VMA TECHNICAL EVENT: ENGINEERING VALVES IN THE EXTREME IS MARCH 1-3

# VALVE

MAGAZINE | WINTER 2017 VOL. 29, NO. 1

## The Industry and the ENVIRONMENT

CLIMATE CHANGE CHALLENGES

FUGITIVE EMISSIONS BASICS

VALVE TECHNICAL DEFINITIONS

PULP & PAPER

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The AUMA SQ.2 Part-Turn Electric Actuator is one of many valve actuator options that can bring unfailing reliability and unsurpassed *precision* to your plant operation. Our innovative engineering optimizes modulating solutions…Superb craftsmanship enhances torque output capabilities… Creative components simplify commissioning and service…

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- *Trim change*
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- *Manual Milling machines & Lathes*
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- *Ball lapping*

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- *Yard capability- unlimited*

## In-Shop Repair
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- *Gate, globe, butterfly & checks through 60"*

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- *Most Western Hemisphere locations*
- *Warranty evaluations*
- *Installation supervision & adjustment*

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- *Up to 40,000 psi water*
- *Gas underwater testing*
- *Hydrostatic burst testing*

## NDE
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## Fire Testing
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- *API 6FA*

## Fugitive Emissions Testing
- *All valve sizes and types*
- *ISO, MSS or customer specifications*
- *Helium or Methane*

## API RP591 Testing
- *Gate, globe, check & ball valves*
- *Manufacturer evaluation*
- *Subcontractor evaluation*

## Cryogenic Testing
- *All sizes and valve types*
- *Testing at -320°F, -150°F & -50°F*

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VMA MAGAZINE
WINTER 2017 | VOL. 29, NO 1

VALVE MAGAZINE

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

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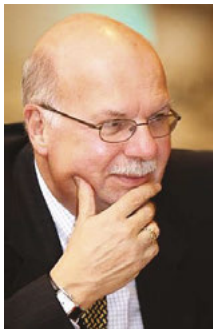
# Forty Years: It's Been a Great Ride



**On Jan. 3, 1977, I walked across the threshold** of headquarters for my first day of work at the Valve Manufacturers Association (VMA). Much has changed in the time I joined VMA. I talked with VALVE Magazine about some of those changes for a story on page 12.

But let's stay in the present for the moment. I just returned from the Valve World Expo in Düsseldorf, Germany, and I can report that the business slowdown we witnessed here in the U.S. and Canada is worldwide. I spoke with valve industry professionals and end users from countries such as India, China, Saudi Arabia and Turkey, as well as all of the European nations. The consistent theme was that 2016 was not our industry's best year and probably the first year since 2009 to show an overall decline.

One highlight of this trip was sharing information with my counterparts at other valve trade associations on our VMA Careers Initiative and how we are trying to bring high school and college students into the valve industry. Those trade people were impressed that many school districts around the U.S. and Canada have asked to have industry representatives address their students about the opportunities in the valve industry.

Sharing a stand once again with our good friends at the British Valve and Actuator Association (BVAA) showed me BVAA has developed a similar initiative called Future Leaders Program that includes visits to various facilities where participants are educated in different specializations.

As a long-time supporter and participant in this industry, it's heartening to see these efforts. The past few years I have seen many VMA members retiring. Knowing how talented these individuals are, I realize this means a great loss of knowledge in our industry. It's vital that we find ways to fill the gap with qualified new industry representatives. That's what our Careers Initiative is all about, and I'm heartened to see this occur. More information of what we're doing is available on our dedicated website—www.valvecareers.com.

As I say in my headline above: I've had a great ride. But I'm also looking to the future, and I like what I see happening for our industry. This may have been a rough year for some, but I've been involved long enough to realize this is cyclical. We will have a better 2017, and we are building toward a bright tomorrow. VM

**Bill Sandler**
*President, Valve Manufacturers Association of America*

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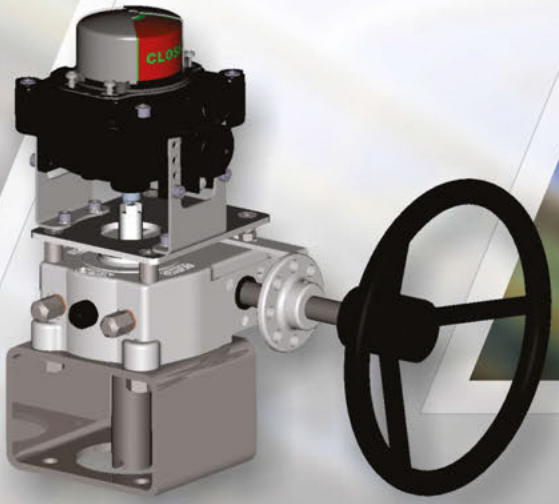
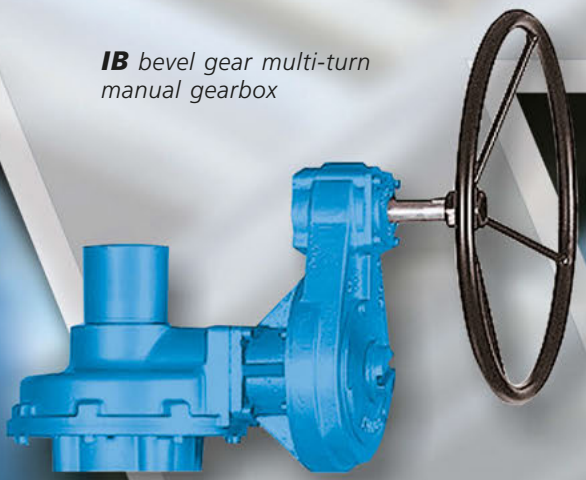
***ILGD-C*** *declutchable manual override*



***AB*** *worm gear quarter-turn manual gearbox*

***IB*** *bevel gear multi-turn manual gearbox*



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**Keeping the World Flowing**

## NEW CONTRACTS

### Velan Awarded Nuclear Contracts in China

Velan has contracts to supply nuclear class valves to China Nuclear Power Engineering Corporation (CNPEC), China Nuclear Power Engineering Co. Ltd., China Nuclear Energy Industry Corporation and State Nuclear Power Engineering Corporation Ltd.

The orders represent a sales value of about $36 million. The valves are scheduled for delivery from 2018 until 2019.

For CNPEC, the contract is to provide valves for two new generation Hualong HPR1000 nuclear plants of Fangchengang Units 3 and 4. The scope of supply consists of critical nuclear-classified forged valves, and high-pressure gate, globe and check valves with electric actuators.

### Weir Oil & Gas Secures Wellhead Deal

Weir Oil & Gas has reached an agreement with Kuwait Oil Company (KOC) for the purchase of 295 wellheads, representing about $12 million.

Weir will provide KOC with 11 different wellhead configurations ranging from 3,000 to 10,000 psi. The products sold include conventional wellheads along with HH cladded trees and solid block dual completion trees.

### DistributionNOW Signs with Rotork/Cameron

DistributionNOW entered into an OEM valve automation packaging agreement with Rotork Controls for the company's flow control products. This is an extension of an existing distribution agreement the company has in Canada for these products. The agreement, along with the global enterprise distributor program DistributionNOW has in place with Schlumberger for Cameron engineered and distributed valve product lines, allows the distributors' customers full access to the Cameron valve line and Rotork actuation and controls.

### Metso Receives Valve Order for New Kilpilahti Power Plant

Metso has agreed to provide comprehensive valve delivery for Kilpilahti Power Plant in Porvoo, Finland. The company's valves will be used in conjunction with the power plant's three different boiler units to control process flows.

The new, combined heat and power plant will generate 450 megawatts of steam and 30 megawatts of electricity. It is jointly owned by Neste, Borealis and Veolia, and will be commissioned in 2018.

### Rotork Supporting Portugal's Advanced Wastewater Treatment Plan

The Viseu Sul wastewater treatment plant in Portugal's Viseu County is the first in the country to adopt advanced membrane filtration (MBR) wastewater treatment technology. Rotork actuators will operate penstocks and butterfly valves for flow control throughout the treatment process.

MBR treatment plants work without adding chemicals and with relatively low energy consumption, combining secondary and tertiary treatment and eliminating traditional sand and carbon filtration.

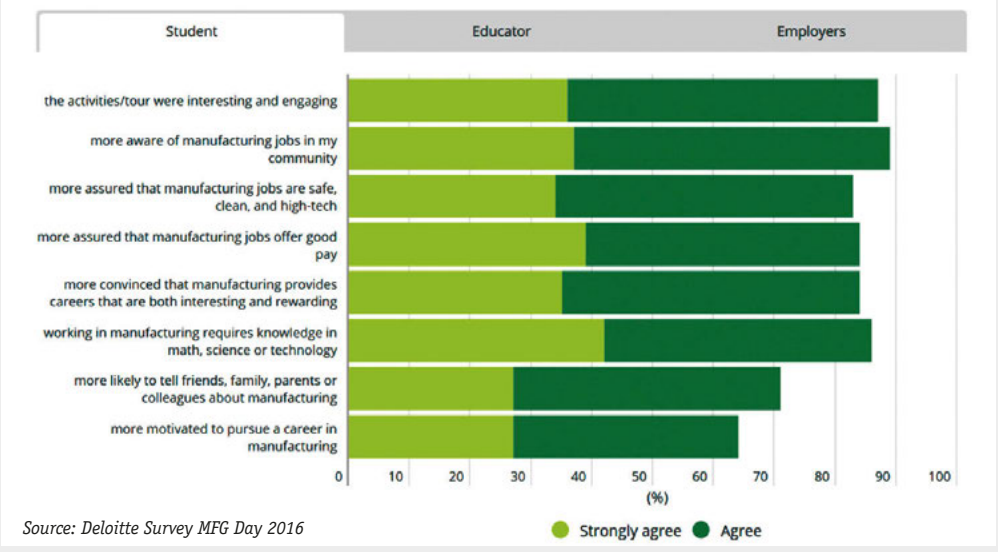
## MANUFACTURING CAREERS: Public Perception on the Rise

One of the reasons for the dearth of recruits to manufacturing in the last few decades is that the sector is perceived as archaic and unsafe by many young people. Additionally, the loss of jobs to offshore factories made it seem that manufacturing was an unwise career choice for those who wanted steady employment.

However, the industry is making positive progress toward changing these perceptions through Manufacturing Day. U.S. manufacturers open their doors to students, parents, civic leaders and educators to show how technologically advanced and safe today's manufacturing plants are, and that workers can earn more than $77,000 annually.

According to surveys by Deloitte, over the next decade, the skills gap will likely result in two million industry jobs remaining unfilled. By working together during and after Manufacturing Day, manufacturers have more opportunity to address the shortage, connect with future generations, take charge of the public image of manufacturing and ensure the ongoing prosperity of the whole industry. Deloitte's study on the impact of Manufacturing Day 2016 showed that nearly 90% of students who participated were more aware of what manufacturing jobs were available to them.

The next Manufacturing Day is Oct. 6, 2017. Companies interested in participating are invited to visit www.MFGDAY.com to find out how to host an event.




*Source: Deloitte Survey MFG Day 2016*

### Honeywell and Flowserve Collaborate on IIoT Solutions

Honeywell and Flowserve will provide Industrial Internet of Things (IIoT) for industrial customers. The collaboration will be part of the Honeywell INspire program, Honeywell's joint customer development program for its IIoT ecosystem.

Honeywell Process Solution products are used at more than 10,000 manufacturing sites worldwide. Flowserve instrumentation and services are co-located at many of those sites.

### MRC Global to Distribute Cameron Products in U.S. & Canada

MRC Global (U.S.), signed an exclusive Enterprise Distributor Program (EDP) agreement with Schlumberger to distribute Cameron measurement and instrumentation products in the U.S. and Canada. The distributor now adds flow metering and electronics, temperature, differential pressure, sampling, transmitters and switches to its inventory of valves, valve actuation and instrumentation in those two countries. Schlumberger will continue to provide technical support as part of the companies' collaboration.

### Siemens Industry Participates in Self-Funded Efficiency Project

Montgomery County, TN has partnered with Siemens Industry Inc. to begin a nearly $5 million, self-funded efficiency project. The project began in October 2016 and will be completed by fall 2017.

Siemens has guaranteed savings of almost 2.5 million kilowatt hours of electricity per year, 34,154 centum cubic feet of natural gas per year, and more than 8.5 million gallons of water per year. The utility expenditures are also expected to drop by at least 23%, and the total projected utility and operational savings over 15 years should be more than $6.7 million.

### Powell Valves Names Niagara Controls Exclusive Representative

The Wm. Powell Company (Powell Valves) and Niagara Controls LLC, a division of The Collins Companies, entered into an exclusive agreement to represent and distribute Powell Valves to Praxair.

Based in Buffalo, NY, Niagara Controls is a technical sales representative and stocking distributor for manufacturers of industrial valves, pressure relief devices and engineered products.

## EXPANSIONS

### Emerson Opens New ASCO Fluid Automation Headquarters

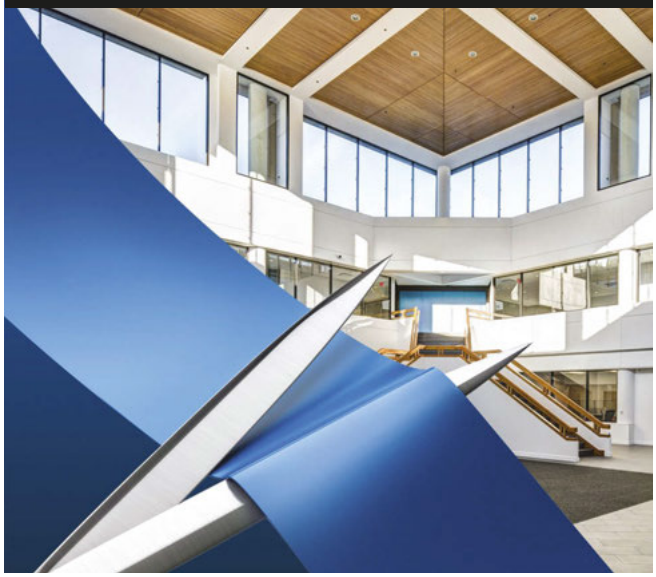
Local government officials and civic leaders in Florham Park, NJ joined Emerson executives to officially open the new global headquarters building for Emerson's ASCO fluid automation business. Florham Park has been home to ASCO for more than 60 years.

The new facility features a product development center with teams of engineers, designers, technicians and marketing professionals working together to develop new technologies to meet growing customer demands in process, industrial, machine automation and medical markets.

### Automation Technology Launches Maintenance Service

Automation Technology, LLC (ATI) announces formation of ATI Frontline Services, a specialized maintenance service dedicated to providing oil and natural gas pipeline customers and other end users with expert field and shop valve actuator and accessory installation, testing, repair, replacement and automation calibration.

Cutting the ribbon for Emerson's new ASCO Fluid Automation global headquarters



**MARCH 2017**

**1–3**
VMA Technical Seminar, Exhibits & Tour
*Nashville, TN*
www.vma.org

**23-24**
VMA Valve Industry Leadership Forum*
*Philadelphia*
www.vma.org/events

**MAY**

**1-4**
Offshore Technology Conference
*Houston*
www.otcnet.org

**JUNE**

**11-14**
ACE 17 Annual Conference & Exposition
*Philadelphia*
www.awwa.org

**20-21**
Valve World Americas Expo & Conference 2017
*Houston*
www.valveworldexpoamericas.com

**AUGUST**

**3-4**
VMA Market Outlook Workshop*
*Boston*
www.vma.org/events

**SEPTEMBER**

**13-15**
VMA/VRC Annual Meeting*
*Fernandina Beach, FL*
www.vma.org/events

**OCTOBER**

**3-5**
Valve Basics Seminar & Exhibits
*Pasadena, TX*
www.vma.org/events

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

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ARTICLE SUBMISSIONS
VALVE Magazine welcomes articles, proposals, manuscripts, photographs and ideas from our readers. For a copy of the magazine's Author's Guidelines, contact Genilee Parente, managing editor, at gparente@vma.org.

