VMA LAUNCHES VALVE CAREERS PROGRAM

VALVE

MAGAZINE | SPRING 2015 | VOL. 27, NO. 2

Heavy Oil

3D PRINTING GAINS MOMENTUM

RESTORING POWER AFTER SANDY

WHAT IS A SURPLUS VALVE?

THE BASICS OF PACKING

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- Gate Valves Over 2,000 Cycles
- Globe Valves Over 5,000 Cycles

Cycle Life Testing of Forged Design Valves per API 602:

Gate & Globe, Bolted Bonnet, Forged Steel Designs

- Gate Valves Over 2,000 Cycles
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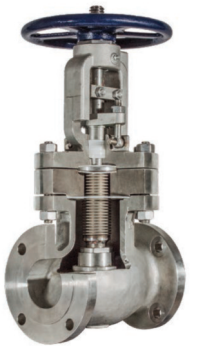

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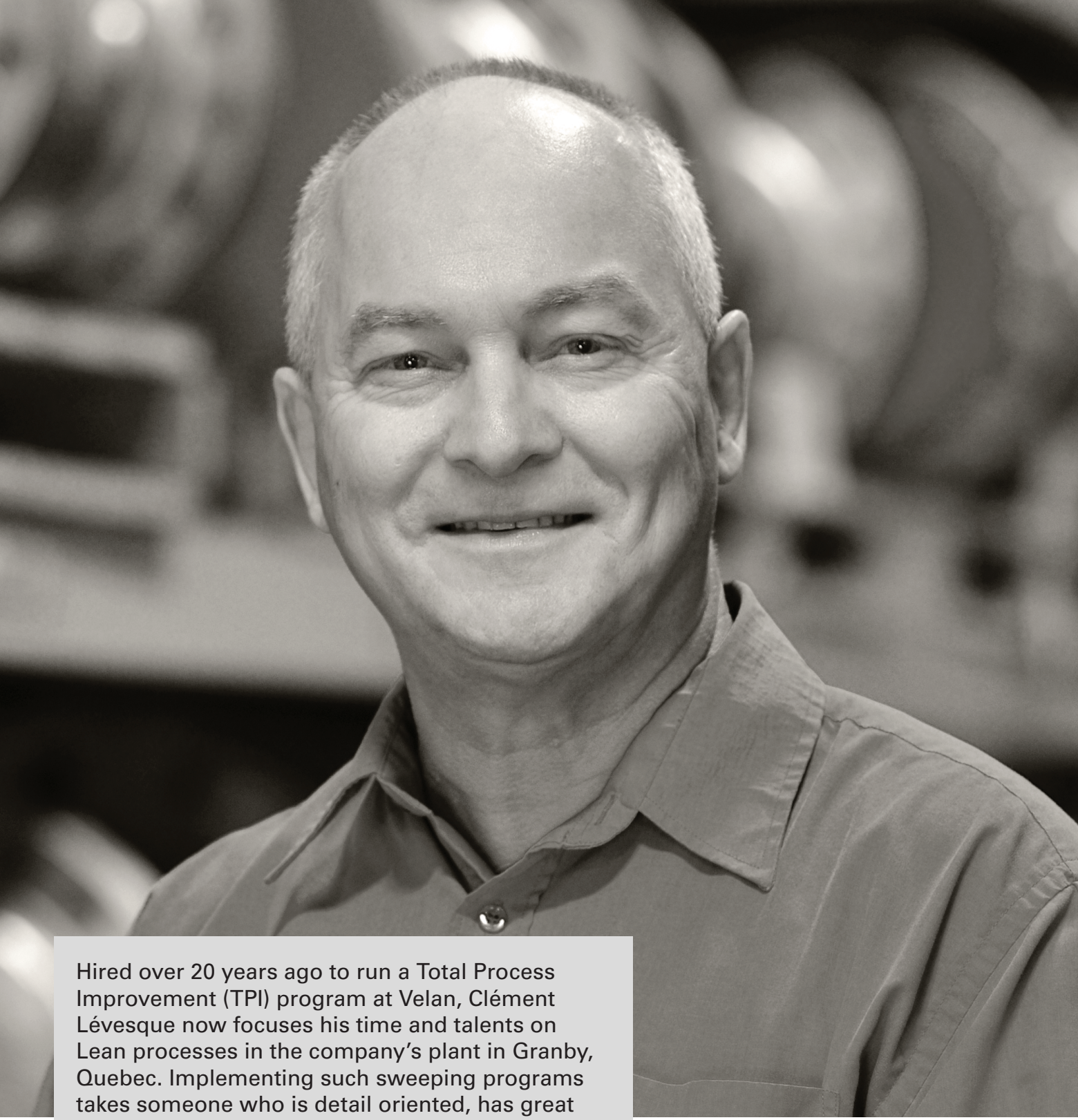

Hired over 20 years ago to run a Total Process Improvement (TPI) program at Velan, Clément Lévesque now focuses his time and talents on Lean processes in the company's plant in Granby, Quebec. Implementing such sweeping programs takes someone who is detail oriented, has great training skills, and knows how to connect with fellow employees. Clément has these qualities in spades.

What you might not know about Clément is that he's also an accomplished guitar player who toured for almost ten years as part of a rock band called Lightning.

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VELAN

VALVE MAGAZINE
SPRING 2015 | VOL. 27, NO 2

VALVE MAGAZINE

www.VALVEmagazine.com

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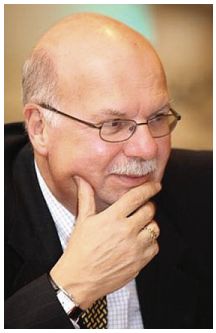
VMA VALVE MANUFACTURERS ASSOCIATION OF AMERICA
The voice of the flow control industry

www.vma.org

A Pessimistically Optimistic Outlook



VMA's recently issued "Market Forecast of Industrial Valve Shipments in the United States for 2015" shows that the industry is continuing to grow, but by less than the spectacular rates we saw during our peak years. We forecast a rise again in 2015 of 2.2% (about the same as last year) to a level of just under $4.5 billion in shipments.

VMA members have seen growth both domestically and internationally over the last few years. However, the question many are facing now is how long this growth will continue before a downturn occurs, as well as how the dramatic drop in the cost of oil is affecting the industries that use and manufacture valves. (For more on that subject, see "Market Focus: Oil & Gas" on page 6 and read "What's Ahead for Oil & Gas" on VALVEmagazine.com.)

