

WAVE



VMA's 2019 Market Outlook: **Attitudes Positive with Some Hesitation**

: ALTERNATE
: PASSAGeways
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: PRESSURE
: RELIEF
: EQUIPMENT
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: PAINTS
: AND
: COATINGS
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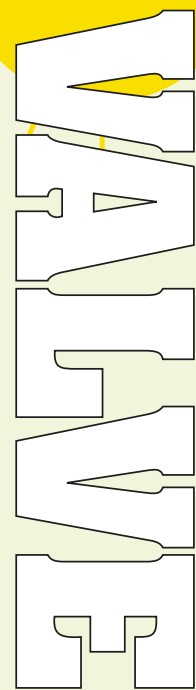


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- » Can Technology Make Your Business More Agile?
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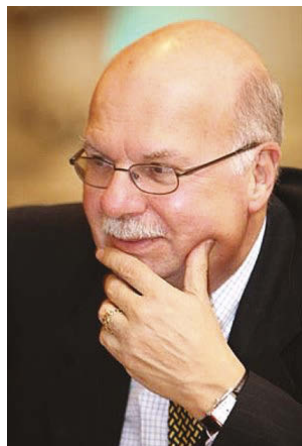
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Outlook for 2019: Guarded Positivity



VMA's 37th Annual Market Outlook Workshop in Chicago in August offered what I'll call a "slightly optimistic" outlook for 2019 after limited real growth in 2018.

The workshop attendance was excellent this year both for VMA/VRC members and for representatives from the Hydraulic Institute, our partner at the workshop for the last 11 years. What those attendees heard this year varied from end-user industry to industry as it always does, but the overall outlook was fairly positive with some reservations and concerns.

Full coverage begins on page 16, but I want to share what we learned from David Teolis, senior manager, Economic and Industry Forecasting—International for GM. Teolis, who was addressing this group for the first time, gave his thoughts on the global market. To sum, he indicated the following:

- The global economy is dynamic and adaptive. It is largely influenced by shocks and unexpected events, as well as policy responses to those developments.
- Cyclical factors are main contributors to current growth momentum. Accommodative monetary policy providing underlying support to cyclical activity and recovery of exports and investment helped global growth return to 3.1% last year.
- Global risks are biased toward the downside. Trade wars and protectionism remain the key downside risk to the global outlook

In addition to listening to Teolis and many other excellent presenters, I also kept my ears open to what attendees were saying about their own business experiences over the first seven months of 2018. Here, too, I detected a glint of optimism, which contrasted with just two years ago when I wrote this column and called the attitude: a hint of pessimism. Hopefully by the time of the 38th Market Outlook Workshop, which we've scheduled for Aug. 8-9, 2019 in San Diego, they'll be even more of an uptick. **WM**

Bill Sandler

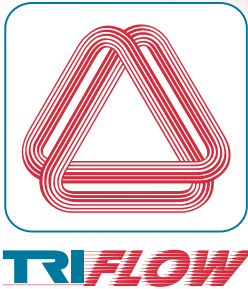
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NEW CONTRACTS

Weir Signs Oil Contracts

Weir signed multi-year contracts totaling more than \$50 million in Iraq with two international oil companies. The contracts secure the provision of Weir Oil & Gas workshop services and engineering support for one oil field as well as valve repair and maintenance services for another field.

Curtiss-Wright Supporting Submarine Program

Curtiss-Wright was awarded a contract valued at more than \$28 million to provide valves for the U.S. Navy's Virginia-class submarines. The award was received from Bechtel Plant Machinery, Inc. to support ship construction and spare parts procurement. The contract includes fiscal year 2018 orders for two ship sets of submarine propulsion plant valves and spares.

Curtiss-Wright is performing the work at its facility in East Farmingdale, NY.

Velan Awarded Offshore Valve Contracts

Velan Inc.'s wholly owned subsidiary in Lucca, Italy, has been awarded contracts for the supply of three different types of valves to MODEC Offshore Production Systems (Singapore) Pte. Ltd. These orders represent a sales value of about \$18 million and are scheduled for delivery by early 2019.

Velan ABV will supply API 6D and API 6A valves for MODEC's new floating production storage and off-loading (FPSO) MV30 Carioca vessel. The FPSO will be deployed at the Sépia field operated by Petróleo Bra-

sileiro S.A. (Petrobras), in a region off the coast of Brazil that has a water depth about 2,200 meters (more than 7,200 feet).

Framatome Becomes Main Chesterton Distributor

Framatome recently signed a teaming agreement with AW Chesterton to become the exclusive distributor of Chesterton's valve packing and mechanical seals to the majority of North America's nuclear energy fleet. This agreement continues a long-standing relationship to support North American nuclear energy facilities. The initial term of the teaming agreement is three years.

Union Tech Awarded MTO Project Contract

Wiscon Energy Engineering awarded Union Tech a



□ Union Tech will provide rising-ball valves and their actuators.

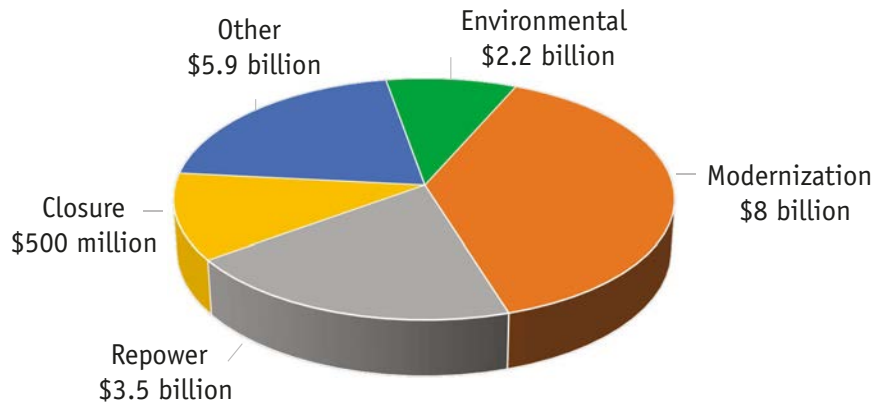
MARKET FOCUS: The Power Industry

Part of Britt Burt's job as vice president of global research for the power industry, Industrial Info Resources, is to track new power plants, expansions, modernizations and scheduled maintenance and outages.

Burt, who spoke at the 2018 VMA Market Outlook Workshop (see page 16), says that in the next few years, he will be watching 246 projects in North America that are due to kick off during that time. Those projects

will be worth about \$20.1 billion. The region with the greatest number is the west coast of the U.S., which will see 42 projects worth over \$2.8 billion. Next is the Southeast, with 32 projects worth about \$1.8 billion, West Canada with 29 worth more than \$1 billion and the Mid-Atlantic states with 29 worth about \$1.5 billion.

A good portion of those projects will be for modernization of facilities.



246 projects worth \$20.1 billion

Source: Industrial Info Resources

contract consisting of Z4 rising-stem ball valves and paired actuators installed in Nanjing Chengzhi Yongqing Energy Technology's 600 kt/a methanol-to-olefins (MTO) project.

The contract spanned a wide range in valve sizes, from one-and-a-half inches up to 10 inches. Union Tech manufactured both the valves and matching linear pneumatic actuators.

Rotork Supplying Chinese Refinery

Rotork received major contracts to supply electric and pneumatic valve actuators and valve gearboxes to Hengli Petrochemical (Dalian) Refinery Co. Ltd. for flow control in its new refinery and petrochemicals complex, one of the largest in China, at Changxing Island in Dalian City.

The contract involves about 2,000 explosion-proof electric actuators to operate gate and ball valves in tank farms.

Metso Gets Major Valve Orders in China

Metso received two valve orders totaling 8,200 valves from major pulp and paper customers in China. The orders are booked in Metso's first quarter 2018 orders received. The total value of the orders and the company names have not been disclosed. Metso has established a strong presence within China's mid- and high-end customers for this market.

Forum Energy Contracted for Submarine Vehicles

Forum Energy Technologies has received an order from Submarine Manufacturing and Products, Ltd. (SMP)

to provide equipment for a submarine rescue vehicle (SRV), a work-class remotely operated vehicle (ROV) and associated launch and recovery systems. The ROV and SRV will be delivered in 2019 and 2020, respectively, and integrated by SMP with additional equipment for delivery to a navy in the Far East.

The SRV will be capable of operating in depths greater than 500 meters, carrying a maximum of 19 people, and will be fully integrated with a hyperbaric rescue facility supplied by SMP.

MERGERS & ACQUISITIONS

Wolseley Acquires Action Automation

Wolseley Industrial Group purchased Action Automation, an automation business headquartered in Alsip, IL. The company will operate as Action Automation, a Wolseley Industrial Group company.

Founded in 1997, Action Automation specializes in providing actuators, actuated valves and repair solutions and is an authorized stocking distributor of Limatorque (Flowserve) actuators and parts for four states in the Midwest.

Quality Valve Bought by Pfingsten Partners

Pfingsten Partners, L.L.C. invested in Quality Valve, Inc. in partnership with the company's founder, Raymond McCaffrey, III. Pfingsten acquired Quality Valve on July 27.

McCaffrey retained equity ownership in the company. According to Quality Valve, Pfingsten's operational capabilities,

conservative capital structure and prior experience in the valve industry will provide additional resources to scale the valve company's customer-centric value proposition.

Weir Group Completes ESCO Acquisition

The Weir Group PLC finalized the purchase of ESCO Corporation effective July 12.

ESCO will operate as a new division of the Weir Group and will be reported as a separate segment alongside Minerals and Oil & Gas.

GE to Separate from Baker Hughes

After a strategic review, GE announced it will focus on aviation, power and renewable energy. In addition to the pending combination of its transportation business with Wabtec, GE plans to separate GE Healthcare into a standalone company, pursue an orderly separation from Baker Hughes, a GE company (BHGE), make its corporate structure leaner and substantially reduce debt. GE's board of directors unanimously approved the plan.

OPERATIONS EXPANSIONS

AUMA Goes into Mexico

AUMA expanded its global sales and service network by opening a new subsidiary in Mexico City. Strategically located, the new office will enable AUMA to strengthen its position in Latin America.

According to AUMA, this economic region holds significant potential for the actuator manufacturer in the areas ranging from

OCTOBER

30-NOV 1

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27-29

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DECEMBER

4-6

Power-Gen International

Orlando, FL
www.power-gen.com

APRIL

9-11

VMA Valve Industry Knowledge Forum: Conference, Exhibit, Tour

Birmingham, AL
www.vma.org/KnowledgeForum

MAY

6-9

Offshore Technology Conference (OTC) 2019

Houston
www.otcnet.org

TBD

Valve Basics Seminar & Exhibits

Houston
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JUNE

9-12

ACE19 - AWWA Annual Conference & Exposition

Denver
www.awwa.org

19-20

Valve World Americas Expo & Conference

Houston
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AUGUST

8-9

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drinking water and sewage treatment to power generation, mining, and the oil and gas industry.

Mueller Water Growing its Tennessee Operations

The Tennessee Department of Economic and Com-

munity Development and Mueller Water Products announced that the manufacturer will expand its operations in Chattanooga and create 96 jobs over the next three years.

Mueller Water Products will invest in domestic

manufacturing capabilities and introduce additive manufacturing technologies to its foundries. The Chattanooga facility expansion is driven by a growing demand for water infrastructure products among municipalities.

PEOPLE IN THE NEWS

EMERSON AUTOMATION SOLUTIONS...

announced that **Lal Karsanbhai** succeeded **Michael Train** to become executive president of Emerson Automation Solutions, effective Oct. 1. Train takes over as Emerson's president and will also serve as chairman of Automation Solutions.

Karsanbhai, who has served as group president of Emerson's Rosemount Measurement & Analytical business since 2016, has more than 23 years of experience with Emerson in a career that spans the globe.

SPIRAX SARCO... promoted **Neil Daws**, executive director and divisional director responsible for Spirax Sarco Steam Specialties operations in Europe, the Middle East and Africa (EMEA), to the position of managing director of the steam specialties business. Daws is now responsible for all the steam specialties business worldwide, including Gestra.

As a result, **Sean Clay** joins the company to take over the position of divisional director, Spirax Sarco EMEA. Clay comes from the Honeywell Group, where he's held a number of roles over the last 14 years.

MUELLER WATER PRODUCTS... appointed **Steven S. Heinrichs** executive vice president, general counsel, chief compliance officer and corporate secretary. Heinrichs reports to Mueller Water Products president and CEO **Scott Hall**.

Heinrichs joins Mueller from Neenah, Inc., where he served as chief legal and compliance officer, senior vice president, general counsel and secretary. Before joining Neenah, Inc., Heinrichs held progressive leadership positions across multiple industries.

WEY VALVE... named **Tommy Baldwin** president and CEO. He replaced **Samuel Sidler**, who's gone on to serve as head of global business development on the board of SISTAG AG.

Baldwyn has held many positions with Wey since 2000, such as vice president of

operations, director of manufacturing and most recently vice president and director of sales & marketing.

VAL-MATIC... named **Tim O'Shea** its new engineering project manager. O'Shea has more than 18 years of experience and has seven valve-related U.S. patents attached to his name.



Tim O'Shea

In addition to his extensive valve design and application experience, O'Shea participates in American Water Works Association committees covering air, ball, butterfly, check, cone, plug valves as well as those for valve actuators, waterworks gaskets and elastomers, and grooved end connections.

A-T CONTROLS... announced the addition of **Andy Cheney** as the company's new southwest regional manager.

Cheney's new role will cover California, South Nevada, Arizona and New Mexico. He has more than 20 years in the valve and automation business and is familiar with A-T Controls from his time working at Sunbelt/Flowmax. Cheney spent the last four years at Flowserve as area sales manager covering most of the same territory.

CPV MANUFACTURING... named **Jay H. Loomis** vice president of sales. Loomis will be responsible for the expansion and development of CPV's sales team. Before joining CPV, Loomis was a national account manager at Airgas USA. His sales and account management experience spans three decades.

CPV also named **Robert Cardona** as director of engineering. Cardona will be responsible for managing the engineering team and for overseeing all engineering projects. Most recently he was a senior engineer at Productive Plastics. Cardona has four patents under his belt and played a significant role in the design of systems and components for the Aegis Radar System.

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Trust Earned Through Performance

ATI Expands Houston Facility

Automation Technology, LLC (ATI) recently completed a \$1.3-million capital investment expanding valve actuation/controls production and assembly capabilities at its Houston area manufacturing facility. The larger capacity plan allows ATI to continue to meet the increased product demand recently experienced in the oil, gas and pipeline market segments.

The internal expansion increased the overall production throughput and established dedicated assembly cells for ATI's direct gas motor and electro-hydraulic power unit product lines.

Conval Moves into New Manufacturing Center

Conval recently moved into its new, 72,000-square-foot advanced manufacturing center at 96 Phoenix Avenue in Enfield, CT. Under development for two years, the facility is adjacent to I-91 and 13 highway miles from Bradley International Airport. With all operations under one roof and 40% more capacity, the new facility will allow for new processes to be added, future expansion of the product line and significant company growth.

Emerson, Texas A&M Building Automation Lab

Emerson and Texas A&M established the Emerson Advanced Automation Laboratory to be funded through the company's donation. The laboratory will provide Texas A&M engineering students a modern, high-tech, active learning environment, simulating real-world plant

operations found in manufacturing facilities for the oil and gas, refining, life sciences, food and beverage and other industries. The lab will be an integral part of the university's new Zachry Engineering Education Complex, a 525,000-square-foot, state-of-the-art facility scheduled to open this fall.

AWARDS & RECOGNITION

The Chemours Company Creates STEM Scholarship

The Chemours Company created the Chemours Future of Chemistry Scholarship, which will deliver \$400,000 in scholarships over three years to talented, high-potential young people pursuing studies in science, technology, engineering and math (STEM), but lacking the financial resources to do so. The company launched the scholarship through a partnership with the City of Wilmington and Mayor Mike Purzycki's signature initiative, the Wilmington College and Career Fair.

Further demonstrating its commitment to the community and to STEM education, Chemours also is building a \$150-million research and innovation center on the University of Delaware's STAR campus—The Discovery Hub.