ATI Frontline Services is located within the company's new headquarters and ISO 9001:2008-certified manufacturing facility in Cypress (Houston), TX. The services are available for all ATI products as well as valve actuators from other manufacturers.

### GE Facility Developing New Technology

GE recently celebrated the grand opening of its new Oil & Technology Center in Oklahoma City. The facility is part of GE's global research network, which already includes 10 centers stretching from Rio de Janeiro to Shanghai. It will serve as a central pipeline for delivering new technologies to the industry.

The center has a "flow loop" where engineers can simulate oil and gas production environments and test how newly designed parts can handle them. It also features 3D machines that can quickly print new part designs to speed up prototyping and testing.

## MERGERS & ACQUISITIONS

### Emerson Acquires Business of FMC Technologies

Emerson is extending its presence in advanced flow measurement and control technologies by acquiring the Blending & Transfer Systems business of FMC Technologies, a provider of systems for lubricant, grease, fuel and chemical blending applications in the refining and chemical industries.

The new business will join the flow solutions segment within Emerson Automation Solutions.

### CIRCOR Acquires Critical Flow Solutions

CIRCOR International has signed a definitive agreement to acquire Critical Flow Solutions (CFS) for $210 million. The Utah-based company manufactures critical severe-service equipment for refining. The acquisition is anticipated to close shortly and become accretive in the first 12 months of combined operations.

### GE Merging Oil & Gas Business with Baker Hughes

GE Oil & Gas and Baker Hughes will join to create an oilfield technology provider with a unique mix of service and equipment capabilities. The new Baker Hughes will be an equipment, technology and services provider in the oil and gas industry with $32 billion of combined revenue and operations in more than 120 countries.

GE will own 62.5% of the new company, and the transaction is expected to close in mid-2017.

### Siemens Industry Acquiring Mentor Graphics

Siemens and Mentor Graphics have entered a merger agreement under which Siemens will acquire Mentor for $37.25 per share in cash, which represents $4.5 billion. Mentor Graphics is headquartered in Wilsonville, OR and has employees in 32 countries worldwide. The acquisition will complement Siemens offerings in mechanics and software with design, test and simulation of electrical and electronic systems.

## AWARDS & MILESTONES

### Largest Canadian Ethanol Producer Gets Emerson Reliability Award

Ethanol Greenfield's Varennes, Quebec site won the 2016 Reliability Program of the Year at the Emerson Global Users Exchange in Austin. The site converts corn into fuel-grade ethanol, distillers' grains, carbon dioxide and corn oil.

Emerson's award recognizes specific sites and teams that are continually improving their reliability culture and programs.

### ASCO Announces 2016 Engineering Scholarship Recipients

ASCO announced recipients of the 2016 ASCO Engineering Scholarship at the Association for Packaging and Processing Technologies' annual Amazing Packaging Race Nov. 9 at PACK EXPO 2016 in Chicago. The two recipients were each awarded a $5,000 scholarship to support their pursuit of a bachelor's degree and their universities' engineering departments received additional $1,000 grants.

The ASCO Engineering Scholarship program has awarded a total of $90,000 in merit-based scholarships to 18 students over nine years and provided an additional $18,000 in grants to 16 schools of engineering.

### Victaulic Raises $50K for Cancer Campaign

Victaulic raised more than $50K during the month of October for the American Cancer Society (ACS).

Executive Vice President

& CFO Joe Savage and International Legal and General Counsel Saleem Saab joined other local men in the ACS Making Strides Against Breast Cancer's Real Men Wear Pink of Lehigh Valley campaign, which raised a total of $93,000. Victaulic employees from around the globe supported the two executives.

### Spirax Sarco Celebrates Safety Milestone

Spirax Sarco recently reached a safety milestone—1.86 million man-hours or 3 years without a lost-time accident, which means 288 employees did not miss work because of injuries suffered on the job.

This significant accomplishment was celebrated on Oct. 6 at the Doko Manor located in Blythewood, SC with a catered lunch and congratulations from President Lorraine Wiseman.

### Richard Industries Recognized for Workplace Safety

Ohio Bureau of Workers' Compensation (BWC) Administrator/CEO Sarah Morrison visited Cincinnati's Richards Industries to recognize the company for its commitment to workplace safety.

The company, which has received six Safety Intervention Grants from BWC totaling $40,000 over eight years, demonstrated specialized safety equipment it uses to protect its employees from injuries. The most recent grant for $7,800 earlier this year aided in the purchase of parts cleaning and mist collection equipment to reduce the risk of employee exposure to oil mist and oil on floors, which creates a slip hazard.

### VMA Members Recognized for Water Projects

The editors of Water & Wastes Digest (W&WD) recognized AUMA-USA as one of the Top Project Award Winners for 2016 during the Water Environment Federation's Annual Technical Exhibition and Conference. Industrial professionals nominated AUMA-USA for its work on the Pipelines Seismic Upgrade Project. For that project, the city and county of San Francisco restored and systematically upgraded a 100-year-old water supply system of reservoirs, treatment plants, valves and pipelines that stretches 150 miles. The project was the largest water infrastructure scheme in North America from 2008 thru 2012.

Mueller Co. also was well represented among Water & Wastes Digest's winners. The company's Mueller and Pratt flow control products were used in at least two of

## PEOPLE IN THE NEWS

**CONTINENTAL DISC CORPORATION…** named **Ben Cox** its new president. Cox brings experience leading businesses in North America as well as Europe and Asia.

He most recently managed his own consulting business. Prior to that, Cox worked at Trelleborg AB, a global polymer solutions company, where he held leadership positions in several business units.

**POWELL VALVES…** announced that **Frank Parker**, senior vice president–Manning Manufacturing, and **Jim Hengehold**, senior vice president–Powell Engineering, retired at the end of 2016.

Parker began his career with Powell in 1960 at Powell's Cincinnati brass foundry. In 1975, he was named superintendent of the company's new steel commodity plant; he spearheaded construction of the new manufacturing plant in Manning, SC in 1981. He was promoted to vice president–Manufacturing in 1997 overseeing plants in Manning and Orangeburg, SC.

Hengehold started his Powell career in 1980 as a project engineer. He later succeeded Bob Koester as chief engineer after serving under Koester as his assistant.

**EMERSON…** recently appointed new senior leadership at its Office of the Chief Executive. **Michael H. Train** is now executive president of Emerson Automation Solutions. He was appointed leader of the newly formed Automation Solutions business in April 2016. Train began his career at Emerson in 1991, and served most recently as president of global sales for Emerson Process Management from 2010 to 2016.

**VALVTECHNOLOGIES**… named **Herman Benard, Jr.** its new director of manufacturing. Before joining ValvTechnologies, Benard served as manufacturing manager for Thrustmaster of Texas and manufacturing engineering manager for Igloo Products.

ValvTechnologies also appointed **Kenny Gorman** industry director for the company's mining and minerals division. Gorman has more than 20 years' experience in engineered equipment strategic leadership, business development and operations.

**THE WEIR GROUP…** appointed **John Heasley** chief financial officer. Heasley has worked with Weir since 2008 and been a member of the executive group since 2014 as divisional managing director of the flow control division. He joined Weir as group financial controller and has since held several financial and operational roles across the business.

**FLOWSERVE…** announced that **Mark Blinn** will retire as president, CEO and a member of the board of directors. To ensure an orderly transition, Blinn will remain in those roles until the appointment of his successor.

Blinn

He joined Flowserve in October of 2004 and was named CEO in October of 2009.

**WATSON GRINDING AND MANUFACTURING**… named **Robert White** its new president. The current president, **John M. Watson**, will remain as chief executive officer.

White spent more than 39 years in executive management for Watson Grinding and Manufacturing; and led the initiative to gain ISO 17025:2005 accreditation for the Watson Coatings Laboratory. Such accreditation is used by laboratories that produce testing and calibration results.

the 10 projects recognized: San Francisco Public Utilities Commission's Peninsula Pipelines Seismic Upgrade Project and North Dakota State Water Commission's Dickinson Finished Water Pump Station.

The program honors water or wastewater projects that were in the design or construction phase over the past 18 months. The 10 winning projects were chosen by the editorial team and presented to the projects' owners, designers and contractors.

### Pentair Valves & Controls Hosts Customer Appreciation Training

More than 200 representatives from Houston's refinery, chemical and petrochemical industries joined Pentair Valves & Controls last fall at its Pasadena, TX facility for a customer appreciation barbecue and training event.

Pentair's Valves & Controls leadership team hosted the event, which included seminars from leading subject matter experts offering guidance on managing widespread industry challenges such as Emergency Shutdown (ESD) and Safety Instrumented Systems ESD, Maximizing Process Productivity in Petrochemical Applications and Overpressure Solutions.


Pentair Valves & Controls' customer appreciation training event

## STANDARDS & CERTIFICATIONS

### MSS Publishes Revised Steel Pipeline Flanges Standards

The Manufacturers Standardization Society (MSS) announced that the substantially revised Standard Practice, SP-44-2016, Steel Pipeline Flanges, has been approved by the American National Standards Institute (ANSI) as a Revised American National Standard (ANS).

The first edition of MSS SP-44 was published in 1952. It is widely employed in the valve and piping industries and referenced in other industry and ANSI-approved standards. SP-44 was originally approved as an ANS in 2014. It gives the industry a national standard for NPS 12 to NPS 60 flanges for high-yield strength materials covered by other current national standards.

### All-Pro Fasteners Receives Monogram Licensing

All-Pro Threaded Products, an All-Pro Fasteners company, received the official API Q1 registration and became the second of only two within the industry to have obtained both the API [American Petroleum Institute] 20E & 20F monogram licenses.

### ValvTechnologies Joins MSS Valve and Fittings Industry Committee

Majka

ValvTechnologies, Inc. has been unanimously approved for membership in the Manufacturers Standardization Society (MSS) Valve and Fittings Industry Committee. Representing the company is Tony Majka, director of engineering, who will serve on several MSS technical committees including: 114 Steel Valves; 302 Marking and Terminology; 304 Quality Standards; 306 Valve Operation; 308 Packings and Gaskets; 310 Valve Modification; and 401 Ball Valves.

# VMA Technical Seminar Addresses New Challenges

Engineering Valves in the Extreme is the theme of the 2017 VMA Technical Seminar, Exhibits and Tour, which will be March 1-3 at the Hilton Nashville Downtown, Nashville, TN. Attendees are both VMA member and non-member representatives such as senior engineers, product and business development managers, application engineering professionals and others who focus heavily on today's technologies.

The theme addresses the increased demands placed on industry from the latest processes, new technologies and upcoming challenges. It's carried throughout the event, starting with a keynote address on the global natural gas outlook from speaker **Angelina LaRose**, director of the Office of Integrated and International Energy Analysis, U.S. Energy Information Administration's Office of Energy Analysis. Other speakers and topics include:

**Kurt Larson**, technology manager for Air Products, will address design considerations unique to high-purity oxygen systems.

**John Shingledecker**, program manager of Electric Power Research Institute, will outline industry changes for fossil power plants, which include more flexible modes of operation, new sources of power generation and how all of that affects equipment.

**Ryan McCall**, product manager, High Performance Metal Seals, Technetics Group, will focus on new extremes in temperatures and how they affect sealing design.

**Elaine Motyka**, principal materials engineer for Technetics Group, will address thermal spray coatings and what they do in severe wear and corrosion conditions.

**Charles Henley**, principal mechanical engineer for Black and Veatch, will talk about design conditions for piping and valves placed in the new supercritical power plants.

**Cliff Welborn**, associate professor for the Middle Tennessee State University, will address lean systems and where waste occurs in terms of product development.

**Mike Devrell**, senior systems design engineer, Rotork Controls, will tackle today's smart technologies and what that means for equipment.

**Matt Wasielewski**, president of Yarmouth Research, will review existing fugitive emissions standards and where shortfalls lie in terms of high-pressure upstream equipment at wellheads and midstream gas transmission.

**Alberto Daglio**, principal applications engineer for Cameron Valves & Measurement, will look at diversification of national codes, standards and user specifications for performance testing of valves.

**Carlos Davila**, product manager for Crane ChemPharma and Energy, will present an update on U.S. standards and corresponding valve guidelines.

**Brad Livingston**, safety and motivational speaker, will explain how he was involved in an incident that could have cost him his life and what caused the incident.

**Brian Bonds**, senior piping materials engineer, and Jim Tesch, senior piping materials specialist, for Bechtel Oil, Gas and Chemical will cover challenges and design considerations for cryogenic valves.

Tabletop exhibits are displayed during the afternoon hours on March 2.

*More information is available at VMA.org > Meetings > Technical Seminar & Exhibits.*

## World's Biggest Oil and Gas Show in May

Thousands of attendees from 120 countries will converge on the NRG Park in Houston May 1-2 for the Offshore Technology Conference (OTC 17). The conference, which started in 1969, appeals to anyone in the energy industries interested in leading-edge technical information. It is sponsored by 13 nonprofit organizations.

At the conference, an extensive technical program covers everything from specific world-class projects in progress, to working in the lower-priced environment to the digital revolution and recurring issues in the industry such as safety and risk management.

In addition, the conference features an exhibit hall of 2,400 companies, the industry's largest exhibit of the equipment that operates the industry and helps its professionals in their daily jobs. Many VMA members are among the exhibitors.

*For information, go to www.otcnet.org.*

# Sandler Celebrates Forty Years with VMA

BY GENILEE PARENTE

VMA President Bill Sandler's first annual meeting at the helm could have been a nerve-wracking lesson on what it takes to run a major trade association show. A hurricane bore down on Boca Raton where the meeting was held; the hotel lost power; the chairman of the board had to climb 14 flights to get to his room; and the annual buffet dinner had to be served by candlelight.

However, his christening turned out to be an excellent example of what he now sees as VMA's greatest strengths: its members' willingness to roll with the punches and roll up their sleeves.

"There was a piano in the lobby and one of our members played. We all gathered around that piano and started singing songs. There were heavy torrential showers going on outside and flooding all around the hotel area. But in typical VMA member fashion, the attendees just said, 'let's make the best of it.'"

Sandler is the longest-serving employee of VMA, celebrating 40 years in 2017; almost half of those years, he's been president: one of only six people to lead the staff in the association's 77-year history.

He says he's seen that can-do attitude of the first meeting repeatedly during his time as leader.

"We have a membership that is always willing to volunteer in all phases of the association, whether it's committee work, making presentations or representing the association. I can put out a call for three volunteers for something important, and have eight within an hour."

"I've talked to counterparts in other associations enough to know how crucial that kind of participation can be," he says.

## FROM DATA GUY TO LEADER

When Sandler is asked what the greatest challenge of his career with VMA has been, he goes back to his start as president. Sandler has a bachelor's in statistics and a master's in finance and had two other association positions before he came to VMA. He started at this association as the person in charge of gathering and sharing economic data, which has always been an important part of member services. However, "the biggest challenge in assuming the top position was having the board and the full membership see me as a leader versus 'the guy who collects the data,'" Sandler jokes.

With guidance from mentor Malcolm O'Hagan, his predecessor, and support from a board and members who listened to his ideas, the transition has been a smooth one, and he says one of the accomplishments he's most proud of is the expansion of membership categories. VMA added "associate" to the member ranks shortly after he took over; then a few years ago, he oversaw adding "distributor/channel partner."

"This completed the triangle that really makes up our industry: manufacturers, suppliers and now those who distribute valves, actuators and controls," he says.

More recently, Sandler says he's proud to have played a role in VMA's educational arm as well as the Careers Initiative. Both are vital to meeting one of the greatest challenges the industry faces today: replacing the skill sets being lost to an aging workforce.

"A large portion of our industry has either retired or is about to do so, and there is no one to take their place.