On the positive side, VMA's monthly internal economic report shows almost 15% of our members are adding personnel to their production teams while only 4% of manufacturers indicate layoffs are occurring. Regarding shipments growth, 39% of the reporting members forecasted shipment growth in 2015 while 46% indicated they expect a status quo this year.

International activity continues to be beneficial for U.S. and Canadian valve manufacturers with Southeast Asia at the forefront of what's happening.

This growth has served VMA well these last few years: We added 28 new members since the start of 2014. This includes 11 distributor/channel partner members, our newest category of membership.

In the summer issue of VALVE Magazine, I'll share the outlook for our European counterparts because I will have just returned from the Annual Congress in Great Britain. Also, look for the special fall issue of the magazine to find out what economists are predicting for 2016. VM

Bill Sandler
President, Valve Manufacturers Association of America

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NEW CONTRACTS

Rotork Providing Actuators for Bicentennial Pipeline

Rotork EH electro-hydraulic actuators have been selected for a pivotal new oil pipeline under construction in South America—the Colombian Bicentennial Pipeline. The pipeline will improve the country's crude oil transportation infrastructure and keep pace with burgeoning production. The three-stage project will run for nearly 1000 kilometers (over 621 miles) from the Llanos region of the country to the port of Coveñas on the Pacific coast.

The first phase of the project includes the laying of a 226-kilometer (over 140 miles) pipeline from Araguaney to Banadia. For this, Rotork EH actuators have been situated at strategic locations along the route of the pipeline for control of 42-inch Class 900 pipeline ball valves.

Moog Flo-Tork Supplying U.S. Navy Virginia-Class Nuclear Submarines

Moog has been awarded a $33.8 million contract to supply more than 1,000 actuators for the next 10 Virginia-class nuclear submarines. This is part of the multi-year Block IV procurement, under which General Dynamics Electric Boat and Newport News Shipbuilding will construct and deliver the 19th through 28th submarines of the Class between 2014 and 2023.

Moog's Orrville, OH facility has installed its technology on every U.S. nuclear submarine starting with the George Washington class in 1958 and has been supporting the Virginia-class program since the SSN 774 USS Virginia began construction in 1998. Moog Flo-Tork will continue to support the fleet with spare parts provisioning and repair service out of its Orrville facility.

MRC Global Signs Supply Contract Extension

McJunkin Red Man Corporation, MRC Global's U.S. operating company, has executed a five-year extension to its current supply agreement with Marathon Oil Company. The agreement, which has been in place since 2009, provides for maintenance, repair and operations (MRO) materials, line pipe, oil country tubular goods and MRO/project services in the Eagle Ford and Bakken Shales, the Rocky Mountain region and the Gulf of Mexico.

Pentair Valves Gets Contract for China's Largest Nuclear Plant

Pentair Valves & Controls has been awarded a contract to supply more than 200 high-pressure, electric-operated gate and check valves for Units 3 and 4 of the Tianwan nuclear power plant, the largest nuclear plant in China.

The Sempell safety relief and isolation valves are due to be installed in the main steam and emergency core cooling systems in the two new VVER-1000 reactors by 2016. The parts

MARKET FOCUS: OIL AND GAS

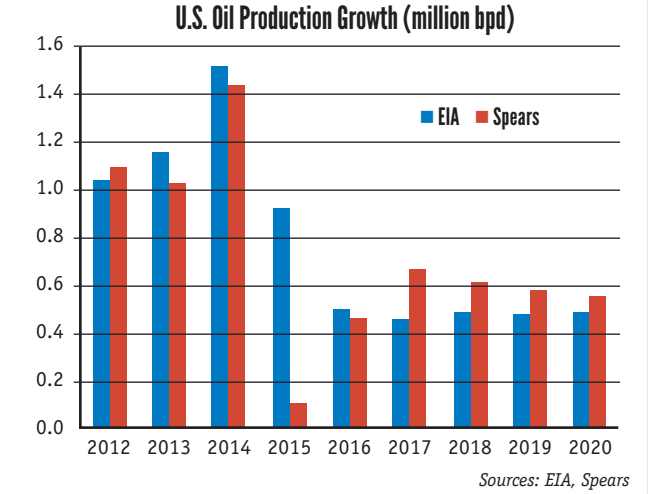
John Spears of Spears & Associates delivered a cautiously optimistic report on the current state of the oil and gas market at VMA's 2015 Leadership Forum, March 19-20. "The recovery has begun," he said, "although it may be a bumpy ride."

Spears believes U.S. oil prices have bottomed and are poised to recover to about $60/barrel (bbl) by the end of this year and $70 by the end of 2016.

The plunge in oil prices led to a sharp decline in the U.S. rig count since 2014 and by the end of 2015 will be down 39% to an average 1,130 active rigs in 2015. However, in light of the expected improvement in oil prices and the reduction in breakeven prices (from about $60/bbl in 2014 to $45-$50/bbl by the end of 2015), Spears expects that U.S. drilling activity will increase approximately 15% from the end of 2015 to the end of 2016.

Regarding drilling, Spears said: "While global activity is falling, a lot of wells are not being drilled. And producers are holding off on finishing wells that are drilled while they wait for a recovery in oil prices and lower cost in fracking before they uncap them and resume."

Spears projects that oil production in the U.S. will fall by approximately 1 million barrels per day (bpd) over the next four quarters. Post-2015, he forecasts U.S. oil production will grow at a rate ranging from 400,000 to 600,000 bpd per year, slightly more optimistic than the Energy Information Administration (EIA), which currently forecasts U.S. oil production to grow around 450,000 bpd per year.



"U.S. midstream gas processing capacity continues to grow at approximately 5% per year, and upstream activity is fairly steady," said Spears. "U.S. petrochemical construction is poised to increase as manufacturers take advantage of low U.S. gas prices."

Spears projects that, overall, "Things will stabilize and recover in 2016."

will be manufactured in Germany.

Metso Wins Order for World's Largest Oil Refinery

Metso has received a significant repeat order for valves with accessories and spare parts for Jamnagar Phase 3 refinery, the world's largest oil refinery located at Jamnagar Gurajat, India. The refinery complex is owned and operated by Reliance Industries Limited.