VMA Members Rank High on Top Distributors' Lists

Modern Distribution Management (MDM) named several VMA members in its 8th annual report on the state of the distribution industry, which includes the lists of top distributors



Emerson's award was presented at McRock Capital's IIoT Symposium.

and trends in 15 sectors. Among the Top 5 Industrial PVF Distributors were NOW Inc. (DistributionNOW) at No. 2, Wolseley Industrial Group at No. 4 and FloWorks International LLC at No. 5.

In the MDM list of Top 40 Industrial Distributors, NOW Inc. is ranked No. 11 while Wolseley Industrial Group comes in at No. 16.

The lists are ranked in order of 2017 revenue size; no other factors were used to compile these lists.

Petrobras Recognizes Metso

Brazilian oil and gas company Petrobras recognized Metso for its valve solutions, including its valve installation and maintenance services. The company evaluated its suppliers on criteria such as quality; adherence to deadlines; management; health, safety and environment; compliance; and integrity.

Petrobras is a publicly-



Petrobras presents Metso award

held company specializing in the oil, natural gas and energy industries worldwide.

Emerson Named IIoT Corporate Leader of the Year

Emerson was named IIoT Corporate Leader of the Year by McRock Capital. The McRock IIoT [Industrial Internet of Things] awards recognize leaders and visionaries around the globe who drive innovation in this area. Nominations are screened by an independent selection committee and evaluated on senior leadership support for IIoT, demonstrated success implementing solutions and continuous work with IIoT technology companies.

DeZURIK Celebrates 90th Anniversary

The public was invited to attend an open house in celebration of the 90th anniversary of DeZURIK at its corporate headquarters in Sartell, MN. The open house was held Sept. 22.

The company was founded in 1928 by Matt DeZurik who developed the first eccentric plug valve. Today, valves with the DeZURIK, APCO, Hilton and Willamette brands are used by customers worldwide.

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Hughes Elected Chair; Meunier Named Man of the Year

Although the nation is in the midst of uncertainty over tariffs as well as ongoing concerns over skill shortages, there was much to celebrate at VMA/VRC's annual meeting Sept. 25-27, at the Ritz-Carlton Lake Tahoe (CA). Attendees were observing not only the 80th year of VMA's existence, but a favorable year for most member companies.

They also welcomed in new leadership for the year. Following annual elections, last year's chairman, PBM's **Mark Nahorski** passed the gavel to Emerson's **David Hughes**, the 2018/19 VMA chairman. In addition, **Bryan Burns** of DeZURIK became vice chairman, and **Brad Ellis** of Crane Co. took over as program chair. Two new members were elected to the board: **Nathan Brunell** of BHGE and **Seth Guterman** of American Valve.

Attendees also recognized and thanked several people for service to the industry including outgoing board members—**Jim White** of Curtiss-Wright and **Bruce Johnson** of Emerson.

Receiving the association's top honor this year was **Stephane Meunier** of Cowan Dynamics, who graciously accepted VMA's "Person of the Year" Award. Meunier has served the valve industry for many years, volunteering numerous times to be on the program committee as well as be a member and then chair of the Technical Committee.

Carlos Davila of Crane, **Thom Jessup** of EGC Enterprises and **Donald**



□ David Hughes (left) takes the chairman's gavel from Mark Nahorski

Polasek of ValvTechnologies all received VMA Service Awards, which are presented to people who have given their time and expertise to the industry. Davila was also honored by Brad Ellis of Crane Co. for

55 years at the company.

CURRENT CONCERNS

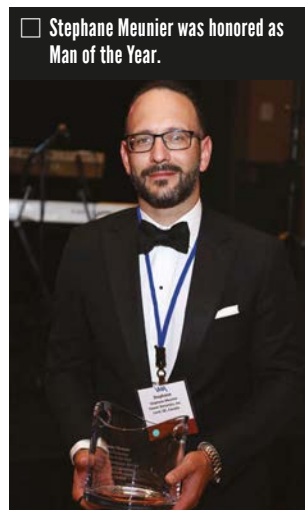
During the annual meeting, attendees had an opportunity to hear what experts have to say about current trends and the state of the

industry.

Connor Lokar, an ITR Economist, told attendees that in this nation, we should expect a cyclical change coming in 2019. However, the downturn is "more likely to be a speed bump, not the Grand Canyon."

Lokar addressed the current Administration's tax cuts, likening them to a shot in the arm. But he warned that the cuts may hurt the U.S. economy by the 2030s.

Lokar recommended advising Millennials and Gen Xers to live below their means and to learn a second language to make them more employable.



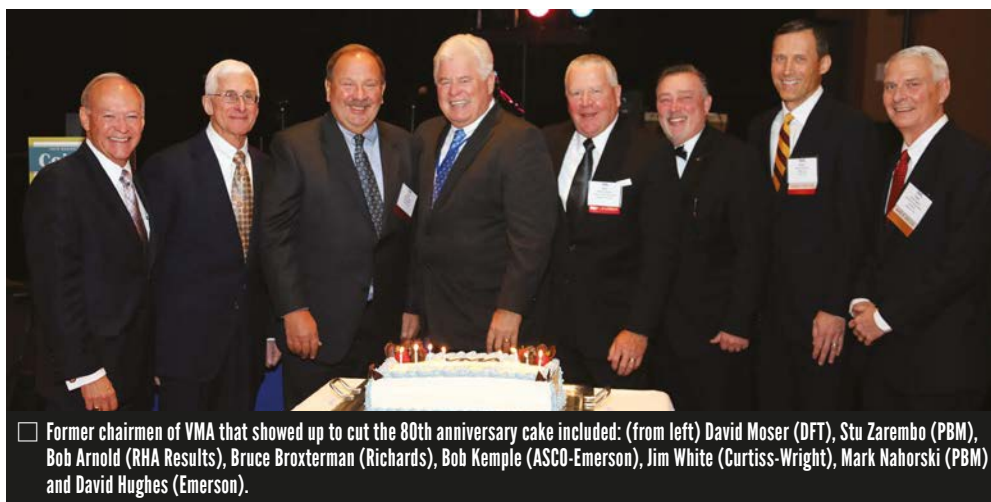
□ Stephane Meunier was honored as Man of the Year.



□ Crane Co.'s Brad Ellis (left) congratulates Carlos Davila for his work with VMA and for having served at Crane for 55 years.



□ Thom Jessup displays his distinguished service award.



□ Former chairmen of VMA that showed up to cut the 80th anniversary cake included: (from left) David Moser (DFT), Stu Zarembo (PBM), Bob Arnold (RHA Results), Bruce Broxterman (Richards), Bob Kemple (ASCO-Emerson), Jim White (Curtiss-Wright), Mark Nahorski (PBM) and David Hughes (Emerson).



□ Economist **Conor Lokar** addressed the domestic economy.

Households going forward “should have multiple or diverse income streams so that all income isn’t coming from the same sector,” Lokar said. He advised everyone to pay off as much debt as possible by 2030 and to learn to be less reliant on getting taken care of by the government.

Another expert, **Jeremy Leonard**, director of global industry services at Oxford Economics, warned that, while the ongoing industrial upcycle boosts valve prospects, the growth peak has passed. He said he expects a slowdown in growth in 2019, but it will not be a recession.

Another important concern today centers on cybersecurity. At VMA’s meeting this year, **Maurice Uenuma** of Tripwire, who is co-chair of workforce management, the National Initiative for Cybersecurity Education at the National Institute of Standards and Technology, noted that, “There are hundreds of things you can do to make your systems more secure, but start with humans.”

That’s because most attacks begin with human error surrounding phishing. Educating employees on best practices is a huge step and controlling passwords



□ **Maurice Uenuma** advised attendees on how to make their manufacturing plants’ cybersystems more secure.

and requiring multi-track verification are effective tools. “If you make it hard to get in, you’ll deter a lot of problems,” he said.

The need to give emphasis to the human factor was also addressed by **Danielle Zaft**, partner in human performance and business transformation at Propulo Consulting. She suggested that success today is largely dependent on understanding behavioral economics.

“Your job as leaders is to motivate your employees’ attitudes, make sure your employees are happy, meaning they are happy to be in your employ and excited about your products,” she told attendees.

“Employees who feel connected to the company and appreciated are more motivated and provide better customer care,” she stressed.

David Harquist, Kelley Drye & Warren LLP, addressed the ongoing issue of the effects of tariffs and **Michelle Burgess**, Emerson, addressed issues surrounding the unconscious biases of today that affect all types of people decisions. Both of those important issues will be addressed in upcoming features in VALVE Magazine. VM

NEW MEMBERS

VMA gained two full members this summer with the addition of **SVF Flow Controls** and **Norriseal Wellmark**, an Apergy Company. SVF, which is headquartered in La Palma, CA has been manufacturing ball valves, actuators and controls for all industrial applications for 35 years. Norriseal Wellmark, Houston, has been supplying valve and control solutions to the upstream and midstream oil and gas industries as well as marine and industrial markets for more than 60 years.

The Valve Repair Council welcomed **Equipment & Controls, Inc.** (ECI) and **Puffer-Sweiven** as new members.

ECI has 60 years of service in Western Pennsylvania, Ohio, West Virginia and Western Maryland, specializing in supplying industrial automation products and solutions for manufacturing and process industries.

Puffer-Sweiven helps process-intensive facilities run more efficiently and safely by delivering products, technical support and staff to customers throughout the Central and Gulf Coast regions of Texas.

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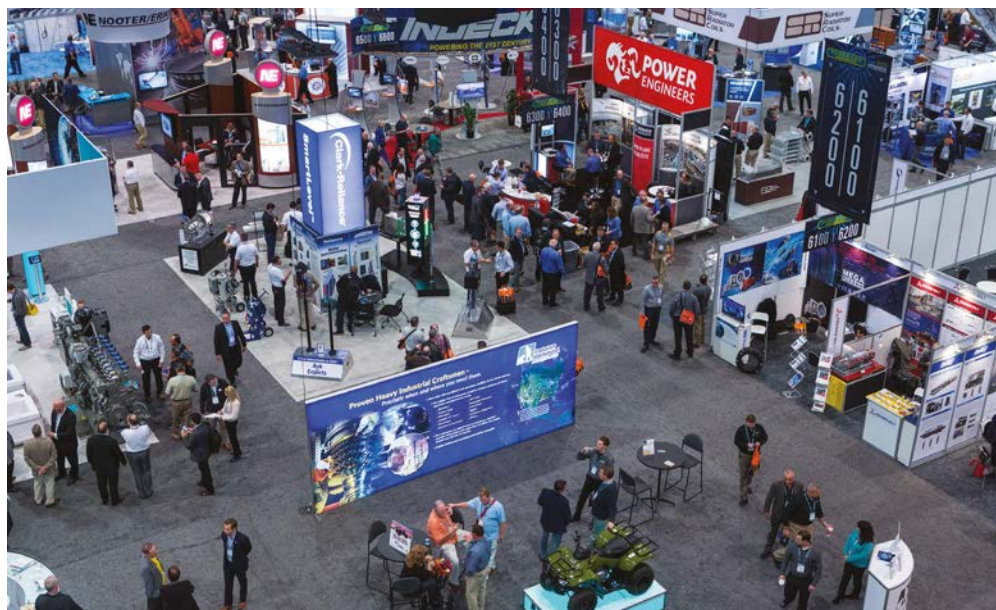
VALVE CAREERS.com

Power-Gen Celebrates 30 Years of Existence

Now in its 30th year, POWER-GEN International is a gathering of the world's experts and professionals involved in all forms of energy. This year's event is Dec. 4-6 at the Orange County Convention Center, Orlando, FL.

Power-Gen attendees come from more than 100 countries around the world. The event offers a multi-track summit of educational and trends topics that cover technology, innovation and policy advancements. It also offers an exhibit of more than 1,100 companies that sell to the industry.

Among new offerings this year are four new tracks on microgrid, solar, wind and hydro, which join the event's 11 other tracks in areas such as operation and design of gas-fired plants, optimiz-



ing plant performance, digital solutions and much more. More than 300 industry experts bring this information to attendees. Among keynote speakers are Greg Scheu, president of the Americas Region, ABB; Robert Yeager, pres-

ident of Emerson Power & Water Solutions; and Russell Stokes, president and CEO, GE Power.

Also new this year are Knowledge Hubs, presentation theaters set up to focus on four areas: decarbonization/decen-

tralization, energy storage & integration, the future of baseload and emerging trends/technologies.

VMA (#1570) and many of its members have booths at the show.

For information, go to www.power-gen.com.

ValveWorld 2018 Coming in November

Valve World, the 11th International Valve Trade Fair and Conference, is Nov. 27-29 in Düsseldorf, Germany. The biennial event covers the entire spectrum of industries where valves are used from oil and gas to water/wastewater, power generation and marine and offshore industries. At the show, attendees gather information on innovations, new products and processes, and trends.

VMA will share a booth with the British Valve and Actuator Association (BVAA) that will be manned by member companies as



well as association leaders including VMA President Bill Sandler. The booth will have space available for clients and colleagues to meet and exchange information.

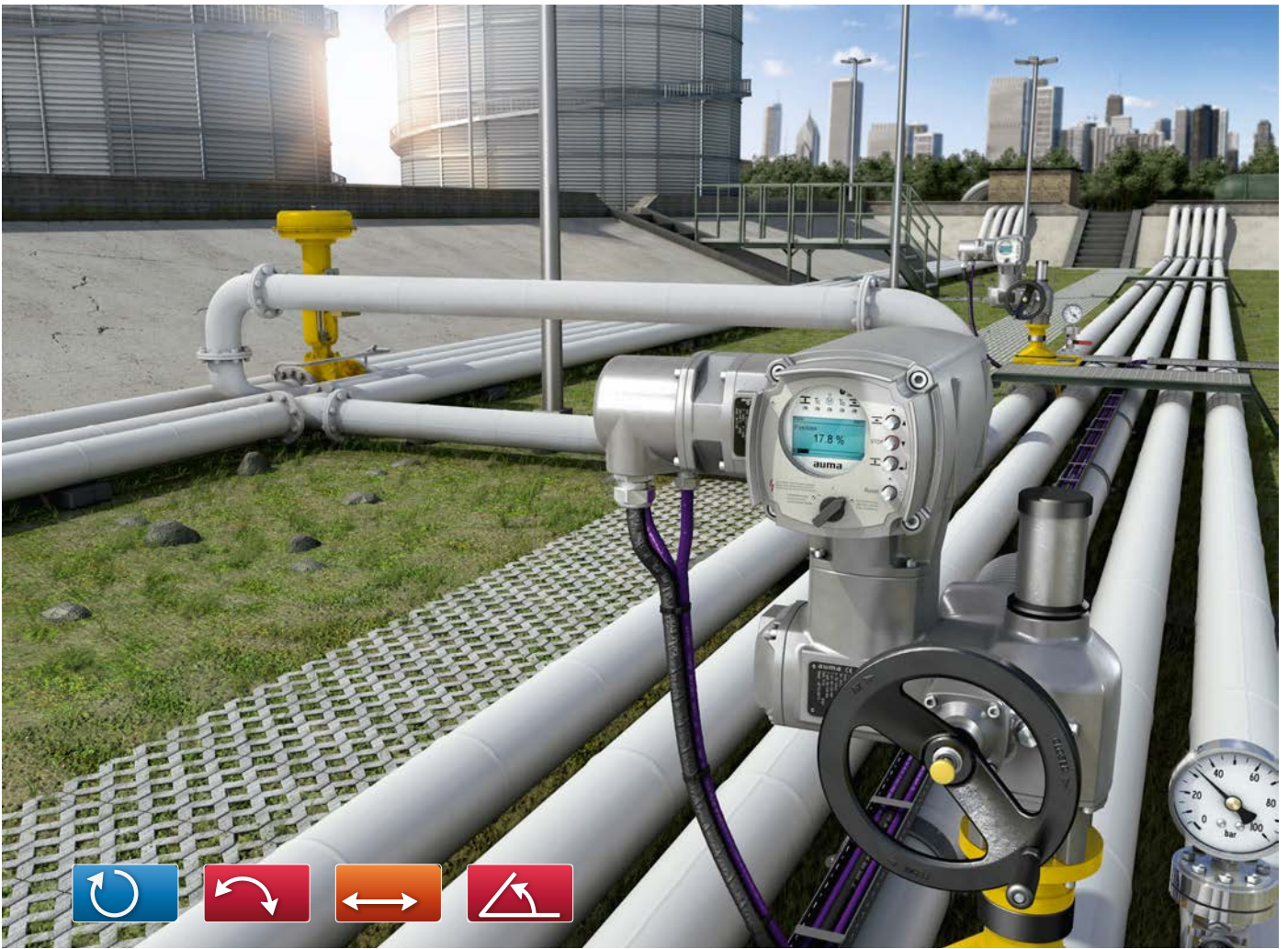
People come from

around the world to listen to experts speak during three days of sessions and educational events including presentations of papers on the latest developments. They also visit an exhibit hall that

covers 20,000 square meters (over 200,000 square feet). During the 2016 event, more than 12,000 visitors flocked to that hall to visit with about 725 exhibitors.