Bill Sandler at the 2015 annual meeting

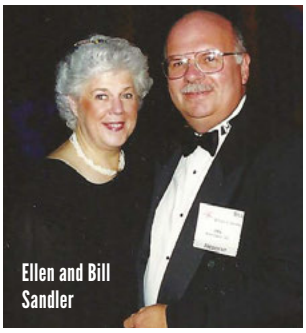
*"In my travels throughout Europe and other places of the world representing the association, one factor I always see is great respect for the U.S. and Canadian valve industry."*

We've got to bring in new people just as we've got to find ways to pass along knowledge and skills," Sandler says. "This industry pays well and presents possibilities for long careers but we have to let the world know," he adds.

He says what's been accomplished so far is promising: The initiative and other efforts are not only reaching young people, they are building the association reputation both here and abroad.

He points to multiple inquiries in the U.S. and Canada requesting that members come in and speak to high schools and community colleges. He also says the educational aspect is the latest VMA effort to receive attention from companies and individuals he meets on his foreign travels, which he says have been a rewarding part of his career as VMA's spokesperson.

Sandler (seated at left) and staff celebrate his 40th birthday. Former VMA President Malcolm O'Hagan is second from left.



Ellen and Bill Sandler

"In my travels throughout Europe and other places of the world representing the association, one factor I always see is great respect for the U.S. and Canadian valve industry. Those countries see our members as leaders and innovators and have adopted many of our programs. At the same time, we've looked at their programs and added to our portfolio," he says.

### WHAT IT TAKES

Sandler speaks highly of his chosen career as an association executive and says the main requirement to serve has been listening skills and the ability to stay neutral.

"You're dealing with a wide variety of people, opinions and backgrounds. You may be talking golf to someone at 10 a.m. in the morning and discussing history with someone completely different at 11 a.m. To do the job well, you must like people and appreciate their uniqueness, but be able to find common ground to bring them together on issues," he says.

However, this people-dealing is exactly why he appreciates his job so much.

"A highlight for both me and for my wife Ellen has to be the many friends we've made over the years. For me personally, the respect the board and members have shown me and the opportunity to meet counterparts around the world have made the job rewarding," he says.

**Genilee Parente** is managing editor of VALVE Magazine.

# Successful Custom Valve Basics Event Leads to Program's Expansion

Following a successful "test" event in Baton Rouge last fall where member presenters taught a custom one-day Valve Basics program to a group of 38 ExxonMobil engineers, the Valve Ed program is now offering the program to other companies. Another large facility is already on the schedule in February to receive the new "we come to you" training.

The custom program works best for companies that have between 25 to 50 individuals who need basics training. In addition, the Valve 101 course can be tweaked to serve the interests and needs of the customer. For instance, a refinery might not want to include a control valve lesson if their engineers don't work with this product category, while another industry would find this lesson essential.

Pricing is done on a flat-fee basis, with the average cost per person less than VMA's one-day Valves & Actuators course. Because the program is presented by member-volunteers, the association is limited as to how many custom programs can be conducted in one year. Valve users, engineering firms, distributors, governmental agencies and member companies are eligible to receive custom training. If interested, please contact Abby Brown, VMA education coordinator, at abrown@vma.org.

### A NEW VENUE FOR BASICS TRAINING

VMA has finalized the date and venue for the next Valve Basics Seminar & Exhibits. We will conduct our 101 and 201 courses at the Houston Area Safety Council's state-of-the-art training center in Pasadena, TX, Oct. 3-5, 2017. Watch for more details on changes to the program—including an expanded Valve Petting Zoo. Go to VMA.org/ValveBasics for the latest information.

Another option is available for companies seeking the flexibility of online training. VMA's Valve Basics Online Training program is currently available and individuals can sign up any time through The VMA Store on VMA.org. In addition, group discounts/licenses are available. For more information, contact Simone Roper (sroper@vma.org).

A clear blue sky over a refinery

# A Primer on Fugitive Emissions

BY GREG JOHNSON

Fourscore and seven years ago, no one had ever heard the term "fugitive emissions." Today, many people wish they'd never heard the expression. Most of us, however, fall somewhere between "never heard of" and confusion.

Fugitive emissions (FE) have nothing to do with gifts left by toddlers in their diapers overnight, although "volatile" chemical compounds are involved. In the world of industry, FEs are undesired releases of hazardous or environment-damaging gases from mechanical equipment including flanged connections, pumps, compressors, storage tanks and valves found in refineries, chemical plants, pipelines, wellheads and even some sewage treatment plants.

The initial push for clean air that got the ball rolling in U.S. industrial plants resulted from the killer "Donora Smog," which afflicted a small Pennsylvania steel mill town in October of 1948. Donora is a steel manufacturing community near Pittsburgh that was home to many industries pouring out tons of pollutants into the atmosphere every year. The fog, which was a mixture of unmoving toxic gases and moisture, sat over the town of Donora for about five days. Before the week was out, 20 persons were dead and thousands were sick from the ugly noxious air.

The Donora incident led to the creation of the first clean air program in the U.S., although its initial focus was the metals industry. The Clean Air Act, addressing air pollution, would be created in 1963. It has been amended and toughened up several times since its inception. The Environmental Pro-

## Executive Summary

**SUBJECT:** Fugitive emissions and their effects on the world are on the tips of everyone's tongue these days. But what does it mean?

**KEY ISSUES:**

- A history of the issues
- Some offenders
- The solutions
- Testing here and abroad

**TAKE-AWAY:** While FE issues cause many people to groan, the world has already felt the effects of mandates on controls.

tection Agency (EPA) was created under the Nixon administration in 1970 as the department to direct the country's clean air and water efforts in the United States.

## LINEAR VALVES: WORST OFFENDERS

As far as valves, the emissions are released through two primary sources: gasketed-joints and packing systems. The biggest offenders are linear valves (gates and globes), which use a rising or rising and rotating stem motion through a packing system. This rising and rubbing motion is harder to seal properly than the short, 90-degree rotary motion of a stem in a quarter-turn valve. Gasketed joints are somewhat easier to seal since the seal is static.

Because linear valves are cost-effective flow control devices, particularly for on-off service, they are present in large numbers in nearly all refineries and chemical plants. This means that fugitive emissions control in linear valves is receiving a huge amount of attention.

Why is controlling fugitive emissions in linear valves difficult? Most of today's premium low-emission (low-E) packings have been tested in accordance with the American Petroleum Institute's (API) Standard 622, Type Testing of Process Valve Packing for Fugitive Emissions. The tests consist of mechanical and temperature cycles, while the candidate packing is contained in a precision-machined test fixture. These graphite-based packings usually do very well in testing, with leakage rates well below 100 parts per million (ppm). The real test occurs when an API 622 tested packing is installed and tested in an actual valve. For linear valves, this test is API 624, Type Testing of Rising Stem Valves Equipped with Graphite Packing for Fugitive Emissions. (For quarter-turn valves, the test standard is API 641, Type Testing of Quarter-turn Valves for Fugitive Emissions).

## CRITICAL FIT & FINISH

Although packing may perform well in a test fixture, when it's put in place, it must function in concert with the dimensions, tolerances, fit and finish found in assembly-line produced valves. The first requirement is that sealing surfaces have the proper surface finish. In the case of linear valves, that means the stem and the stuffing box. The stem itself must be straight and true and not have any deviations in diameter where it passes through the packing. If it is not, the packing can be reamed out slightly, causing an unsealable leak path.

☐ Preparing for a fugitive emissions test on a large valve

Alignment of the bushings above and below the packing also is critical for sealing success. The upper bushing/bearing, which is called the stem bushing, must be machined in perfect alignment with the packing gland area. The second bushing, which is the backseat bushing, is found below the packing area. It, too, must be aligned perfectly with both the packing gland area and the handwheel bushing.

The best low-E packing in the world will fail to contain potential emissions if tight tolerances between all these components are not met. This means repeatability in manufacturing is even more critical for valves in low-E applications: Only time will tell if this component machining repeatability issue will be successfully met.

When all the components are in correct alignment and within tolerance, the next consideration is that low-E packing must be installed correctly. Low-E packings generally require a lot more torque to seal than

### A SUMMARY OF THE ISSUES

- Linear valves are harder to seal than quarter-turn valves.
- API 622 is the graphite packing testing standard.
- API 624 is the linear valve FE testing standard.
- API 641 is the quarter-turn FE testing standard.
- ISO 15848-1 is the ISO (generally non-U.S.) FE valve testing standard.
- Methane gas is used as the test gas in the U.S.
- Helium gas is used in other parts of the world as a test gas.
- Helium leakage cannot be correlated with methane leakage.
- Dimensions and tolerances must correct for low-E valve packings to work.
- Consent decrees are agreements between the EPA and offending plants, dictating what steps must be followed to correct emissions problems.
- The industry is currently aiming for 100 ppm maximum leakage.
- Pipeline valves and wellheads are now being scrutinized for FE leakage.
- Very high pressure (above 10,000 psi) methane or helium gas testing is problematic.

non-low-E types, and the packing manufacturer's instructions must be followed to the letter.

## FE TESTING

For a manufacturer to qualify his line of valves as "low-E compliant," the design must be verified through the testing of prototype valves. In the U.S., this testing is performed with methane gas. Testing with elevated temperature methane carries some risks, but the EPA currently only recognizes results performed with methane. In Europe and some other parts of the world, type testing is performed with helium in accordance with the International Organization for Standardization's ISO 15848-1, Industrial Valves–Measurement, Test and Qualification Procedures for Fugitive Emissions. While ISO 15848 recognizes methane testing, no direct correlation exists between helium and methane leakage. That fact bears repeating—*there is no correlation between methane leakage rates and helium leakage rates*.

Just recently, API published its API 641 quarter-turn testing document. It is fundamentally different from the linear testing document (API 624) in that it covers testing of elastomers and also has a range of test temperatures. Passing the API 641 test procedure is expected to be much easier because of the limited amount (90-degree) of stem movement.

## CONSENT DECREES

A buzzword in the valve industry these days is "consent decree." A consent decree means the EPA has found a plant guilty of exceeding the emissions amounts it should be releasing and must make changes to stay in business. An analogy would be this: You take permanent markers away from your four-year-old (who has just re-painted the kitchen floor) and sternly say that: "from now on you must use erasable markers if you are going to paint. And you better not paint the floor anymore either or you will be in big trouble!"

Consent decrees usually dictate specific steps that must be taken by the offending plant to keep operating. As far as valves go, they may require testing of all new valves or they may require a change in valve designs to meet the best available control technology. Included in many of these consent decrees is the requirement that valves be guaranteed to meet low-E requirements for a period of five years. This five-year warranty requires a confident valve manufacturer that is also very comfortable with its packing vendor.

Most of the U.S. uses methane in testing.

Because of advancements in detection technology, the EPA now can use mobile plant-perimeter monitoring systems to detect in-plant leakage from outside the fence. If suspected leakage is observed, a detailed component specific test is then performed in the plant to confirm the actual leakage rate.

## THE EPA LOOKS UPSTREAM

Until recently, valve FE control has focused on the downstream refinery sector as well as petrochemical and chemical plants. Now, the EPA is looking at upstream and midstream applications as well. This new focus includes wellheads and pipeline valves, which have been exempt from FE inspection until now.

Linear pipeline gate valves manufactured under the API 6D design standard will now have to face the same issues that refinery gate valves have overcome. The ambient operating temperature of these valves and their use of non-graphite packings should help; however, this study and implementation of any necessary design changes is just beginning.

Wellheads face a unique set of problems. While they generally operate at ambient temperatures, the pressures required to contain them under operating conditions and especially under 1.5X operating pressure testing is hard to contain if a gas such as methane or helium is used as the test fluid. At more than 10,000 psi pressures, the helium will permeate the elastomeric seals and show leakage, and at those pressures, testing with methane is too dangerous. As a result, the upstream wellhead industry is looking into the feasibility of testing with argon if they can correlate the leakage rate of argon to that of the EPA-approved methane.

## WHAT NEXT?

Although the EPA has focused on the chemical, petrochemical and refining industries, other industries may be just over the agency's horizon. The wastewater industry, with its methane-gas-rich sewage treatment plants, could possibly be the next EPA target.

But while much grumbling about the EPA and their regulations occurs, those who have lived in the Gulf Coast area have seen a big difference in the days before and after regulation. As a life-long resident living within a dozen miles of the Houston area petrochemical complex, I can report that it used to be the best way to tell the wind direction at home was to go outside and smell. Today, the air around those plants is clear, and I need to consult the weather forecast to determine the correct wind direction. VM

**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 VMA's Education & Training Committee, is vice chairman of VMA's Communications Committee and is past president of the Manufacturers Standardization Society. Reach him at greg1950@unitedvalve.com.

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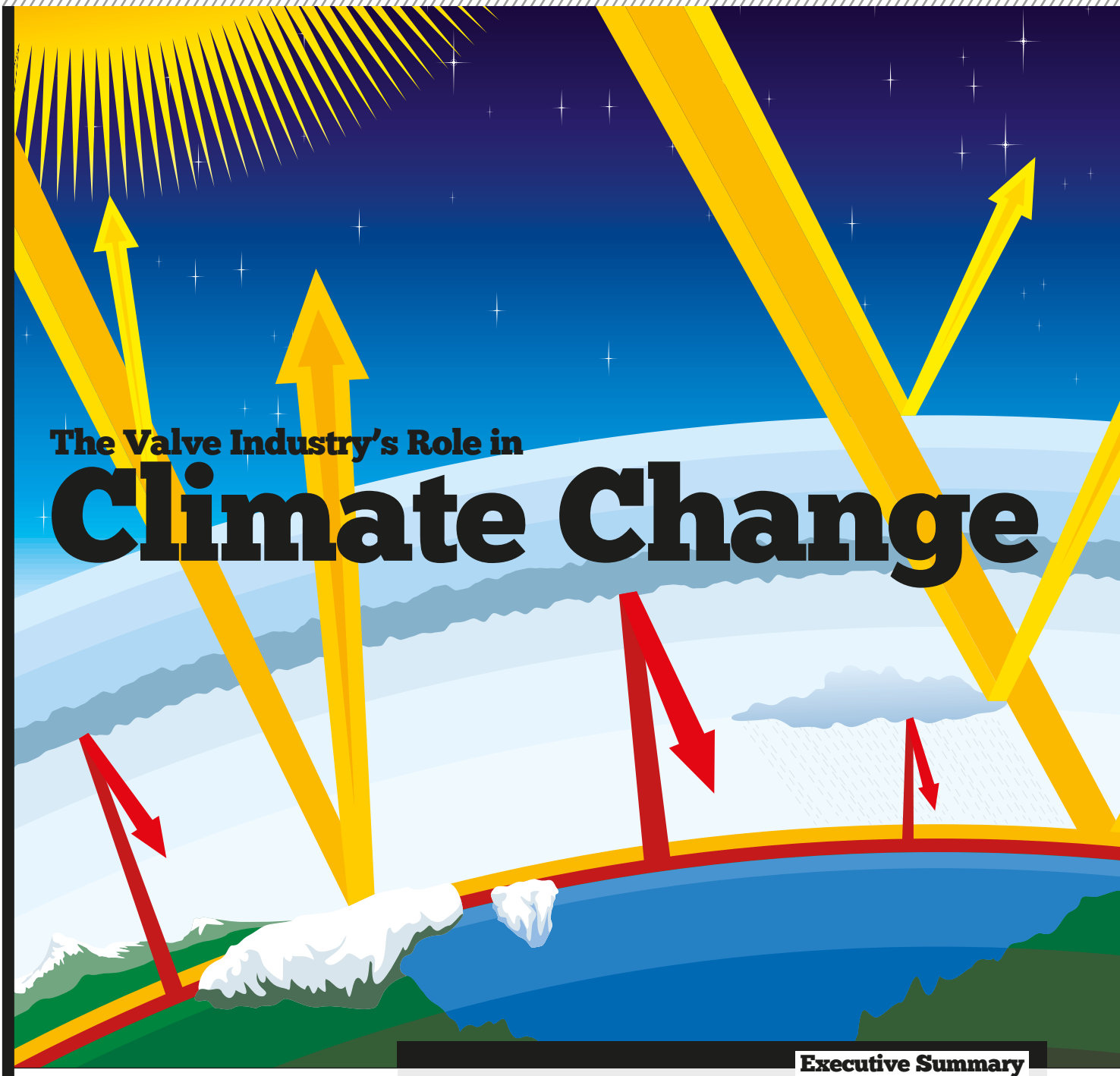


# The Valve Industry's Role in Climate Change

**Executive Summary**

**SUBJECT:** The valve industry offers technical solutions to mitigate the accumulation of greenhouse gases, which has an effect on climate change.