During 2014, Metso received several orders for the Jamnagar Phase 3 project.

A.W. Chesterton Expands W&O Supply Relationship

W&O Supply announced expansion of its distribution territory with A.W. Chesterton Company to include Washington and Oregon (W&O) for the Pacific Northwest maritime market.

The partnership began with W&O supplying Chesterton sealing solutions in the Gulf of Mexico, then expanded to include the San Diego and Los Angeles territories.

In September 2014, the two companies partnered to offer W&O's first pump and valve school, where customers had the opportunity to learn about fugitive emissions and how to increase the reliability of rotating equipment and valves. A second school is planned for this summer in Houston.

Cameron Enters Subsea Well Intervention Agreement

Helix Energy Solutions Group, Inc., OneSubsea, a Cameron and Schlumberger company, and Schlumberger announced definitive agreements for the companies' non-incorporated alliance. The alliance is formed to develop technologies and deliver equipment and services intended to optimize the value chain of subsea well intervention systems.

It will focus on increasing the operating envelope of today's subsea intervention technology, which will offer clients an integrated approach to achieve simpler, more cost-effective intervention solutions.

Weir Valves and Controls Wins Exelon Project

Exelon Corporation awarded Weir Valves and Controls USA the fleet contract for hardened containment vent system isolation valves. Weir Valves will supply triple offset butterfly valves to the Exelon fleet of affected Mark I and Mark II boiling water reactors (six sites) over the next two to three years.

Mandated by the Nuclear Regulatory Commission, the purpose of this post-Fukushima plant upgrade project is to provide assurance that, during and after any event like Fukushima, there is sufficient venting capacity to maintain containment integrity and provide safe plant shutdown.

NEW FACILITIES

ValvTechnologies Has New HVOF Capabilities

ValvTechnologies, Inc. has expanded the company's existing in-house coating capabilities by purchasing two additional robotically integrated spray booths. The company is also hiring a new staff of spray technicians, providing hundreds of hours of training and developing new procedures to implement proprietary HVOF thermal spray-coating techniques.

Emerson Center Helps Customers Strengthen Workforce Skills

Emerson Process Management has expanded its European Educational Services network with a new customer training center in Cluj-Napoca, Romania. Courses at the new facility cover theory, configuration, installation, operation, troubleshooting, diagnostics and maintenance of

CONTINUED ON PAGE 8

A new Emerson training center helps customers strengthen workforce skills.

MAY

4-7
2015 Offshore Technology Conference
Houston
www.otcnet.org

12-14
VMA Valve Basics Seminar & Exhibits
Charlotte, NC
www.vma.org

JUNE

7-10
AWWA'S ACE15
Anaheim, CA
www.awwa.org

9-11
Global Petroleum Show
Calgary, AB, Canada
www.globalpetroleumshow.com

JULY

15-16
Valve World Americas
Houston
www.valveworldexpoamericas.com

AUGUST

6-7
VMA Market Outlook Workshop*
Chicago
www.vma.org

SEPTEMBER

26-30
WEFTEC-The Water Quality Event
Chicago
www.weftec.org

30-OCT. 2
VMA/VRC Annual Meeting*
Naples, FL
www.vma.org

OCTOBER

21-23
VMA Valve Basics Seminar & Exhibits
San Antonio
www.vma.org

DECEMBER

8-10
Power-Gen International
Las Vegas
www.power-gen.com

*Open only to VMA/VRC members

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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.

Emerson products. Emerson also offers training services using mobile facilities that provide the same hands-on training experience. The center will allow Emerson to further develop employees' competencies.

ATI Actuators Invests in New Equipment

ATI has invested in a new computer numerical code vertical mill to meet the growing demand for customized automation around the world. The new machine features faster tool changes and error-proofing through standardized programs, allowing ATI to increase capacity while reducing lead time and controlling cost.

CONTINUED ON PAGE 10

PEOPLE IN THE NEWS

ROTORK CONTROLS... Howard Williams has been appointed general manager of the Gulf Coast facility located in Houston. In this position, Williams will be responsible for Rotork business operations across the Gulf Coast region


Howard Williams

Rotork also announced that **Pamela Bingham** is the new managing director of Rotork's Gears division. She joined Rotork in 2012 as group business development director.

AUMA ACTUATORS... Matthew Thiel joined the company at its Canonsburg, PA headquarters in February as an executive vice president reporting to president Sam Bennardo. In his new position, Thiel will be responsible for AUMA's North American sales, service and marketing functions.

VELAN... Yves Leduc has been appointed president of the company, reporting to CEO and former president Tom Velan. Until recently, Leduc was a corporate officer at BRP Inc. as vice president, general manager of its North American business since 2006. Before that, he was with McKinsey and Company as a management consultant working on projects in North America and Europe.

BRADKEN-ENERGY... director of metallurgy **Elaine Thomas** became the first woman to ever receive the Steel Founders Society of America's (SFSA) Charles W. Briggs Memorial Technical & Operating Medal for her career contributions in metallurgy, awarded at the SFSA 68th Annual National Technical and Operating Conference.


Elaine Thomas

Along with a medal and certificate of award, Thomas received a scholarship in her name, which is presented to the school of her choice. Thomas chose to award the scholarship to Washington State University, where she became the first women to graduate with a degree in Metallurgy in 1976.

GE OIL & GAS... James Mock became vice president, finance. Mock joined GE in 1999 and has held a series of leadership roles in finance for GE Corporate Finance, GE Capital and GE Aviation. Most recently, he served as senior executive, finance for GE Oil & Gas.

SOLON MANUFACTURING COMPANY ... Perry Blossom is the new president and CEO. Previously, Blossom was vice president and manager of the Belleville springs division at Solon. He joined the company in 1993 and has served many roles. Former president **Tim Dunn** will remain on the Solon board of directors.