Many of the world's leading manufacturers and suppliers, including many VMA members, exhibit their range of flow control equipment including valves, actuators, controls, pressure relief devices, gaskets and sealing and more.

For information, go to www.valve-world.net or for information on the show and booth, write to Bill Sandler, wsandler@vma.org.



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VMA's 2019 Market Outlook: Cautious Optimism

BY KATE KUNKEL

The overall mood coming out of the 2019 Market Outlook Workshop was bright: Most end-user industries are seeing some uplift from an economy that's doing well in many parts of the world. The abundance of natural gas and crude oil in North America and how it will affect the energy markets remain at the top of everyone's list of developments to watch, especially any of the industries dependent on energy or power.

But two issues of concern also were frequent topics from speakers this year: What will happen to the world in light of possible trade imbalances and how the labor shortage is reaching into almost every industry.

Some key issues that came out of the workshop this year included:

- There is a need to move oil and gas. Several presenters brought up the fact that pipelines are not being built fast enough to transport the oil and natural gas coming from new sources in North America and new technologies used to extract crude.
- While low unemployment is a positive development for consumers, a lack of workers and skills is having an effect on both the U.S. and global economies.
- Inflation is headed our way and with it, challenges in terms of material costs, buying ability, tightening of monetary policies and more.
- The protectionist attitude developing around the world may create trade wars that could slow the current rate of global economic growth.

MANY SECTORS UP

The cautiously optimistic mood of everyone at this year's event was reflected in comments made by Michael Halloran, senior research analyst, Robert W. Baird.

"Things feel a bit better this year, although nobody has any real idea where the situation is going from here," he said.

Halloran and many other speakers listed the shrinking labor force as a significant concern. One reason is that, while it seems counterintuitive, low unemployment metrics have been a fairly reliable leading indicator in the past of recessions.

"As unemployment moves lower in the latter stages of any business cycle, employers increasingly struggle to fill their labor needs. Their growth prospects begin to suffer as a result of labor constraints," Halloran noted. "This is particularly true today because the retiring Baby Boomer generation and crackdowns on immigration are producing structural reductions in the U.S. labor pool," he added.

In such a situation, employers are often forced to increase wages to attract workers, and they incur training and turnover costs.

This development also can lead to inflation because companies are forced to increase the cost of finished goods to offset rising labor costs. This then can force faster tightening of monetary policy (to avoid hyper-inflation), which typically produces recessions. The situation is further complicated today because "other inflationary levers such as tariffs are contributing to higher inflation metrics," Halloran said.

Still, the U.S. industrial economy

continues to trend positively in the short term, he said. What's more, resolution of supply/demand imbalances could offer more stable and higher commodity pricing. However, higher transportation and commodity price tags also increase industry costs.

With respect to tax reform, Halloran believes that tax savings and new depreciation rules could encourage additional spending in 2018 and beyond.

"However, having tax reform this late in the cycle doesn't result in significant stimuli," he said. Also, because tax reform and trade wars are coming at the same time, "inflation is starting to creep through supply chains and profit/loss statements," he said.

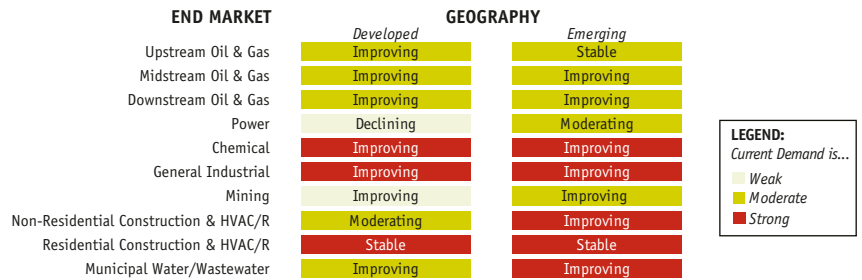
Demand for Valves/Equipment

Halloran said most process control companies are on track for organic growth in 2018.

Markets exhibiting growth are aerospace/defense, agriculture, chemical, upstream/midstream/downstream oil and gas, general industrial, mining and municipal water/wastewater.

According to Baird's 2018 survey of process control companies, expectations remain very high for growth this year. "This is the healthiest they've

End Market Demand Continues



Source: Baird analysis

[respondents] seen in a long time," said Halloran.

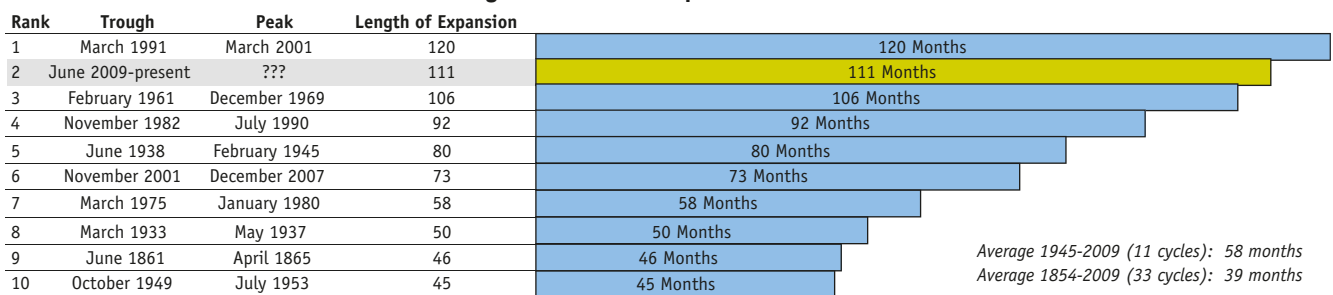
Regarding specific sectors, Halloran said that, in the upstream oil and gas market, a short-term problem exists for takeaway capacity because there just aren't enough pipelines. He said he spends much time today addressing the question of what this means for pricing; who has or doesn't have the capacity today and what the situation means for overall activity levels. Although he anticipates fits and starts in supply, the market is stable over time, he said. Midstream is also healthy but a bit choppier, he added.

The major growth in oil and gas will be downstream and chemical processing in the U.S. gulf, the Middle East and China. Power is in secular decline, but water/wastewater is very healthy.

FORECAST:

- Halloran sees inflation being a drag on the economy through 2019.
- Early signs of price inflation are likely to aid pricing over time, particularly in price-positive process control niches.
- Falling regulatory burdens and faster approvals may spur additional investment/projects.
- Historically high government and consumer debt remains a drag on global growth prospects.

Longest U.S. Economic Expansions on Record



Source: NBER and Baird analysis

OVERSUPPLY CHALLENGES

John Spears, president of Spears and Associates, also had a generally positive picture to paint for 2019, but warned that the health of the oil and gas upstream segment is dependent upon the ability of U.S. companies to find markets abroad.

“To access export markets, we now have to be very cognizant of issues surrounding midstream infrastructure,” he said. This is because, “Pipeline takeaway issues are constraining opportunities.”

The Oil Market

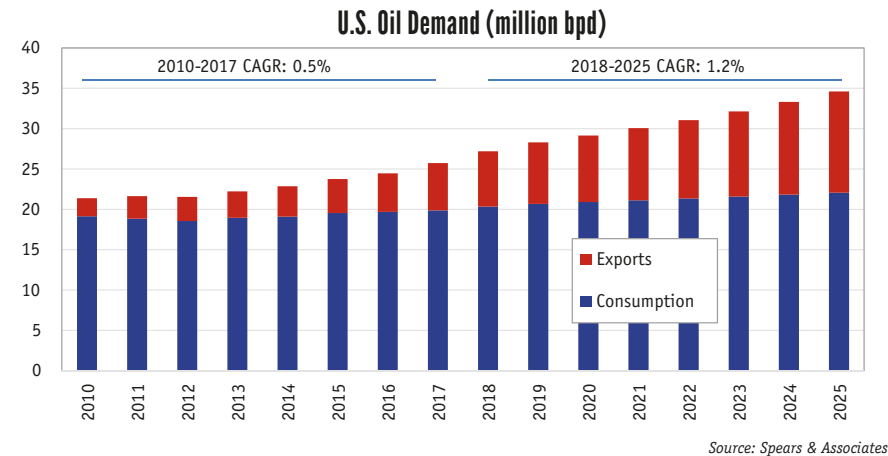
Globally, the market for oil continues growing at a healthy rate, about 1.5% annually going forward to 2025, Spears said. Emerging nations now account for about 53–54% of global oil consumption, which is key because those nations are growing at 3% per year in consumption.

The U.S. is set to become the largest crude producer in 2019 (12% of the total share) and will continue to supply incremental growth over the near term, he said. However, demand could be impacted by threatened trade disputes, a slowdown in China’s growth or higher oil prices.

As far as pricing, as of August 2018, there was a gap between the two benchmarks used for oil prices, which are the Brent, a proxy for global oil prices, and the WTI, the marker price for U.S. oil. WTI will average close to \$66/barrel while the Brent is about \$15 higher. That’s because of an excess of production in WTI, a differential that will sustain until sometime later next year when more pipelines can be built in the Permian Basin to transport the oil.

Spot oil prices will continue to increase as the market tightens. As of the Market Outlook event, the near-month prices of oil futures were higher than long-term prices, which is an indication that world oil traders believe a sufficient production capacity is available to meet expected demand increases.

After the end of 2018, the spare capacity will be about 1 million barrels per day (bpd). However, sanctions



Source: Spears & Associates

against Iran and an ongoing crisis in Venezuela will complicate the matter. There is a dwindling overcapacity, so the price of oil could tighten if some geopolitical event disrupts production anywhere.

An increase in consumption of oil in the U.S. is occurring because of increased transportation and industrial (petrochemical) demand. At the same time, exports are up, but Spears warned that if trade wars ensue, exports will go down.

Meanwhile, production in the U.S. is higher than expected previously because shale wells are not declining as rapidly as before—they are expected to reach 3.75 million bpd in the second quarter of 2019 and 4.25 million bpd by the fourth quarter of 2019. However, Permian Basin producers have begun to slow or postpone completion work until takeaway capacity improves.

The Gas Market

The U.S. (at 21%) and Russia (at 17%) are the two largest gas producers of the world today.

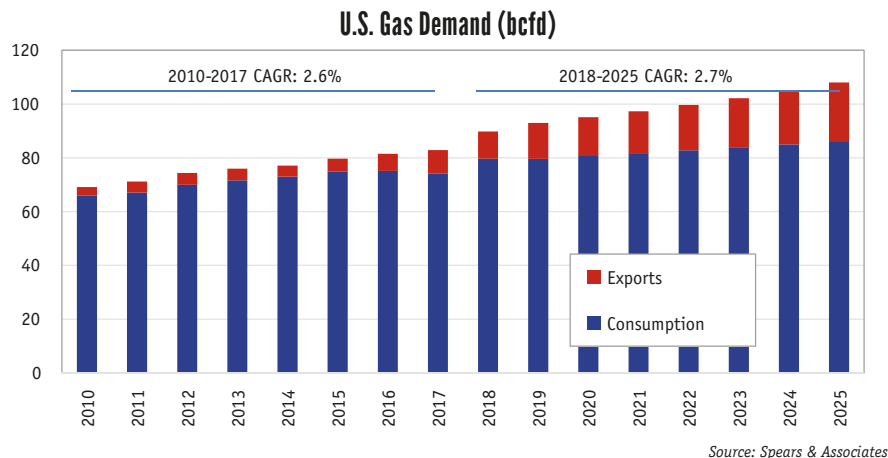
U.S. spot gas prices have fallen

to about \$2.00 per million British thermal units (mmbtu). This is because traders anticipate U.S. gas production to ramp up sharply and zero-bid pricing to temporarily emerge in the next 12–24 months in places where midstream capacity proves insufficient to handle rapidly-growing volumes of associated gas.

U.S. spot prices are expected to be flat for 2019 and reach about \$2.65–\$2.80/mmbtu over the long term. “People think it’s possible oil production will increase by 50% over the next five to seven years, which also means more gas as a byproduct,” noted Spears. “The trick is to find customers for it.”

On the demand side, the global market for natural gas has been growing at 1.7% compound annual growth rate (CAGR) since 2010. An increase in gas exports will account for virtually all net gain in the demand for U.S. gas next year.

Mexico will account for about 65% of U.S. gas exports by pipeline this year with export pipeline capacity to Mexico increasing 3.2 billion cubic feet



Source: Spears & Associates

per day (bcfd) this year to 14.4 bcfd.

Exports could be affected negatively by trade disputes and additional foreign liquefied natural gas (LNG) supply from Australia, Qatar and Mozambique, among others.

Meanwhile, the biggest issue facing oil and gas producers over the next year is the need for additional infrastructure above what has been announced for the next five years: pipeline takeaway of 3.3 million bpd of crude; 5.1 bcfd of gas; 0.5 million bpd of natural gas liquids; and 7.3 bcfd of gas processing.

FORECAST:

- For 2019, the commodity price outlook is U.S. spot oil at \$71/barrel (up 9%); U.S. spot gas will be \$2.25/mmbtu (unchanged).
- In the U.S., consumption of oil is forecast to average 20.7 million bpd in 2019, up 1.6%. Oil exports are expected to average 7.6 million bpd in 2019, up 12%. Oil production in the U.S. is expected to average 11.4 million bpd in 2019, up 8%.
- U.S. gas exports are projected to average 13.4 bcfd in 2019, up 33%.
- U.S. drilling activity is expected to increase 10% in 2019. Canadian and international drilling activity is still waiting to ramp up.
- The rig equipment market, including wellheads and flow lines/valves associated with that equipment, is expected to be up about 5% to a little over \$4 billion in 2019.

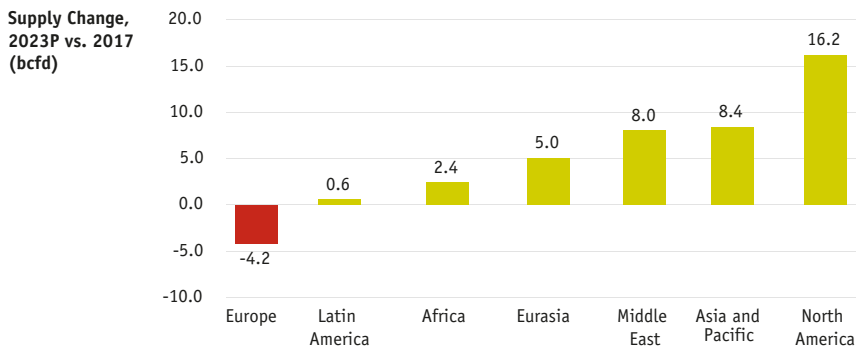
LNG MARKETS

A QUESTION OF CAPACITIES

While Russia and Iran hold the most reserves of natural gas around the globe, North America tops production growth, according to Jacques Rousseau, managing director of Clearview Energy Partners. He said the International Energy Agency (IEA) anticipated a 16.2% increase in the U.S. from 2017 to 2023. How this affects the LNG market will depend on capacity and demands.

Demand growth is focused largely in the Asia and the Pacific areas; power generation is where most of the world's natural gas ends up going.

Global Gas Production Growth



Source: ClearView Energy Partners, LLC using IEA data

That segment will not experience the greatest growth in the near future, however. Growth will come from the industrial side.

2018 will be a significant year for LNG plants to come online in the U.S., and some capacity growth is also occurring in Australia, Rousseau said. There are also several plants in pre-final investment decision (FID) stage. The companies building plants need contracts in place to secure the needed bank financing. However, LNG is a buyers' market right now, and if overcapacity occurs, it will be harder to get contracts lined up.