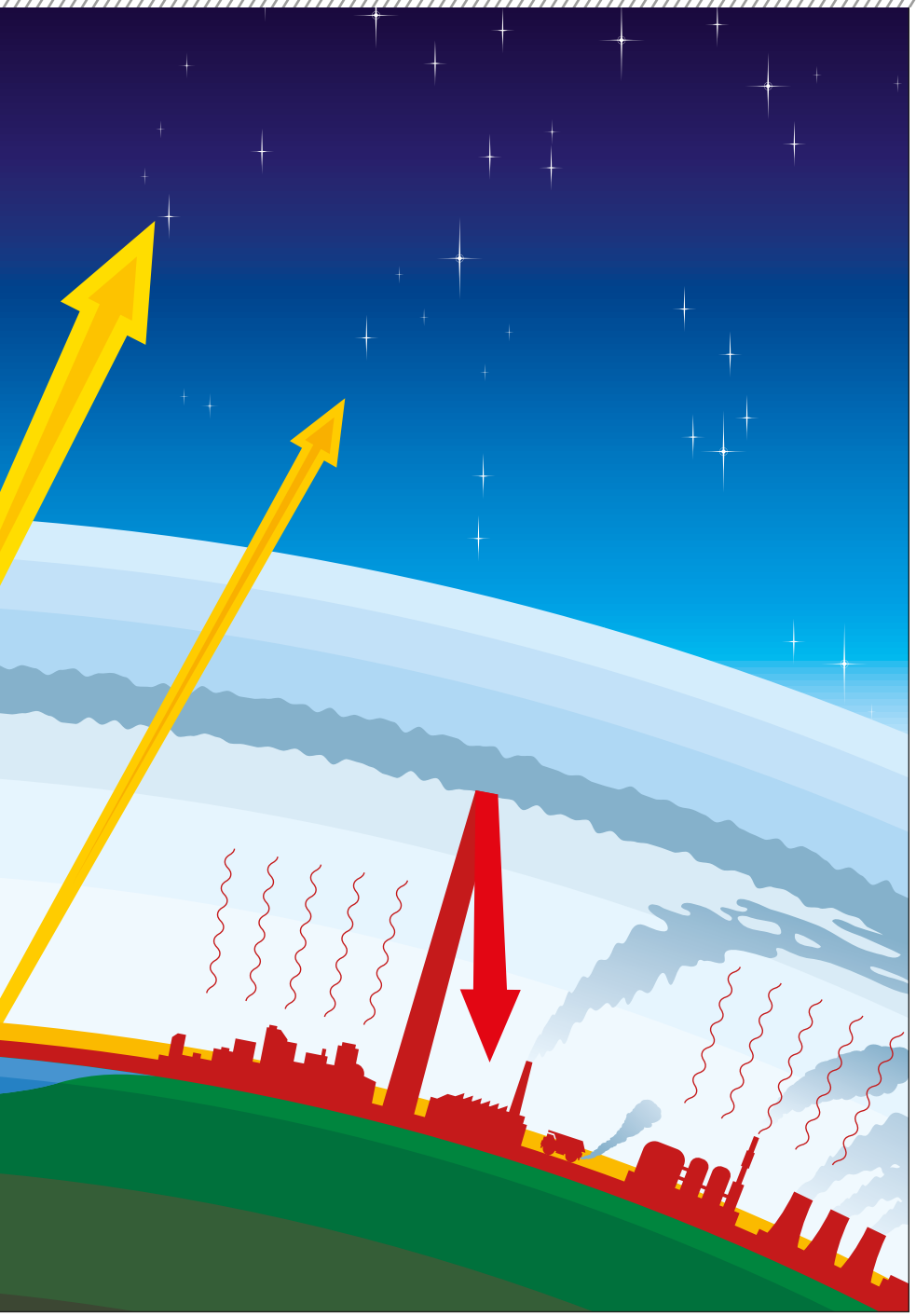
**KEY ISSUES:**

- How valves save energy
- Solutions from valve technology
- Social response of valve makers

**TAKE AWAY:** Advances in valve technology and the management of valve factories with social responsibility can save energy and reduce the effects processes have on emissions and the environment.

BY JOHN V. BALLUN, P. E.

The world may not agree on all the causes of climate change, but most people realize our actions over the last 150 years have directly contributed to greenhouse gas (GHG) buildup, most notably accumulation of carbon dioxide and methane. The concern about global warming is based on regular measurements and projections that document quantitatively how these GHGs are added to the atmosphere at a rate far faster than natural processes can remove them. Moreover, these gases are transparent when it comes to



solar radiation while absorbing infrared radiation expelled from the earth's surface. This acts like a blanket over the planet and causes the greenhouse effect, which most of the world agrees is affecting our climate.

Energy balance equations clearly reveal that the result is increased global temperatures and higher sea levels over this century.[1] The debate continues about how severe the planet's situation is, but science tells us we better take notice and take action soon.

Although the valve industry's role is not often recognized, the industry can be critical in mitigating climate change. This occurs through education of valve users on how to reduce energy consumption and how to control emissions through valve selection, advanced valve technology and modern factory management. While governments around the world contemplate various treaties and policies, the valve industry actively participates in solutions.

## ENERGY SAVINGS

Valves are vital to most fluid systems because they control and contain flow and pressure, release gases, and prevent backflow and leakage. Their ability to minimize energy consumption, thereby reducing carbon footprint, is often overlooked.

Pumping systems need significant energy to overcome the combination of the static head of the system and the friction head of the piping. The friction head is caused by roughness of the pipe's inside surface as well as local flow disturbances from fittings and valves. Although valves come in

**Table 1. Typical NPS 12 Valve Flow Coefficient Data[2]**

| TYPE OF VALVE | Control Valve | Swing Check Valve | Eccentric Plug Valve | Tilted Disc Check Valve | Butterfly Valve | Ball Valve |
|---|---|---|---|---|---|---|
| PORT SIZE | 100% | 100% | 80% | 140% | 90% | 100% |
| $C_v$ (gpm) | 1,800 | 4,200 | 4,750 | 5,400 | 6,550 | 21,500 |
| Illustration |  |  |  |  |  |  |

many varieties, they cause friction head in similar ways.

Valve body geometry dictates the general flow area through the valve. A common practice is for valves to restrict the flow area to below 80% of the pipe area. Also, the internal contours of the body and seat may be rough or contain cavities and transitions, which creates excessive turbulence. The design of the closure member is important for two reasons: First, the lowest head loss is achieved if the closure member swings or rotates out of the flow path. Second, the closure member for check valves should have contours that mean they fully open at low fluid velocities and create a smooth flow path through the valve.

Computing the head loss produced by various types of valves is normally simple—the most ubiquitous flow coefficient for valves is the $C_v$ flow coefficient, which is defined as the amount of water (in gallons per minute or gpm) that will pass through a valve with a 1 psi pressure drop. Hence, the more efficient the valve, the greater the $C_v$. Table 1 presents the flow characteristic and generic $C_v$ values for several general valve types showing that the full port ball valve has the highest $C_v$ given its full, unobstructed flow path.

To save energy, it is important to consider the head loss between types of valves; the head loss between various suppliers of a given valve type does not typically produce significant changes in system operations. This fact is also the reason piping system computer simulations accurately

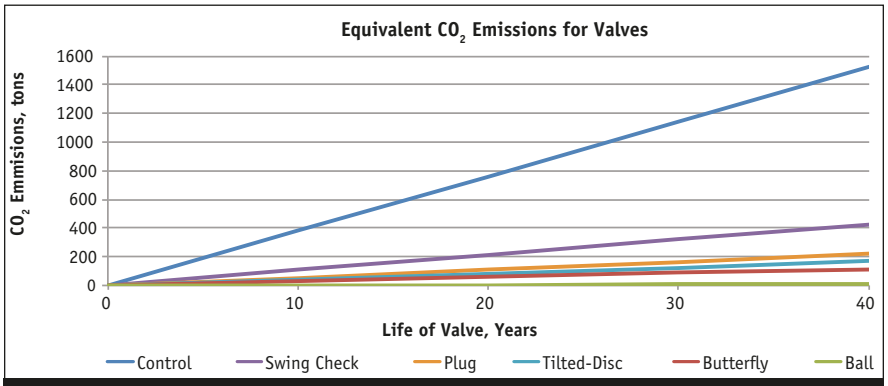



Figure 1. Valve choice has a dramatic effect on emissions.

model system behavior based on generic valve characteristics data.

The flow conditions of the system also can affect the valve head loss. In general, head loss is a function of fluid velocity squared. That means a doubling of the line velocity will increase the pipe, fitting and valve head losses four-fold. This is why pump discharge velocities are typically held to the 8- to 16-foot-per-second range, and pipeline velocities are kept to the 4- to 8-foot-per-second range. Since valve coefficients and head loss are a function of velocity, the overall cost of energy consumption versus pipe costs should be evaluated to see where there is an optimum pipe size and velocity that provides the lowest present value of installation costs plus annual operating costs.

Water and wastewater plants in the United States annually consume about 75 billion kilowatt hours (kW-hr) of energy.[3] Nearly 80% of the energy is consumed by potable water plants for high-service pumping to overcome the static head and friction losses of distribution systems. Water utilities have an opportunity to employ various energy saving strategies, including valve selection, that can result in a 20-50% reduction in energy consumption, thereby reducing operating costs.

The head loss from valves can be directly converted into an energy cost related to electrical power needed for the pumping to overcome the additional head loss from the valve, using this equation[4]:

$$A = (1.65\ Q\ \Delta H\ S_g\ C\ U) / E$$

Where:

- A = annual energy cost, dollars per year
- Q = flow rate, gallons per minute
- $\Delta H$ = head loss, feet of water
- $S_g$ = specific gravity, dimensionless (water = 1.0)
- C = cost of electricity, $/kW-hr
- U = usage, percent x 100 (1.0 equals 24 hours per day)
- E = efficiency of pump and motor set (0.80 typical)

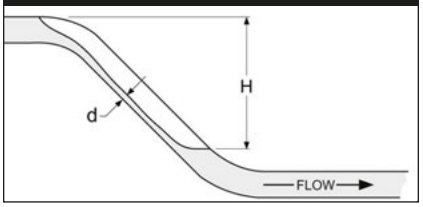
An example for a Nominal Pipe Size (NPS) 12 control valve operating at 12.7 feet per second would be:

A = (1.65 x 4500 x 14.42 x 1 x .08 x 0.5) / 0.8
= $5355 per year

If the control valve in this exam-

Figure 2. Air valves on pump discharge reduce air in pipelines in Chino, CA.

Figure 3. Head loss (H) due to an air pocket in a pipeline



ple has a 40-year life, the total energy cost will be $214,200, which could be reduced to $1,488 if a low head loss valve such as a full-port ball valve was used. What's more, larger valves handling higher flow rates consume even greater amounts of energy. This makes it clear that valve selection plays an important role in energy and cost savings.

Moreover, saving electrical energy reduces the need for burning fossil fuels, which further reduces ways to create GHGs. On a national average, for every kW-hr of electricity used, about 1.14 pounds of $CO_2$ emissions are generated. This means in the example above the use of a ball valve instead of the control valve could result in savings of 1,525 tons of $CO_2$ emissions over the 40-year life of the system (Figure 1).

## AIR RELEASE

Another family of valves important to energy conservation are air valves. Even after a pipeline is commissioned, air is continually introduced into pipelines from vertical pumps, entrained air and external connections. It often comes as a surprise to pipeline designers that the cause of a pumping system's inefficiency or stoppage can be a result of air in a pipeline because many people assume it is easier to pump air than water.

Every time a vertical pump is started, however, the air in the pump column must be expelled by the air valve mounted on top of the discharge pipe (Figure 2.) When a pipeline contains highpoints followed by descending runs, air will inevitably be trapped because of the buoyancy of the air unless the pipeline is equipped with automatic air valves. Figure 3 shows that trapped air forms a long pocket along the pipe descent with a constant depth "d". Since the air is at the same pressure along the air pocket, the head loss may be equal to the vertical height of the pocket or dimension "H".[5]

Figure 4. Tank blanketing vapor recovery regulators reduce emissions from petroleum tanks.

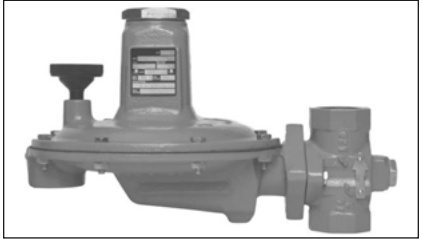


Figure 5. A technician works on a valve certified to meet new EPA emission standards.

When several highpoints in a pipeline exist, the head losses are additive. Therefore, during initial pump startup, the line can appear to be blocked because the pump cannot overcome the sum of the head losses in all of the highpoints—even at the pump shutoff pressure.

Using automatic air valves eliminates the air pocket and restores the pumping efficiency of the pipeline.

The importance of air valves cannot be overlooked. These valves not only maintain the flow efficiency of a pipeline, they also perform many other functions including surge control, corrosion prevention and vacuum protection. Their location and sizing are covered in American Water Works Association Manual M51.

## VALVE TECHNOLOGY

Not that many years ago natural gas valve actuators may have been powered by the process fluid, which consists mostly of methane. The pressurized gas was used to drive a valve actuator cylinder and then was expelled to the atmosphere. This was before GHGs were monitored and their impact fully understood. Today, we know that certain GHGs such as methane have 25 times the impact on the greenhouse effect as others such as carbon dioxide. As a result, process valves are now powered by clean gases or fluids.

A drive-by of any refinery reveals the noticeable odor of hydrocarbon fugitive gas emissions. Historically, one cause was that when tanks were filled with petroleum, the hydrocarbon-laden gases in the tank were expelled to the atmosphere through a vent valve. Technology has changed, however, and now vent valves have been replaced with vapor recovery regulating valves that automatically control the blanketing pressure over the fluid in the tank as it is filled, allowing the excess gas to flow into a vapor reclamation system.

Another cause of emissions is leakage through valve stem packing. The valve industry worked with the American Petroleum Institute (API) to develop valve packing and valve testing standards to verify that valves meet emission requirements the U.S. Environmental Protection Agency (EPA) has established. API standards now follow EPA low-emission requirements of 100 parts per million (ppm) for five years and provide testing and qualification steps for valve packing and valve assemblies at various mechanical and thermal cycles. While no valve is perfect, the valve industry is prepared to meet the requirements set for fugitive emissions to reduce effects on the environment.

Regulating fuel valves control the operation of power plants and furnaces across the country. The valve industry continually works on creating and using more precise and efficient process control technologies to conserve fuel and eliminate waste in these energy systems. Next-generation fuel

Figure 6. Specially designed ball valves (blue valve) are used to safely isolate a geothermal wellhead.

pressure regulator valve assemblies, for example, are now used for engines to maintain fuel system pressure, assure quick starts and protect fuel systems from overpressure by returning excess fuel to fuel tanks. Valves used in this service are located within the in-tank fuel pump module, and they are designed to handle customer-specific applications by determining the opening pressure and flow characteristics needed for optimum fuel system performance. By more precise control of flow rates and pressures, fuel is conserved, and engines and furnaces run more efficiently while producing lower emissions.

