grow as it continues to expand its pump fabrication and service business.

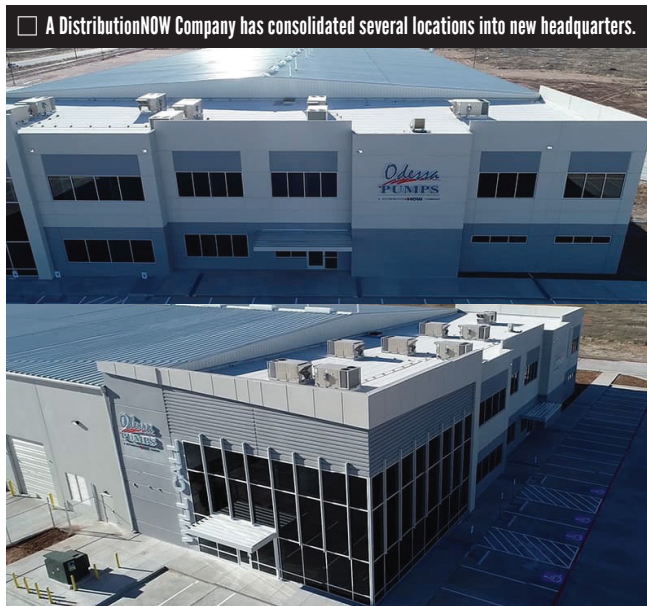
**Mueller Water Products Brass
Foundry Being Built**

Construction has begun on one of the world's largest modern, finished-goods brass foundries, which will be in Decatur, IL. Mueller Water Products' new facility will employ 250 workers to help increase production capacity and meet the growing needs of the water infrastructure industry.

Mueller was founded in Decatur in 1857 by German immigrant Hieronymus Mueller, which means that building the new brass foundry in the same city where the company was born was a full circle moment in its 162 years of history.

**DeZURIK Opens New Rapid
Fulfillment Center**

DeZURIK, Inc. announced the opening of a new, 15,000-square-foot Rapid Fulfillment and Service



□ A DistributionNOW Company has consolidated several locations into new headquarters.



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Contact Abby Brown at
abrown@vma.org or 240.328.3866.

Center in Leduc, Alberta, Canada. The new center will have an inventory of a variety of valves, actuators and accessories required to meet the needs of facilities in the oil sands and mining industries of Alberta. In addition, the facility will offer full repair and rebuild services for DeZURIK products.

MERGERS & ACQUISITIONS

Curtiss-Wright to Acquire Dyna-Flo Control

Curtiss-Wright Corporation entered into an agreement to buy the stock of Dyna-Flo Control Valve Services Ltd. for \$62 million. The acquired business will operate within Curtiss-Wright's Commercial/Industrial segment.

Founded in 1993 and headquartered in Edmonton, Alberta, Canada, Dyna-Flo's core product offering addresses most control valve applications with designs ranging from compact, low-profile to heavy-duty severe service.

Emerson Collaborating on AI for Oil and Gas Industry

Emerson and Quantum Reservoir Impact (QRI) have teamed up to develop and market next-generation applications for artificial intelligence (AI)-based analytics and decision-making tools customized for oil and gas exploration and production.

As part of the ongoing collaboration, the companies will apply advanced computational technologies to help geoscientists and engineers make actionable

and reliable field development decisions quickly, mitigating risks and leading to higher productivity and better performance.

Crane Co. to Buy CIRCOR Instrumentation & Sampling

CIRCOR reported an agreement to sell CIRCOR Instrumentation & Sampling to Crane Co. The transaction closed in the first quarter of 2020, and the complete transition will take place in the following months. CIRCOR Instrumentation & Sampling brands included in the sale include Hoke valves, Gyrolok fittings, Go regulators, CircorTech sample-conditioning products, Texas Sampling and Dopak sampling systems. VM

PEOPLE IN THE NEWS

MRC GLOBAL... Kelly Youngblood joined MRC Global Inc. as executive vice president (EVP) until the retirement of James E.

Braun, EVP and chief financial officer (CFO), which occurred March 1, 2020. Youngblood then assumed the role of EVP and CFO.

Youngblood brings more than 30 years of energy and finance expertise to MRC Global. He joins MRC Global from BJ Services, LLC, the largest North American-focused pure-play pressure pumping services provider, where he was EVP and CFO.

EASTERN CONTROLS... announced the addition of Jason Ordanoff to the organization. As the business development manager for valves and actuation, Ordanoff will be focused on delivering solutions through Eastern Control's major manufacturing partners.

Ordanoff brings more than 20 years' experience in the process industry.

METSO... Aleksanteri Lebedeff, senior vice president, general counsel of Metso Corporation, was granted recognition as a TOP 100 Corporate Counsel Award winner. Lebedeff has acted as Metso's general counsel and secretary to the board since 2006.

CURTISS-WRIGHT... promoted Kevin M.

Rayment to the newly created position of segment president. Rayment was named president of the commercial/industrial segment.

Most recently, Rayment was senior vice president and general manager, Curtiss-Wright Industrial division.

DISTRIBUTIONNOW... appointed Dick Alario interim CEO, replacing Robert Workman. The DistributionNOW board is in the process of engaging a search firm to assist with the recruitment of a full-time CEO.

Alario has served as a member of DistributionNOW's board since the company's spinout from National Oilwell Varco in May 2014, and he will remain a director while he serves as the company's interim CEO. He has worked in the oilfield services industry for almost 43 years.

FLOWSERVE... appointed Amy B. Schwetz as senior vice president and CFO. Schwetz joins Flowserve from Peabody, where she was executive vice president and CFO. She also serves on the board of directors for Dril-Quip, Inc.



Amy B. Schwetz

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www.vma.org/MarketOutlook2020

SEPTEMBER

9-11 VMA/VRC Annual Meeting*

Santa Barbara, CA
www.vma.org/AnnualMeeting

OCTOBER

3-7 WEFTEC 2020

New Orleans
www.weftec.org

13-15 VMA Valve Basics Seminar & Exhibits

Houston
www.vma.org/ValveBasics

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

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3. To ensure that all parts match specifications, an articulated coordinate measuring machine (CMM) is used. The "Faro-Arm" is used with 3D software to create highly detailed 3D views of parts and components.

4. Sometimes it just takes simple tools and gentle hands to perform accurate valve work. We are blessed to have a great team of experienced, dedicated engineers, technicians, machinists and welders, to combine with the best technology available.

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Connecting and Learning: It's a Whole New [Virtual] World!

While everyone is still coping with the enormity of the COVID-19 crisis, forward-looking organizations are looking beyond the immediate challenges to what the new world may bring.

"We're living in a different environment than what we knew, but it doesn't change the need for the industry to learn new skills and make new contacts," says VMA President Heather Rhoderick. "Companies and individuals still need to get business done. VMA is committed to bringing the industry together to advance business and the industry through networking and education using whatever method works best for our members and the valve community—whether that be virtual or live events—or a combination of the two."

The association already has several tools in place that can help facilitate the learning process.

VMA'S WEBINAR PROGRAM

VMA has launched webinars to help members address and share approaches on addressing COVID-19 concerns. The success of these will be used to build a robust set of virtual experiences from webinars, roundtables, training and more. Beginning late this spring VMA will bring the industry topics that cover a variety of subjects of interest to those who manufacture, distribute and use valves, actuators, controls and related products. This will be open to non-members as well as members.

"Webinars allow us to



share our expertise with a broad audience so that we can help to raise the level of knowledge in the industry," Rhoderick explains. "We can reach hundreds of people without the expense of traveling to a physical location—or the need to leave our homes and offices."

The program was being finalized as this issue went to press. Watch for announcements on VMA.org and in VALVE eNews, the biweekly e-newsletter that is sent to more than 25,000 valve industry professionals. (If you do not receive VALVE eNews, please email rsalet@vma.org to request a free subscription; view past issues on VALVEmagazine.com > News).

LEARNING REMOTELY VIA VBOT

Industry newcomers requiring a primer on the basics who are unable to travel have the option of using VMA's Valve Basics Online Training (VBOT).

The VBOT program was developed several years ago to present the Valve, Actuator and Controls 101 seminar to people via their own computers. After paying an access fee to the narrated program, users have 90 days to take the course at home or in the office.

The course includes:

- An introduction to the valve industry including pressure ratings, different classes of equipment, standards, valve components, actuators and controls and more
- Information on the different types of valves and what they do such as linear, check, quarter-turn and pressure-relief valves
- The role of pneumatic, hydraulic and electric actuation
- What control valves and systems do.

A one-person license is \$295 (\$235 for members) but companies that want to encourage multiple employees to take the VBOT course will receive a group licensing rate. For more information, visit the VMA store at www.vma.org/Store.

WE'LL COME TO YOU

Once social distancing is behind us, VMA will be able to deliver another alternative to traditional classroom learning—the Valve Basics Custom Training program. This affordable way to learn is offered to any U.S. or Canadian company with at least 25 employees who needs an overview of the products used in the industrial valve industry—with-

out the expense or inconvenience of traveling to a far-away site.

Companies can choose from a list of lessons based on what will best fit their learning needs. In addition, the lessons can be customized for specific industries for a deeper learning experience.

Since custom training courses must be booked far in advance—and the number of programs each year is limited—companies interested in a custom course later this year or next, should contact Abby Brown, education & training coordinator (abrown@vma.org). Information about the program is also available at www.vma.org/CustomTraining.

WHEN WE MEET AGAIN

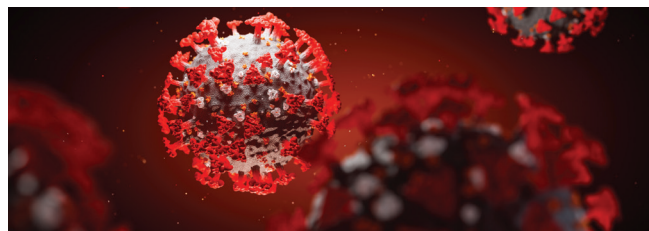
Recognizing the continued value of in-person networking and hands-on learning experiences, VMA plans to continue its face-to-face meetings in the later part of this year and beyond. "No matter how sophisticated the technology or how strong online content and connections may become, meeting face-to-face accelerates relationships, business, innovation and learning. We will continue to offer this for our members and industry. Upcoming meetings and events may be a little different, but we look forward to providing this invaluable tool to business and the valve and flow control industry. We'll take this time to rethink and refresh our events, so when we do meet again, they provide even more value," says Rhoderick. **VM**

VMA Resources: Coping with the Impact of a Pandemic

VMA member companies are essential businesses currently working under challenging circumstances while providing their customers with the products and services they need to succeed. VMA has represented these realities to the government to ensure the needs of members and the industry are recognized and met.