Asia is short on gas so that's where receiving terminals are needed and where they currently are being built. However, twice as many receiving terminals exist as facilities to liquify the gas, Rousseau pointed out.

In the U.S. \$50 billion in capital expenditure (capex) is planned for liquefaction: 32% on construction and 30% on equipment, such as valves.

Influences on Pricing

When China began using 7% of global oil in 2003/2004, oil prices started to rise. China's demand for gas will reach 7% in 2019/2020. That reality won't be the only factor pushing gas prices up, but it will have an influence, Rousseau said. China is also the key driver for demand growth, so any project must consider China as a market. In 2017 30% of the global demand growth came from China; the IEA thinks it will go to 37% by 2023. China has strategic oil reserves and will need the same for its gas; the country will add 20% onto demand requirements to have the gas the

country needs stored.

Japan currently imports twice as much LNG as the rest of the world. But now that nuclear will be coming back online, the country will use less LNG.

Marine/bunker fuel presents an opportunity for additional LNG needs, according to Rousseau. An International Maritime Organization bunker fuel specification change takes effect in 2020 that reduces the marine fuel sulfur limit from 3.5% to 0.5%. One option to meet such a requirement is to change the fueling system of container ships to LNG alone.

Opportunities/Challenges

While LNG plants don't run all the time, and they have much unplanned downtime, there is still potential for excess capacity. This means not as many investments and building of LNG plants going forward.

On the supply side, the U.S., Qatar and Australia are building many LNG export facilities. Those countries will have half the global supply next year. Only a natural disaster will cut production and provide a significant price spike.

In the U.S. the Permian Basin has increased gas because it's a byproduct of oil production there. This gas supply is growing at significantly faster rates than anticipated so there is some question where it will go—pipelines to take some of it out of the region haven't been built fast enough.

For valve manufacturers, the greatest opportunity for the LNG market is in the pipelines that take the gas out of both the Appalachia and Permian regions and in supplying to the ships that move the LNG around the world.

FORECAST:

- Australia, Qatar and the United States could be home to about half of liquefaction capacity by 2020.
- China could account for 37% of global gas demand growth between 2017 and 2023.
- Excess liquefaction capacity could result in declining usage rates thru 2020.
- LNG capex in the coming years could be well below peak levels of 2014.

PETROCHEMICALS

TRIPLE CHALLENGE

The energy and chemical industries are facing what Mark Eramo, vice president of Oil/Midstream/Downstream/Chemicals, IHS Market, called a “trilemma”: balancing economics, society and the environment.

“Society wants clean beaches and to get rid of plastics. But it also wants jobs and a healthy economy,” he said.

Everything going forward for the petrochemical industry must take all three into account.

Energy & Feedstocks

Rising crude oil prices are solidifying the North American (gas-based) advantage.

“The spread between oil prices and natural gas means that investors are looking to the U.S. and Canada to build the plants that make the products,” Eramo said. For the foreseeable future, higher crude oil and natural gas production will ensure a significant supply of competitive natural gas liquids and methane feedstocks for chemicals. Meanwhile, Mexico is not developing its oil and gas markets,

“so the flow of products will continue from North to South,” he said.

Also, as crude oil prices remain low, people are using less money to buy fuel, which means more money to buy other consumables. Meanwhile, if the price of crude is lower, plastic price tags are lower in comparison to other products such as glass or wood.

As far as capacity expansion, a build-cycle disruption will be seen in 2020/21 as industry awaits FIDs for the next wave.

“Back in 2014 and 2015 when crude oil collapsed, the industry didn’t know what was going on,” Eramo said. “They were heading into the U.S. elections, there was Brexit, Middle East uncertainty and other issues so very few FIDs were made.”

That means less building for 2020/21, but from the producers’ point of view, the situation with competition is better because there isn’t as much online with which to compete.

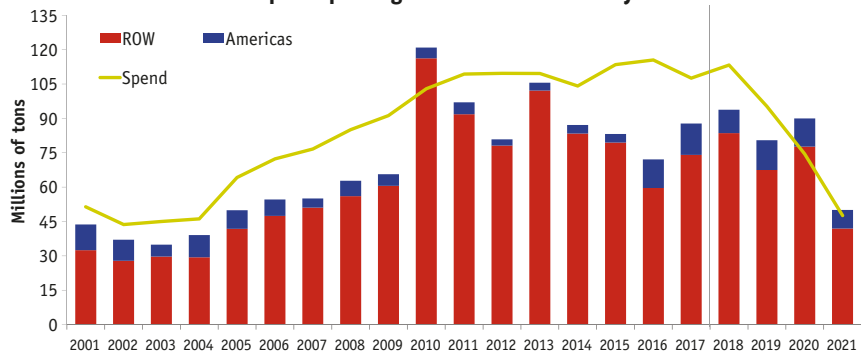
Supply and Demand

As the economy grows above 3% per year around the world, the level of growth in base chemicals becomes substantial. However, it will take more than economic forecast to drive strong up-cycle conditions from a supply/demand perspective.

Ethylene will grow the most; just to keep up with global demand, industry must start up four to five steam crackers per year, keeping the ethylene market tight until the next wave of steam crackers can be built. Demand for chlor-alkali is also going up, so supplies will be tight there as well.

Currently, a huge risk has been created from uncertainty in geopolitics from Iran, North Korea and

Capital Spending in the Chemical Industry



Source: IHS Market



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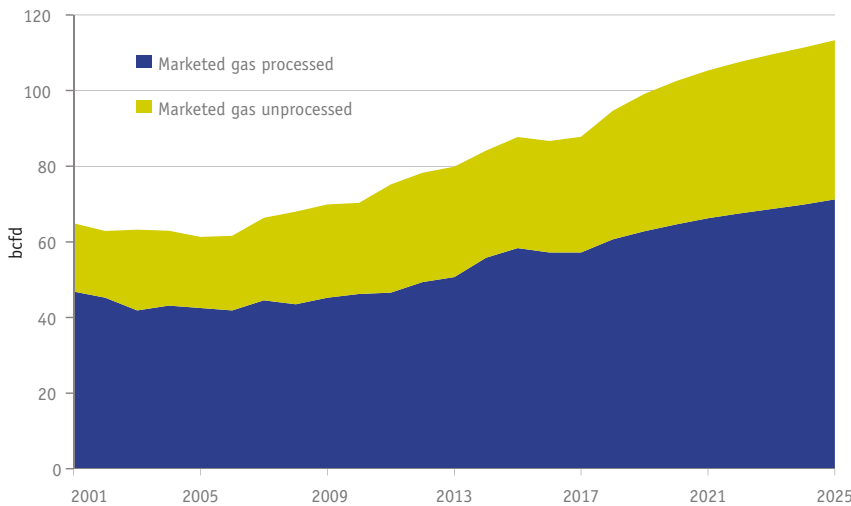


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U.S. Lower 48 Marketed Natural Gas Production



Source: IHS Market

some G8 and G7 groups. The growing protectionist approach to trade and government fiscal policy is also creating risk because these are issues that make consumers or businesses less confident. Questions are starting to be raised about what can happen, Eramo said.

The next stage is the evolution of refinery and petrochemical integration.

"There is a view that says higher fuel efficiency and increased use of electric vehicles create a forecast for a declining growth rate in the demand for refined products," Eramo warned. Because of this "more oil and refining companies are considering putting assets into petrochemicals." In China, for example, four refineries are being built that also include petrochemical plants.

Many other changes are also occurring in China, which is a significant player in the chemical industry, producing 200 million metric tons of chemicals per year. More plants have combined private/public ownership for example. This reality, combined with the country's goal of being self-sufficient in getting the petrochemicals they need to manufacture products, is spurring ever more growth in this country. Also, there is a significant cost advantage over North America because it is much cheaper to build plants there.

As far as environmental issues, local communities and corporate entities are exploring bans on single-use

plastic applications in answer to the troubles of plastics waste in oceans. This type of mainstream media event may mean a slowdown in growth for commodity plastics demand over the long term. According to Eramo, the industry is taking many steps to solve the problem, but those steps are not out there in the public eye. The solutions to this will come from a cooperative approach that brings all stakeholders together to solve the complex issues.

FORECAST:

- *The chemical industry likely will carry strong profit momentum into the 2020s.*
- *Ethylene will grow the most in the near future, reaching 6 million tons*

per year from 2018 to 2023.

- *Sustainability issues from carbon to plastics will remain top priorities.*

POWER

RENEWABLES GETTING ATTENTION

Across the globe today, the energy industry is seeing "huge growth in renewables such as biogas, digester gas, wind and solar," as well as hydropower, according to Britt Burt, vice president of global research for the power industry, Industrial Info Resources.

Even though solar offers the fewest opportunities for valve use among the renewables, "There are some concentrated solar thermal projects in development and in operation that do use valves."

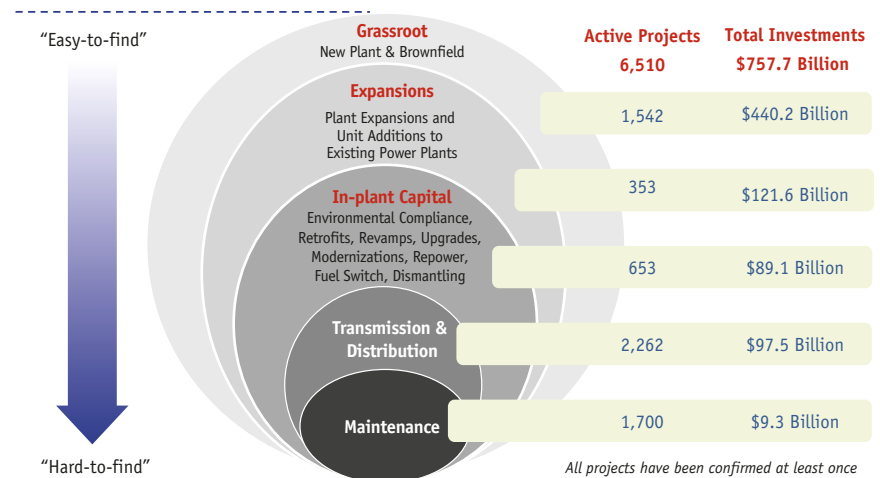
The hydropower industry, meanwhile, is growing rapidly.

"There are nearly as many hydro plants being built as there are already in existence," Burt said.

In the burgeoning countries of India and China, "There is a lot of talk about moving away from coal and more toward renewables," he noted. However, in the long term there, "I don't see [those countries] moving away from coal. It will continue to be developed because of the lower cost and availability."

In North America, new plant and brownfield projects scheduled to kick off from now through 2020 include

North American Project Coverage: Power



Source: Industrial Info Resources – Data Generated via Industrial Info's PECWeb Database.

windfarms, natural gas plants, solar farms, etc., that total \$440 billion.

"It looks like a huge increase, but those figures include all [projects] that have even been proposed. There will be some project fallout. There will be cancellations and others that are put on hold," he said.

One area to watch today is expansion, which includes adding more units to plants. In natural gas, for example, that would mean adding another turbine or expanding combined-cycle capability.

In North America, expansion of power capability may be significant because some traditional types of power sources are diminishing. However, "Not all the nuclear or coal plants are going to close down tomorrow," he said. "So there will be a lot of activity going on, meaning in-plant capex will be needed to keep what's there operating efficiently and competitively."

Maintenance saw a bit of a dip in activity in 2018 from 2017, and Burt said he expects even more of a decline next year and in 2020.

North American Power

Low fuel prices today are keeping natural gas attractive for a new generation of natural gas power plants and for replacement of coal-burning plants. This situation will continue for some time, Burt said. Even if LNG exports increase, Industrial Info Resources doesn't see a drastic increase in natural gas prices in the U.S. for power generation.

Meanwhile, tax credits and mandates continue to drive the renewables forward. For example, tax credits for wind projects are still in place for any project starting between now and the end of 2019. In solar, a 30% tax credit remains in place through the end of 2019, although that drops to a permanent 10% in 2020.

Investments for the coal-fired and nuclear-powered sectors are limited to operating and maintaining existing assets. Burt predicted more nuclear capacity going offline in the future because of the lower natural gas prices and renewables but warned that the industry will not disappear completely.

From 2012 to the present, most of the generation capacity that's been closed down has been coal. During that timeframe, 116 gigawatts (GW) of energy has gone offline or been closed, and of that amount, about 65 GW was coal. Some natural gas traditional steam units have closed because they were using less-efficient technology. These are being replaced by higher-efficiency machines.

From now until 2022, Burt expects another 55 GW of coal capacity to go offline and be replaced by renewables and by natural gas. This year has been a banner year for natural gas capacity, he said, and by year's end "nearly 28 GW of power will be added to the grid."

Burt also noted a growing sector in the power industry: industrial energy producers such as refineries, chemical plants, and pulp and paper mills that are building energy-producing projects on their sites. There are 743 high-probability projects valued at \$10.1 billion from 2018 to 2020, and he said he anticipates even more onsite power generation in coming years.

FORECAST:

- In total, IIR estimates 31.5 GW of energy is coming online for 2019 and 34.5 GW for 2020.
- Burt projected that 499 power projects worth \$97 billion will start between now and 2020. These projects will largely be comprised of renewables (wind, solar and natural gas.)
- Burt also projected an estimated 116 expansion projects worth \$25 billion adding 23 GW of power starting between now and 2020.

WATER/WASTEWATER

A FLAT GROWTH LINE

According to Tom Decker, water marketing and business strategy consultant, the water and wastewater market is just hanging on, showing neither great growth nor great decline.

In the U.S., wastewater capex spending is currently about \$60 billion, while the fresh water treatment industry is about \$40 billion. That compares to global capex of \$300 bil-

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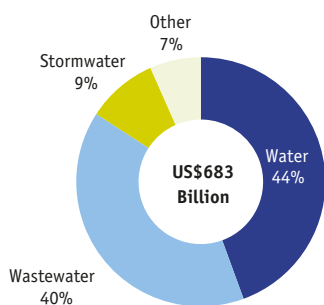
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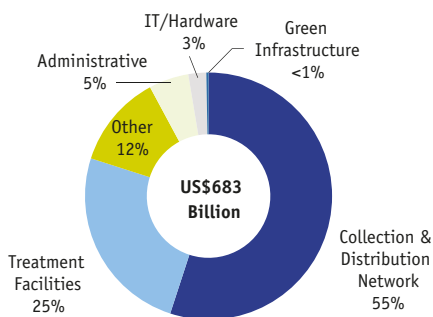
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Municipal Water & Wastewater Outlook

Forecasted CAPEX, 2018-2027



Total CAPEX Spend by Segment, 2018-2027



Source: Bluefield Research

lion, half of that going to fresh water.

While growth in the U.S. has been slow over the last couple of years, the second half of 2017 saw increased activity; during 2018, wastewater construction is up 9% and water is up 6.1% (as of the workshop).

Deteriorating infrastructure is the main driver of growth. Each year there are 240,000 pipe breaks and over 6 billion gallons of non-revenue water lost per day. The Environment Protection Agency's (EPA) latest water needs survey found that, just to keep systems in respectable condition, it would be necessary to spend \$313 billion in pumping stations, including pipes, valves, pumps and attendant equipment over the next decade.

"Fortunately, financing is pretty good right now for the water industry," said Decker. Also, "Rates [for services] are up about 5-6% per year since 2010." That's partly because officials used to be afraid to raise rates, but lately, they've had to because they need the money and public perception of the need has changed, he said.

Decker said water infrastructure funding (the Water Infrastructure Finance and Innovation Act—WIFIA, a credit program that's EPA-administered) projects are starting to get loans. For example, "three WIFIA loans have been put out in 2018 and the funding itself was increased to \$63 million in 2018," he said.

Decker pointed out that, while that seems like a relatively small amount of money given the huge number of projects that need work, the figure is only the amount needed to budget for defaults. "Because the money [for the loans themselves] will be paid back,

the full amount doesn't have to be accounted for in the budget. This can be leveraged into hundreds of billions of dollars of work," he said.

Still, the federal government funds only about 4% of water/wastewater projects in this country so it falls to municipal bonds to finance about a third of needed infrastructure improvements. Meanwhile ratings are stable and defaults are very low so the bonds remain a solid investment.