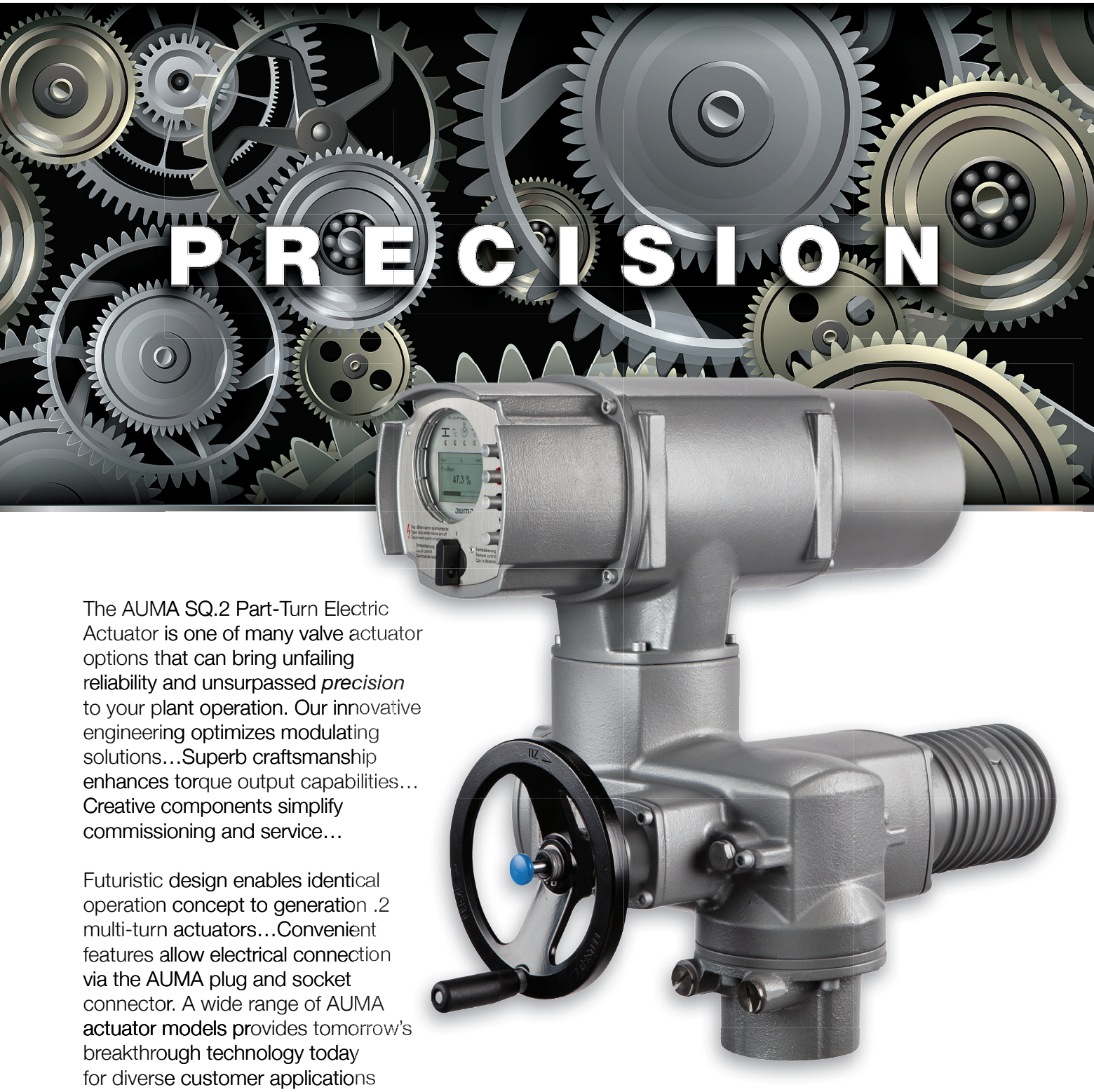

Perry Blossom

COLFAX... Terry Ross has been named vice president, investor relations, reporting to **Scott Brannan**, senior vice president and chief financial officer of Colfax. Ross most recently served as senior vice president and general manager of reliability services for Colfax Fluid Handling.

VALVTECHNOLOGIES... Benny McCallum is now general manager of MCE Group, plc, a UK-based master valve distribution, modification and service facility. McCallum will be responsible for the business management of MCE Group, including business development and sales, customer service and operations management.

COWAN DYNAMICS... Stephane Meunier has been appointed as director, international business development. He joins Cowan after a 12-year career at Velan and brings considerable industry and project experience to his new role. VM

PRECISION



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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Please visit us at our website: www.auma-usa.com

MORE MEMBER NEWS

Victaulic Wins 2015 Top Workplace Award

Victaulic was recognized as the 2015 Top Workplace among large employers in the Lehigh Valley by The Morning Call newspaper.

In addition to this honor, Victaulic also received a special award for "Clued In Senior Management," an acknowledgement given to the organization whose employees most believed that senior management within their company exhibited value-based leadership caring about concerns while moving the business in the right direction.

ITT, Victaulic Honored for 2014 Breakthrough Products

ITT Engineered Valves and Victaulic were among companies selected by Processing magazine for 2014 Breakthrough Products of the Year. ITT received the honors for its Pure-Flo EnviZion line, and Victaulic was noted for the FireLock Series 745 Fire-Pac.

The awards recognize products, technologies and services poised to make significant contributions in the process industries.

High Pressure Equipment Acquired by Graco

Graco Inc. has agreed to acquire the stock of Pennsylvania-based High Pressure Equipment (HiP) company for $160 million. Graco expects to complete the transaction in the first quarter of 2015, subject to regulatory review.

Emerson Process Management Acquires Cascade Technologies

Emerson Process Management has acquired Stirling, Scotland-based Cascade Technologies Ltd., a manufacturer of gas analyzers and monitoring systems using Quantum Cascade Laser (QCL) technology. Emerson will add the technology to its Rosemount Analytics gas analysis portfolio. Terms of the acquisition were not disclosed.

Metso Selling Process Automation Systems to Valmet

Metso Corporation and Valmet Corporation have entered into an agreement on the sale of Metso's Process Automation Systems business to Valmet. The divestment is in line with Metso's new strategy announced in July 2014 under which the company will focus on the product and services businesses for the mining, aggregates, and oil and gas industries.