One of the best tools companies have when faced with a crisis the proportion of the COVID-19 pandemic is information—but too much information can be overwhelming and not helpful.

VMA recognized that reality early and created resources curated specifically for the valve and flow automation industry that serve as a focal point for getting help: a COVID-19 general page for industry and a members-only resource page to help VMA members deal with the challenges. The association also



launched a series of weekly webinars to help members wade through the mountain of information being generated for manufacturers and other businesses.

The general page on VMA.org was created to aid industrial companies by providing the most up-to-date information possible in the rapidly changing world created by the pandemic. It provides tools to understand the general issues such as what's happening state by state, how manufacturing has been affected, what federal and state laws and regulatory guidance have been created and what help is available to companies.

The members-only resource page delves deeper into specifics by providing access to forms, tools and samples needed to deal with what's happening, legal data from VMA's counsel, sample letters and talking points to handle specific challenges, information on end-user industries and how they are affected and more. The resource page also has links to the COVID-19 webinars, which have covered topics such as:

- The changing face of labor and human resource law and how members can respond
- Updates on the Families First Act and other state

- and federal legislation springing from the crisis
- Implications of the federal relief package
- Limiting the effects of COVID-19 on manufacturing
- What the CARES Act means

"Our industry is a critical component of delivering the services that people rely on every day like water and wastewater and energy, helping to keep products in healthcare in stock, plus so much more. We are fortunate VMA was able to react swiftly to help our members and keep the industry informed, and to represent them to policy makers during this unprecedented time," says VMA President Heather Rhoderick.

The public page is at www.vma.org/covid19industry. The members only page is at www.vma.org/covid19 with a log-in.

Sandler Scholarship Award Offers Opportunities

Given former VMA president Bill Sandler's longevity and dedication to the valve industry, it seems logical that the scholarship program that bears his name would be designed to shore up the future of that industry by encouraging more young people to enter manufacturing fields. The William Sandler Scholarship program accomplishes that goal.

The scholarships are offered to dependent children of any full-time employee from a VMA member company who is pursuing a full-time

undergraduate course of industrial or engineering studies in an accredited two- or four-year college, university or vocational/technical school. They can be students already in those programs or high school seniors accepted into a program, and they must maintain or achieve a 3.0 grade point average.

The program offers two main awards to eligible winners:

- **The William Sandler Engineering Award, an award of \$1,000 to**

each recipient. Up to three awards per year will be given to applicants who are entering or in an engineering discipline consistent with the needs of the valve manufacturing industry.

- **The William Sandler Vocational Award, an award of \$500 to each recipient.** Up to two awards per year will be given to candidates entering a technical or vocational school in a manufacturing or related field such as welding.

This is the first year for the program, which was established to honor Sandler, who served VMA for 42 years and retired last year. Sandler himself started as a data analyst for the association and rose to serve two decades as president, leading and guiding the industry and association over those many years.

The application deadline for this year is May 30. For information, visit www.VMA.org/SandlerScholar or email Marc Pasternak at mpasternak@vma.org.

WATER INFRAST

Getting Some Long Overdue Attention



STRUCTURE:



Executive Summary

SUBJECT: While systems are aging and water needs are increasing, federal funding and a healthy bond market are making it somewhat easier to finance needed upgrades.

KEY ISSUES:

- Today's infrastructure problems
- Sources of funding
- The role of a new rule
- What tomorrow may bring

TAKE-AWAY: The future looks bright for those who make and sell products to the water market.

BY KATE KUNKEL

In April 2019, Tom Smith, executive director of the American Society of Civil Engineers, reported on National Public Radio that 240,000 water pipeline breaks occur each year in the U.S. That works out to one incident every two minutes. The numbers are not so surprising given the reality that, in the U.S. and Canada, construction of an underground water infrastructure began in the 19th century.

While those pipelines and other equipment were not all installed at once, much of the equipment is nearing the end of its useful life.

"The piping systems are particularly old and frail," says Don Bartell, vice president of municipal sales at DeZURIK. At the same time, new innovations are under development. This will be essential going forward since, "The latest pipe and valve technology must be employed to replace those worn-out systems," he says.

The situation presents enormous challenges to local water utilities struggling with aging, and insufficient piping and valves, while trying to deal with budgets stretched to the limit. Projected costs to bring the water infrastructure system up to what is needed are astronomical. For example, the American Water Works Association estimated \$1 trillion will be needed in the next 20 years.

Although this scenario makes headlines because of the sheer size of the water market and the reality that leaks make good headlines, progress is being made in some areas.

According to Thomas Decker, Thomas E. Decker Consulting, the needs of this nation are being met slowly and steadily with more spending going on in the last two years for drinking water than for wastewater.

"In 2018, the volume of freshwater spending grew at twice the rate of wastewater, a full 19% compared to 9% growth [for wastewater]," he says. Meanwhile, "In 2019—on the construction side alone—water grew at about the same pace as wastewater, something that ordinarily doesn't happen," he says.

Finding the money to do the work needed is a huge issue. But so is finding sufficient water supplies and getting them where they are needed.

Bartell points out that, as demand for water exceeds local availability, larger and longer pipelines will be required to transport that water. An example of this is the



Integrated Pipeline Project in East Texas. This pipeline, which is under construction, will bring water from Lake Palestine to supply water to Tarrant County and the City of Dallas. It is a joint project to enable utilities to bring an additional 350 million gallons per day into the metroplex.

Shelly Hattan, an engineer with the project, says one of the most significant challenges will be to coordinate the manufacture and delivery of the huge valves needed for this type of project. She describes the difficulties they experienced getting one, 108-inch diameter, metal-seated parallel-faced gate valve to Texas from its manufacturing plant. It was so large (oversized and overweight at 117 tons and 40 feet tall), it could not be hauled on many of the planned roads and bridges.

While that is an unusual situation, Hattan points out that coordinating delivery with installation is an issue that often comes into play with pipeline projects.

SERVICING AN AGING SYSTEM

Many challenges arise with the maintenance and repair of aging freshwater systems. According to Dave Johnston, director of SMART infrastructure at Mueller, an obvious problem is how to deal with the reality that most pipelines are buried and difficult to access. That's a real challenge "for capital spending investment programs. How do you know what [equipment] to

replace next [when you can't see or access it easily]?" he says.

Robert Whritenour, Fluid Control Specialties, Inc., agrees.

"Leak detection and associated technology are becoming more and more important because of the costs" of dealing with aging issues, he says, as well as the catastrophes that have occurred recently. "When these unexpected emergencies happen, facilities must take action to fix the immediate problem," Whritenour says.

However, dealing with emergencies is reactionary, and according to John Skalla, municipal regional sales manager for DeZURIK, this makes it harder for facilities to plan both financially and technically. At the same time, "There is a benefit in that emergencies give management an increased understanding of the importance of using quality products that meet prevailing standards," he says. "After witnessing infrastructure failure, facilities are more willing to tighten specifications to get better products," he adds.

This has resulted in a push not only for better quality products but also for more monitoring of valves, meters and hydrants with leak detection as well as sensors to anticipate issues.

Fortunately, technological advances are making this easier and less expensive, and many valve companies are now adding new products with smart capabilities to expand on monitoring the condition and status of valves.

"Using IoT [Internet of Things]

technology and sensors such as pressure or vibration technology sensors, you can see how a system is performing and the condition [of equipment] very quickly," says Speggen. He points to leak detection technology available today that can relay where a leak is along a pipe within feet.

With pressure-sensing and water quality analysis, it's also possible to tell within a city block if a leak has occurred or if the pressure is too low, which is important since these situations could allow contaminants and other materials to get into the system.

While this monitoring and gathering of data is helpful, turning that data into a valuable way to problem-solve is key to meeting longer-term needs. "Pressure fluctuations are just numbers unless you know what they mean," Johnston says.

It's also important to have many sensors on valves throughout the system. For example, sensors on water quality that measure chlorine levels can indicate how strongly water is able to resist infiltration. Pressure measurements, meanwhile, will indicate whether a required 15 psi level has been met to prevent foreign materials in the environment from coming into the pipe.

The problem is always cost. Johnston suggests that one strategy to minimize outgoing expenditures is to rely on infrastructure already in place. "There are fire hydrants all throughout municipal systems. We can add sensors and communication to them and leverage the current infrastructure," he explains. There also are points in water distribution networks where something is already set up for measuring factors such as pressure and chlorine levels. "You can tap into all that," he says.

To accommodate the need for pinpointing problems, Skalla says the industry is beginning to focus on asset management software that monitors systems and equipment.

"These advanced communications protocols can deliver mountains of data; the important aspect will be presenting the data so that facilities have something usable and actionable, for example, predictive maintenance abilities," he says.

LABOR

Even with new technology and better ways to analyze data, utilities face another monumental challenge: a dwindling and changing labor force. Keni Takeuchi, senior vice president of engineering at Mueller, points out that a lot of the tribal knowledge and know-how to do repairs and maintenance is being lost as baby boomers retire.

"That info is potentially leaving," he says, "And the younger workforce has two challenges. One is training and getting up to speed on the knowledge and the other is embracing technology and its solutions. A big positive in this is that the younger generation coming in is more comfortable with that technology."

Takeuchi says a large portion of the research and development going on at his company is geared to working with utilities and other users to get the workforce up to speed on how to work with artificial intelligence, augmented reality and machine learning.

By doing so, those who are learning "will be able to use these tools to help prescribe and have insights into activities that need to be done. Hopefully,

"Leak detection and associated technology are becoming more and more important because of the costs."

— Robert Whritenour, Fluid Control Specialties, Inc.

this will also help with alleviating the strain from the depleting workforce," he says.

Providing the technology that can help utilities focus on what needs to be done and finding the needed workforce still require meeting the largest challenge: funding, which has been an issue for a long time. Water supply and treatment are all largely invisible to ratepayers and voters, so unless problems arise, it's easy to ignore the reality that money must be attributed to these essential services.

So where will this money be found?

DWSRF PROGRAM

Congress provided \$1 billion in new funds for waterworks activities in 2018 through the Drinking Water State Revolving Fund (DWSRF) program, which is designed to be a

partnership between the states and the federal government to provide communities a permanent, independent source of low-cost financing for infrastructure projects.