There also is public support for water infrastructure spending. The Value of Water survey for 2018 (<http://thevalueofwater.org/>) found that 88% of respondents supported greater federal investment in infrastructure.

Technology/New Methods

Some feel that technology may be the answer to where money should be spent.

A Bluefield Research study said utilities could save almost \$42 billion by 2027 through effective deployment of smart technology. Sensors, networks and data management can make water systems more efficient and effective.

Decker stressed that the brightest prospects for manufacturers is in the distribution and collection systems. "The mass expanse of pipes and pumps between the meters and the plants is where the biggest opportunity is for valve and pump manufacturers."

Several utilities also are looking at conservation-related projects to save money or gain opportunities. In particular, energy generation from bio solids is happening, though the energy earned is not for running the facilities; rather it provides energy for utilities to sell.

"Ten years ago, we would have seen less than 100 [reuse projects] and 80% are in Texas, California or Florida," said Decker. That's expanding. Just this year, for example, "Arizona rescinded its ban on direct potable reuse—now they are going to get into this game. This uses a lot of valves," he concluded.

Meanwhile, desalination is experiencing solid growth around the world, and in the U.S., California just provided funding for eight different desalination plants in that state.

Negative Influences

One of the developments that has the potential to slow down markets is cost to homeowners. Almost 12% of households now cannot afford their monthly water/wastewater bills, Decker said, which has the potential to slow the pace of the rate increases that pay for improvements and maintenance.

Water use also is down, which means less revenue for utilities. Yet even though those utility companies process less water when less is used, fixed costs remain the same, so they will likely have to consider a different way to charge for services.

Creeping inflation and rising interest rates are possible negative influences that are coming. According to Associated General Contractors, material prices in commercial construction were up 9% from May 2017 to May 2018, and construction costs were up 5.6%. Other uncertainties include federal rate hikes that push inflation further upward, and tax cuts and jobs legislation, which impact municipal bond yields and attractiveness. The prospect of tariffs from abroad also threatens costs.

"It's also harder to find qualified people to build right now," said Decker, noting that some contractors have refused jobs in the sector because they just do not have the staff. Decker warned: "When things are uncertain, water and wastewater utilities don't build."

FORECAST:

- *Affordability issues could affect more than 35% of households in the next year if rate increases continue at the current pace.*

- Bluefield Research says capex spending in the U.S. will be \$683 billion over the next 10 years.
- Bluefield Research also projects a 37% increase in water reuse projects in the U.S. by 2027.
- Smart technology will generate \$14 billion in capex through 2024.

THE GLOBAL ECONOMY

TRADE TENSIONS

Even though it's been a decade since the Great Recession of 2008, the world still feels like it's living in it, according to David Teolis, senior manager of economic and industry forecasting, International, at GM.

"The reason for protectionism and the populist movement stems from what happened during the post-crisis period," he said.

Before the recession, globalization was spreading, beginning with the North American Free Trade Agreement in 1994, creation of the Eurozone in 1999 and advancing to 2001 when China joined the World Trade Organization (WTO).

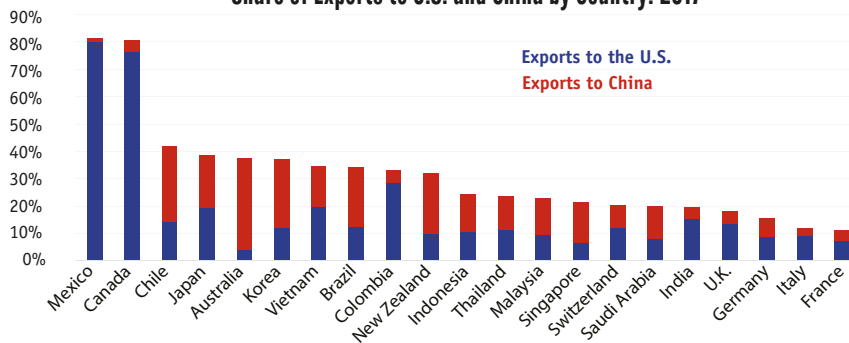
Up until then, the biggest influence on the world's economies came from advanced countries. Afterward, developing countries began to have a bigger influence. China's entry into WTO created a commodity super cycle in the world from 2003 to 2014. That created much economic stimulus and global gross domestic product (GDP) growth of 4%.

"When the global financial crisis occurred, China kept things going by stimulating its own economy," Teolis said. The country already had 600 million people living in poverty so if it hadn't done something, "it would have created havoc," Teolis noted.

From 2012 to 2016, the world slowed to below 3% growth rate, the longest period of such low growth. That lasted five straight years and created weak wage growth and unemployment fears.

When such conditions last longer than a couple years, stress builds up everywhere so when the European crisis with migrant/Syrian refugees occurred "people began feeling very anxious," which contributed to the

Share of Exports to U.S. and China by Country: 2017



Sources: IMF Direction of Trade Statistics, Haver Analytics; Calculations: GM Economics Team

move toward protectionism, he said.

Post-Recession

A key contributing factor to the slow recovery of business fixed investments that has occurred in recent years was low productivity growth.

According to Teolis, overinvestments during the years preceding the global financial crisis contributed to subpar investment spending in the post-crisis period. This development, combined with the weaker labor productivity growth and slower growth of the working-age population, created the slower potential real GDP growth.

He also said a shift has occurred

from private sector imbalances and excesses before the crisis to public sector imbalances and excesses after the recession.

High private sector debt, high dependence on commodities, overinvestment in housing, infrastructure and financial sector insolvency all contributed to the severity of the recession. The only way to fix those problems was with structural reforms. Regulations were instituted to protect the economy.

However, some of the protections created during the crisis have been taken away by the current Administration.

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Also, an unsustainable picture has been painted by high public debt and deficits, tax revenues that are low because the economy has been slow and governments spending more to limit the degree of recession damage.

This leads to the biggest concern for Teolis. "If there is a fall into a recession because of trade wars," the world's governments won't be able to stimulate what has already been stimulated.

"If we fell into a recession today, the central banks can't do any more," he said. "The U.S. can't spend more or go into more debt," he said.

Teolis agreed that the largest bilateral trade deficit for the U.S. is with China (at \$375.2 billion). But he said tariffs are probably not the answer and noted that nobody complained about trade deficits when economies were good.

He also posed the questions, "Are financial markets fully pricing in the potential impact of a trade war? Is the strong U.S. economy providing a positive offset, or are stock buybacks masking downside risk?" The answer to those issues largely will determine the true impact of potential trade wars, he said.

FORECAST:

- *Protectionism remains the key downside risk to the global outlook.*
- *Inflationary pressures could be an overlooked downside economic risk.*
- *Implementation of structural reforms and new technological advancements should have a positive impact.*
- *The ability to absorb a negative shock depends, in part, on where the economy is in the cycle.*

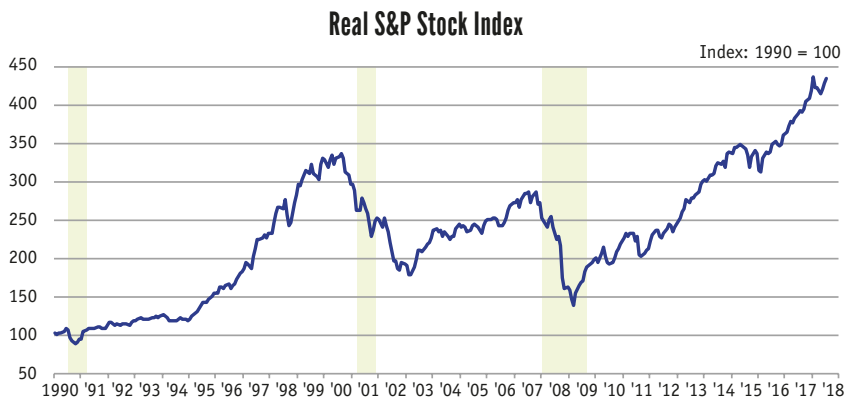
U.S. ECONOMY

THE BRIGHT SPOT

The domestic economy is doing well, according to William Strauss, senior economist and economic advisor at the Federal Reserve Bank of Chicago.

"We are in the ninth year of our economic expansion, the second longest in U.S. history," he said.

GDP expanded by 2.8% over the past year, which is "well above the



trend growth of the economy." It's also contrary to what some doom-sayers believe, which is "just because we have an economy running well, doesn't mean it's going to run out of steam. It continues to grow at trend, which is 2%," he said.

Looking Forward

The Federal Open Market Committee (FOMC) expects GDP to grow above trend this year, just shy of 3%, then continue to do well in 2019, but at a slower pace. By 2020, the growth rate should be around trend again, Strauss said.

The index of leading indicators continues to rise, so economic activity seems to be on very solid footing and no recession is expected for the next two quarters.

"We are continuing to add workers at an unprecedented rate," Strauss said. However, "you cannot continue if you don't have the workers to fill the jobs."

Meanwhile, the low unemployment rate of less than 4% would normally make the Fed nervous about inflation. But wages and benefit costs are also increasing at moderate rates. Real wages are rising less than 1%, which is a frustration for workers not getting raises.

Although businesses say they are considering giving higher wages, they are not doing it, Strauss pointed out. He thinks that's partially because of low productivity (below 1% growth for several years).

Strauss surmised that the reason productivity has not grown is because of the weak pace of investment (in machinery, etc.). Businesses had a choice between hiring workers or

investing as they climbed out of the recession. Because there was so much nervousness about another recession, they opted to hire workers instead of spending what capital they had on equipment.

Now, capital spending is improving, not because of the tax incentives, according to Strauss, but because the economy was moving along, and businesses needed to invest. Thus, productivity growth is bouncing back up, and Strauss hopes that the economy will strengthen further with this capital spending.

When food and energy prices are removed from the picture, the rate of inflation remains below the core rate of 2% and the FOMC anticipates that inflation will be around that level through 2020.

"Manufacturing output is increasing after being unchanged for the past couple of years," noted Strauss. "Also, capacity utilization has been moving higher over the past year, but, at about 75%, it's still below full utilization." Manufacturing employment increased by 327,000 workers over the past 12 months.

FORECAST:

- *The U.S. economy should expand at a pace above trend in 2018 and 2019 and close to trend in 2020.*
- *Employment is expected to rise moderately with the unemployment rate remaining very low.*
- *Inflation is forecast to rise to the Fed's inflation target this year.*
- *Manufacturing output is expected to increase at a rate above trend in 2018. VM*

KATE KUNKEL is senior editor of VALVE Magazine. Reach her at kkunkel@vma.org.

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□ This gate valve has multiple auxiliary connections.

Why We Have Auxiliary Connections

BY GREG JOHNSON

Valves are a vital part of the piping systems that run like arteries and veins throughout industrial plants. The ports of the valves are the main passageways for fluids; however, situations when additional, smaller supplementary lines attached to the primary valves are needed happen often.

Regardless of which drains, valves or piping assemblies are attached to the main valve, they must be designed and constructed in accordance with many of the same construction and design standards and codes as those of the base valve and piping system so they can safely handle the same conditions, including the same pressures and temperatures. The auxiliary piping is attached to the valve by either a mechanical (threaded) or welded connection.

WHAT THEY DO

Auxiliary valve connections have many uses in piping systems. While the most common is to bypass, other design types are popular as well. A drain attached to the lowest point of a valve body, for example, is often used to completely evacuate the valve body

Executive Summary

SUBJECT: The main valves in a pipeline often have auxiliary lines and equipment that help regulate the flow of media.

KEY ISSUES:

- What different types of auxiliary connections do
- How they're regulated
- Why they're needed

TAKE-AWAYS: These connections are used to make the process flow more efficient.

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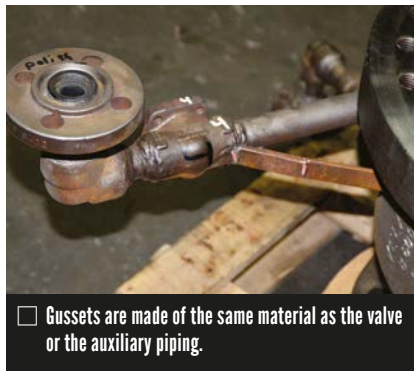


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of fluid or pressure. These drains may either be extended body, small-diameter valves welded directly to the base valve, or they are short sections of pipe and drain valve welded to the base valve.

Auxiliary connections may also sometimes improperly be used as steps for climbing on the piping system, so they must be built to be stout with the correct pipe thickness (schedule). This need for a very stout connection led to the creation of the extended body American Petroleum Institute (API) 602 (initially API 606) valve design standard in 1989. Such valves have extra thickness for strength as well as a much larger area for welding onto the base valve.

Many process applications introduce fluids that can become solids or semi-solids as they attach to the internal valve components. This situation occurs frequently for valves in coker service. If left alone, the coke becomes rock hard and will adhere to the internals of a valve. A common method to eliminate this coke buildup is to attach auxiliary connections that feed into the seating areas of the valve. These lines are then energized with pressurized steam that keeps the moving parts moving and the valve



□ Gussets are made of the same material as the valve or the auxiliary piping.

closure member (disc or ball) free to move. These steam injection lines are often used in other services where fluid solidification can seize the valve and prevent proper operation.

Steam injection lines are also used to “warm up” valves before high-temperature process fluid enters a cold, closed valve and a downstream pipeline, a situation that can cause thermal shock and potentially damaging stresses.

While drain lines are usually attached to the lowest point of the valve body, additional connections sometimes also are made to help the drain function. Many times, an additional connection is made near the top of the valve body or bonnet. This connection, combined with the lower drain connection, allows for a pressurized

flushing action to occur in the valve body. The pressurized flushing can be used to remove traces of one fluid from the body before a different fluid is introduced in the piping system.

Double-block-and-bleed valves require a drain to accomplish the “bleed” function of that type of valve. These valves may have a single bottom drain or a secondary upper connection, depending on the application.

THE BYPASS

The bypass has been around for over a hundred years, used for steam and waterworks applications in the early 20th century. This was a time when pipe welding was only a dream and the only material for large valves was cast iron.

But just what is a bypass? A bypass is a small-diameter pipeline that runs from the upstream side of the valve closure element to the downstream side. Some bypass systems include connections to both sides of the closure element as well as to the valve body.

Valve manufacturers handled construction of bypasses in many cases by casting actual flanged bosses onto the valve body. Cast or bolted bypass valve assemblies were then used to connect the bypass to the valve body. One additional characteristic of these early-day bypasses is that they were usually much larger lines than are used today.

Probably the most popular use of a bypass is to warm up the downstream portion of a heated fluid or steam line. The slower flow of the small bypass line around the large main closure member allows the downstream portion of the line to warm up slowly, reducing the potential for temperature shock.

Bypass systems also can be used to roughly regulate the pressure in an upstream piping system. However, unless the bypass piping system is part of a control loop, accurate pressure regulation cannot be accomplished.

Another use for auxiliary connections is to attach gauges and other fluid-monitoring devices. Sometimes it's much easier to add these connections to valves than to tap into the main piping system.



□ Positive material identification is performed on a drain connection piping.

CONNECTING TO THE VALVE

To make a sound connection onto the valve, wall thickness has to be enough to allow for proper depth of the threaded or socket-welded connection. This means some smaller, thin-walled valves are not good candidates for auxiliary piping connections.