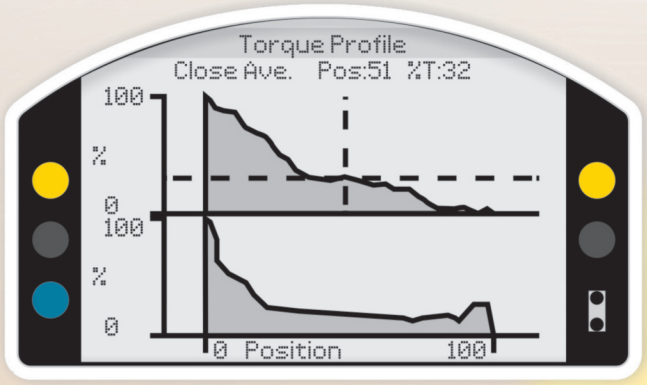
Regal Beloit Buys Emerson Power Transmission Solutions

Emerson has agreed to sell its Power Transmission Solutions business unit to Regal Beloit Corporation, parent company of Mastergear Worldwide. The transaction is valued at $1.44 billion and is expected to close in the first quarter of 2015, subject to regulatory approvals.

Bradken Facilities Earn SAI Global Certification

A Bradken foundry in Atchison, KS and machining facility in St. Joseph, KS received certification by SAI Global for successful implementation of an environmental management system. The certification signifies conformity with international standards for environmental protection. VM

The 3rd Generation of IQ Intelligent Valve Actuators is Now Available



Providing a clear window into your process

With the third-generation IQ you get unparalleled data analysis of the condition and operational status of the valve, at the valve. The data is displayed on a revolutionary new screen that enables field operations and maintenance personnel to view accurate asset management data in real time.
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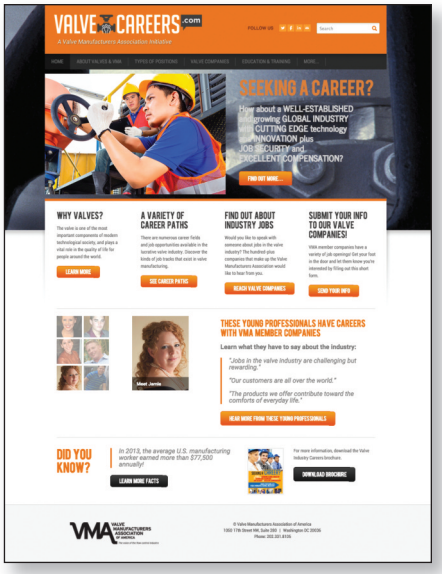
New Website Launches First Phase Of Valve Careers Initiative

On May 1, the Valve Manufacturers Association (VMA) is launching ValveCareers.com, a new resource developed to inform and educate young people about the valve industry and the many job opportunities and career paths available through VMA member companies.

With so many baby boomers retiring—and so many industries competing for a limited pool of applicants—VMA aims to raise awareness of the valve manufacturing industry as a source for upcoming and recent graduates seeking positions.

Although not a job board or placement service, the website does provide a way to help connect prospects with VMA and VRC (Valve Repair Council) members. The site contains a member listing, brief description of the company and link to the company's website and career page. In addition, those who would like to share their educational background and career interests with all member companies can fill out a short form that will be forwarded to human resources personnel for possible follow-up.



Visitors to the site will learn about some of our "Young Professionals" (YPs) who are currently working in the valve industry and would like to share their experiences with others contemplating a career in the valve manufacturing arena. Among them:

- *Valeska*—a world traveler and amateur jewelry-maker who studied metallurgical engineering and materials engineering before entering the valve industry as an applications specialist

- *Nang*—a proud uncle to seven beloved nieces and nephews who never realized the critical role of valves until he started work as a global product manager in the industry

- *Elyse*—a project manager and former aspiring architect whose passion for engineering flourished in high school while taking advanced math and physics courses.

While ValveCareers.com is an important part of VMA's Careers Initiative, it is just the start of a multi-year program in which VMA will reach out to its target audience in a variety of ways. Additional activities and projects in the works are:

- Visits to career fairs
- Social media outreach
- Contact with—and providing materials for—career counselors in high schools and colleges
- Placement of articles in a variety of media
- Production of a video featuring our Young Professionals

With this program and through this website, we hope to enlighten young people in North America about the promising, challenging and rewarding careers available in the world of valves. If you'd like to learn more about this initiative, please contact Jessica Bello, careers program coordinator, at jbello@vma.org. VM

VMA RANKS EXPAND WITH FIVE NEW MEMBERS

VMA welcomes two new manufacturing members, Bray International and Cowan Dynamics:

Bray International, incorporated in 1986 and headquartered in Houston, manufactures quarter-turn butterfly valves, ball valves, and pneumatic and electric actuators, and is among the largest manual and automated butterfly valve manufacturers in the western hemisphere. Visit Bray's website at www.bray.com.

Cowan Dynamics' head office and manufacturing facility are in Montreal, QC. The company produces pneumatic and hydraulic actuation and other process control solutions for mission-critical applications in manufacturing and other heavy industry sectors. Learn more at www.cowandynamics.com.

The following have joined VMA as supplier members:

Houston-based **Jet-Lube, Inc.** (www.jetlube.com) was founded in 1949. Jet-Lube, a wholly owned subsidiary of Capital Southwest Corporation, provides manufacturing lubricants to oilfield, water well and industrial maintenance/ repair/operations customers around the world.

SIGMA Corporation (www.sigmaco.com) was established in 1985 by engineers with new ideas for supplying AWWA pipefittings. The company makes commercial castings for the valve industry as well as a wide range of waterworks, fire protection and OEM products. The corporate office is in Cream Ridge, NJ.

EGC Critical Components (www.egccomponents.com), a division of Fenner Advanced Sealing Technologies, supplies major OEMs with special needs for dealing with elevated temperatures, chemicals and media resistance, extreme pressure, wear and lubricity. The company has been in business 50 years and is located in Humble, TX.

We Can Help You Cope With Fugitive Emissions Issues

Fugitive Emissions Testing | **Fugitive Emissions Re-Packing** | **"Low E" Repaired Valves** | **Packing Systems Evaluation**

United Valve offers a variety of testing capabilities and valve upgrade services to help meet your fugitive emissions compliance goals.

United Valve has one of the largest and most comprehensive fugitive emissions testing facilities in North America. The facilities are housed in a new 45,000 sq. ft. 40-ton crane-served engineering testing and valve repair building annex. We offer quick turnaround on FE tests with four large testing units that can handle valves up through 12″ class 1500 and 24″ class 150 and five smaller test units for API 602 valves. All tests are operated and monitored via our proprietary control system hardware and software. The United Valve engineering testing department is actively supervised by two staff engineers.