"As a result, related equipment manufacturers have seen a large number of expansion projects bid along with refurbishments starting in 2018," says John Ballun, president and CEO of Val-Matic. Many of these projects were previously delayed from the lack of funding.

However, "it's difficult to know if the increase in activity is due to the new funds or simply the desperate needs of municipalities," he adds. "Sadly, most of the project activity is reactive work rather than proactive. In general, federal funding certainly supports our industry, but the impact does not seem significant."

Skalla notes that his company has seen some examples of public-private funded projects under this initiative.

"For example, we participated in a project where a local brewery and the City [Stevens Points, WI] worked together to change how the brewery's industrial wastewater was pumped to the wastewater treatment

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facility because of high biochemical oxygen demand levels in the influent stream," he says.

Bryan Burns, president and CEO at DeZURIK, points out that federal funding has spurred work before. He cites The Clean Water Act from the 1970s, which created a good deal of business for valve manufacturers. "However, the improvements from that funding are now close to 50 years old," he adds, "and everyone recognizes that much of our country's infrastructure is in dire need of repair. There's been a significant discussion about the need, and there's bipartisan support for increased funding, but it's time to move past discussion and take action."

Whether this funding helps smaller utilities with refurbishing or updating facilities and equipment is yet to be determined. Takeuchi says that what he's seen so far is that much of the activity has come in the form of very large investments as opposed to improvements in smaller systems. For example, "Houston is building a whole new reclamation system to outfit the growing population there," he says.



“Related equipment manufacturers have seen a large number of expansion projects bid along with refurbishments starting in 2018.”

— John Ballun, president and CEO of Val-Matic

FEDERAL ACTIONS AFFECTING WATER DISTRIBUTION

In January 2020, the Trump administration finalized a rule to strip away environmental protections for streams, wetlands and groundwater. Some people question if this rule will have any effect on municipal water systems, but Takeuchi says it adds a layer of uncertainty.

Meanwhile, Bartell suggests that the new rule could provide a boost for other industrial sectors because the reversal of older regulations allows more gas and oil pipelines to be built by eliminating some of their constraints.

Decker points out that, with the reduction of some of the environmental permitting requirements, more work could get done faster as well. "With the larger complex, big water supply projects, it [removal of constraints] will move projects into design and construction."

Still, Whritenour notes that city or county regulations prevail in the world of water protection so the new rule shouldn't have much effect on either the utilities or the valve industry. "For example, the state of Florida has increased regulations because of problems with pesticide runoff, red tide and nutrient pollution associated with urban and agricultural runoff," he says.

One development from Washington, D.C. that has affected the Integrated Pipeline Project in Texas is trade wars. Tariffs "are slowing things down with ductile and steel," Hattan says. "Costs also went up because contractors couldn't get proper quotes and details got delayed."

LOOKING FORWARD

Some pressure exists today to explore new business models that vendors to the industry can use to satisfy the needs of municipal water systems.

For example, "A lot of discussion has gone on about business models for OPEX [operating expenditures] or CAPEX [capital expenditures] services," says Takeuchi. One tool might be services offered through subscriptions such as the provision of sensors and metering. Such a setup would provide a way for utility companies to move funds around where needed.

Speggen also notes that requirements such as Prop 65 in the State of California (which sets specific limits on what can end up in drinking water) could drive additional business in the water industry as utilities and other organizations seek technological solutions for meeting the new limits.

In such a case, "Funding will be heavily weighted to early adopters,

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like any other kind of technology," he predicts.

No matter what happens with these new ways of doing business, overall, the municipal valve industry looks to be a growing business.

Bartell says that, despite forecasts of a recession in 2020, the market seems to be steadily improving.

"Last year, the industry as a whole had better-than-average growth," he points out. "The interplay of industry drivers such as changes in population, regulations, the economy, funding challenges and failures in existing infrastructure will determine growth in the coming years."

Decker adds that one of the primary sources of funding for public sector water utilities is the municipal bond market, which is solid right now, and that many projects are now being funded by the Water Infrastructure Finance and Innovation Act (WIFIA), the federal law passed in 2014 that has financed over \$8 billion in water infrastructure projects.

The WIFIA program, "is only for large projects, providing up to about 49% of the funding through a very low-interest federal loan," Decker explains. "This has helped a number of projects get started."

Importantly, for municipalities, these loans don't interfere with bonding capacity, so that leaves cities and utilities the ability to issue the full bond allotment to finish the funding.

Meanwhile, "Inflation is tame right now, so the rates are held down, and the yields are good, making the investors happy," Decker adds.

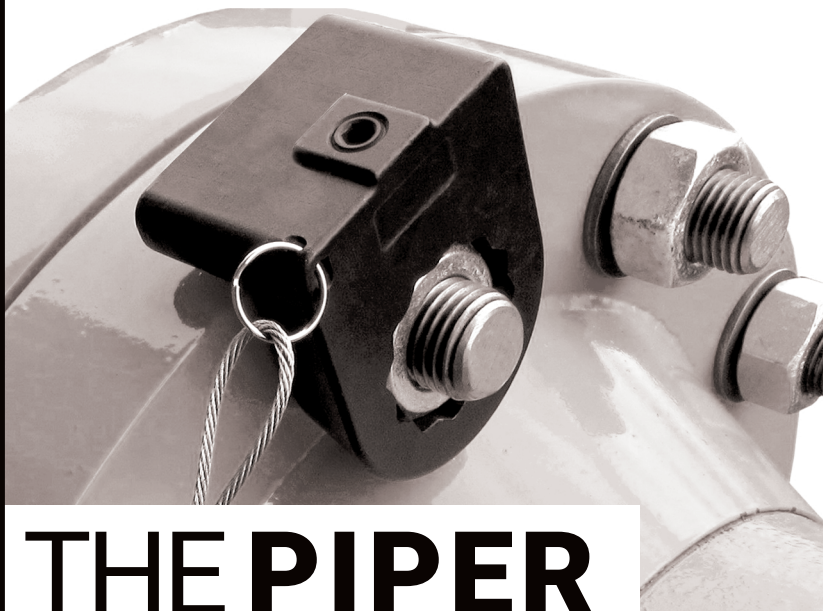
That translates into continued growth for the next year, and Decker expects final numbers for 2019 to reflect double-digit gains.

Bartell agrees that the future looks good right now.

"We reference a wide variety of sources for insight into construction market forecasts that consider all market influences, including government initiatives," Bartell notes. "They all point to a strong market in 2020." VM

KATE KUNKEL (www.katekunkel.com) is the former senior editor of VALVE Magazine and is currently a freelance writer contributing to numerous publications and blogs. Reach her at katel.kunkel@gmail.com.

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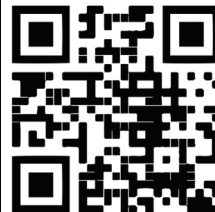


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Valves Tough Enough to Handle Hydrofluoric Acid

BY MIKE DUNN

Hydrofluoric (HF) acid: just the name itself strikes fear in some people, even among those who work around it every day.

Two places where this substance is commonly used are refinery and chemical plants where HF acid, and the valves that handle it, are usually segregated from the rest of the refinery by a large painted curb. The unit operators that run the unit and maintain the valves are easy to recognize: They're the ones donning face shields, rubber jackets, pants and gloves, along with a sticker to show that they've had the extra training necessary to step past that curb. Their caution is absolutely necessary—HF acid is extremely hazardous. That's why most refineries take maximum measures to ensure the safety of their employees and their surroundings and protect the equipment that must handle this scary stuff. That's also why handling these valves requires following strict guidelines.

Executive Summary

SUBJECT: The valves that handle HF acid are challenged by major safety issues. Yet these valves are critical to many refining and chemical plants.

KEY ISSUES:

- The history of HF acid use
- What the challenges are
- Materials and types used
- Repair and testing issues

TAKE-AWAY: Proper design of valves and strict adherence to best practices helps to ensure that the dangers of HF acid are minimized.

HF ACID IN REFINING

Refiners use large volumes of highly concentrated HF acid or sulfuric acid as chemical catalysts in a process called alkylation. Alkylation creates additives that boost the octane of gasoline.

Several benefits to using HF make it more attractive than sulfuric acid. First, the typical HF alkylation unit requires far less acid than a sulfuric acid unit to achieve the same volume of alkylate. Second, the HF process only creates a small amount of organofluoride side products. These side products are continuously removed from the reactor and the consumed HF is easily replenished. Third, HF alkylation units are capable of processing a wider range of light-end feedstocks with propylene and butylene. They also produce alkylate with a higher-octane rating than sulfuric plants. However, because of its hazardous nature, HF acid is produced at very few locations and transportation is stringently managed and regulated.

A BRIEF HISTORY

On Dec. 25, 1942, the first-ever commercial HF acid alkylation unit (HFAU) began production at the Borger Refinery of the Phillips Petroleum Company. The United States' entry into WWII created an urgent national requirement for expanded aviation gasoline production, which sparked a meeting that was sponsored by Phillips at Amarillo and Borger, TX. The purpose of the meeting was to present the full details of the design and operation of this new process to the petroleum industry at large. It was widely attended by refiners and engineering contractors and resulted in numerous requests that the industry be kept advised of developments on corrosion rates, mechanical problems and similar considerations. These findings were released as they became available, and the attendant process policies became known as blue books (because of their blue covers). These process policies eventually became the Phillips Licensing Specification. The two major licensors of the HFAU process were UOP and Conoco

HF acid is extremely hazardous. That's why most refineries take maximum measures to ensure the safety of their employees and their surroundings.

Phillips, which at the time, held similar shares of the market. The two have since been combined as UOP under the ownership of Honeywell. While most refiners operate under the UOP umbrella, plants are still referred to as legacy "Phillips" or legacy "UOP" operating facilities. Today, about 50 U.S. oil refineries use HF acid.

MATERIALS AND TYPES OF VALVES

Most refiners refer to the current UOP specifications as a guideline to determine what valves they can put into an HF unit area. UOP offers options based on valve type, size, manufacturer and service conditions. Readers of the specs have to be vigilant because the options may seem inconsistent. For example, a manufacturer may be approved for a 1-inch, 800-pound socket weld gate valve, but that same manufacturer may not be approved for a 2-inch, 300-pound flanged gate valve.