The American Society of Mechanical Engineers (ASME) B16.34, Valves-Flanged, Threaded, and Welding End, contains the rules by which many auxiliary connections are made. Here are some excerpts from that document pertaining to auxiliary piping connections:

6.3.1 General. *Auxiliary connections, e.g., for bypass connections, shall be designed, fabricated, and examined so as to warrant at least the same pressure-temperature ratings of the valve.*

6.3.2 Pipe Thread Tapping. *Threads for threaded auxiliary connections may be tapped into the wall of a valve if the metal is thick enough to allow the effective thread length specified as shown in Figure 4 [of B16.34].*

6.3.3 Socket Welding. *Sockets for socket welding assembly of auxiliary connections may be provided in the wall of the valve if the metal is thick enough to accommodate the depth of the socket and the thickness of its shoulder as specified, as shown in Figure 5 [of B16.34]. Where the metal thickness is insufficient, or the socket opening requires reinforcement, a boss shall be added as shown in Figure 4 [of B16.34].*

ASME B16.34 also contains this recommended table of minimum auxiliary connection sizes:

Valve Size, NPS	Connection, NPS
2-4	1/2
4-8	3/4
Larger than 8	1

In the mid-20th century, the valve industry decided that some standardization in auxiliary piping locations was needed. The Manufacturers Standardization Society (MSS) responded in 1953 by creating SP-45, Bypass and Drain Connections. This document details the locations where auxiliary

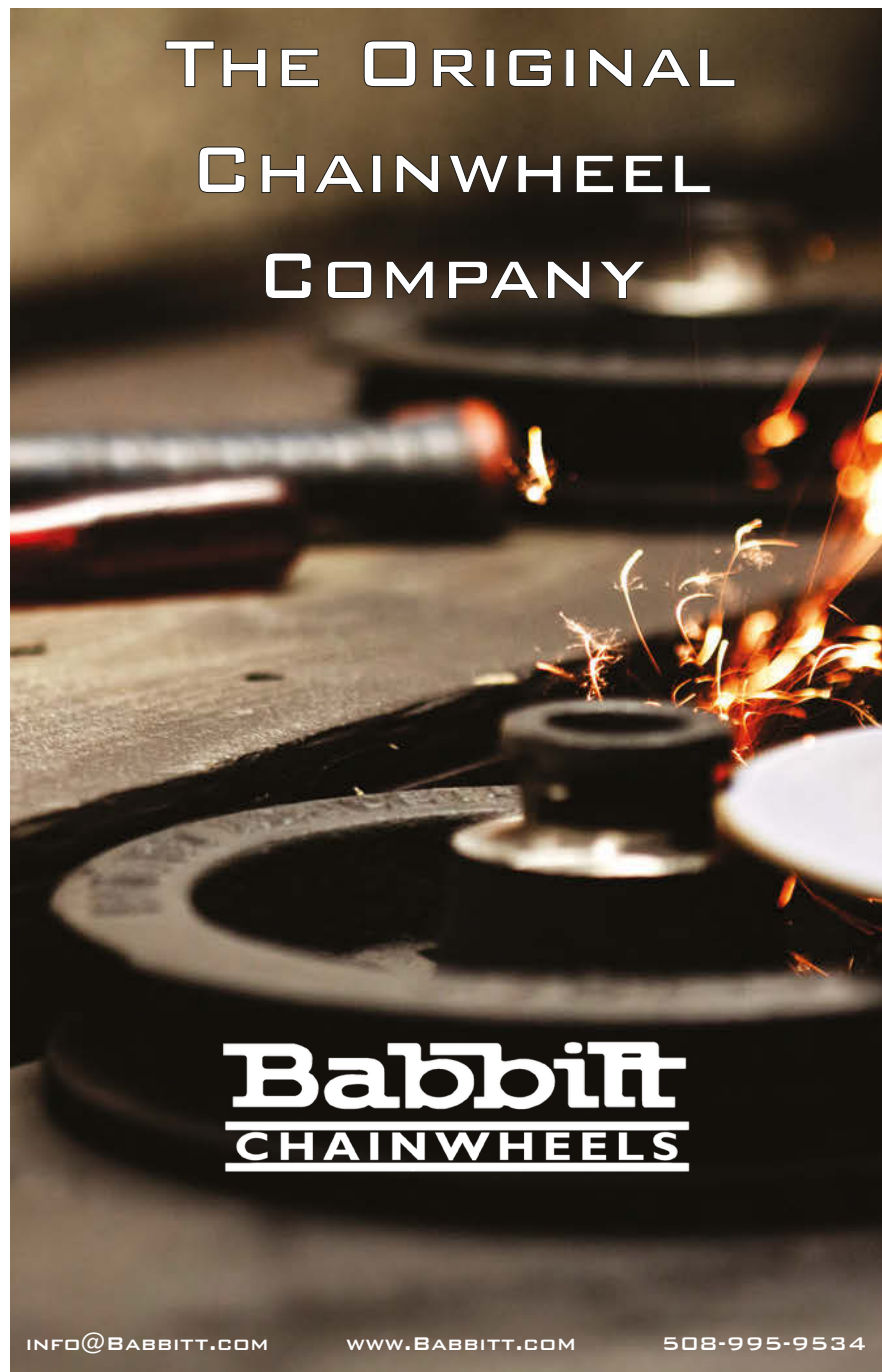
connections are preferred. In most cases, extra wall thickness (bosses) are provided at these points. The document has been updated over the years to include gate, globe, check, angle, plug and ball valves. MSS SP-45 also lists preferred locations for standard bypass installation if no specific location is specified in the purchase order.

END-USER REQUIREMENTS

Some end-user/owner companies also have their own additional specifications for auxiliary valve connections.

For example, some refiners require that auxiliary piping be reinforced with gussets. These gussets must be made of the same material as the valve and/or auxiliary piping.

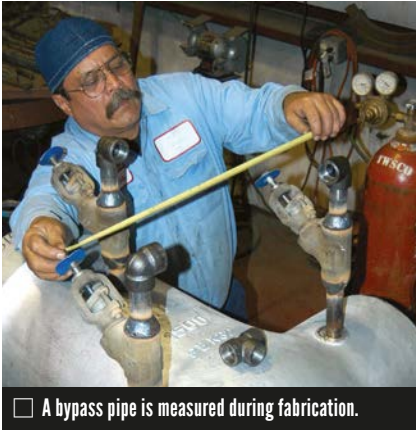
Some additional end-user requirements include the seal-welding of certain threaded connections. One refiner requires that any threaded plugs or caps that are used only for hydrostatic testing that are in dangerous service be seal-welded. A minimum of two weld passes are required, and all threads must be covered.



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□ A bypass pipe is measured during fabrication.

One dimension that is still not standardized after all these years is the length that the loop of pipe sticks out from the main valve. Some end users specify this dimension, but many just leave it up to the OEM or the company installing the bypass.

Large cast or ductile iron valves are still very popular for use in waterworks service. Many times, these valves require bypasses or other auxiliary connections as well. Since iron is not easily welded, threaded connections are used. This requires some old-school pipe-fitting to get all the pipe sections, fittings and bypass valves

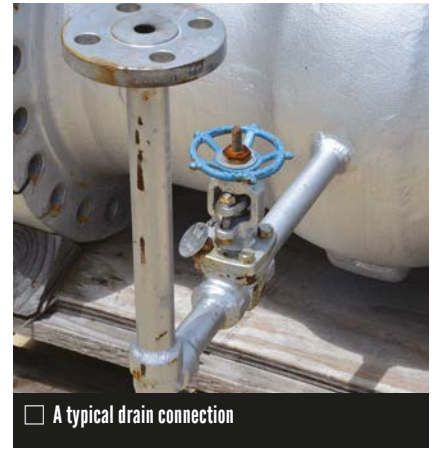
in proper alignment and leak-tight. These connections will usually also contain at least one union to assemble the piping assembly.

It is rare to see requirements for threaded bypasses on steel valves. The ease and efficacy of the welded connection is usually a much better choice.

WELDED CONNECTIONS

Welding of any auxiliary connection or bypass requires that proper welding procedures be employed. The welding qualifications and associated documentation should follow the requirements of ASME Section IX, Welding, Brazing and Fusing Qualifications. This section of the ASME Boiler and Pressure Vessel Code provides requirements for welding, brazing and fusing procedure and performance qualifications for procedures and personnel employed in making these welds.

The typical procedure for socket welds requires that the connecting pipe be inserted into the socket (on the valve) and then backed slightly out before welding. This process ensures that thermal expansion will



□ A typical drain connection

not cause cracks in the weldment.

Any required heat treatment per the applicable construction code must be performed as well. This can be tricky if the entire base valve and piping containing a valve is furnace heat treated. The furnace heat treatment can sometimes cause an auxiliary valve's seats to become loose, requiring replacement of the valve and reinstallation of the piping assembly. Localized heat treatment using blanket or band-type heaters can lower the risk of possible valve damage, but the process is more cumbersome.



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□ A bypass for a valve

Another welding process sometimes required in auxiliary piping attachments to valves is the creation of bosses where none exist. This process requires buildup of a pad of the appropriate weld metal to the required thickness, followed by cosmetic grinding of the weldment.

Sometimes an end user will require that a special outlet fitting such as a socket-weld or threaded outlet be welded to the valve and then the auxiliary piping attached to the fitting. These fittings can help if the wall thickness of the base valve is minimal and added strength is desired in the weldment.

Although most auxiliary piping is connected to valves at the locations recommended in MSS SP-45, special situations occasionally require some unique attachments. For example, one particularly unusual auxiliary connection that has been requested is drilling the connection through the body of the flange.

Pipeline valves almost always have some form of auxiliary connection. These can be emergency seat lubrication ports or drain lines. For valves installed above ground, simple check valves or injection-type fittings are threaded directly into the valve body. For buried valves, welded pipe connections are usually employed. Such pipelines are required to elevate the seat injection and drain lines up to the surface.

When permitted by the owner, auxiliary connections are also sometimes made for emergencies, particularly to inject compounds into leaking valves to stop gasket leaks. These connections are drilled and tapped, and button-head-type check valve fittings are installed to allow sealant to be

injected into the leak area. An additional emergency connection is also sometimes made in the packing gland of the valve. This connection is used to inject packing sealant into a leaking valve that is causing excessive fugitive emissions leakage. As in all industrial practices, strict adherence to safety standards and procedures is required.

Auxiliary valve connections are a lot like accessories added to your car or truck to make it operate either more efficiently or to run better. While the vehicle will perform its main function without those accessories,

the function of your auto is enhanced by their presence. It is the same for auxiliary valve connections—the valve works without them, but they help make the whole piping system run better and more efficiently. ❧

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



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Monitoring Pressure Relief Devices

BY MARCIO DONNANGELO

The purpose of a process plant control system is to keep process variables at the desired operating point and within safety limits. However, control systems may not be able to handle all process upsets. Operator intervention, safety instrumented systems and pressure relief devices (PRDs) then become the last lines of defense.

PRDs can be pressure relief valves (PRVs), pressure safety valves (PSVs) or rupture discs (RDs) and pins. They activate when the pressure gets too close to the maximum allowable working pressure of a vessel or a process component. Regulations stipulate that all PRDs must be mechanically powered by the process itself so that external power or intervention is not required for them to function.

Traditionally, PRDs have a simple mechanical design to ensure reliability under foreseeable conditions. Excessive pressure in the pressurized system is relieved by blowing process fluid (gas or liquid) to the environment or to a closed recovery system. A PRD is sometimes the only indicator that a process upset has occurred—the sooner an event can be detected, the sooner operators can respond to the root cause.

The three main types of PRDS are:

PRVS

PRVs are safety devices protecting a vessel against overpressure (Figure 1). In a typical spring-loaded PRV, the disc between the process side (inlet piping) and the discharge side (discharge piping) is pushed against

Executive Summary

SUBJECT: Various types of pressure relief devices (PRDs) are used to protect against process pressure upsets leading to emissions, operational performance and maintenance challenges.

KEY ISSUES:

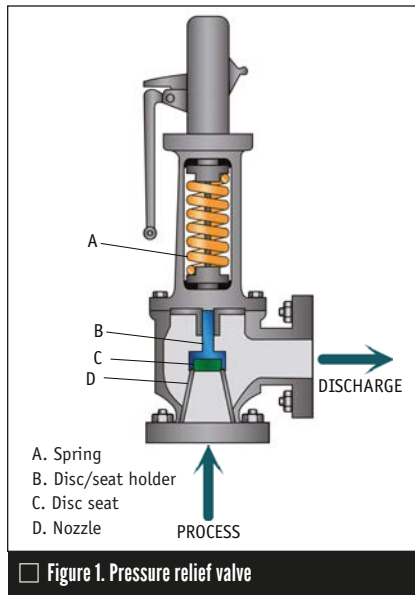
- Types of PRDs
- Why they need monitoring
- How it can be done

TAKE-AWAY: Wireless transmitters are a reliable and economic way to monitor pressure relief devices for regulatory compliance, improved operations and maintenance management of the process.

the seat by a compression spring. The spring force determines the PRV set pressure, and it is adjusted by the compression nut during calibration and certification.

When the spring force exceeds the force resulting from the process pressure and the pressure in the discharge side (backpressure), the disc blocks the flow from the process side to the discharge. When the process pressure exceeds the valve set pressure, the disc pushes the spring, opening the valve and forcing the process fluid to the discharge pipe. The valve will remain open until the process pressure drops to about 95% below set pressure. The about-5% dead-band, also known as valve blow down, prevents the valve from chattering when the process pressure varies close to valve setpoint.

Unaccounted discharges occur when the valve chatters, which is when the vessel pressure oscillates around the PRV setpoint with an amplitude larger than the dead-band. This chattering occurs when the valve is not specified correctly, is not properly set, or the piping was not designed properly.



The valve opens proportionally to the excess pressure and returns to the closed position when the process pressure returns to normal. The discharged fluid can be released to the atmosphere or routed to a treatment unit or flare system.

In many cases, when the process pressure returns to normal, the PRV does not close completely, caused by

several factors including:

- Pressure increases on the discharge side.
- The valve seat is damaged after repeated actuations.
- A deposition or formation of solids occurs between the disc and the seat.
- The process fluid is altered.
- Corrosion has occurred.
- A mechanical malfunction occurs.

PSVs

PSVs are commonly known as “pop valves” because they open completely and rapidly when the pressure exceeds the setpoint (Figure 2). The valve will remain open until the process pressure drops to about 95% of set pressure. These valves are primarily used for gas and steam.

PSVs are slightly different than PRVs. The disc blocking the nozzle has a small area and is contained in a larger diameter chamber. When pressure exceeds the setpoint, the stem starts to lift, allowing the process fluid to flow to the chamber. Because the

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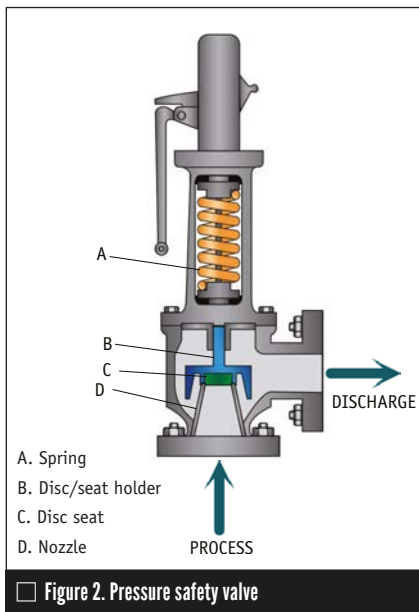


Figure 2. Pressure safety valve

chamber area is much larger than the one exposed by the disc, the uplifting force is much greater than the spring force and the valve opens completely.

When the discharge happens, the pressure reduces in the chamber, and the valve closes. If the process pressure is still above the setpoint, the valve keeps popping open until the pressure returns to normal levels.

When the process pressure fluctuates around the PSV setpoint value, the blocking disc will lift slightly to allow the chamber to fill. The process fluid vents to the discharge pipe, reducing the pressure but not opening the valve completely. This process is called simmering, and it can cause material buildup on the disc seating and stem misalignment, which prevents the valve from closing completely. The discharge caused by simmering and its side effects are not usually detectable by conventional methods.

PSVs are commonly equipped with a lever so an operator can initiate a manual release. This release is useful for testing the valve, cleaning scale or solids deposited on the seat surface and dealing with special process conditions during startups or shutdowns.

RDS

Rupture discs (Figure 3) are for one-time use. They consist of a membrane that bursts when the differential pressure between its two sides exceeds a set value. These devices are used alone or in combination with a PRV, provid-

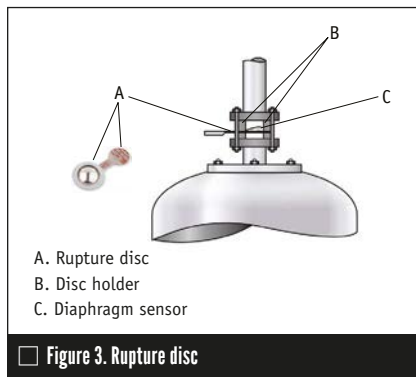


Figure 3. Rupture disc

ing a physical isolation layer between the process and the relief valve, especially on processes containing highly corrosive fluid. Some models are equipped with a sensor that indicates when the diaphragm is broken.