Finally, recent improvements in ball valve technology have allowed greater energy conservation. New materials and manufacturing processes mean ball valve seating systems have advanced greatly over the last decade. Both metal seats and resilient seating technology have been reengineered to provide low- to zero- leakage under extreme conditions. The advent of five-axis computer numeric coding machining capabilities means ball valve manufacturers can now make perfectly matching spherical ball and seat-metalized surfaces. As a result, a ball valve can be used for traditional high-temperature globe valve applications in power plants, which saves energy and reduces GHGs from the ball valve's extremely high $C_V$.[6]

Similarly, design enhancements have occurred such as a specially machined ball with recesses, which forms a raised sealing surface in both the open and closed positions. This provides self-cleaning action during operation to extend use of the valve in applications where sediment is a problem. Such valves are used on geothermal wellheads at pressures to up to 508 psi (3500 kilopascal) and temperatures reaching 500°F (260°C) with fluids consisting of moderate saline chloride brines containing total dissolved solids[7] (Figure 6). Leak-tight valves with robust integrity improve the efficiency of fluid processes and prevent the release of the process fluid to the atmosphere.

Evolving valve technology also contributes to new energy technologies. A global emphasis has been placed on new energy generation systems to mitigate climate change, including renewable energy sources such as biomass, hydroelectricity, geothermal power and nuclear power. Valve technology is following that development to support these evolving energy technologies. For example, the safe, high-performance nuclear valves available for decades are now used with new, passive nuclear plant designs and high-temperature recycling reactor waste systems to make nuclear energy generation an attractive solution.

## VALVE FACTORIES

U.S. valve manufacturers and other industries take social responsibility seriously and actively engage in activities that mitigate climate change.

Examples include using energy-efficient lighting and equipment in factories. Meanwhile, coating processes for valves have migrated from solvent-based coatings to coatings with high solids content to reduce volatile organic compounds. More advanced coatings include powder-based coatings with zero emissions such as fusion bonded epoxy (FBE).

It is now common practice for factories to sort and recycle spent materials as well. Many quality management systems require excess and scrap materials be carefully controlled, segregated, and shipped to recycling centers for reprocessing, often back into the same foundries to produce castings for new valves. Valve production also can use large volumes of water for cleaning and testing final products. Recycling systems are employed to reuse water to reduce the burden on our municipal water and wastewater systems (Figure 7).

An important focus in the valve industry is lean manufacturing practices. Lean manufacturing is not about cutting jobs, but rather improving processes to reduce waste. Many tools are employed to accomplish these goals, but all of them are designed to improve the efficiency of the overall manufacturing process.

Figure 7. Efficient equipment with recycled fluid is used to test FBE-coated valves.

## CONCLUSION

Valves not only play an important role in the function of piping systems, they also can reduce energy consumption and help mitigate the release of greenhouse gases. For example, proper selection and placement of air release valves can greatly enhance the energy efficiency of fluid systems. While it is important for purposes of efficiency to calculate the head loss and energy costs associated with valves, these energy savings also translate into a reduction in the world's carbon footprint. The valve industry has evolved rapidly with new technologies and products to help in these efforts, and it will continue to find ways to contribute to the mitigation of climate change. VM

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Refineries today use a wide variety of valves and related equipment.

# FEL The Preferred Phase for Valve Technical Definition

BY ROCKY GOH

A typical oil and gas capital project cycle consists of a process of structured stage gates that ensure activities are processed or completed in a logical sequence. Each gate serves as a verification point for deliverables and objectives to be evaluated to determine if they have been completed to a preset acceptable level before proceeding to the next stage.

This stage gate process starts with Front End Engineering Design (FEED) (Figure 1, page 27), in which Front End Loading (FEL) activities are performed before the project is sanctioned or authorized. FEL is essentially pre-project planning, starting with conceptual studies, scope development, and evaluation of project feasibility in terms of engineering and commercial aspects to determine the overall balance of risk to reward.

During FEL, when the ability to influence design changes is relatively high and the cost of changes is relatively low, discovery and understanding of strategic information can be used to reduce risk and make commitments to resources that will maximize the potential for project success. Some project teams use information gathered from FEED deliverables to facilitate final investment decision making.

## FRONT END LOADING

Well-executed FEL is increasingly important today in light of the current environment of increasing project complexity, broader scope of work and schedule-driven contracting strategies. Intensive resource loading during the early stages of a project will help to develop a technical foundation, which may include the project design basis, concept definitions and defining documents. Potential challenges are identified and resolved up front, ensuring a project can be executed smoothly during the stages of detailed engineering, construction and commissioning.


**Executive Summary**

**SUBJECT:** Valve front end loading offers many benefits to those involved in today's complex, schedule-tight world of oil and gas projects.

**KEY ISSUES:**

- Challenges of late valve engineering
- Importance of valve FEL
- The benefits of valve FEL

**TAKE-AWAY:**

It's better to engineer the valve requirements early in the process.

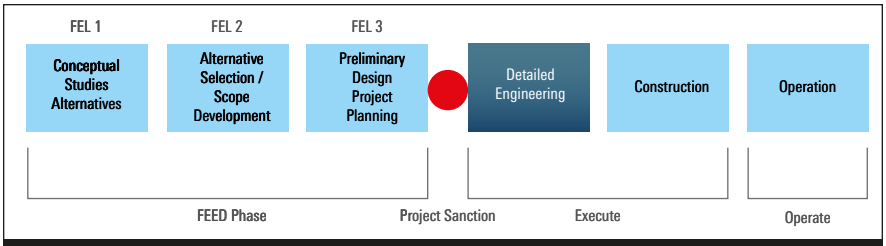



Figure 1: Stage Gate Process (Zein, 2011)

A project with compressed FEED could face challenges in detailed engineering and execution because it lacks design maturity caused by limited time available to perform full FEL. Problems that could surface from this compression include incomplete key project defining documents and undefined key project design parameters and scope. These, in turn, can lead to cost overrun and delays in overall project schedules.

## FEL IN OIL & GAS

FEL generally is applied to a project's facility and system design. Because of this, it may not be adequately implemented at the time of valve technical definition. The reason this happens might be project schedule limitations and resources that push valve technical definition to the detailed engineering stage. In such cases, the focus is often on completing project key FEED deliverables to meet contractual obligations, and most of the time, valve development is limited because that development is perceived as having minimal impact on the project. The project team may not realize that, although the short-term objectives are met in FEED, addressing valve technical issues at later stages can be detrimental to the project in the long run in terms of higher costs. Early stage interventions, on the other hand, can influence valve costs greatly, as illustrated in Figure 2.

The reason for this is that, in the early stages of a project (for Figure 2 the core activities are planning and conceptual engineering design), it is relatively easy to make changes without incurring high costs. As the project progresses, the opportunity to influence cost decreases radically at the same time costs for change increase exponentially. Addressing the valve technical definition at the detailed engineering stage is ineffective because major project technical definitions and basis have already been set so even minor changes can incur higher cost.

Valve engineering is commonly performed as part of the Detailed Engineering phase; however, considerable cost would be avoided if this occurred during the FEED phase.

## PARADIGM SHIFT FOR VALVE FEL

Introducing a paradigm shift (Figure 3), where FEL includes valve technical definition, places valve core engineering activities back to the front end. This shift can influence more timely major valve engineering decisions. It moves valve engineering changes from the traditional approach of carrying them out in the detailed engineering stage to a new approach of introducing them in the FEED stage. This paradigm shift can advance valve technical definitions to a place before the detailed engineering phase, thereby achieving a well-defined and clean valve technical request for quotation (RFQ) package. This, in turn, reduces cost overrun risk and schedule delays for the overall project.

## THE VALUE OF VALVE FEL

Valve technical definition during FEED is also crucial for reducing the potential for a large amount of rework as a project moves towards the detailed engineering stage.

By leveraging valve FEL, value can be maximized by:

- Achieving valve engineering and design optimization fit for the application (fit-for-application)
- Injecting industry best practices and lessons learned
- Achieving compliance and standardization
- Optimizing costs and reducing schedule risk

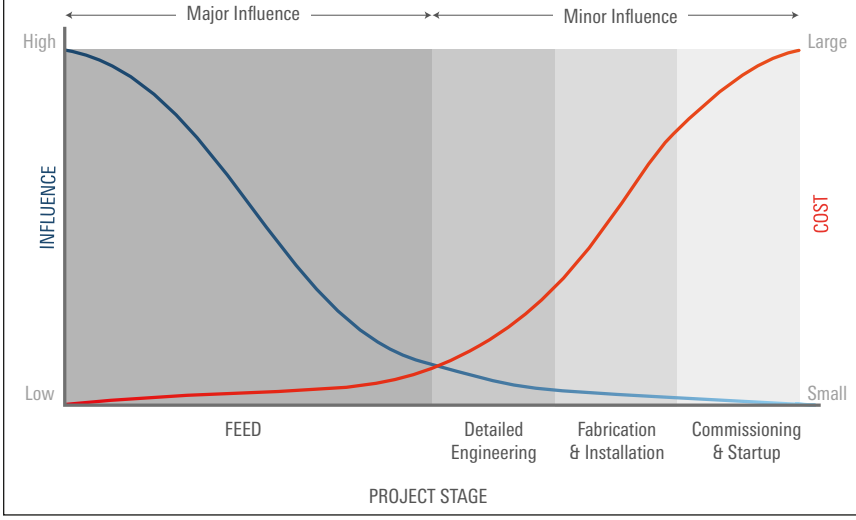
## FIT-FOR-APPLICATION/DESIGN OPTIMIZATION

Choosing the proper valve for the application has always been the key focus of procurement philosophy. This fit-for-application valve selection and design optimization also are critical for meeting overall expectations for safety, operability and availability.

To achieve these project expectations, valve requirements should undergo review to ensure that project design intent and functional expectations are met. Design intent consideration means specified valves go through compatibility evaluation to ensure they can meet the conditions to which they will be exposed. For functional requirements, valves would undergo process evaluation to see if they meet expected operation and performance needs.

Valves that do not meet project

Figure 2: Project Cost/Influence Curve (adapted from Ebert, PE, 2013)



design and operational considerations can impact project integrity through conditions such as seat and external leakage, premature material corrosion and erosion, and more. They also can impair process operability and result in ongoing system reliability and loss of efficiency.

## BEST PRACTICES AND LESSONS LEARNED

Another key element for achieving complete valve technical definition is adopting applicable lessons learned and industry best practices during the FEED stage. A highly qualified valve FEL team will have access to a wide variety of applications, cross-industry resources and best-in-class technology data on materials, designs and philosophies. This access can be leveraged into a near-real-time continuous-process improvement knowledge base. This deters mistakes, repeats of valve challenges encountered in the past, as well as more recent and emerging technical challenges. This real-time process improvement in a rapidly changing application and cost environment reduces risk, expense and schedule overruns.

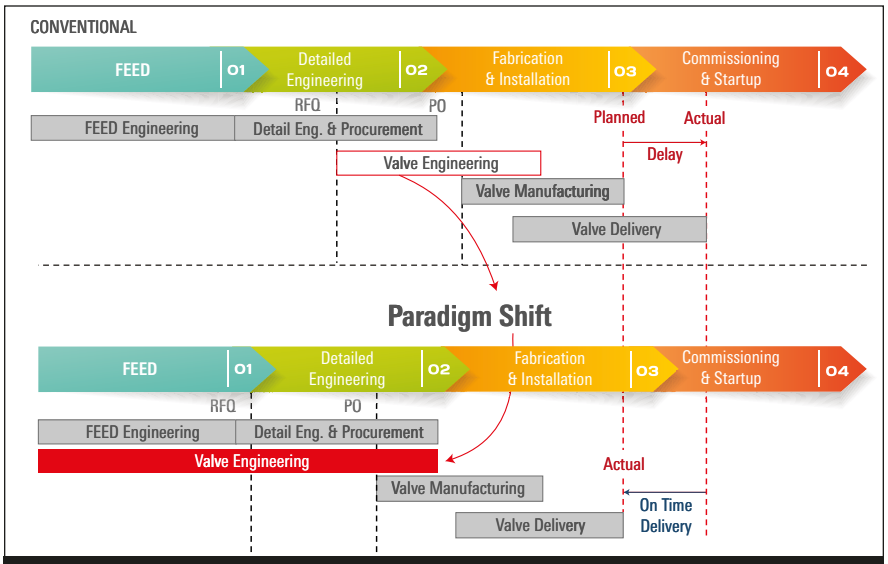



Figure 3. Paradigm shift: FEL for valve technical definitions

In practice, these process changes can be applied throughout all project execution phases. By setting fundamental guidelines early, the quality of project deliverables, the maturity of the valve technical definition and the project's schedule are all improved with less recycling of the ever-increasing volume of information. This in turn reduces administrative resource requirements and the possibility of sliding schedules. It also allows for improved future information rather than correction of past errors. Many areas can reap benefits from application of these practices such as valve engineering, quality control (testing and inspection), manufacturing operations and documentation.

As industry continues to evolve and advance, it is vital that project governance is committed to developing, capturing and maintaining the best information and practices as guidance for making sound decisions.

## COMPLIANCE AND STANDARDIZATION

Besides complying with corporate and industrial valve standards, project-specific valve requirement compliance is vital for meeting facility design intent. Because of increased project complexity and contracting strategy, engineering procurement contractors (EPCs) tend to adopt individualized practices to meet contractual commitments. These practices often are based on lessons learned from unique sets of circumstances as well as personal preferences among lead EPC managers. However, those practices may not apply with the specific project under contract—they may misalign with owner requirements or cause over- or under-specification of valves. The convergence of EPC practices with owner requirements also can lead to inconsistent, subjective interpretation of project specifications that result in time-

consuming bid clarifications as well as specification deviation.

Ultimately, when valve technical definition lacks maturity, it can lead to procurement of noncompliant valves. By obtaining valve manufacturers and subject matter expert input during the FEED stage (before the RFQ phase), compliance challenges can be identified and resolved to enhance valve quality.

In addition to compliance challenges, facility development can encounter standardization challenges, especially for a project with multiple EPCs. In most cases, this means a hodgepodge of valves and spares would be procured. This wide variety of valves creates intensive operations and maintenance (O&M) management and excessive holding of spares. Standardization is best achieved in the early project stages by aligning valve O&M philosophy with project valve selection and procurement strategy.

## COST OPTIMIZATION/REDUCED SCHEDULE RISK

Shorter engineering cycles and a compressed FEED phase can mean that most of the project execution will tend towards prioritizing major processing equipment over valves. Meanwhile, a lack of focus on valve engineering in the early phases of a project can result in overlooked valve cost optimization and identification of schedule risks.

Valve cost optimization is commonly achieved through fit-for-application selection of valve types, cost-effective material selection and purpose-driven nondestructive examination and testing. Exercising valve engineering in the early phases maximizes cost optimization results.

Valve schedule risks can be alleviated by identifying valves with long lead times (i.e., valves that require prototype development and testing) in the early stage of a project. With valve manufacturers providing realistic manufacturing lead-time information, timely risk mitigation can be exercised to ensure valve delivery does not impact the overall project development schedule.

## CONCLUSION

Valve FEL brings value to project owners and EPCs as well as manufacturers. The optimal window to perform valve engineering is during the FEED phase. FEED involvement allows major valve technical challenges to be addressed without huge cost and schedule impacts. FEED stage involvement by a valve FEL team ultimately results in a well-defined valve technical definition before the RFQ stage. VM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WHERE VALVES ARE USED

Paper pulp in a warehouse

# Valve Selection in Pulp and Paper Operations

BY TODD GREER

Over the centuries, the pulp and paper industry evolved greatly: from the first recorded paper made from rag stock in China (circa 100 AD) to paper derived from wood pulp (the 1840s) to the highly technical manufacturing and chemical processes of today. Paper use historically was for communication, but electronic channels have created significant decreases in newsprint and coated paper. However, other industry sectors emerged, and the world's growing population and modernized economies mean these new sectors, which include packaging and boxboard, tissue, toweling, diaper and personal hygiene products, among others, are flourishing.

In response to this evolution, some traditional pulp mills have converted to produce fluff pulp, which is used for personal hygiene products; others have converted to make alpha crystalline cellulose for the manufacture of rayon fiber in the textile markets. Paper machines also are being repurposed to produce tissue, toweling or boxboard predominantly from recycled fiber.