Monel 400 and 500 are still the

most popular materials used in HF acid service. Instead of traditional B7 or B16 bolting, HF acid valves require B7M bolting, which is heat treated. The treatment makes the bolting softer, which makes it more resistant to cracking when exposed to HF acid. While Monel spiral-wound gaskets are still the most common gasket used, the use of Kammprofile gaskets has steadily increased in popularity, especially in the HF alky market. Kammprofile gaskets maintain stability in high-temperature and high-pressure applications, and they offer a flexible and highly reliable seal.

Gate, globe, check, control and relief valves typically have carbon steel bodies with Monel internals, including but not limited to stem, disc, seat, backseat and packing pusher. Trim packages typically depend on the atmosphere and the concentration of HF acid. UOP uses terms such as HF-1, HF-2, etc. While carbon steel bodies with Monel internals are a common trim package, for areas running higher-concentrated to full-strength HF, solid Monel valves are most often recommended.

Some gate and globe valve manufacturers have started implementing the bellows seal design between the stem and the stuffing box area. This serves as an added layer of protection to help reduce any leak detection and repair issues that can arise from the packing areas.

□ Some of the most common valves used in HF service are pictured here. They are distinctive by their yellow paint that turns red when in contact with HF acid.





□ A mass spectrometer helps to meet stringent, helium valve testing requirements.

Sleeve-lined plug valves are generally the most common block (isolation) valve used in HF systems today. Although many manufacturers have proprietary designs, the general design is the same: A Teflon liner is installed in a valve body. A tapered

plug is then installed to fit between the sleeve and the body, creating the passageway seal. Most sleeve-lined plug valves must be factory-tooled, and technicians must be specially trained to install the liners into the valve bodies, which is why using

factory-authorized service centers is critical. Construction is complete after the top cap and diaphragm are installed on the valve.

Most customers in the petrochemical industry require new plug valves to pass their own stringent set of criteria, known as their recommended practices (RP) plan, to be allowed in their refineries. Supplying a valve that adheres to the customer's RP plan is crucial to ensure that the valve meets all the criteria established by the end user.

Check valves use the API [American Petroleum Institute] RP 600 construction criteria. This allows for check valves with both external and internal hinge pins. Most refiners are starting to lean toward an internal hinge pin design to eliminate the extra leak path created by hinge pin plugs of legacy designs.

REPAIR AND TESTING

API RP 621 lays out a foundational protocol focused on the repair of valves. It covers most repair questions, including allowable wall thicknesses, stuffing box tolerances, stem tolerances and more. However, this RP is simply foundational; numerous HF repair end users require more intensive documentation during a repair. Most require positive material identification on all wetted parts that comprise the valve. Some even require the identification of the amount of residual elements that exist in the casting.

After repair of HF acid valves, most companies require that hydrostatic testing of the repaired valves be completed with a medium such as kerosene, diesel fuel or mineral oil. Water has a corrosive effect when it comes in contact with HF acid, so its use is not recommended. In addition to a hydrostatic test, some companies take the additional precaution of requiring a helium test, which uses a mass spectrometer to interpret the volumetric leakage rates.

API RP 751

In 1992, the API released its API RP 751, which is the guideline to owners

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□ Wall thickness checks on valve bodies can help to ensure they meet customer specifications.

of HF units entitled Safe Operations of Hydrofluoric Acid Alkylation Units. This document provides valuable feedback to both valve manufacturers and remanufacturers alike and includes guidelines on bolting requirements, heat treatment requirements, fireproofing, testing frequency (for relief valves) and more.

Decontamination is one of the most important subjects discussed in API RF 751. This subject is especially important for transportation and for centers that receive valves for repair. The discussion on decontamination focuses on how to decontaminate valves before they can leave the unit boundaries. The processes are different for different types of valves and are not complicated. For instance, gate and globe valves should be opened with the bonnet bolting loosened, the packing should be removed, the body-to-bonnet connection should be broken to allow a neutralization solution to permeate the entire valve cavity.

Check valves should have the bonnet bolting, as well as any plugs, loosened during the decontamination process. Sleeve-lined plug valves should be open with the bonnet bolting loosened and the liner removed to ensure there is no trapped HF behind the valve liner. Most often, plugs are shipped independently of the

valves to avoid scarring the plug during transportation. While API RP 751 does not give specific detail on how to properly decontaminate valves other than gate and globe valves, it does state that other areas where HF pockets may have accumulated should be disassembled. All neutralized equipment should have a tag affixed stating that the equipment has been in HF service and has been neutralized. While it is ultimately up to the unit owner how the valves are shipped, 751 does facilitate best practices pertaining to this matter.

CONCLUSION

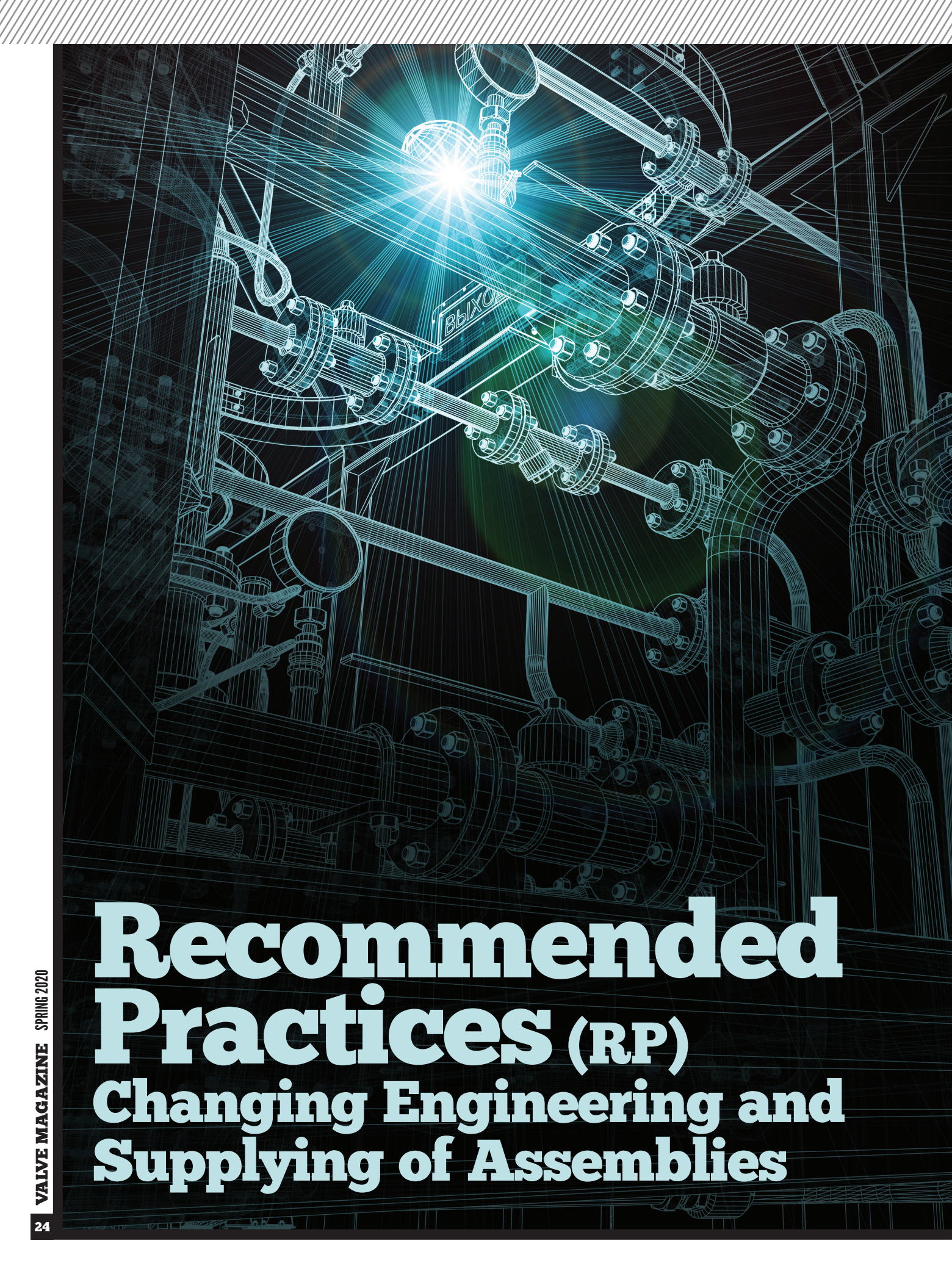
HF acid is a hazardous and corrosive liquid. If accidentally released, it can form a vapor cloud. This presents serious health dangers to those who work with and around HF acid. However, proper design of alkylation units and strict adherence to best practices for maintenance, repair and proper decontamination techniques will help to protect the safety of refinery employees, repair shop technicians and the surrounding community. ❧

MIKE DUNN is president of Refining and Pipeline Operations with J-S Machine and Valve Inc. (jsvalve.com). Reach him at mdunn@jsvalve.com.

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Recommended Practices (RP)

Changing Engineering and Supplying of Assemblies



BY ALEX KOIFMAN
AND HENK HINSSEN

Engineering actuated on/off valve assemblies (AVs)

has always carried challenges. One of the most acute of those challenges is the discipline gap between the valve and the actuation parts of the assembly when the valve is part of the piping package while instrumentation provides the automation. The issue is that assemblies are not currently treated as “engineered” items; they are often produced by slapping the actuator on the old (or new) valve specified by the piping requirements without much understanding of the specifics of the interactions between valve and actuator connections through the drive train (coupling). A similar challenge in control valve engineering was addressed several decades ago through the evolution of responsibilities, practices and vendor participation. It will be some time before the world knows if something similar will happen with assemblies.

AVs remain challenging today because of several factors, namely:

- Multiple different disciplines and parties are involved in all processes with varying terminologies and definitions and often shifting responsibilities in design and procurement practices;
- AV sizing data sheets lack standardization when addressing application requirements;
- A wide variety of definitions of the valve torque data exists, which influences factors and coefficients, creating ambiguous and confusing models;
- Quality valve torque data including application-specific correction factors is often missing;
- The lack of a standard approach in matching valve torque data to actuator selection contributes to under- or oversizing of the actuator;
- An underdeveloped functional safety model and certification exist that take into consideration all components of the assembly.