Unlike pressure relief or safety valves, the rupture disc will remain open until the ruptured diaphragm is replaced. Diaphragms are less susceptible to causing fugitive emissions, but a possibility exists of pitting corrosion, which creates pinholes leading to undetectable leakage.

RELIEF VALVE (RV) WITH RD

In some applications, a rupture disc is installed upstream from the RV (Figure 4).

The main reasons for this are:

- The RD can prevent fugitive emissions through the RV.
- The RD protects the RV against corrosive process fluids. The RV may not be available with the material required for long-term resistance to the process fluids, or it may be too expensive. The RD diaphragm works as a shield between the process and the RV.

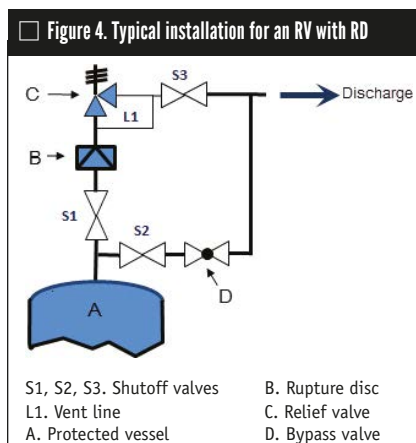


Figure 4. Typical installation for an RV with RD

S1, S2, S3. Shutoff valves
L1. Vent line
A. Protected vessel
B. Rupture disc
C. Relief valve
D. Bypass valve

- The RD protects the RV against solid particles. These particles can damage or prevent the RV from working properly, failing to open, or remaining open after a release.
- The RD protects the RV against frozen vapors, material polymerization, hydrate formation or other problems that may prevent it from working properly.

If the rupture disc diaphragm has a pinhole leak caused by corrosion or other adverse conditions, the pressure between the RD and the RV will be equal to the process pressure. In that case, the pressure differential on the RD will always be zero; i.e., it will never blow up even if the process pressure exceeds its limit. Therefore, the leakage caused by the pinhole goes to the discharge line and can go undetected for long periods of time. Monitoring the line pressure between the PRD and PRV can detect the pressure buildup.

To avoid this problem, a vent line is often installed to keep the pressure between the disc and the valve equal to the discharge line pressure (Figure 4).

Bypasses and discharges through PRDs are considered a violation of laws in many countries, requiring plants to monitor discharges of individual PRDs.

EFFECTIVE MONITORING OF PRDS

A typical plant will have several different PRD makes, models, sizes and operating pressures from various vendors. This makes it difficult to design a standardized monitoring system.

Monitoring how many times PRDs activate and how long each releases product helps plant personnel understand processes better. It also can improve combustion control. However, monitoring does not give visibility on leakages caused by PRD malfunction.

A reliable, effective and economic way to monitor PRDs is to use wireless acoustic transmitters.

Process fluid flowing through valves and orifices generates acoustic waves in a wide and complex range of frequencies and magnitudes. Most of the acoustic energy is in the ultrasound range, but some of it is also in the human audible range. Acoustic

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Our most sincere thanks to the many VMA and VRC member companies who have supported this vital effort to educate newcomers to the valve industry.



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The Valve Ed program was developed by the Education & Training Committee of the Valve Manufacturers Association.



Figure 5. Wireless acoustic transmitter clamped to a pipe

transmitters can detect ultrasound acoustic waves in the pipe wall, as well as indicate temperatures. These devices are wireless, small, lightweight and non-intrusive, so they do not require changes in plant installations. They can be easily clamped on an exhaust pipe (Figure 5).

PRD operating conditions can be determined by:

- An increase in noise level indicates that the PRD has been activated.
- When the noise level returns to the previous level, it indicates that the PRD is no longer discharging.
- When the noise level returns to a level above the previous level, it indicates leakage from the valve not closing completely. This may be caused by deposition of particles or scale between the disc and its seat or from a mechanical misalignment.
- When the noise level changes continuously, it indicates that the valve may be simmering or chattering.
- Temperature changes can be an additional indication that validates a release.

RV Monitoring

Acoustic wireless transmitters should be installed downstream of the RV, as close as possible to the valve. RVs are usually installed with shutoff and bypass valves for maintenance and special operating conditions. Bypass valves may be inadvertently left open or not close completely, causing unexpected flow to the recovery system.

The wireless acoustic transmitter installed properly monitors not only discharges or leakages of the relief valve, but can also monitor flow through the bypass valve (Figure 6).

RD Monitoring

Some types of RDs are equipped with a burst detector that generates a discrete signal indicating disc rupture. Devices also can be installed on the RD surface that can detect when the disc ruptures and indicate the event through a discrete signal. RDs also can be monitored with the use of a wireless acoustic transmitter that can detect when the disc ruptured and the duration of the discharge, as happens with RVs; but with RDs, the devices also may detect small leaks caused by pinholes.

MONITORING RV/RD COMBINATIONS

Once RDs burst, they cannot close again, so the process fluid will be discharged until not enough pressure exists to make the fluid flow. RVs are a better solution in this case because they close when the process pressure returns to normal conditions. However, in some applications, the fluid flow

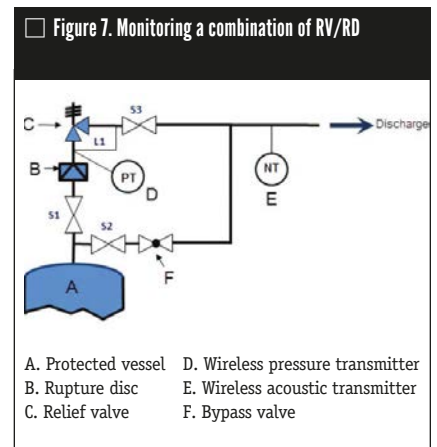
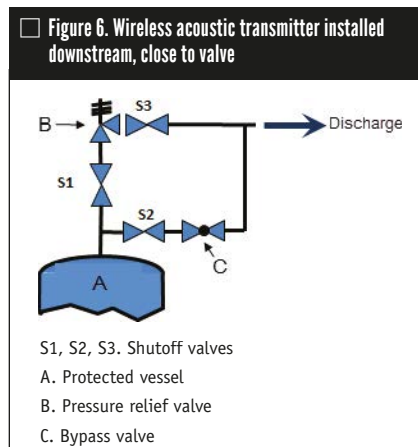
must be isolated from harsh process conditions by using RDs. In normal operation, the RV is not in contact with corrosion, gumming or hot process fluids. If the vessel pressure reaches unsafe levels, the RD bursts, followed by the RV opening. The RV closes when the pressure returns to safe values.

One problem with this type of installation is the possibility of RD leakage caused by pinholes. The volume between the RD and the RV can be filled with process fluid, and the pressure between the two sides of the RD will be the same, so the disc will not burst. Vent lines or excessive flow valves may be installed to release eventual leakage, but to be safe, standards and regulations ask for remote monitoring of the pressure in that space. A wireless acoustic transmitter installed downstream of the RV provides dependable information about RV releases (Figure 7).

The wireless devices mentioned in this article use wireless HART technology, which is an open standard that provides secure, reliable and flexible wireless communication. Planning, installation and configuration of the wireless network is simple and flexible.

By monitoring pressure relief devices in this way and feeding the results into a valve asset management database, it is possible to recognize potential failures before they happen and identify actions that could eliminate or reduce the chance of the potential failure occurring. **VM**

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Rigging and Lifting of Large Valves

BY JOHN V. BALLUN, P.E.

Lifting heavy and large loads is a challenging task. When the complexity of large valve geometries, extensions and oddly-shaped actuators is part of that task, great care and understanding are required to accomplish safe load-lifting operations. This challenge occurs both in the factory and on the job site. This article outlines the challenges of lifting large valve assemblies weighing several tons and illustrates the industrial rigging equipment and lifting operations typically used for these valves. The purpose of this article is not to provide comprehensive training on rigging, but instead to increase awareness of the special risks and care required to safely perform lifting operations for large valves.

VALVE CHARACTERISTICS

Rigging is defined as connecting a load to a source of power so that it can be lifted and moved safely and predictably. To rig a large valve, a basic understanding of valve construction is required. Figure 1 is typical of most large valves consisting of a body, a closure member that either rotates or translates in the body, and an external actuator, which is used to operate the closure member.

Figure 1. Installation of 90-inch butterfly valve



COURTESY OF VAL-MATIC VALVE

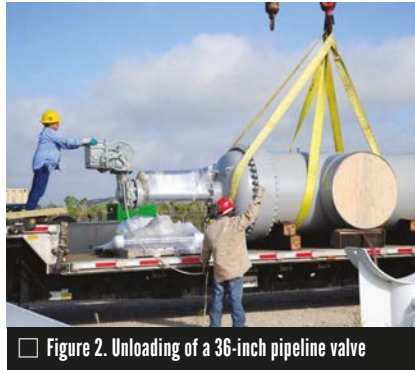


Figure 2. Unloading of a 36-inch pipeline valve

COURTESY OF UNITED VALVE

The body may include a flange or flanges with bolt holes that can facilitate lifting. If the valve is installed with the actuator removed, the closure member must be secured from rotating or translating, which will shift the load. The interior of the valve is not to be used for lifting. Valves also should not be lifted using straps, cables or chains through the valve interior because the precision-machined seating surface could be damaged (per American Water Works Association—AWWA—guidance). When moving a valve with a forklift, it is important to protect the valve flanges from scrapes or gouges. The flange surfaces are machined to accept and seal to mating pipe gaskets and should not be treated like structural beams. It is recommended that large flanged butterfly valves with eyebolts or rods through the flange holes and large gate valves be lifted with straps around the valve body.

Valves are surprisingly heavy. Care must be taken to determine the weight of the valve (and actuator) being lifted and the capacity of the crane, hoist, forklift or other equipment being used to lift it. For example, the 90-inch butterfly valve assembly shown in Figure 1 weighs 24,000 pounds or 12 tons. Such an item can't be moved around with a typical forklift truck or backhoe. Significant 20- to 40-ton crane power is required to handle these large valves.

It is also important to note that the center of gravity of the valve

varies with the location of the closure member and the relative weight of the actuator. While it's logical to rig to the centerline of the valve, doing so may place the load out of balance. The center of gravity must be estimated, and the slings or cables connected in such a way that they balance the load. In Figure 2, the lifting slings are placed toward the actuator on this 36-inch pipeline valve to balance the load.

While it might be tempting to simply connect the crane hook to any accommodating surface on the valve, the actuator or handwheel should never be used to lift a valve. They are not designed to support the weight of the valve. Figure 3 illustrates how not to lift a gate valve. Figure 4 illustrates rigging the valve by wrapping the slings around the body of the valve. Note that if the valve flanges were used to lift this 60-inch gate valve, its tall center of gravity would make the lift unstable and dangerous.

VALVE RIGGING EQUIPMENT

Many types of rigging equipment are commonly used with valves. It is dangerous to simply insert the crane hook into the nearest flange hole or cavity of a valve. Valves can be made of grey

Figure 3. How *NOT* to lift a gate valve



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Figure 4. Hoisting a 60-inch gate valve

iron, which can be brittle and may not support the high, localized stresses from a crane hook.

The connection to the crane hook is typically made with a combination of shackles, synthetic slings, wire rope slings and chain slings. It is recommended that a swivel eye bolt or hoist ring be employed to connect to a valve flange as shown in Figure 5. These devices are simply inserted into two or more flange holes and auto-



COURTESY OF UNITED VALVE

Figure 5. Use of swivel rings to lift a 144-inch butterfly

Figure 6. Safety checklist for hoisting

How	H	heavy is the load?
What are the	O	operating limitations of the crane and rigging?
When was the last	I	inspection performed?
How will	S	sling angles affect lifting capacity?
Have you performed a	T	test lift to check stability?
Move the load with	S	smooth and steady actions.
Is the	A	area clear of personnel and obstructions?
Can the load be	F	flown and landed safely?
How will the	E	environment affect the safety of the lift?

matically aligned to the lifting strap angle to prevent damage to the strap or the eye bolt. Alternatively, bars of diameter equal to the bolt holes can be inserted into opposite flange holes for lifting.

Large valves are easily flipped over with swivel rings. A large butterfly valve can be lifted and stood up on its edge. Then, the swivel rings can be inserted into one side of the valve's flange face and re-lifted. The valve will swing from the vertical and can be lowered down flat to the ground on the other side. Needless to say, the valve in Figure 5 would need to have the closure member rotated to be within the interior of the valve laying length if not fully closed before laying the valve on its edge. Some valve closure members extend beyond the flange face even when fully closed. Hence, it is always advisable to have wood blocking under the flange faces before setting the valve down on the ground.

In Figure 4, we see large nylon straps used around the valve body for lifting. It is important to note that many valves have sharp edges as part of the body geometry, especially adjacent to flange faces. Slings must be padded or protected from sharp edges. Moreover, how and at what angle the strap is attached will affect its load-carrying capacity.

SAFETY

Several publications from the Occupational Safety and Health Administration (OSHA) and organizations such as the Mechanical Contractors Association of America are available for training personnel. They provide guidance for safe lifting practices and instruc-

tions on the use of rigging equipment. Figure 6 presents some of the common safety tips for lifting heavy loads.

This list is a reminder that the adequacy and condition of all equipment used should be checked. It is important to know a valve's weight and center of gravity. Similarly, the capacity of all the lifting equipment must be confirmed. The lift zone and movement area must be clear of personnel, power lines and other equipment. But one reality is that valves are often handled outdoors in muddy trenches and horrible weather. These conditions affect the safe procedures and the strength of some equipment, such as fabric slings. Still, it's best to work smoothly and use care at all times, no matter the conditions.

By understanding the special characteristics of valves and following safe rigging and lifting practices, the chances of successful valve installations are greatly increased. **WM**

JOHN V. BALLUN, president and CEO of Val-Matic Valve, is a regular contributor to VALVE Magazine. Ballun is also a member of VMA's board of directors and serves on the VMA Communications Committee. Reach him at jvb@valmatic.com.

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Paint & Coatings

BY GREG JOHNSON

A walk through a typical valve distributor's warehouse will yield a contrasting view of either silver or black products. These two colors have been nearly exclusive for iron and steel valves for the last 75 years. The iron valve is painted black, while the steel valve is silver. Stainless valves are generally not painted at all, unless the end user decides to do so for some special reason.

In many instances, paint found on new valves is just a temporary coating, designed to delay exterior corrosion while the valve is in storage or until the final paint or coating is applied to the entire piping system after installation.

Valve standards, except for ferrous valves in waterworks service, have been nearly silent on painting and coating for new valves, referring to the paint as "manufacturer's standard," with newer editions of American Petroleum Institute (API) 600 adding that the paint should be a silver or aluminum color. There was one API 600 valve manufacturer that painted its ferrous valves a pleasing light blue color for several years.

While factory OEM paint may be rudimentary, end users today have elaborate painting and coating requirements that are requested for many of the valves they purchase. These requirements go far beyond the simple coat of silver or black that encases the valves as they leave the factory.

But what makes up the paint and coatings used?

Most of us know that paint often is related to a thinner. This thinner indicates more than one compound or chemical constituent is contained in the paint or coatings. Most are organic compounds made up of carbon-based components. They contain four primary elements:

- 1) Pigments, which provide not only the coloration, but also help with corrosion resistance and the overall strength of the



□ A check valve cap receives a coat of epoxy.

- coating or paint mixture
- 2) Additives, including thickeners, UV stabilizers and anti-foaming agents
- 3) Resins, which are acrylic and epoxy that bind all the components together into a homogeneous substance
- 4) Solvents that affect the drying time and viscosity of the paint mixture

The most basic of industrial paints are lacquers and enamels. These polymer types make up the plain vanilla of the industrial painting world. For residential and commercial applications, water-based acrylics are the primary choice. In some countries where volatile organic compound (VOC) regulations are extremely strict, waterborne acrylic latex (referred to as emulsion coatings) are used in industrial applications.