Correctly selecting valves for applications in this modern and ever-evolving industry can significantly enhance a mill's performance and increase profits (Figure 1).


## Executive Summary

**SUBJECT:** The world's paper use has changed dramatically and so have the mills and machines that produce a widening array of paper and packaging products. Knowing how to choose valves for applications in the growing industry of today can enhance performance and create profit.

**KEY ISSUES:**

- Cost and application considerations
- The different processes of mills and machines
- What valves make good choices

**TAKE-AWAY:** The right valves often are not those with lower initial costs, but rather those that provide the lowest cost of ownership over the life of the valve.

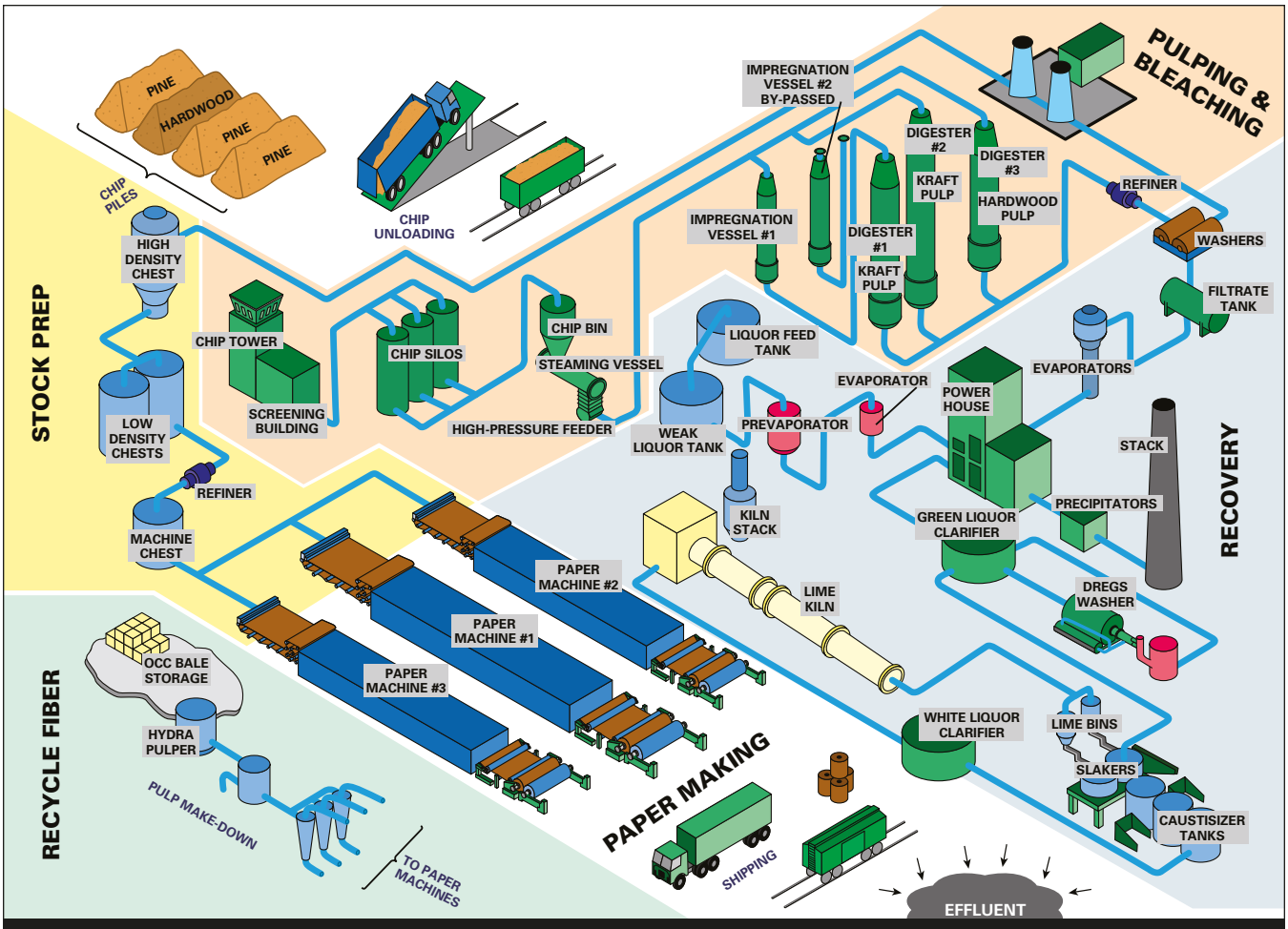


Figure 1. Diagram of a paper mill operation

## BETTER OPERATIONS/BETTER MARGINS

Continuous improvement is driven by decreasing process variability while increasing process reliability. This has a positive impact on profit margins. In the early 1990s, EnTech Control Engineering identified the fact that process variability in a control loop was often caused by control valves that were unable to respond to controller output signals quickly, precisely and in a predictable manner. This undesirable behavior was the single biggest contributor to poor control loop performance and destabilization of process operations.

Control valve manufacturers responded to this finding, and the performance of the valve/actuator/positioner package is now demonstrated by exacting quality tests. Selecting control valves with high control accuracy and reliable mechanical performance allows plants to run processes closer to their setpoint—an important factor in increasing plant efficiency and reducing running costs.

## APPLICATION CONSIDERATIONS

When evaluating a valve for any application, primary considerations are:

1. *Function:* isolation, control or mixing/diverting
2. *Process conditions:* pressure ratings, temperature range, chemical compatibility, consistency freeness and scale tendency
3. *Valve operation:* leak-free packing, seat leakage, frequency of valve operation, fluid velocity, cycle duty, speed of operation, accuracy and speed of response performance through partial stroke testing or inline diagnostic testing
4. *Maintenance and installation:* dimensions and accessibility for installation or maintenance

Safety is paramount in any mill environment, and valve selection plays a critical role. The importance of having a valve with the proper pressure rating, temperature capability and chemical resistance are obvious. Other safety considerations include the probability of packing leaks that could allow media to create slip hazards in walkways, fugitive emission constraints, ease of actuation and ergonomics associated with actuation of manual valves, and the need for double block-and-bleed associated with lockout and confined space requirements.

Also, a compatibility requirement often forgotten in the pulp and paper process is the boil-out (removal of deposits) or solvent chemistry used to remove scale buildup or biological growth in a pipeline. These chemicals are typically on the opposite end of the pH spectrum from the process media so they dissolve precipitated scale buildup. Valve materials that are compatible with the process media must also be compatible with the solvent chemistry.

For isolation valves, an important criterion is the allowable seat leakage, especially under low-pressure condi-

tions. The specification used most commonly is American National Standards Institute/Fluid Controls Institute (ANSI/FCI) 70.2. The leakage rating ranges from Class I to VI. Class IV is the most common for metal-seated valves at 0.01% of rated valve capacity ($C_v$). Class VI is common for resilient-seated valves at near-bubble tight. It is imperative that the test pressure be qualified because it is not explicitly specified in this standard.

Control valves are designed to throttle flows and typically are not required to provide bubble-tight shut off. Because seat friction is often the enemy of good control, a clearance seat can be used to reduce friction. Where control and bubble-tight shutoff are both required, a control valve and isolation valve are used in combination.

When selecting control valves, corrosion, erosion and abrasion also need to be considered. Corrosion occurs through deterioration from chemical attack. Erosion is deterioration caused by moving fluids. Abrasion occurs from mechanical contact between two materials. It is common for these three factors to happen in conjunction with each other. The higher the fluid velocity, the more likely such damage will occur. Proper valve style selection, material choices, installation procedures and system design are critical in combatting these potential pitfalls.

Cavitation is erosion that commonly affects control valves caused by a phase change of a liquid to a vapor and then back to a liquid as the fluid passes through the vena-contracta of the valve and exits downstream. Cavitation is dependent on the pressure drop ratio of the valve: valve pressure drop divided by the inlet pressure and the valve pressure recovery factor. It is largely controlled by proper valve sizing, selection and system design. Mitigating cavitation improves the life cycle of the valve and control performance. Most control valve suppliers provide free software programs for properly sizing valves for service conditions including the likelihood of cavitation.

Many mills have developed partnerships with valve manufacturers to enhance plant expertise. This requires good technical communication of process conditions between mill personnel and the manufacturer for each area of the mill—information that can be used to select the correct valves for that area. Whenever possible, the mill should provide an International Society of Automation (ISA) Valve Data sheet (Form S20.50) to specify the criteria for selecting the correct valve.

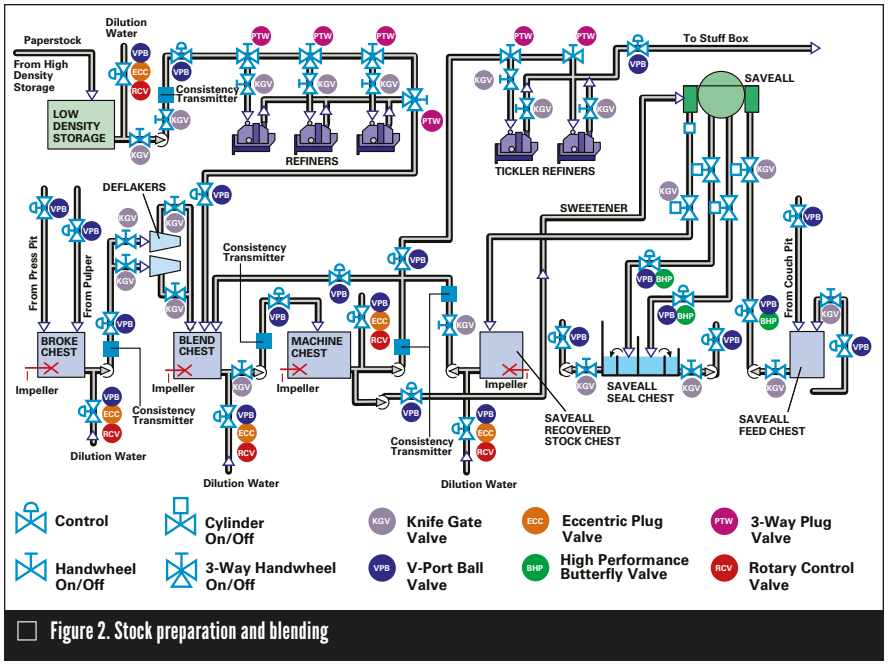


Figure 2. Stock preparation and blending

## STOCK PREPARATION

Stock preparation (Figure 2) is the interface between the pulp mill and the paper machine. In an integrated mill, stock preparation begins with high-consistency stock at the discharge of a high-density pulp storage

**Table 1. Valve Applications for Stock Preparation**

| Purpose | Valve Selection |
|---|---|
| Isolation/shutoff | knife gates, high-performance butterfly valves |
| Flow control | v-port ball |
| High consistency | o-port |
| Dilution water control | eccentric plug, v-port ball, rotary control |
| Clarifier and thickener effluent | eccentric plug |
| Abrasive media (kaolin) | rotary control |
| Refiner stock control/ mixing/diverting | 3-way or 4-way eccentric plug valves, knife gate |

chest and ends with the blended paper-making pulp furnish (the pulp and any ingredients added before it's introduced into the machine) at the machine chest. In a non-integrated mill, stock preparation starts by feeding pulp bales into a repulper system. The most common valves in the stock preparation area are knife gate valves.

For pulp slurries, the percent concentration of fiber is called stock consistency. The rate at which pulp slurry will dewater is defined by a property called freeness and is measured by Canadian Standard Freeness (CSF) points. Both stock consistency and freeness are critical application criteria in valve selection.

High-consistency pulp stock is stock in which fiber exceeds 6-8% and has a high freeness rate of more than 500 CSF points. If high-consistency stock in the pipeline is not flowing, it will dewater and inhibit a valve from closing. For this application, an o-port valve is recommended. When an o-port gate valve closes, it removes a cross section of the media in the pipeline to allow the valve to seat. When the o-port is opened, it replaces the cross section back into the pipeline.

Moderate consistency stock ranging from 2-6% with a freeness rate of less than 500 CSF points is handled best by a metal-seated knife gate valve rated for full-reverse pressure. A metal-seated valve in this service will have a longer lifecycle than an equivalent resilient-seated valve because of the rugged metal construction. Metal-seated valves also offer the advantage of not having an elastomer that can fail and color-contaminate the stock. A quarter-turn valve such as a v-port ball with a metal seat will provide a cutting action that keeps the seat face free of fiber buildup so the valve seals tightly.

For consistencies below 2% or general mill white-water applications that require bubble-tight shutoff and bidirectional service, a perimeter resilient-seated knife gate valve is the right choice for on/off service. For a quarter-turn control valve in this application, a resilient-seated v-ball or plug valve is the right selection (Table 1).

## SECONDARY FIBER REPULPING—RECYCLING

Recycled fiber is growing rapidly as an environmentally friendly and economical fiber source. Recycled paper is separated for quality and cleanliness into a multitude of grades and costs. The

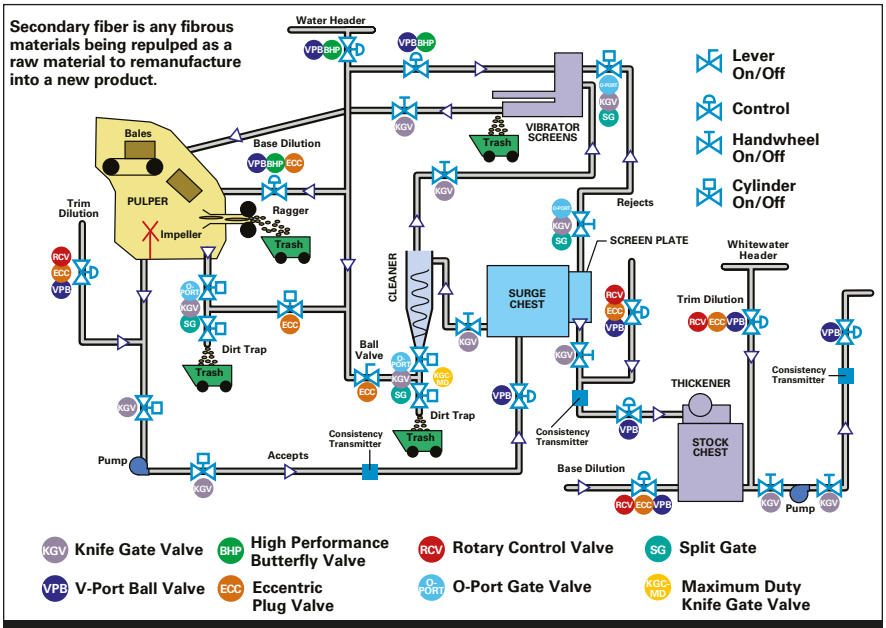


Figure 3. Secondary fiber repulping operation

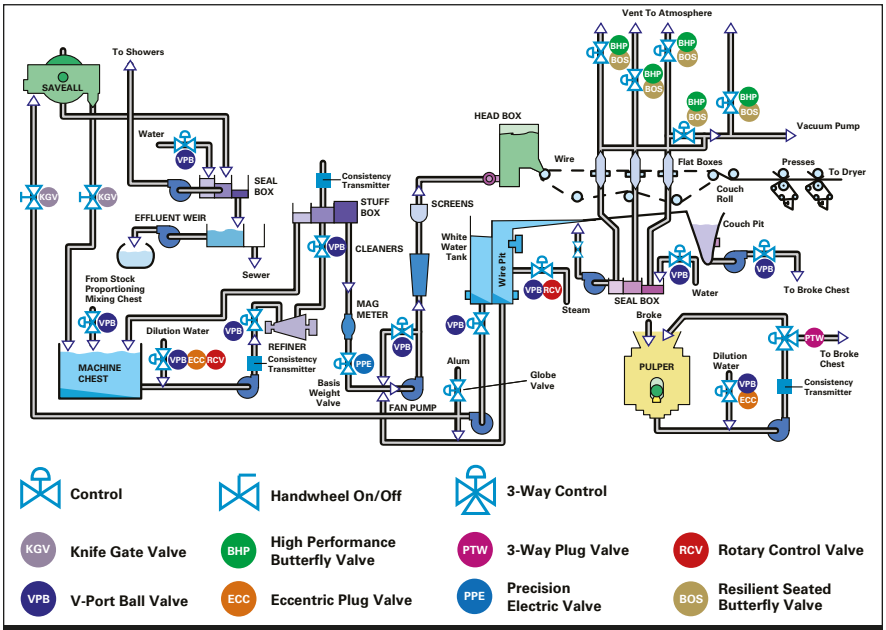


Figure 4. Fourdrinier wet end

## Table 2. Valve Applications for Paper Machines

| Purpose | Selections |
|---|---|
| Basis weight control | plug or v-port ball valve with highly precise electric actuation |
| Cleaner and pump isolation | metal-seated unidirectional and resilient-seated bidirectional knife gates |
| Flow and level control | v-port ball |
| Vacuum control | high-performance butterfly, resilient-seated butterfly |
| Tank level sensing and drains | metal-seated knife gate |
| Steam service | v-port ball, high-performance butterfly, rotary control |
| Condensate service | v-port ball, high-performance butterfly, rotary control |

most economical and highest volume of recovered material is labeled "post-consumer." It contains a high amount of contamination, and the level and variety of that contamination present unique valve selection critera.