The WIB Actuated Valve Assembly Recommended Practice (AVRP) for

part-turn automated on-off valves (S 2812-X-19) was released on June 1, 2019, and has recently taken on new importance. Results of this multi-year effort, which was led by Kees Meliefste (Dow Chemicals) and Henk Hinszen (formerly with ExxonMobil) with broad industry support has now been approved by the International Organization for Standards (ISO) Technical Committee 153. ISO/TC 153 derives an international AV assembly standard using WIB AVRP as seed material. This ensures continuous interest from all the parties traditionally involved in AV assemblies. This article seeks to address the impact of the future standard on certain existing work practices of owners/operators, engineering and manufacturing contractors and suppliers without trying to explain or analyze the technical content of the AVRP.

THE CHALLENGES

While actuated valves are widely used in the process industry, the AVRP focuses more practically on critical emergency shut-down valves (ESDV) or blow-down valves (BDV) because they are the most challenging, safety-critical and costly segment. Safety-related applications where these valves are most commonly used are particularly challenging when the valves are in long, stand-still mode, lying dormant for years between turn-arounds but required to react and operate within seconds. Commonly used as safety instrumented system (SIS) final elements, ESDVs/BDVs require significant resources during project design and often represent a challenge in project startup as well as continued operation. This, in part, is because of the attention of the licensing bodies, which require proof of sound design and robust implementation.

From the very beginning, owners or process designers need to consider, define and clearly communicate application parameters for the valve assembly being designed. This will have a smaller impact on new capital projects where the assembly will be part of the process and control management. A more significant challenge occurs for operating facilities for which process parameters

Executive Summary

SUBJECT: A new RP on valve assemblies introduced last year will likely have an impact in the years to come.

KEY ISSUES:

- What challenges led to the RP
- What the RP does
- What it means for the different players.

TAKE-AWAY: Changes are coming to all who make, sell, integrate or use on-off valve assemblies.

and the operational envelope for installed equipment (as well as vendor certified data) are harder to obtain. In some cases it won't be possible at all to get these parameters or data if valve vendors did not provide certified torque data for that equipment in the past or the torque definitions vary from those in the RP. For these reasons, it's likely the application of the RP on new projects will be seen first and then a gradual adaptation will occur for existing operating facilities during turnarounds and reliability assessment or improvement programs.

Currently, an instrument specification datasheet, based on the International Electrotechnical Commission (IEC) or International Society of Automation (ISA) standard forms, is the common medium communicating application parameters, manufacturer's data or materials and components. This datasheet is clearly not capable today of handling all of the information on torque and other data necessary for application solutions; there is no place on the sheet to hold the necessary information elements. Even a simple visual comparison of the control valve specification and on/off valve specification forms will show that the control valve contains more information relative to the actuated valve.

WHAT THE RP PROPOSES

The RP proposes an on/off valve assembly sizing data sheet (Figure 1) with the necessary level of the detailed torque and correction factors, such as maximum allowed torque drive train (MAST) or sizing safety factor (SSF), but also has some overlap with the specification datasheet. Certainly, both owners and engineering, procurement, construction firms (EPCs) will initially struggle with the introduction of another critical engineering and design document. However, balance will eventually be found by adopting the sizing datasheet suggested in the RP or its variations, and using the data as part of the valve assembly documentation package, similar to

VALVE		Valve size	dp	20	3"	End User	39		
VALVE	Line pressure		BTO	175	253	Nm	End User	40	
	2.2 Break to Open torque	net# ODCF corr	BTO _u	0	0	Nm	Valve manufacturer	41	
	BTO break away angle		RTO	58	128	Nm	Valve manufacturer	42	
	2.2 Run to Open torque	net# ODCF corr	ETO	104	228	Nm	Valve manufacturer	43	
	2.2 End to Open torque	net# ODCF corr	BTC	104	260	Nm	Valve manufacturer	44	
	2.5 Break to Close torque	net# ODCF corr	RTC	58	128	Nm	Valve manufacturer	45	
	2.2 Run to Close torque	net# ODCF corr	ETC _u	0	0	Nm	Valve manufacturer	46	
	ETC break away angle		ETC	104	228	Nm	Valve manufacturer	47	
	2.2 End to Close torque	net# ODCF corr	MAST _a	685	685	Nm	Valve manufacturer	48	
	Max allowable torque drive train (MAST)		F10	500 Nm			Valve manufacturer	49	
	Max allowable flange torque (ISO521f)			No			Valve manufacturer	50	
	Stem / top works dimensions provided Y/N?								
	MOUNTING KIT	Material						Mounting kit manufacturer	51
		Height aspect			hot temperature			Mounting kit manufacturer	52
		Max allowable coupling torque		MAST _k	685		Nm	Mounting kit manufacturer	53
MK mechanical integrity checked & documented				No			AV Assembly Contractor	54	
Stem orientation				vertical			End User	55	
ACTUATOR	Supply pressure	min/max		5.1	5.3	bar(g)	End User	57	
	Air volume	open/close				liter		58	
	Sizing Safety Factor	SSF		1.1			End User	59	
	Actuator drive medium			pneumatic			End User	60	
	Actuator drive medium quality (ISO 57)			clean			End User	61	
	Actuator style			scotch yoke			AV Assembly Contractor	62	
	Model			A03.A.s015-0175-1-1			AV Assembly Contractor	63	
	Size			100		inch2	AV Assembly Contractor	64	
	Spring set number			1:1			AV Assembly Contractor	65	
	Spring to Start torque	STS		537		Nm	Actuator manufacturer	66	
	Spring to Run torque	STR		232		Nm	Actuator manufacturer	67	
	Spring to End torque	STE		316		Nm	Actuator manufacturer	68	
	Air to Start torque	ATS		896		Nm	Actuator manufacturer	69	
	Air to Run torque	ATR		378		Nm	Actuator manufacturer	70	
	Air to End torque	ATE		576		Nm	Actuator manufacturer	71	
Air to Start torque @ max press	ATS _{max}		853		Nm	Actuator manufacturer	72		
Max operating pressure	MOP		10		bar(g)	Actuator manufacturer	74		

Figure 1. Section of an assembly sizing datasheet

how control valve sizing calculation sheets are often accompanying control valve specification datasheets.

One aspect of this RP adoption will be that substantial amounts of new torque and other assembly information will need to be handled for selected systems. Most owner/operators and EPCs are using one of the commercial off-the-shelf instrument design and documentation systems (IDDS). Without a doubt, their preference will be to adjust and expand the use of these systems to cover new technical data. However, this will drive a need to add valve manufacturers or assembly integrators to the pool of users, complicating an already tangled communication and information technology (IT) connectivity

structure for the typical project or plant IT networks. Because of the slow pace of evolution for the popular IDDS, this may mean standalone dedicated applications are more likely to be successfully deployed for early adoption. Figures used in this article are taken from a prototype of a dedicated AV assembly sizing and selection tool created in support of the RP development.

Misuse and overuse of the AV assembly sizing safety factors have plagued the process for a long time. Introducing a method to derive an on-demand correction factor (ODCF) from objective application parameters allows tightening of the operating envelope while simplifying assembly and often reducing the actuator size and weight (Figure 2). This results in cost savings with a better

Figure 2. ODCF calculation

ON DEMAND TORQUE CORRECTION FACTOR calculator						Scenario Manager #					
Characteristic	Sample application data		setting	uom	CF	For which torque values applies the ODCF?					
	CF %	value				BTO	RTO	ETO	BTC	RTC	ETC
long stand still time	130%	12	5.8	month	130%	FO				FC	
Fluid Characteristics											
state / phase	Liquid										
clean service					100%	X	X	X	X	X	X
non-clean service					140%	X	X	X	X	X	X
polymers	220%	X			220%	X	X	X	X	X	X
sticking service					136%	X	X	X	X	X	X
slurries					152%	X	X	X	X	X	X
temp minimum			-150	°C	133%	X	X	X	X	X	X
temp maximum			500	°C	131%	X	X	X	X	X	X
fluid correction factor	220%		Max of fluid parameters			Legend					
ODCF	250%		Sum			X applicable for both FC and FO applications FC applicable for FC applications only FO applicable for FO applications only					

understanding of the safety factors.

In addition, combined graphical representation of various torques applicable to the assembly, as defined in the AVRP, will allow a focused analysis of operational cases. An example of this is shown in Figure 3, with air torque (AT, Atmax), MAST, valve opening (VTO) and allowable flange (FLANGE) clearly relating to each other.

Another aspect of the on/off valve assembly sizing datasheet that should be closely considered in the adoption of the RP is the ownership or responsibility for the data. This assembly sizing datasheet clearly identifies where—in addition to traditional owner and process designer/EPC-provided data—different component vendors and assembly contractors' input is necessary. Owners, EPCs and even major equipment or package vendors and suppliers are familiar with the process of using centrally managed projects or facility IDDS, but this could be a major step for assembly integrators/contractors. They will need to join the IDDS multi-discipline user environment or feed the necessary information to the general engineering contractor responsible for entering the data into the IDDS and issuing the sizing datasheet. Both practices are likely to be adopted and their use will depend on the project contractual engineering and supply responsibilities.

THE ROLE OF INTEGRATORS

Safety certification has been a norm and a standard of the day affecting all equipment and component supply chains for some time, but industry and certification bodies have struggled with the relationship between the components of the actuated valve assembly. In part, this is because, unlike typically single-sourced control valves, actuated on/off valve assembly components are usually supplied by different vendors. Individual assessment and certification of the components (valve, actuator or coupling/mounting) are not sufficient because they do not take into consideration

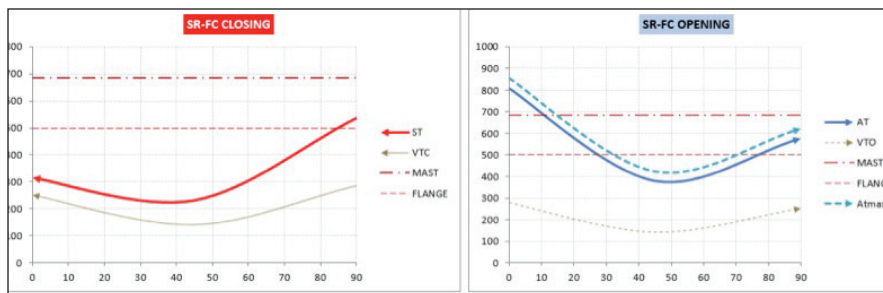


Figure 3. Spring Return Fail Close (ESDV application) selection analysis graphs

assembly integration. A likely effect of the RP adoption will be a shift of the certification focus from the component manufacturers to the integrators, based on the manufacturer-certified data. This may result in time and cost savings by applying certification to the final engineering product.