United can perform fugitive emissions tests per API 622, API 624, ISO 15848-1, 15848-2 or any custom or end-user test specification. In addition to the actual testing, we can provide complete metrological analysis of valve components before or after testing. Our staff can also assist your company with valve packing selection assistance, packing performance evaluation, and propose corrective actions if required.

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Valve World Americas Grows Again

Thousands of people will be at the George R. Brown Convention Center, Houston July 15-16 for the third Valve World Americas Expo & Conference. The 2015 event follows a successful 2013 conference that had 2,120 visitors and 151 exhibitors from the United States, Asia, Canada, Europe, India and Mexico. More of both are expected for 2015, and the exhibits have been moved to a larger hall to accommodate the growth.

Valve World Americas is the showcase for the flow control industry, modeled after the global Valve World Expo in Düsseldorf, Germany, but designed to specifically address issues on this side of the ocean

and to allow maximum networking and interaction with vendors. A technical program covers a variety of valve and valve-related topics essential in today's marketplace.

Plenary sessions cover hot topics such as the future of shale gas and the overall outlook for energy. Workshops focus more closely on specific subjects such as cryogenic applications, valve testing for emissions, comprehensive approaches on materials, casting specifications and much more. VMA President Bill Sandler is on the steering committee for the conference this year and helped to set some of the topics.

Valve World Americas also brings together manufacturers, suppliers, fabricators and distributors who showcase their latest products and services, forge business relationships and meet with end users on the floor of the exhibit hall. Many VMA members are among the exhibitors, and VMA has its own booth at Location 4, just outside the entrance to the hall.

VMA's Valves & Actuators 101 will be offered at the same location all day July 14, the day before the regular conference starts.

For information or to download a preliminary program, go to www.valve-world-americas.com. You may also register for the Valves & Actuators 101 course on the Valve Americas Expo website.

ACE15 Addresses Water Challenges


AWWA

ACE, the American Water Works Association's conference and exposition for water professionals, travels to the west coast this year for an expanded program in cooperation with AWWA California-Nevada. The program, "Uniting the World of Water," is June 7-10 in Anaheim, CA.

ACE15 welcomes about 12,000 people who will attend sessions on water sector issues such as infrastructure renewal, potable reuse applications, drought response and much more. Professionals from all walks of the water world present papers, speak and serve on panels. The show gets off to a sporting start with opening general session speaker Brent Frew, chief engineer for the Forty Niners Stadium Management Company, who will take attendees behind the scenes of the new Levi's Stadium complex.

New on the program this year is a Smaller Utilities Day, June 10, where issues will focus on smaller communities, utilities, and water and wastewater systems. The show also has tracks on business management, utility management practices, leadership, emergency response and many others.

In addition, almost 500 exhibitors will feature their products and services. For information, go to www.awwa.org.

Global Petro Bigger than Ever

More than 63,000 people from 100 countries are expected to attend the Global Petroleum Show, which is one of the world's biggest energy shows and has been in existence since 1968. The show, which is geared to the global oil and gas industry, is June 9-11 at Stampede Park, Calgary, Alberta, Canada.

GPS brings together leaders, engineers, industry professionals and field operators who focus on learning the latest on trends and technology in the petroleum world. The 70,000-square-foot exhibit hall is open all three days and features over 2,000 exhibitors catering to people who buy or are just interested in seeing the latest products and services in the energy industry.

The show is held in conjunction with two other conferences: The SPE Canada Heavy Oil Technical Conference and the International Energy Capital Forum. Visit www.globalpetroleumshow.com for additional information about the event. VM

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- **VALVE REPAIR COUNCIL** OEM-certified service, repair and maintenance firms for U.S. and Canadian manufactured valves, actuators and controls

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Heavy Oil: Producing in a Hostile Environment

BY KATE KUNKEL

Today, the world has many resources of heavy oil. For those that seek to tap into that oil, the challenge has always been extraction, the process of "mining" the heavy crude. Today's producers have developed new technologies that allow them to get such oil to the market efficiently.

When the market is stable, heavy oil assets have the potential to generate many years of steady cash flow—wells can typically produce for more than 50 years. However, when oil hovers around $50 per barrel, as it was at the time this article was written, the economic feasibility of production comes into question. Still, heavy oil is an attractive solution to meet global energy needs and an excellent market for valves.

HOW HEAVY IS HEAVY?

Oil production falls basically into three categories. They are (in order of lightness): conventional, heavy oil and oil sands. Conventional most often means light crude that can easily be captured by

Executive Summary

SUBJECT: Valves used for the extraction of heavier oil have a unique set of challenges to face.

KEY CONCEPTS:

- What constitutes "heavy"
- How it's extracted
- What functional/operational issues valves face

TAKE-AWAY: The world's demand for energy means the market will grow.

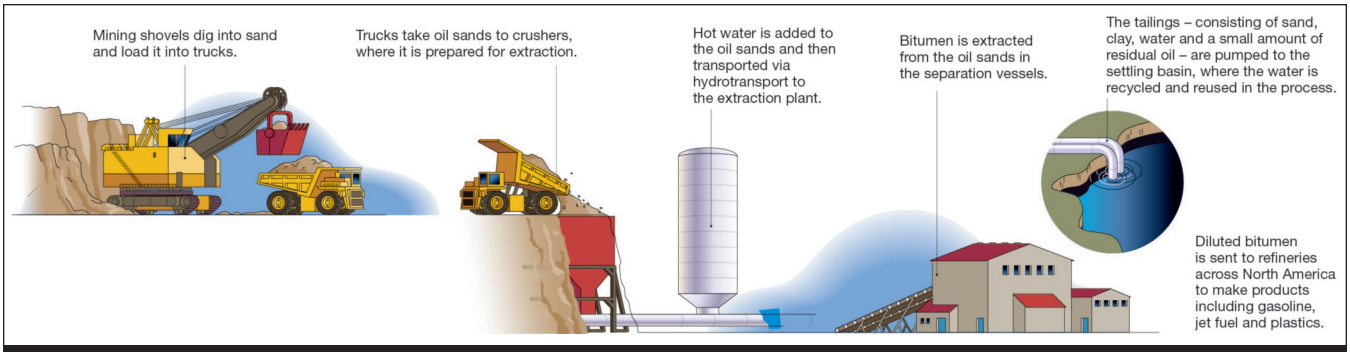

Figure 1. Mining extraction method

simply tapping into a reservoir. It is the source for the images of gushers spraying oil that fueled the hopes of many a wildcatter in the early days of oil exploration.