The repulping process (Figure 3) begins as bales of recycled paper delivered to the pulper. Junk trap valves remove sand, metal, staples, glass and rocks directly off the pulper using high-density cleaners. Recycle fiber with high levels of contaminants and abrasive slurries are extremely erosive—standard stainless-steel valves can be compromised in the matter of days. As a result, valves used in this service need metallurgy that will hold up to abrasion such as heat-treating stainless steel to increase the hardness of valve seats, gates and bodies. Other choices include using chrome carbide overlays to provide a protective surface with a greatly increased Rockwell C hardness.

## PAPER MACHINE

Paper machine (Figure 4) advancements have created ever-increasing speeds, wider webs of paper and more exacting standards of quality. No valve exemplifies the importance of proper valve selection better than the most critical valve on any paper machine: the basis weight valve. If this valve fails, it will immediately shut down the paper machine.

Proper basis weight control is integral to the cost of the finished paper product and its variability. Such control is critical in machine operation uptime and can impact lost time that occurs from paper breaks caused by draw variability, retention aids, drying performance and maximum production speeds. These factors all equate directly to operating efficiency and profit.

Understanding the process parameters that lead up to the basis weight valve is important. One critical parameter is consistency, which is the additive effect of numerous control loops before the basis weight valve. Other parameters include pressure control, valve sizing and the interface into the distributed control system for loop-tuning control, a detail critical to providing exceptional basis weight control (Table 2).

## BLEACH PLANT

Cellulose fiber is inherently white. Lignin (also called wood pitch) contributes the brown color of unbleached pulp. To produce high-quality, stable paper pulps, bleaching methods use chemical process such as chlorination, alkaline extraction sodium hydroxide-based, chlorine dioxide, oxygen, hypochlorite bleach, peroxide and ozone. Bleaching is usually perfomed in sequential stages, and each stage has specific fiber and chemical considerations for properly selecting valves. Many of these processes require higher alloy metals or valves with resilient liners. Valve manufacturers offer elastomer and metallurgical chemical compatibility tables for corrosive materials to aid in proper selection.

## PULPING

Pulping involves steaming wood chips to soften them and then either physically grinding or chemically dissolving the chips into pulp. Quarter-turn valves such as v-port ball or rotary control valves with hardened trim are well suited for the steam and chemical-handling applications of the pulping operation (Table 3).

## DIGESTERS

A batch digester is essentially an industrial pressure cooker filled with wood chips and liquor. Most batch units are now equipped with an automatic capping valve—the most popular are ball valves—but knife gates can be used as well. The bottom of the digester has a blow valve to hold pressure.

Batch digesters can either be sulfate chemistry (referred to as kraft pulping) or sulfite pulping. Valve selection for these processes is affected by the fact that kraft pulping is an alkaline process (high pH), and sulfite pulping is an acidic process (low pH).

Continuous digesters use a heated, pressurized chamber that retains wood chips at sufficient temperatures and time for the chemical reaction to dissolve the lignin bonding the fibers. The predominant valve used around the digester is a rotary dual metal-seated valve for both continuous and batch digesting.

**Table 3. Valve Applications for Pulping**

| Purpose | Selections |
|---|---|
| Steam impregnation | v-port ball with hardened trim, rotary control |
| Steam venting | v-port ball with hardened trim, rotary control |
| Flow & pressure control | v-port ball, rotary control |
| Dilution water for consistency control | eccentric plug, v-port ball, rotary control |

☐ V-port valves can provide highly accurate control of paper stock.

## CHEMICAL RECOVERY

From the blow tank, pulp fiber is separated from spent cooking liquor in brown stock washers and sent to the bleach plant. Recovery of chemicals from the spent cooking liquor and incineration of the organic residuals (lignin) starts with weak black liquor from the brown stock washers and follows this process:

1. Evaporation to concentrate black liquor
2. Incineration of black liquor in a recovery boiler
3. Dissolving inert chemicals to form green liquor
4. Causticizing green liquor with lime to form white liquor
5. Burning lime mud in a kiln to reconstitute the lime for the causticizing process
6. Returning white liquor to the digester for chip pulping

Valves operating in severe service conditions such as pulping liquors, abrasive slurries and scaling media require special design criteria to perform reliably and handle the challenges. Valve selection should include consideration of design features as well as metallurgy, wetted trim requirements and abrasion resistance.

In high-scaling applications such as green liquor, full-ported ball valves are preferable. Ball valves limit the surface area available for scale buildup, and the seat designs will scrape the ball clean through the 90-degree actuation rotation before seating, which provides tight shutoff. O-port valves are an alternative when the seating surface of the gate can be cleaned by using a scraper.

For control valves, plating wetted trim components with tungsten carbide provides a barrier surface. Ceramic trim is an option, especially for smaller control valve applications on abrasive slurry service such as calcium carbonate or titanium dioxide.

## CONCLUSION

The pulp and paper industry has experienced significant changes in the last 20 years that have made selecting valves providing maximum performance and lowest cost an important strategy. Selecting the proper valve for each area of the mill requires technical capability and in-depth process knowledge. Although that selection may not have the lowest initial cost, it should be the valve that has the lowest total cost of ownership over the valve's life. VM

*EDITOR'S NOTE: Pulp and paper plants use many types of valves. This article provides an overview of some common valve styles and where they are used. It is not meant to be all-inclusive.*

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# The Challenges of Slurry Valve Packing

BY CAMERON RAPOPORT

Because of the difficulties of dealing with slurry as a medium, the equipment assigned to move it along faces many challenges. One that gets lost among a host of others for slurry valves is packing. While packing-less valves (such as pinch valves) exist, most valves have a stuffing box and need packing to create a seal against the stem or gate. Proper packing selection, failure analysis and installation procedures are critical to the leak-free operation of valves.

Packing life is affected by many factors; however, the main failure in slurry service packing is solids that embed into the packing, creating leak paths and damaging the fibers. The solids start to tear up the packing. But also, the packing itself squeezes the solids against the sealing surface, causing wear to the stem. This is especially prevalent in rising-stem valves, which make up the majority of valves in slurry service.

Even though these solids end up being the final cause of packing failure, the root cause is best determined through inspection of the failed packing and valve. Those who do that inspection should be looking at:

- ***Temperature issues***—Although it seems obvious that packing should be selected to be compatible with the temperatures of the application, it doesn't always happen. Signs of burning or glazing, especially on the lower rings, can be indicators of excessive temperature.
- ***Chemical compatibility***—Slurries, especially in the ore processing and chemical industries, contain corrosive or aggressive chemicals. Signs of chemical attack often are either a hardening or softening of the packing. Chemical attack can also result in discoloration of the yarn. The packing should be compatible with any chemicals in use, including ones that may be used to clean equipment in between batches.
- ***Extrusion***—The bottom ring should be checked for signs of extrusion past the throat of the stuffing box, and the top ring should be checked for extrusion around the gland nose. Extrusion could be the result of poor design, tolerances or wear over time. Extrusion out of the bottom of the stuffing box can be addressed with a bushing, and extrusion around the gland can be remedied with a new, tighter tolerance gland.
- ***Abrasion***—If the media is physically attacking the packing, a wiper ring at the bottom of the stuffing box should be considered. This can be either a very tough packing such as a para-aramid fiber ring or a polymer lip seal. A wiper is always recommended in media that tend to develop a scale, such as lime slurry. Manufacturers also are making packing that combines a tough, resilient material with a softer material for better sealing capabilities.

Knife gate valves are cleaned prior to repair and repacking.

## VALVE INSPECTION

Slurry valves need inspection, especially when multiple packing failures have occurred. Some factors to consider include:

- ***Inspect all of stem/gate***—The valve should be all the way open to inspect the entire stem/gate. Look for burrs or scaling that could potentially damage the packing as the valve actuates or any axial scoring that would open easy leak paths. Inspect for evidence of metal-to-metal contact.
- ***Inspect the gland***—The gland should be able to freely enter the stuffing box all the way. Note whether the gland nose is less than one packing cross section high. If so, it will limit the ability to adjust the packing as it consolidates. When this is the case, consider purchasing a gland with a longer nose.
- ***Stem concentricity/movement***—Measure the stem's distance from the bore of the stuffing box in several locations to ensure it is concentric. Fully actuate the valve, stopping to measure several times to ensure the stem remains concentric through the entire cycle. Keep in mind that in gate valves, seats are often misaligned, causing radial shaft movement when the valve closes.
- ***Deep stuffing boxes***—While it may seem logical that more packing rings would create a better seal, excessively deep stuffing boxes that require six or more packing rings can create unnecessary issues. This is because all packing consolidates over time, and more packing rings will lead to more consolidation and require more frequent gland adjustments. Testing has also shown that very little gland load is transferred beyond five rings, so deeper rings will not expand to create a seal. Testing has shown that four to six packing rings is optimal. Deep stuffing boxes can be fitted with a split carbon or bronze bushing.
- ***Knife-gate valve issues***—Knife gates are some of the most common valves used in slurry serv-

This gate valve leaks on the upstroke and downstroke, which will cause corrosion issues from leaked fluid.

ice. While some knife gates seal on the valve stem with a standard cylindrical stuffing box, many seal on the gate with a rectangular stuffing box. Packing can have trouble conforming around the sharp corners of the gate; the large sealing surface gives more opportunities for leak paths to form. In this case, more pliable packing may be needed. Using a knife gate that seals on the gate for any service where leakage cannot be tolerated, such as toxic or otherwise dangerous media, is not recommended.

Knife gates on vertical pipes are often mounted horizontally. (If clearance around the pipe allows, it may be best to mount the knife gate vertically.) Horizontal mounting causes the weight of the gate to over-compress one side of the packing and under-compress the other, resulting in leakage. In this case, consulting the manufacturer on how to better support both the gate and valve to keep it aligned is recommended.

☐ Bad stem and packing

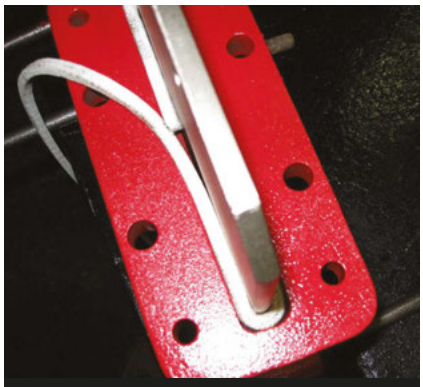
## INSTALLATION

Installation procedures are vital to the life of the packing, especially in slurry service where initial solids embedment can occur with poor installation practices. This can significantly decrease the life of the packing and increase the likelihood of damaging the sealing surface.

- ***Cutting the rings***—Using skive cut rings (a 45-degree cut) for slurry service is recommended to make it more difficult for solids to get into the cut. Using a sharp knife and avoiding too much back-and-forth sawing also is extremely important to make the cut as clean as possible. The cut

is the weak point in a packing ring so it's worth the extra time and effort to make it as strong as possible. Cut rings also should always be checked against the stem, gate or a mandrel for fit. Many manufacturers offer pre-cut rings, which can reduce operator error.

- ***Installing the rings***—Every ring should be tamped snugly into place, especially the bottom ring. If that bottom ring is not tamped firmly into place, the gland will not necessarily move the ring into position before startup. If solids penetrate the packing set before the rings settle into position, the life of the packing is drastically reduced. The splits should be rotated 90 degrees between each ring, unless the installation is on a knife gate valve that seals on the gate. In that case, splits can be rotated 180 degrees.
- ***Tightening the gland***—First, ensure the nut can freely travel along the threads of the bolt, and that the threads are free of corrosion/burrs. Alternately, tighten the gland bolts to compress the packing evenly. The packing manufacturer should be consulted for information on gland bolt torque, noting whether that manufacturer specifies a torque with or without anti-seize. A best practice is to always use a high-quality anti-seize on valve gland bolts.



☐ Packing here does not fill the stuffing box completely around the knife gate corners.

- ***A note on control valves and critical valves***—Control valves present a more difficult sealing application because they are actuated far more frequently than a typical block or on/off valve. Valves also should be ranked by criticality based on temperature, pressure, the media they are sealing and the consequences of packing failure. For these valves, pre-consolidating the packing by actuating the valve several times might be considered, then retightening the gland. This process should continue until the gland is not noticeably looser after actuation. For better results, a calibrated torque wrench should be used. On "bad actor" or particularly critical valves, disc springs under the gland bolts can be used to better maintain load on the packing set as it consolidates.

In conclusion, slurry valves are a difficult environment for packing to seal. However, proper packing selection, failure analysis and installation can drastically affect success. VM

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# Q: There is a new version of NACE [NACE International] MR0103 called NACE MR0103/ISO 17945. How do the requirements in this International Organization for Standards (ISO) document differ from those in the previous version?

BY NICHOLAS ROHRDANZ

**A:** Following in the footsteps of MR0175/ISO 15156, MR0103/ISO 17945 was released in 2016. This new version replaced the 2012 version of MR0103. Too many small changes to the wording were made to comprehensively describe in one column; however, a brief overview of key changes is provided here.

Some of the most visible changes were to the format of the document; the numbering and layout conventions were changed to conform to ISO style. Several sections were added to the beginning of the ISO version, including normative references, terms and definitions, and symbols and abbreviated terms. As a result, paragraph numbers from the previous MR0103 will not reference the same clauses in the ISO version.

Most of the technical requirements (environmental conditions, hardness, composition, heat treatment, microstructure, etc.) of MR0103-2012 have been transferred over to MR0103/ISO 17945 without change. Two major exceptions are Appendices C and D of MR0103-2012. Non-mandatory Appendix D, Duplex Stainless Steel Welding Consideration, was dropped from the standard entirely in the ISO version. Mandatory Appendix C (Annex C in the ISO version), which deals with welding procedure qualification hardness survey layouts, has been extensively rewritten as outlined below.

A clause was added to Annex C in MR0103/ISO 17945 to address when temper bead technique is used for weld qualifications. This clause directs the user to the hardness testing survey requirements for temper-bead qualifications described in ASME [American Society of Mechanical Engineers] Boiler & Pressure Vessel Code Section IX.

The hardness survey line locations and indentation locations have been changed for all the figures in Annex C, placing a greater emphasis on the heat-affected zone (HAZ) and weld metal immediately adjacent to the fusion line on the toes of the weld at both the cap and the root.

In addition to changes in the location and number of indentations required for butt, fillet and overlay weld qualification hardness surveys, MR0103/ISO 17945 Annex C also added a figure for partial penetration welds and a figure for special repair weld qualifications that may be used when deemed necessary.