Industry adoption of the RP is likely to have a direct business impact on the supply chain for the actuated valve assemblies. Existing integration contractors—specialized independent firms, valve or actuator manufacturers asked to provide complete packages or small specialized providers—will universally benefit from easily available standardized valve torque data. This will allow them to offer faster design, more flexibility and a wider choice of components for the assembly. However, openly and easily available certified valve torque data also will lower the entry barriers for new players into the area of integration, which will increase competition and give owners/operators a wider choice of assembly suppliers.

For practical reasons, the initial RP scope was limited to the pneumatically actuated, part-turn valves. However, industry interest and support may drive continued expansion with the working group to look into electrical actuators to be added to the RP in the next 12 months. Also, further expansion of the RP is likely for hydraulic actuation, especially in the areas of testing, ODCF testing and certification.

Past experience with the adoption of the new engineering and technology practices shows that it likely will take several years to see if

the RP will be successfully adopted by the industry or if the search for a perfect solution will continue. In the first year or two, there's likely to initially be an in-depth internal analysis and review by the major owner/operators, which will need to adopt and require their contractors to apply the RP. At the same time, valve vendors will be looking at availability and quality of the torque data based on the RP definitions and testing and collecting this information where it's not available. A capital project of medium size is likely to be used by an owner as a proving ground for the RP use followed by the "lessons learned" for which the benefits and costs of the RP application will be assessed. Project start-up experience as well as assessed impact on the reliability of the delivered facility will be major considerations along with the added project costs. Still, the benefits of improved safety and reliability are likely to outweigh the costs, which should not be high, anyway, since these improvements are applied early in the engineering and design phase of the lifecycle.

It is still early to see what twists and turns the road to the industry adoption of the automated valve RP will take, but it is sure to be an interesting path. **VM**

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Maintaining Hygienic Diaphragm Valves

BY PAUL MCCLUNE

The biopharmaceutical industry relies on hygienic diaphragm valves for its demanding process applications because of the unique needs for cleaning and draining and for pressure and temperature capabilities. Over the last 40 years, the basic design of these valves has remained the same: body, diaphragm, topworks and four fasteners (Figure 1). Properly installing and maintaining the valves requires experienced personnel and stringent maintenance practices to assure consistent and reliable valve performance.

PREVENTATIVE MAINTENANCE BENEFITS

Facilities can cut costs and decrease downtime through preventative maintenance, which involves a schedule and process for maintaining equipment; preventative maintenance is particularly important when it comes to valves.

It can take hundreds of hours a year to properly maintain hygienic diaphragm valves, resulting in thousands of dollars of maintenance cost and lost hours of production. However, the primary function of a maintenance program is maximized production uptime, reduced planned and unplanned man-hours of labor and early detection of diaphragm failure. Many plants fail to have a maintenance schedule for their

Executive Summary

SUBJECT: A process-specific preventative maintenance program improves productivity and reliability.

KEY ISSUES:

- The benefits of such a program
- Maintenance procedures
- What a program does for design

TAKE-AWAY: When used in conjunction with good design, these programs can reduce costs and decrease downtime.

hygienic diaphragm valves and some even wait until a piece of equipment fails before performing any maintenance at all—resulting in a costly and lengthy plant shutdown.

Failure of the diaphragm, which will occur if it is not replaced on a routine basis, will most likely contaminate the

process somewhere along the process lines. In many cases, the three major types of failures include valve leakage (fluid leaks between the diaphragm and the valve body into the atmosphere), complete diaphragm rupture (the diaphragm tears, allowing process fluids to escape through the valve bonnet) and diaphragm tears (tears that allow process fluids to escape through the valve bonnet).

The result of these failures can be a loss of product. In addition to the product that escapes, a leak can put the entire batch at risk because of possible contamination entering the system. A diaphragm rupture can introduce contamination from the non-sterilized internals of the valve topworks, allowing the product to come into contact with greases and other contaminating liquids. Diaphragm tears can cause contamination from fluids that get entrapped in the tears. Such tears can be especially insidious. Because the pressure boundary of the diaphragm is not breached, the inline instrumentation does not detect a system problem. Often, all the process fluids produced from the time of detection of the problem may be recalled or put on hold for testing.

Valve leakage also can result in lost production time and the need for more maintenance and time to clean up the equipment and repair the leaking valve. Additionally, valve leakage can cause potential safety risks, including employee exposure to dangerous process fluids, steam leaks, clean-in-place fluids and dangerous organisms.

Preventative maintenance can help to maintain these seals and decrease the risk of leakage. Ultimately, detecting failures before they occur can result in improved sterility and minimized risk of contamination, and therefore, reduced maintenance hours and commissioning. Also, going through the process of preventative maintenance reduces the need for managers to unnecessarily replace valves or react to potential problems that can occur, resulting in greater efficiency, reliability and ease of use.

The keys to proper valve maintenance are knowing the steps involved and implementing a preventative plan that works for a particular facility and application.

HOW TO MAINTAIN HYGIENIC DIAPHRAGM VALVES

Hygienic valves act as both the static seal (shell seal) and a dynamic seal (weir shutoff). They often are exposed to harsh chemicals, high temperatures and high pressures, resulting in high amounts of wear and tear and an increased need for

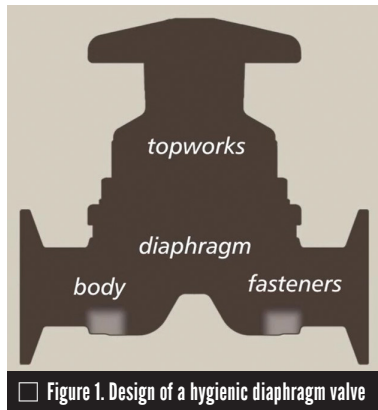


Figure 1. Design of a hygienic diaphragm valve

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routine maintenance. Proper valve maintenance requires several steps by the maintenance team to ensure the valve will function to its full potential.

Valve assembly/installation. One of the most important parts of maintenance is proper assembly during the diaphragm change-out process. Valves that are not assembled properly leave room for batch contamination, poor valve performance and short lifecycle. Proper diaphragm installation following manufacturer's instructions is essential. If installed improperly, excessive force during operation can result in diaphragm damage. Fluids can then pass through the closed valve or, in the worst case, cause catastrophic failure that results in process fluid contamination and leaks. Torquing and retorquing are also important steps in the assembly process. Because of this, improper practices can often lead to seal failure by either making the seal too tight or too loose for proper performance.

Replacing the diaphragm. Another aspect of valve maintenance is knowing when a replacement diaphragm is needed. To make sure valves do not fail, some companies change out their diaphragms on a regular basis (e.g., every six months), regardless of whether or not a new one is needed. Facilities that use diaphragms with a shorter life expectancy, such as rubber-type diaphragms, may be more likely to require more regular changes. However, consistently replacing diaphragms with no signs of failure can cost plants unnecessary expenses and time.

Knowing the signs of valve failure is also essential to maintaining a facility's valves. Physical signs that a valve or diaphragm need to be replaced are excessive wear, corrosion or fluid leakage.

FACTORS TO CONSIDER

Because of the wide range of applications and conditions within the pharmaceutical processing industry, preventative maintenance programs should be built up over time and should be specific to the application. Programs can vary widely from one plant to another.

Many factors should be considered when facilitating a preventative maintenance program. The biophar-

maceutical industry is fairly unique in that valves are used in many different applications with different exposures to temperatures and harsh fluids. Different applications for valves can include steam-in-place (SIP) or high-temperature sterilization; cleaning in place (CIP) where caustics and acids act as detergents; cold processing where purification is usually below ambient conditions (36–46°F or 2–8°C typically); and purification processes, such as chromatography and filtration. Many of these processes run in sequence or through the same pipes, which means the valves are exposed to a wide range of application temperatures and conditions.

Other factors that affect valve performance and maintenance include the amount of exposure time to liquids and steams, the type of diaphragm (one-piece vs. two-piece diaphragms) and the thermal cycle (the swings between minimum and maximum temperature).

Diaphragms and other soft parts, such as gaskets and o-rings, often face fluctuations between steam sterilization and cold-processing temperatures in the biopharmaceutical industry. A typical valve undergoes hundreds of thermal cycles in its maintenance lifecycle, which can affect the valve seal and ultimately the product. As thermal cycles increase, the valve diaphragm is continually compressed and relaxed, resulting in thinning of the diaphragm. These dimensional changes create less seal contact and will eventually result in valve leakage to the atmosphere. Although some leaks can be addressed with retorquing, most end-user procedures do not allow valves to be retorqued after the process has been released to production.

Thermal cycle performance has been a significant topic for the biopharm industry for some time. The American Society of Mechanical Engineers Bioprocessing Equipment Committee, which drives many of the industry best practices, has developed a test procedure that will help the end user determine the potential performance of a given seal/diaphragm in varying conditions. This "Appendix J" test¹ allows seal/diaphragm manufacturers to rate the performance of

References

1. ASME, "ASME Bioprocessing Equipment" (New York, NY, 2014)
2. ITT Engineered Valves company data

their elastomers based on a standard test protocol. This testing is currently non-mandatory and is in its infancy of adoption by end users. Eventually these Appendix J ratings will provide end users a consistent basis to assess expected life expectancy with regards to thermal cycle performance.

Many of the forward-thinking pharmaceutical companies are now partnering with valve manufacturers to assess maintenance frequencies. With proper application data, including temperature, pressure, process fluid data and exposure times, valve manufacturers can help to develop a maintenance program that aligns with the risk profile of a particular end user. In this way, the end user can save unnecessary maintenance costs and production downtime, ultimately reducing total cost of ownership of the process system.

IMPROVED VALVE DESIGNS

In recent years, the design of the hygienic diaphragm valve has been optimized to increase productivity, ultimately advancing maintenance practices in biopharmaceutical facilities. New valve technology, for example, can reduce average diaphragm replacement time from 23 minutes to three minutes and total maintenance time from hundreds of man-hours to just a few hours, hence reducing maintenance cost by more than 90%.² Preventative maintenance practices and more innovative technology, such as valves that do not require tools or retorquing, are decreasing the potential of human error and making processes safer and more efficient. Improved designs can help meet the biopharmaceutical industry's growing demand for increased productivity, extended maintenance intervals and reduced operating costs when the design is backed by an effective preventative maintenance program. **WM**

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The Needs of Today's Up and Coming Engineers

BY GREG JOHNSON

What's it like to be a young engineer given responsibility for parts of a multi-million-dollar plant full of potentially hazardous fluids linked together by pipe, fittings and valves that, for a newcomer, are shrouded in a semi-transparent veil of mystery? The answer is a combination of self-confidence, fear and a strong desire to succeed, all bound together with a thousand questions.