Specific coatings come in dozens

TABLE 1

SSPC #	NACE #	Title
SP1	-	Solvent Cleaning
SP2	-	Hand Tool Cleaning
SP3	-	Power Tool Cleaning
SP5	1	White Metal Blast Cleaning
SP6	3	Commercial Blast Cleaning
SP7	4	Brush-off Blast Cleaning
SP10	2	Near-white Blast Cleaning
SP11	-	Power Tool Cleaning to Bare Metal
SP12	5	Surface Preparation and Cleaning of Steel and Other Hard Materials by High and Ultra-high-pressure Water Jetting Prior to Recoating
SP14	8	Industrial Blast Cleaning

of different compositions. Each end user may have many different requirements depending upon the specific exposure to weather and in-plant environmental effects. Two requirements exist for all these different coatings: the first is proper surface preparation and the second is the need for a primer coat.

Primers are the interface between the final paint or coating and the base material. They provide temporary corrosion resistance during transportation and storage. The most popular types of industrial primers are those with a corrosion-inhibiting zinc base.

SURFACE PREPARATION

Proper surface preparation is critical for the successful application of any coating. The surface may be prepared either chemically or mechanically. The chemical preparation process yields an etched surface to give more bite to the coating to be applied. Mechanical surface preparation involves removing surface imperfections by water or dry-blasting techniques. In some rare instances, old-school grinding or brushing is still employed. Different paints require different surface finishes to adhere properly.

Grease, oils, dirt and rust are removed before any coating application.

Detailed surface finish preparation procedures and requirements are specified in the Society for Protective Coatings (SSPC) documents. SSPC also publishes a host of standards and recommendations for all types of industrial painting and coating.

Both SSPC and NACE International (NACE) have specifications for various degrees of surface finishes for painting and coating (Table 1).

Two of the most referenced surface preparations are SSPC SP6, Commercial Blast Cleaning and SP10, Near-white Blast Cleaning.

OVERZEALOUS PREPARATION

Every year thousands of valves and actuators are damaged because of improper protection during surface preparation for coating. Linear valves seem to suffer the worst damage, particularly outside screw and yoke (OS&Y) bonnet valves. Quarter-turn valves also are not immune to damage during the surface preparation stage. Some areas that are frequently damaged during surface preparation blasting include those listed in Table 2, page 44.

TYPES OF COATINGS

The coating industry has come a long way in developing new products to protect piping systems from corrosion. In the years before World War II, popular coatings included coal-tar and asphalt, which were used to protect buried pipelines. Today's list of common popular industrial paints and coatings includes:

- **Acrylic.** Acrylic paints used in protective coatings are based upon either organic or water-based solvents. Waterborne acrylic latex coatings are also referred to as emulsion-based coatings. They are generally used



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TABLE 2

Damage location	Damage description	Corrective action
Linear valve stems	Stem scratches and dents from blast media	Thicker protective tape covering all the exposed stem
Linear valve yoke bushings	Blast media in the threads and imbedded in the lubricant	Complete protective coverage of top and bottom of bushing area
Packing stuffing boxes	Blast media around both sides of the packing	Complete protective coverage of the stem-to-gland follower interface and around the packing gland-to-stuffing box interface
Inside valve ports	Potential seat, disc or ball damage	Suitable end protectors tightly adhered to the valve flanges or ends
Actuator controls	Blast damage of switches and indicators	Complete coverage of switches and indicators with thick protective film or tape
Actuator stem ports	Blast media inside the stem and bushing area	Suitable stem port protectors tightly adhered to the actuator body

when there are VOC release concerns during the coating process.

- **Alkyds.** Alkyds are fatty-acid modified polyester resins. Most of the alkyd-based paints dry from a chemical reaction between the fatty acids and the air.
- **Epoxy.** Epoxy coatings are two-part resins that, when combined, form a chemical reaction between the epoxy and the hardener that cures the epoxy. Epoxies are generally very tough, corrosion-resistant coat-

ings, but their pot-life is short. Most epoxy coatings also have poor UV stability.

- **Polyurethane.** Like most epoxies, polyurethanes are two-part coatings. They exhibit a smooth finish often used as a final coat over epoxies and zinc primers.

THE RIGHT COATING

The first question that needs to be answered when a coating is being selected is “why is the equipment being coated?” In piping systems and valves, the answer is usually for corrosion resistance rather than overall

attractiveness.

The second, and most important question concerns what the coating will be exposed to with considerations such as:

- 1) Are chemical fumes close by?
- 2) What is the operating temperature?
- 3) Are chemical splashes or spills likely?
- 4) Will the coating be covered with insulating materials?
- 5) Will the coating be cleaned, and what cleaning process and chemicals will be employed in the cleaning process?
- 6) Will the coating be applied over an existing coating?

Other questions regarding proper selection include: Where will the coating be applied, in the shop or in the field; and what is the expected service life of the coating?

A last question is: What is the budget for the coating? This question quite often trumps some of the other questions, depending upon budget, life expectancy and other considerations.

REAL-WORLD EXAMPLES

Coating specifications consist of three parts that constitute the complete coating process. They are: 1) pretreatment and surface preparation, 2) paint or coating application and 3) paint or coating curing. A paint or coating is transformed into a solid paint film through the curing process. This



□ Coated valves await shipment.



□ These valve components have been coated and will soon be assembled.

curing may occur at room temperature or in an oven.

The paint or coating requirements of an end user are different from those of the valve manufacturer. Here are some sample paint/coating specifications from both those entities:

Petro-chemical plant, general piping system, including valves:

Surface preparation: SP10
 First coat: Phenolic epoxy
 Second coat: Phenolic epoxy

Offshore facility, process equipment piping:

Surface preparation: SP5
 First coat: Solvent-based inorganic zinc
 Second coat: Silicone acrylic

Ball valve manufacturer, standard finish:

Surface preparation: SP3 (equal)
 First coat: Phenol-modified alkyd resin paint
 Second coat: Synthetic resin aluminum paint

Gate, globe & check valve manufacturer:

Surface preparation: SP6 or SP3
 Undercoat: Phosphate
 First coat: Modified alkyd resin primer
 Second coat: Silicone-modified alkyd resin paint

Compact gate, globe and check valves, designed in accordance with API 602, are usually shipped from the factory without paint. However, they normally have a corrosion-resistant (e.g. phosphate) coating to stave off corrosion until they are installed, and the piping system receives its final coating.

The development of dozens of paint and coating choices has helped to increase the lifespan of installed valves. This means that potential leaks caused by exterior corrosion are all but eliminated. Also, with the ongoing significant emphasis on fugitive emissions, one less leakage worry is certainly a good thing. **VM**

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The Dynamics between Manufacturers and Distributors

BY JEFF KELLEY

The relationship between valve manufacturers and their sales channels is intriguing, dynamic and at times challenging. When managed appropriately, the relationship delivers a high level of end-user satisfaction, market share growth for the manufacturer and a healthy business outcome for both the manufacturer and its sales channel partner. Sales channels include a diverse number of business organizations, including distributors, representatives, agents, integrators, etc. This article deals with distributor organizations, as defined herein.

A distributor's focus is on the end-user market and aftermarket support for a given product portfolio. If the end user operates 24/7, then the distributor must have the capability to safely respond in kind. The distributor's investments are in facilities located close to the end user, in carrying a significant inventory of products, and most importantly, in personnel knowledgeable enough to support the technical selling needed—who know the applications and can give the support needed for the product portfolio.

For distributors who also possess field service and shop repair capabilities, the investment list grows significantly to include major capital equipment such as machine shops, paint booths, trucks, on-site trailers, welding and testing equipment, and once again, personnel who are trained and certified to perform these functions.

These capabilities often exceed what a manufacturer could support directly because the core of the manufacturing business is to innovate, design, engineer, manufacture, test, deliver and support quality products. The investments for the manufacturer range from research and development to marketing to establishing factories strategically located around the world.



In an ideal state, the manufacturer's desire to be "all things to all people" is clearly present. However, it's often not practicable (nor financially possible) to take on the additional investments.

Thus, the relationship between the valve manufacturer and distributor is born. Distributors fill the operational space between the end-user's needs and the manufacturers' capabilities. Based on the realities listed above, this should be an ideal match for the two entities, and in many instances, the relationship leads to a satisfied end user with both manufacturer and distributor recognizing healthy results. When it doesn't work that way, however, the relationship is strained, leading to a variety of outcomes ranging from loss of reputation (for either the manufacturer's brand or the distributor) or missed opportunities to grow the respective businesses.

Key items for anyone involved in the relationship to consider are:

- Ensuring the wants and needs of each party, as well as the end user, are understood by the other
- Both sides agreeing on what "good" looks like
- Understanding what to do when disappointment strikes

Managing these three aspects will help to ensure effective communication between the manufacturer and

distributor, thereby positioning the relationship for success.

WANTS AND NEEDS

Understanding the wants and needs of each party is the first step in creating winning and sustainable relationships.

Manufacturers want organic growth year over year. In instances where they produce multiple brands or models, they want market share gains for each of the lines. In slow markets, they may look for additional (or alternate) distribution paths to market. When business is favorable, they rightfully anticipate and expect business through distribution to grow at an accelerated rate. When the primary channel to market is via a distributor, it is imperative to the manufacturer that their products are receiving the appropriate amount of focus within the distributor's business. As most distributors carry multiple lines within their portfolio, this is an understandable concern.

Engineered products are designed to solve existing problems. Because

of this, the manufacturer aims for this to be written into specifications supporting the manufacturer and design features. When new products are introduced to the market, manufacturers target specific applications before launch to ensure strong reference points. Both scenarios require plant-level relationships, as well as a technical presence where the application, process and product features are understood. In many cases, the distributor working closely with (or on behalf of) the manufacturer can successfully provide this presence.

Distributors seek to perform to levels that justify and achieve exclusivity with their manufacturers. Exclusivity is a two-way commitment between distribution and manufacturing wherein the distributor is the sole provider of the manufacturer's product for a specific industry or territory. The exclusive relationship often easily justifies extensive training for distributor personnel and allows the distributor to generously invest in inventory. In exclusive relationships, distributors routinely support long sales cycle efforts on the manufacturers' behalf. In today's market, exclusive arrangements between manufacturers and distributors are less commonplace than in years past, outside of a few product categories. Although the reasons for multi-distribution channels are plentiful, such arrangements often create friction.

Because distributors are the bridge between the manufacturer and the end user, they depend on the manufacturer to ensure product quality and delivery. Distributors do not have any immediate bearing on the manufacturing quality or delivery capabilities (unless they hold inventory). Therefore, it is critical that the information provided to the distributor always be accurate. Failure to have effective correspondence during the delivery of a product can quickly diminish the relationship between the end user and the distributor and has a further negative impact on the relationship between the distributor and manufacturer.

WHAT "GOOD" LOOKS LIKE

Establishing clear goals and tactical steps is vital within the manufacturer

and distributor relationship. In some cases, successfully gaining a minor install base should be a major accomplishment—but only if this goal was clearly identified in advance. Creating and agreeing upon a mutual business plan where both parties outline the opportunities at hand as well as the resources devoted to accomplishing the tasks needed to carry out the plan is a powerful route to drive business improvement between the manufacturer and distributor.

WHEN DISAPPOINTMENT STRIKES

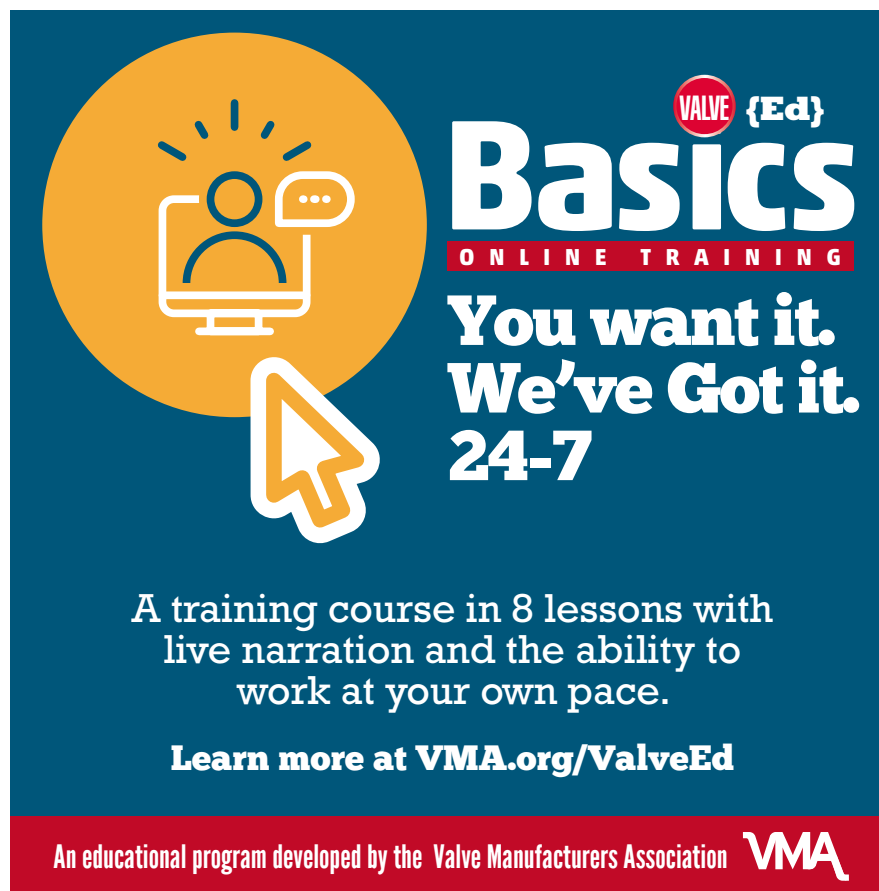
It is a given that with relationships that last long enough, challenges will occur. Between a manufacturer and their distributor, the issues can come from quality, pricing, delivery or performance. Understanding the severity and impact of each issue is critical. So, too, is knowing who to contact within the respective organizations when those issues arise and knowing well in advance before something happens. Where it has been agreed upon beforehand, minor issues are handled between local staff at the distributor and the manufacturer.

Urgent issues might be escalated to management and critical (or "line down") issues might be elevated and become visible to executive management. Who needs to be involved and how issues are handled is dependent on a variety of aspects that vary from one company to another.

In conclusion, manufacturers need strong distribution and distributors need strong manufacturing. As time moves forward, the dynamics between the two entities will evolve further. Customer requirements, innovations and the generational knowledge gap within industry are likely to be key factors in the future.

To maximize the relationship and to create a mutually beneficial arrangement, it is imperative that all parties communicate openly and regularly. Listening and understanding the three items above allows both parties to be a better partner and to offer end-user industries the best service. **WM**

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Crane ChemPharma & Energy

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Made of cast stainless steel (316L), the DEPA DH pump features an optimized pump design that can improve efficiency by up to 57% and increase flow rate by up to 10%. With a free-standing, bolted design, it is made of fewer parts than previous models, improving maintenance-in-place capabilities.



Spirax Sarco US introduced shipping within four business days for its Spira-trol modular control valves. Spira-trol valves leave the Spirax Sarco US factory pre-commissioned for applications, enabling quick, plug-and-play installation. Spira-trol modular design, with a quick-change, clamp-in-place seat, means its duty can be altered to match changing plant conditions, rather than replacing the entire valve.



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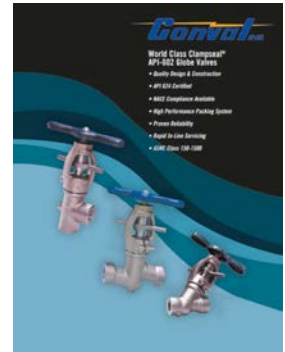
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surements such as percent a valve is open/closed, open and close dwell times, valve transition times from open to close, and last open/close stroke time.

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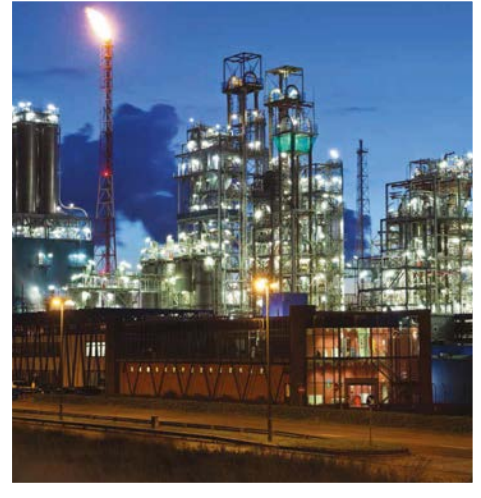
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