MR0103/ISO 17945 Annex C makes an allowance for hardness surveys performed on prior welding procedure qualifications. MR0103/ISO 17945 allows hardness surveys performed in accordance with MR0175/ISO 15156 before 2009 for carbon steel and before 2011 for all other materials requiring hardness surveys. Hardness surveys performed in accordance with MR0103 or NACE SP0472 prior to the release of MR0103/ISO 17945 also do not have to be redone.

In summary, users of MR0103/ISO 17945 will find that the technical requirements remain largely unchanged, but documentation may need to be updated to reflect the new paragraph numbers. Existing weld procedure qualification hardness surveys can be used without modification but new hardness surveys will need to follow the new hardness survey figures in Annex C. Please refer to the standards for more detailed review of the modifications. VM

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# Video Game Technology Changing the Offshore Industry

BY KATE KUNKEL

One of the most powerful innovations in training staff for offshore oil rigs was developed thanks to the video game industry. Virtual reality, also known as augmented 3D training, has been used by companies such as BP, Shell and others with great success not just for training new personnel, but also for reducing maintenance expenses and increasing safety.

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Everyone involved in a project can virtually walk through a realistic 3D model of a facility that is still in the planning stages or virtually conduct maintenance and repair before going onsite.

## TRAINING

While on-the-job training for onshore oil and gas carries its own set of challenges, offshore platforms can be dangerous places to learn. It's also expensive to transport and house trainees on a platform while the training is occurring. This relatively new modality makes it possible for recruits to supplement traditional learning methods such as classroom lectures, reading and quizzes with first-person-perspective 3D virtual reality technology exercises. Since many new recruits are millennials who have grown up gaming on increasingly sophisticated systems, the technology is a natural, intuitive way to learn.

Companies such as Program-Ace, Aveva and Siemens have developed interactive 3D solutions that are available off-the-shelf or in completely customized formats. Programs can take trainees right from the first view of a rig as they fly in a helicopter to the site through drilling operations or operating equipment, including valves and actuators on a particular rig. Staff members are also trained to handle accidents, including evacuating in emergency situations.

Virtual environments can be created so precisely they reflect every detail of the rig. Users can virtually perform everything from a simple inspection patrol to vital maintenance work on malfunctioning controls or drilling equipment. The virtual environments, which are constructed entirely from clients' own 3D designs, allow multiple avatars to interact with each another as well as with the various pieces of equipment that would be on a real rig.

Since many new recruits are millennials who have grown up gaming on increasingly sophisticated systems, the technology is a natural, intuitive way to learn.

This ability to interact is especially important because the teams on rigs constantly change. Additionally, the technological complexity of equipment on these rigs means the ability to virtually update operational details goes far toward ensuring that training is always up to date for each recruit. In other words, when a valve is replaced on the physical rig, that information is input into the simulation software, and all data including maintenance records is available while virtual training or maintenance is occurring.

Training also can be done before a rig is actually built so that when it's ready, operators are already accustomed to the environment and have "hands-on" training to ensure safe and efficient operation. Using detailed engineering plans, platform simulators can be adjusted to the needs and peculiarities of each platform even as changes are happening during construction.

Several studies have shown that such immersive training courses are highly effective and trainees are much more likely to remember actions they have performed themselves than those taught in classrooms or shown in videos.

## MAINTENANCE AND SAFETY PROCEDURES

Another huge advantage of virtual or augmented reality is that maintenance can be planned and conducted from a remote location, increasing profitability and reducing potential for safety issues. This is accomplished because the operator has already experienced situations before conducting the activities on the rig.

Current plant data can be accessed from the cloud or through proprietary systems and be used for maintenance that can be carried out through immersive operator training. Participants can move freely throughout the virtual environment, talk to one another and work together on a variety of scenarios. By using 3D simulation-based systems,

CONTINUED ON PAGE 48

# Relevance in a Digital Age

BY KATE KUNKEL

The distribution model of the past 50 years is changing rapidly thanks in part to the digital revolution. Joseph Nettemeyer, president and CEO of Valin Corporation, says that means distributors must find ways to add more value to solutions offered to customers. It also means they must become digital experts in communication and in the transfer of information.

Nettemeyer

Today, "We are used to getting information instantly in our lives," Nettemeyer said in a recent interview. This is true not only for the Millennial Generation, but for everyone, he added, referring to the "ask Siri" phenomenon of smart phones. The expectation that we can ask and get data immediately has transferred to the industrial marketplace, he said.

"Companies that are complacent, thinking they can do business the way they've done it the last 30 years are going to be irrelevant," Nettemeyer warned. For distributors, the situation requires that data coming into their systems is consistent so that it's easy to automate and send back out. "You can't have three different ways to say one thing. It causes problems with finding information," he said. A change as simple as switching a colon to a semi-colon can corrupt processing and complicate the picture, he explained.

Data also must be "normalized," which means it must be organized using relational databases, and it must be easily searchable. Such changes cost a lot to implement and take added labor, "but it is absolutely necessary. There has to be a seamless connection of information leading to the answers buyers need," he said.

This instant, searchable database replaces a world in which manufacturers, distributors and customers had islands of data that wasn't cross-referenced. In contrast, customers today expect answers within 24 hours of the first online click, he said.

## WHAT THAT MEANS

Nettemeyer said Amazon.com has redefined the buying experience for many things. They've been able to accomplish this not through staffing, but rather through software, he pointed out.

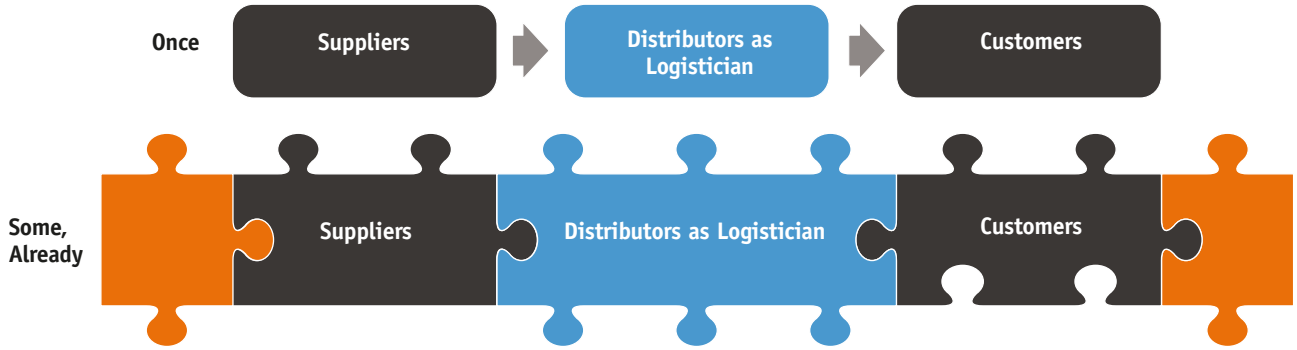
"People today are used to doing their purchasing research for anything online and having all relevant information at their fingertips," he said.

Part of the problem with how that translates to the industrial world is that the data for suppliers and distributors is not set up in a fashion that makes it possible to research and purchase the way buyers now expect, he said.

That will have to change.

The call for normalization of data means manufacturers must re-define the metrics of what they measure to focus on creating a customer experience. They have to stop focusing so much on the product and start focusing on "the experience of purchasing the product," he said. Unfortunately for companies used to doing business the old way, that also means looking at branding differently.

### The Changing Role of the Distributor




Partners link upstream and downstream to unlock new value; software migrates from record-keeping to experience.

"Amazon is out to maximize the experience and maximize their transaction profitability," he said. Distributors that are more used to focusing on branding "must now add value to the products to be relevant and to excel," he said.

"You have three seconds to grab someone's attention," and about two minutes to close the sale. "How are you making that easy for someone who is making the decisions?" he asked.

The 50-year-old strategy that focused on product features and benefits is simply no longer relevant, he said. In today's markets, many customers have already decided what to buy before they approach the purchasing process, which compares to just a decade ago when a business customer would call distributors and manufacturers to request more technical information so they could specify a product. "As a result," said Nettemeyer, "One million B2B [business to business] sales reps will lose their jobs to e-commerce by 2020—22% of the 4.5 million U.S.-based B2B sales agents will be gone," he said.

## COLLECTING DATA

Successful businesses will learn to gather information quickly and act on it, creating a speedy purchasing process while adding value into products, logistics services and wrap-around offerings, Nettemeyer said.

"The control is no longer with the sales reps. The buyers are taking control since they are doing their research online," he said.

As a result, customers should have easy access to price and availability from suppliers on the digital platform so that they don't have to chase information.

Meanwhile, all product brands are at risk in the next 10 years, he said.

"What makes you think that just because you have a good brand, it's going to stay that way?" Nettemeyer challenged. Unless a patented technology is involved, many brands can be usurped.

Brands won't go away, but to survive and thrive in this environment, those brands must be accompanied by digital savvy; the products must solve problems; and the companies must define themselves.

"You must also have a channel strategy," Nettemeyer said. "The dumbest guy in the room is the one who focuses on market price. We all have the same discounts, so that cannot be your strategy," he said.

Nettemeyer admitted that becoming a digital company is a learning process that requires redesigning the whole business to be able to communicate digitally with not just customers, but also with the supply chain. The information must flow seamlessly in all directions. To make that happen, companies must:

- Normalize all data
- Build a strong digital interface (website) with good content
- Ensure seamless information transfer; the distributor and customer do not want to chase information.

Companies also must offer service that is top-notch: If a customer needs a special lead time on a valve, for example, it has to be delivered right away, not in several days.

"Service is expected," Nettemeyer said, at the same time it's subject to different interpretations. As a result, companies must look inward at how they handle things.

While it's important to think outside the box, our perception of the "box" needs to change, Nettemeyer said.

"How are you measuring yourself against the expectations?" he challenged. He recommended customer satisfaction surveys to ensure continuous monitoring of what makes a good experience.

To truly thrive, it is important to remember that:

- Status quo is the enemy.
- Relevance is the new mandate.
- We own our future; if not us, who?

"Take a moment of self-reflection, look at yourself in the mirror every night and ask yourself if you did your best," he said. "That's the challenge for all of us." VM

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  www.xomox.com
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**DFT Inc.**
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www.dft-valves.com

**Elliott Manufacturing**
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  www.emersonprocess.com/eim
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  www.fisher.com
- **TopWorx**
  Louisville, KY
  www.topworx.com
- **Valve Automation Division - Bettis**
  Houston
  www.emersonprocess.com/bettis

**Everlasting Valve Company, Inc.**
South Plainfield, NJ
www.everlastingvalveusa.com

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- **Flowserve Durco, Automax, Worcester**
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**Forum Energy Technologies - Valve Solutions**
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www.f-e-t.com

**Franklin Valve LP**
Houston
www.franklinvalve.com

**GE Oil & Gas**
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**Hunt Valve**
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**Indelac Controls, Inc.**
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www.indelac.com

**ITT Engineered Valves**
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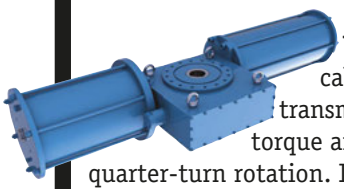
**GE Oil & Gas** and BP announced start-up of Plant Operations Advisor (POA), a new digital solution designed to improve the efficiency, reliability and safety of BP's oil and gas production operations. POA rapidly integrates operational data from producing oil and gas facilities to deliver notifications and analytical reports to engineers so they can identify operational performance issues before they become significant.



**Velan ABV's** new patent-protected cable drive actuator benefits from a transmission system with constant torque and high accuracy along the entire quarter-turn rotation. Its modular construction comprises a center body, pneumatic or hydraulic power cylinder and a spring cartridge for emergency action. The newly designed center body with its innovative cable drive system separates it from the standard scotch yoke actuator.

**Spirax Sarco** released the TD46M range of ASME 600 thermodynamic steam traps, which includes the UTDS46M, TDS46M and TDC46M. These traps offer a robust solution for medium-pressure applications where venting air quickly during start-up and reducing warm-up time is required.

The maintainable internals allow end users to repair the traps as an alternative to replacement thereby reducing the total cost of ownership.

**AUMA** SA multi-turn actuators for continuous underwater use offers new application possibilities for electric actuators: for water supply, in hydropower plants, in civil engineering constructions for water applications, and for specific underwater applications.

A universal sealing system is combined with comprehensive corrosion protection, double-sealed cable glands at the electrical connection, inner seals on all housing covers and a one-piece solid shaft.

**Cowan Dynamics** announced availability of E2H Series Electro-Hydraulic linear valve actuators for artic service. Rated down to -50°C (-122°F), the E2H has been designed to pack high performance into the smallest possible installation envelope. All hydraulic components and sensors are integrated into a single compact manifold block that also houses the actuator and integral oil reservoir.

**Metso's** PlantTriage gathers process data from many different control systems and thousands of control loops. For increased security, PlantTriage Version 13 contains several cybersecurity enhancements. Integration with Microsoft Windows Authentication allows administrators to manage network security seamlessly.


**Rotork** RI Wireless is a new concept for wireless valve monitoring and diagnostics. It transmits real-time position indication to the control room and enables predictive maintenance for actuated valves, delivering capital and operating expenditure reduction, increased safety and increased productivity.

Designed for new and existing plants in the process industries and utilities.

**Mueller Co.** has introduced a line-stopping solution designed specifically for polyethylene (PE) pipes distributing natural gas. The Shur Stop PE Line Stopping System incorporates Mueller Co.'s NO-BLO technology providing leak-free performance. It increases the safety of utility workers by giving them complete control of natural gas flow during stop off.

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## EDUCATION & TRAINING CONTINUED FROM P. 41

engineers can develop precise, detailed plans so they can execute work correctly from the outsight by going through various scenarios virtually before attempting work on the actual equipment. This lowers the risk of mistakes, delays and reworking, and increases overall performance for operations and maintenance procedures.

Mandatory training for workers and subcontractors a few weeks a year is common in the offshore industry even though rigs are accessible only by helicopter or boat. Meanwhile, teams of crews are generally replaced every six weeks. That means transportation is a huge expense for the industry. Since on-site training is expensive and disruptive to routine work, conducting training exercises off site while the crews are on land is common. However, off-site mock-ups are expensive to construct and often do not realistically replicate the real-world scenarios on the job. Thus, many companies are turning to virtual reality for supplemental operational and safety training for seasoned workers as well as new employees.

Fires, gas leaks or accidents can be simulated so that operators are fully prepared and trained to deal with them should they happen. Siemens gave an example of the value of this type of training by citing the scenario of a leaky pipe on a production platform that catches fire. With intense heat and dense black smoke, a crew would have only seconds to respond. Inexperience in situations like these can be deadly, but with virtual 3D training, technicians have "experienced" such scenarios already so they can respond precisely as needed to avert disaster.

### SUMMARY

Platform operators naturally want to reduce downtime and save money on transportation and training costs. With virtual reality making it possible for technicians to operate processes and handle emergencies more efficiently and safely, there is little doubt that 3D, virtual and augmented reality may become a standard for training offshore personnel. VM

KATE KUNKEL is senior editor of VALVE Magazine.


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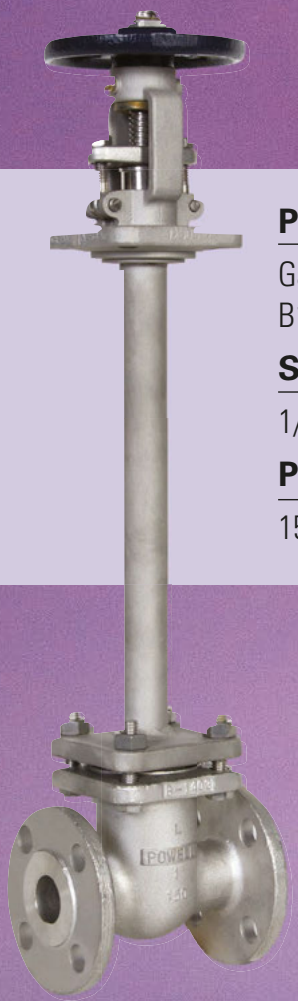

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