Having taught valve training courses for more than 10 years, I have seen and heard all the varied stories these up and coming young men and women have. These mostly millennial engineers and technicians are now the professionals running our plants as the working life of their greying superiors approaches an end. Virtually all the newbies come from engineering or technical school with just enough valve knowledge to be a little confused and the potential to make a wrong decision when it comes to valve issues.

WHERE TRAINING'S BEEN SOURCED

Most large oil and chemical companies provide some valve training for new hires. Often this consists of shadowing an experienced hand or working for a short while as an assistant, which hopefully means learning by osmosis and some well-placed questions. Some larger companies have a valve manual or a set of valve selection documents to learn from or to reference. These two channels have been the crash course that on-the-job-training for valves has become.

It wasn't always this way, especially for some of the major refiners and chemical producers. In decades past, Humble (later Exxon) used to provide a well-rounded training regimen for its new engineers. When a new engineer was hired, he or she spent a short period becoming quickly acclimated to plant life and its surroundings. The young prodigy-to-be then was assigned to the procurement department's inspection group for a hands-



□ Valve Repair Manager Donald Polasek demonstrates tear down and inspection procedures during the basics class for Exxon, hosted by United Valve.

on course in plant equipment, including valves. The new hires served a period of months as source inspectors for new equipment, which involved reviewing purchase orders and specifications and comparing those against the finished products ready for shipment to the refinery.

As for the valve aspect of this training, there were meetings with vendors to review documents and lots of time spent witnessing assembly and testing of specially engineered or critical valves. Along with this technical inspection training came collateral experience gained in how to deal with a variety of problems and a multitude of personality types.

Following the source inspection training, a new, semi-trained engineer was assigned to a specific unit in the plant. He or she would become familiar with all the fixed and rotating equipment found in the unit while also applying the practical hands-on inspection experience they gained. The not-quite-green-anymore engineer then rotated throughout the plant with stints in many of the other units. After all this training, a much-more-confident engineer or technician was now ready to be placed into a position of responsibility within the company. This whole process from hire to final placement could last two

to three years, depending upon the specific needs of the plant.

Today, this process has been homogenized down to a matter of months from new hires to positions of importance. While billions of bytes of digital information are available to the young engineer through their office computer or smartphone, the aspect of having seen it in person and hands-on experience is lacking.

TODAY'S YOUNG ENGINEERS

As part of the VMA's ValveEd training team, I have been privileged to participate in training events for several end users at their facilities. The audience in all cases was predominately young engineers along with some mechanical technicians. In this small group (usually 20-25 people) environment, the fear of dumb questions is reduced and questions are more focused on individual process applications and questions. Although onsite teaching locations are limited to the samples carried in by instructors, the presence of some form of hands-on training helps to reinforce the two-dimensional aspect of the visuals on a screen.

The questions uttered in these small groups can be a bit shocking to some of our presenters who have decades of experience under their belt. But these basic questions reveal the

need for continuing valve education such as that offered by VMA.

This past January, my company hosted 54 young ExxonMobil engineers for two, one-day valve and valve repair basics courses. As we went around the room, participants introduced themselves and stated how long they had been working at their job. On the first day, the first row of that class averaged just over one year's job experience. For the total course, the average experience was about four years. (That four-year number was skewed a little by two veterans with 18 and 20 years who attended the class).

What we discovered was that all the attendees had a pocketful of valve-related questions, which in some cases were answered by the hands-on training they received that day.

A follow-up email survey asking about valve issues they faced in their day-to-day duties revealed a need for additional specific valve application training along with some "valves 201" (advanced and application-specific issues) curriculum. These will serve as program topics for future ValveEd training courses. Also recognized by those planning future basics courses was a need for a condensed valve basics course that could be offered in engineering schools.

WHAT KNOWLEDGE DO THEY NEED/WANT?

With today's strong focus on the environment, as well as much internal



□ Engineer Jonathon Lu demonstrates a modern digital coordinate measuring machine.

corporate pressure to control fugitive emissions (FE), it should come as no surprise that FE is a topic on the minds of respondents. A popular request among those queried was for training in the proper method of repacking valves with fugitive emissions packing.

An interesting general request also came from the need to readily review the internal design of the various valve types and how they function. Amazingly enough, the request was for some form of a large-sized poster showing the cut-away views of the basic valve types. It seems that even for millennials, a bit of colored ink on a large sheet of coated paper can sometimes be more useful than an eight-square-inch

view on a smartphone or a larger one on a computer display.

An analysis of other comments shows a need for experienced sales engineers to make calls on these engineers. Although the "hi, have a donut, how are you doing" approach to sales may elicit a response and the memory of a name, these young engineers could benefit tremendously from interfacing with technically savvy valve sales engineers who can answer their application and "valves 201"-type questions. Even though reaching this group of plant personnel is challenging, it's clear that persistence in doing so would be worth the effort.

The biggest take-away from the hands-on training course we had was the effectiveness of the hands-on portion of the training. Although in this case "hands-on" is more of an "eyes-on" exercise, the ability to move around and view the components from all angles elevates some of the concepts from the visualization to reality stage. It also shows how effective a more-advanced hands-on valve and actuator assembly and disassembly program could be. Practical experience has shown many of us that during valve outages and turnarounds, when an engineer breaks away from the plant to see and touch a critical valve, the level of understanding increases tremendously.

Any one- or two-day valve basics courses may bring up as many questions among those in attendance as it answers, but that is not necessarily a bad thing as long as new questions are addressed and answered. As I referenced in a previous VALVE Magazine (Summer 2017), "The Road to Valve Knowledge," valve expertise is not a destination but a career-long journey. As valve trainers, we need to be good listeners and provide training that makes the learning journey more productive and hopefully more enjoyable for these engineers. **WM**

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□ United Valve COO Matt Lovell explains how specific valve components are machined during a repair procedure.

Stress Wave Monitoring

BY SAL TAREEN

Surfaces in relative motion or in contact with each other, such as bearing or gear components, produce a frequency response when they interact. This response, known as a stress wave, is an ultrasonic, structure-borne signal correlated to the natural frequency of the structural material.

An increase in stress waves produced by a mechanical system indicates an increase in component friction and impact events, which means potential issues can be identified by detecting and monitoring these waves.

Typically, machine failure occurs when an excess of friction and impact events occur. When left unchecked, such issues cause secondary effects such as an increase in temperature or vibration. Early detection of potential issues by monitoring a mechanical system's stress waves is an effective method for determining the presence of anomalous mechanical conditions before they reach critical damage points along the failure progression process.

Stress wave detection today is being used to monitor the condition of many types of industrial equipment such as motors, pumps, gearboxes and other rotating machinery. Because fluid media imparts high frequency structural energy throughout valve bodies, monitoring stress waves is also an effective method for identifying valve leaks.

BENEFITS OF STRESS WAVE MONITORING

Because stress wave monitoring detects ultrasonic energy, using such monitoring does not require the external surfaces of a structure to be shaking or in motion to detect problems. Rather, measuring stress waves filters out and ignores relatively low but audible frequency generated by shaking and then "listens" for the much-higher frequency stress wave pulses inside the structure generated by friction and impact events. Stress waves also can diagnose various aspects of these events, including



□ Systems that already have a lot of mechanical vibration, such as wind turbine systems, are often hard to monitor. Stress wave technology filters out low-frequency vibrations.

contact surface area and smoothness/roughness, relative surface speeds, contact pressure, lubricant condition, and operational load and speed. Similarly, when damage starts, stress wave levels detect characteristics such as impact velocity, damage depth, and damage size and area.

To detect stress waves, a specially designed sensor tuned to an ultrasonic frequency range of 35-45 kHz is attached to the mechanical device's surface. Since the stress waves radiate throughout the monitored component's structure, no positional requirement is needed; only a structural sound-path is necessary. The sensor generates an output signal that combines the ultrasonic stress wave carrier frequency with the modulated machine-generated stress wave frequency. This combination signal is sent to either an analog or digital signal processing system, which strips out the ultrasonic carrier frequency and outputs the machine-level operational frequencies used to determine if the machine is exhibiting normal or abnormal mechanical behavior.

ADVANTAGES OVER VIBRATION MONITORING

When paired with analysis, the sensitivity of stress wave energy detection offers advantages over vibration or temperature analysis capabilities. In fact, issues can be detected and corrected before they become problematic enough for other methods to detect.

One advantage of stress wave monitoring over traditional vibration methods, for example, is its ability to identify stress-inducing operating states and internal mechanical damage for operational mitigation and maintenance planning purposes long before the external structure shakes enough to register vibrational changes. This means the technology provides an early indication of impending damage, which also permits the trending of the damage's progress as correlated to facility-supplied process information. This combination allows tracing a problem to its potential causes, which in turn allows determination of whether or not an issue is process related. Studying the trending of these stress waves also provides users the

ability to determine the time frame in which observed damage will force the machine system to cease production and shows how manipulating the machine system's processes can affect failure progressions.

Stress wave detection is optimal for specific applications where traditional monitoring techniques have been proven less effective. These include systems with inherent mechanical vibration (such as wind turbines) and systems that have slow rotation (such as large cooling water pumps).

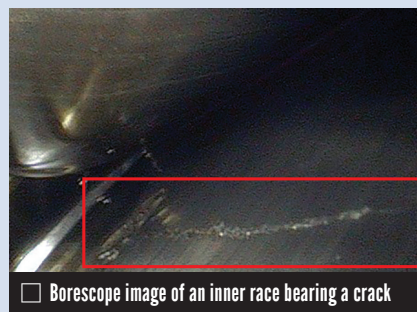
Systems that exhibit inherent mechanical vibration during normal operation tend to overwhelm vibration monitoring devices, making it difficult to determine the difference between a mechanical anomaly and normal operation. Because stress wave detection technology intrinsically filters out low-frequency vibration energy, it is immune to the presence of inherent mechanical vibration and can identify the existence of mechanical faults. Systems such as wind turbines fall into the category of applications where stress wave technology can help since turbine systems must deal not only with the machine's vibration but also environmental vibrations needed to power the turbine.