Heavy oil is very different. It has high specific gravity (American Petroleum Institute gravities from 10 to 20 degrees), low hydrogen-to-carbon ratios, high carbon residues and high amounts of asphaltenes, heavy metal, sulphur and nitrogen. Its extremely viscous nature creates both technological and economic challenges, and the heavier the oil is, the more difficult it is to extract. Many different processes are involved, and they are both costly and complex.

The Heavy Oil Science Center in Lloydminster, Canada, which straddles the border between Alberta and Saskatchewan, is a valuable resource for information on the heavy oil industry. Franklin Foster, one of the founders, provided much of the information shared here about the characteristics of heavy oil, the methods of processing it and the challenges.

RECOVERY METHODS

Bitumen is oil that is too heavy or thick to flow or be pumped without dilution or heating. At 52°F (11°C), bitumen, which is what is normally considered oil sands, is hard as a hockey puck. Such oil is recovered using two main methods: open-pit mining and in situ drilling. The chosen method depends on how deep the reserves are deposited.

Bitumen close to the surface is mined through the open-pit method, which is similar to many coal mining operations (Figure 1). Large shovels scoop the oil sand into trucks that take it to crushers where large clumps of earth are broken down. This mixture is then thinned out with water and transported to a plant, where the bitumen is separated from the other components and upgraded to create synthetic oil. About 20% of oil sands are recoverable through open-pit mining.

Most heavy oil production, however, is accomplished with other technologies, including cold heavy oil production with sand (CHOPS), vapor extraction (VAPEX) and thermal in situ methods (e.g., steam-assisted gravity drainage or SAGD and cyclic steam stimulation or CSS). The main oil-related challenges involved in production are gravity and the viscosity of heavy oil. The technologies used must be robust enough to withstand the challenges of abrasive solids as well as corrosive media.

The CHOPS method, which was pioneered in Canada, allows sand into the wellbore with the oil to improve well productivity. Wells that formerly produced only 20 barrels a day have been observed to produce more than 200 barrels a day using this method, according to Canada's Centre for Energy.

VAPEX is a non-thermal recovery method that involves injecting vaporized solvents into heavy oil, creating a vapor-chamber that oil flows through because of gravity drainage. This method has lower greenhouse gas emissions and significantly less water consumption compared to other technologies currently in use. It also can be used to recover bitumen from zones too thin for traditional thermal recovery.

SAGD (Figure 2) is a thermal in situ recovery method that is based on two well-known and basic facts: Hot oil flows better than cold oil, and gravity pulls the densest materials to the bottom.

For SAGD, two or more wells are drilled into the pay zone of an oil-bearing reservoir. A horizontal production well is drilled into the lower part of the reservoir, and horizontal or vertical steam injection wells are drilled above and close to the production well. Steam is continuously injected through the upper wellbore. When enough steam is injected, a steam chamber rises to the top of the reservoir, while hot oil drains down to the producing well. That oil is then pumped to the surface. This system makes it possible to continuously recover bitumen from the play.

Another thermal in situ recovery method is CSS (Figure 3), which is also

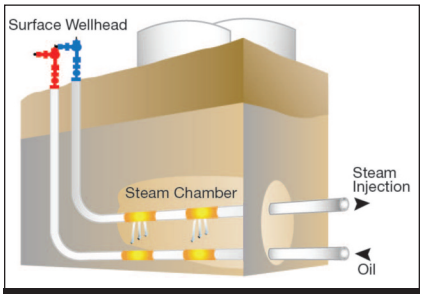

Figure 2. How SAGD is done

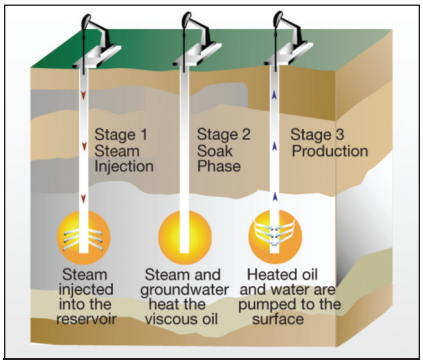

Figure 3. The CSS process at work

known as "huff and puff." This is a three-stage process involving several weeks of steam injection, followed by several weeks of "soaking." After these two phases, a production phase occurs where oil is produced by the same wells into which the steam was injected. As production declines, the injection phase is restarted. The high-pressure steam not only makes the oil easier to move, it also creates cracks and channels through which oil can flow to the wellbore.

While SAGD and the other steam injection methods sound similar to hydraulic fracturing, the two extractions are quite different. In the case of steam injection for heavy oil, the steam is not used to fracture the rock and provide pathways for gas or oil to escape the rock. It is simply heating the oil to make it softer, allowing it to flow easier.

"In the early days of in situ steam injection, companies tried to use regular power plant valves. It was assumed that the applications would be easier than a power plant because the temperatures were lower."

– Bill Patrick, Velan

EQUIPMENT CHALLENGES

According to Bill Patrick, regional manager for Velan, companies historically believed that the same valves and pressure classes would apply to heavy oil as conventional light oil applications. Hotter temperatures and other challenges, however, have made that impossible.

"In the early days of in situ steam injection, companies tried to use regular power plant valves," he explains. "It was assumed that the applications would be easier than a power plant because the temperatures were lower."

However, power plants generate super-heated steam that is very dry and generally less damaging to power plant components such as turbines.

"Power applications sound like a more difficult service because the temperatures are higher for the same relative pressures compared to an in situ steam injection application," Patrick says. However, steam injection applications are more difficult for several reasons, including:

Because in situ steam injection uses lower temperatures, the flow is not necessarily pure saturated steam. There may be liquid in the steam that is not removed because hot water is still contributing to the heating effect on the oil. Therefore, sites for in situ steam injection rarely use steam traps and don't usually have steam dryers. This two-phase flow (steam and condensate) is much more difficult to handle from an erosion point of view, and sometimes from a corrosion point of view, than the dry and pristine superheated steam of a power plant.

In a power plant, the same water typically is used over and over in a closed loop system. A tremendous emphasis is placed on water treatment because it must be a very clean environment. In an in situ application, the water is most often dumped down a hole into the ground so the water

Many valves used in heavy oil transport lines are operated by hand.

treatment is not extensive, and the steam quality is not high. This does not create a danger to the environment, but it can significantly damage the piping components that must handle it.