In relatively large systems with slow rotations, vibration monitoring struggles to identify issues. This is because a small mechanical defect does not produce enough vibration energy or force to create motion within the mechanical system. However, the same defect fundamentally creates stress waves throughout the mechanical structure that can be detected by a stress wave sensor, regardless of rotation speed or system size. Machines such as water-cooling pumps fall into this category. If a large, water-cooling pump has a small crack in its shaft bearing, it may not exhibit enough energy to create motion within the pump; thus, a vibration sensor will not detect the issue. The same crack, however, will cause stress waves to radiate throughout the structure of the pump.

Trending the data collected by stress wave monitoring and then analyzed over time also allows repeat issues to be correlated to other events,

THE CASE OF THE MISSED FAILURES

A large wind turbine facility was monitoring each turbine's mechanical condition using a combination of traditional monitoring techniques consisting of data collection on temperature, vibration and oil condition for the major mechanical components. Despite this monitoring strategy, engineering was consistently missing failures and unable to determine the specific cause of the failures.



□ Borescope image of an inner race bearing a crack

The facility added stress wave monitoring to the wind turbines to gather data on the bearings and gears. The monitoring system identified a failure of a gearbox bearing that had not been indicated on traditional monitoring systems. Additionally, the stress wave system indicated exactly where and when the stress waves were originating on the bearing, specifically on the inner race.

This information allowed the engineering and maintenance teams to take action before the bearing crack escalated, preventing greater failure within the gearbox or total failure of the gearbox as a whole. The maintenance department swapped out the bearing by performing an up-tower replacement rather than replacing the whole gearbox, which would have been a complicated procedure involving mobilization of a crane for the swapping activity.

such as improper maintenance or lubrication.

It's clear that, because of its advantages, tools using stress wave monitoring will continue to be fine-tuned

and released to industries where those advantages may make a difference. **VM**

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Welding Specifications Issues

BY CHERRA MELOY

Q: I NEED TO QUALIFY A WELDING PROCEDURE SPECIFICATION PER THE ASME BOILER AND PRESSURE VESSEL CODE. GIVEN THAT SECTION IX OF THAT CODE PROVIDES QUALIFICATION REQUIREMENTS FOR WELDING, BRAZING AND PLASTIC FUSING (JOINING PROCESSES), WHAT ARE SOME OF THE BASICS I NEED TO UNDERSTAND?

A: To the new user, Section IX of the ASME Boiler and Pressure Vessel Code is very complex, and the rules for qualifying welding procedures vary depending upon the welding process used and the materials welded. However, a few fundamental concepts are commonly misunderstood, and gaining a firm understanding of those concepts makes it easier for a new user of this code section to determine how it works.

Section IX, Part QG contains general requirements for all material-joining processes (welding, brazing and plastic fusing). It defines key portions of the qualification process: a procedure specification (QG-101), a procedure qualification record (QG-102), a performance qualification and performance qualification record, variables (QG-105), organizational responsibilities (QG-106), ownership transfers (QG-107), qualifications made to previous Section IX editions (QG-108) and definitions (QG-109). Before starting the qualification of a welder, welding operator (both of which are outside the scope of this article), or a procedure, a good practice is to review Part QG. The definitions in QG-109 can be especially helpful because some terms used throughout the text have evolved over the years and are specific to the welding field.

Section IX Part QW (which covers welding) is divided into five articles (I, II, III, IV and V). Article I contains general requirements for welding. Article II contains requirements for qualifying welding procedures. Article III contains requirements for the qualification of welders and welding



operators. Article IV contains welding data (variables, base material groupings, test specimen requirements, etc.). Article V contains information on standard welding procedure specifications (which is outside the scope of this article).

A good practice is to read Articles I and II before beginning. It is not necessary to read through all of Article IV to get started because most of this article is dedicated to describing variables. However, the text at the beginning of each major section should be reviewed, including QW-401 (description of variables), QW-420 (base material groupings), QW-424 (base metals for procedure qualification) and QW-430 (F-Numbers).

The end goal is a viable welding procedure specification (WPS). The WPS is a document that provides direction to the welder/welding operator, and states requirements regarding the materials that may be welded, which welding process must be used, the filler metals to be used, the minimum preheat temperature, welding parameters such as current, voltage, travel speed, interpass temperature, post-weld heat treatment requirements, etc.

The WPS is based upon the successful creation of a welded qualification test coupon. The procedure qualification record (PQR) is a document used

to record the required data associated with the creation and testing of the qualification coupon.

The rules in Section IX govern how the parameters specified in the WPS are determined using the PQR data as a basis.

In Section IX terminology, a variable is a parameter or factor determined to have an effect upon the welding characteristics or the resulting weldment. Section IX includes many variables and categorizes them for various welding situations as “essential,” “nonessential” and “supplementary essential.”

For a given welding situation, an essential variable is one identified as critical to the success of the welding process or to the properties of the resulting weldment. A change in an essential variable requires the requalification of the welding procedure (meaning a new PQR must be created).

A *nonessential variable* is a variable that must be documented in the WPS but may be changed by revision without the requalification of the procedure.

A *supplementary essential variable* is a parameter or factor that becomes an essential variable when impact testing is required by a referencing code section (e.g. Section I, Section III, Section VIII, etc.) or customer specification.

Essential, supplementary essential and non-essential variables for various welding processes are listed in tables immediately following paragraph QW-250. For example, QW-253 covers shielded metal arc welding joining and lists the paragraphs in Article IV that describe the essential, supplementary essential and nonessential variables that apply. Two examples of variables listed in QW-253 and their impact are:

QW-406.1 "Decrease > 100°F (55°C)" is an essential variable. Paragraph QW-406.1 states:

"QW-406.1 A decrease of more than 100°F (55°C) in the preheat temperature qualified. The minimum temperature for welding shall be specified in the WPS."

Therefore, assuming the PQR lists a preheat temperature of 150°F (65°C), the WPS can be written with a preheat temperature as low as 50°F (10°C). If desired for creating or revising a WPS to use a preheat temperature below 50°F (10°C), the procedure would need to be requalified.

QW-406.3 "Increase > 100°F

(55°C) (IP)" is a supplementary essential variable. Paragraph QW-406.3 states:

"QW-406.3 An increase of more than 100°F (55°C) in the maximum interpass temperature recorded on the PQR. This variable does not apply when a WPS is qualified with a PWHT above the upper transformation temperature or when an austenitic or P-No. 10H material is solution annealed after welding."

Since this is a supplementary essential variable, it only applies if impact testing is required. If such testing is required, this supplementary essential variable also only applies to certain materials in certain heat treatment conditions as described in QW-406.3. Assuming it applies and assuming the PQR lists a maximum interpass temperature of 500°F (260°C), the WPS can be written with a maximum interpass temperature of up to 600°F (315°C). If desired to create or revise a WPS to increase the maximum interpass temperature to higher than 600°F (315°C), the procedure would need to be requalified.

procedure would need to be requalified.

Note: Many QW-4XX paragraphs describe variables; however, the only ones that apply to the welding procedure are those referenced in the QW-25X tables for the welding processes used.

A valid WPS lists all essential and non-essential variables (and supplementary essential variables when required) and provides appropriate values for each.

New users of Section IX sometimes think they can just use the example forms in Section IX Nonmandatory Appendix B and fill them in based upon what seems obvious. This approach is highly unlikely to result in a procedure that properly addresses the variables. The best way to ensure a WPS is complete and correct is to use the QW-250 tables to ensure all appropriate variables are included and properly addressed, and to review the definitions in QG-109 to ensure all terminology is interpreted and used correctly. **W**

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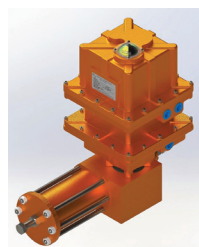
For more information on joining the Valve Repair Council, contact Marc Pasternak at 202.331.0104 (mpasternak@vma.org).

DeZURIK's new "Valve Solutions for Mining" guide highlights valve styles that have solved mining application problems. The new bulletin includes process diagrams that illustrate DeZURIK valves used for services such as pump station processing and system water, grinding, hydrocyclone, column cell and more. The bulletin also contains chemical, temperature and process pressure guidance.



A-T Controls added a three-plate attenuator as an option to its Segment Control valve line. The attenuator is designed to break pressure drop down to lower the pressure recovery of the control valve, which allows the valve to operate in higher pressure drop applications, thereby preventing cavitation and reducing noise production. The design lets the valve maintain shutoff rating as well as maintain an equal percent flow characteristic.

Baker Hughes and C3.ai have launched BHC3 Production Optimization, an AI-based application that allows well operators to view real-time production data and project future production better. The application continuously uses machine learning algorithms to aggregate historical and real-time data across operations and creates a comprehensive view of production from individual and multiple wells to the pipeline, distribution and point of sale.




Indelac Controls introduced models ASC4, ASC6, ASC10 & ASC12 to its ASC series of spring return electric actuators. The heavy-duty actuators use an electro-mechanical clutch to achieve modulating control, as well as DC voltage options for the spring return electric actuators. Indelac spring return electric actuators are equipped with a hardened steel spur and helical gear drive train to guarantee reliable protection against catastrophic process failure during loss of electricity.

Emerson introduced the ASCO Series 158 Gas Valve and Series 159 Motorized Actuator. Designed for burner-boiler applications, the new series gives OEMs, distributors, contractors and end users a new combustion safety shutoff valve option that increases safety and reliability and enhances both flow and control. It offers a higher close-off pressure of 75 psi (5.2 bar), which ensures a safe shutoff in the event of a fuel train system failure and eliminates the need for additional safety components.



Flowserve's Valtek FlowTop general service (GS) valve was engineered to help refineries, petrochemical facilities and other operations balance valve performance and cost. The fully integrated offering includes a FlowTop GS globe body assembly, a FlowAct pneumatic diaphragm actuator and a Logix digital positioner (with automatic calibration).

Victaulic launched its StrenghThin 100 Series E125 Installation-Ready butterfly valve. Ideal for HVAC applications, the butterfly valve offers the benefits of a grooved valve combined with the ease and speed of installation of an installation-ready coupling. By encasing the capability of a rubber-lined butterfly valve within a coupling, the Series E125 valve offers a reduced footprint, quick installation and lightweight. The series allows for full, 360-degree orientation. 



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