In a power plant, almost all valves are indoors in a controlled environment. In an in situ application, the valves are scattered inside and outside, and are exposed to rain, dust and ambient temperatures, which can create massive cycles of temperature swings.

The cyclical nature of the in situ process application creates a major challenge for valves. This is a problem that in situ valves share with their counterparts in combined-cycle power applications. In a base load plant, everything runs smooth and steady. But in a combined-cycle plant, operators have to deal with peak loads (starts and stops), low loads and sometimes latency, which is a challenge for piping system and valve designs. In situ steam injection for heavy oil is similar. It is fully "on" some days and shut off on others, creating thermal and pressure extremes that are tough on castings, welds, gaskets and packing.

Some oil sands steam generators are built in with a cogeneration plant, which is a different set-up from straight steam production. In such a case, steam for power is generated at the same time as steam is required for the process. Some power may be used in the plant or it can be tied into the grid.

OTHER CHALLENGES

Experts consider corrosion one of the most costly problems plaguing the heavy oil industry, and according to Foster, it is not just the water from steam that contributes to corrosion of equipment, including valves.

"Salt water produced with oil is highly corrosive, and most crude oils contain varying amounts of hydrogen sulfide, which is also quite corrosive," Foster says.

He goes on to explain that anticorrosive measures can be taken, including injecting a chemical corrosion inhibitor down the casing/tubing annulus; using plastic-coated tubing; and using special corrosion-resistant alloys and cement-lined pipe.

"Each of these methods has distinct advantages and disadvantages," he says. Frequently, however, the cost of reducing the corrosion rate is so high, it cannot be justi-

fied, in which case no anticorrosion measures of any kind are taken and the equipment is replaced at the end of its useful life.[1]

VALVES USED

The valves used in steam injection include gate, globe and check valves, along with some ball valves. Their function is for both on-off and throttling or modulating services.

"The base valves that are used for the steam injection might look the same as any other ball or gate valves," Patrick says. "But the trim and packing materials are quite different from that used for cold production."

For the internals, the trim is a vital design consideration, with hard materials used on the steam side, replaced by softer materials when used on sour applications on the production and plant side.

Most applications in situ can be handled with very basic materials like carbon steel for the body and bonnet, although sometimes stainless steel is required. "For the side of the piping producing the oil, those valves used for heavy oil are not that different from those used in conventional production."

In mining operations, valves are used where oil and sand is mixed with water, then chemicals are used to separate the oil from the sand. Low-pressure slurry valves really take a beating in such operations, according to Patrick. "Generally, knife gate valves do the job, though some pinch valves are also used," he says.

As far as valves for control within in situ facilities, "An amazing number of the valves in the field are manual control," Patrick says.

This is because some valves cannot be remotely operated. "Production is cyclical, so operators may fire up one pad as another goes down; the valves are often simply opened and closed by hand," he explains. On the plant and upgrader [the facility where the bitumen is upgraded into synthetic crude], there are many standard refinery valve types with the addition of metal-seated ball valves as well as many types of control valves.

CONCLUSION

The technologies for heavy oil extractions have evolved as this source of petroleum has become a bigger part of the market. Even if the market price for crude makes heavy oil production a little less attractive cost-wise, the growing demand in the world for energy translates into a growing need for the valves that are capable of handling the demanding applications in the process of extracting heavy oil and getting it into production. VM

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

CANADIAN INVESTMENT IN HEAVY OIL

Technological innovations and political policies friendly to the oil industry have brought unprecedented oil sands development in Alberta and Saskatchewan since the turn of the 21st century. Investments in Canada's oil sands have grown by tens of billions of dollars since 2003 (with the exception of a recession in 2008/2009).

Until the recent plunge in oil prices, the Canadian Energy Research Institute (CERI) projected Alberta could expect to get $350 billion in Canadian dollars (about U.S. $278 billion) in royalties and $122 billion in Canadian dollars (about U.S. $97 billion) in provincial and municipal tax revenue from oil sands over the next 25 years.

The decrease by half (to about $50 per barrel at press time) in the price of oil since December 2014, however, has changed the outlook. The International Energy Administration cut Canada's production growth forecast by 430,000 barrels per day by 2020, and Canadian oil and natural gas firms have announced capital expenditure cuts totaling $109 billion in Canadian dollars (about U.S. $86.4 billion) from their 2015 budgets. Experts at one of Canada's largest banks, RBC, say exploration and production companies may reduce capital spending by 31%.

Existing projects by Canadian oil sands producers can operate profitably below this $50 per barrel price, according to financial data by Cenovus, Husky and others. Break-even points for long-operating projects such as Cenovus' Christina Lake and Husky's Lloydminster range from a low of $26 to a high of $42 per barrel, which makes them profitable even at today's prices. However, Suncor, Canada's largest oil company (by production volume), has joined many other North American energy producers in slashing its operating budget, saying it will shave $1 billion in Canadian dollars (U.S. $810 million) from its budget and lay off 1,000 contract workers.

Peter Hall, chief economist at Export Development Canada, does not believe these cuts are all bad news. "Crisis is the mother of transformation," he said. "A full blown crisis is a huge motivator to rethink the model and to invent solutions that have not been thought about before."

One area that needs such motivation is finding ways to reduce the amount of energy needed to extract and process the heavy oil. For thermal recovery, energy consumption amounts to 20% of the produced quantity, mostly to generate huge quantities of steam. For mining processes, it is equivalent to 10% of the bitumen produced. With the technologies and resources currently available, the price of crude oil must be around $80-90 dollars per barrel for oil sands development to be economically viable, according to oil experts.

This will mean many opportunities for creators of technologies that will lower costs and for innovative companies that can make them work.

Despite current prices, companies such as Suncor have pledged to move ahead with certain growth projects, though Alister Cowan, the company's chief financial officer, says his company will consider slowing investment in large-scale projects if prices remain closer to $45 per barrel for the next two to three years.

Ironically, this is precisely when you want to build a major capital-intensive project "because nobody else is," Cowan explains. Also, companies that know how to tap into skilled workers "are seeing a big increase in productivity. That's precisely why we want to build now," he says.

REFERENCE:

1. Lloydminster Heavy Oil: www.lloydminsterheavyoil.com/workover.htm

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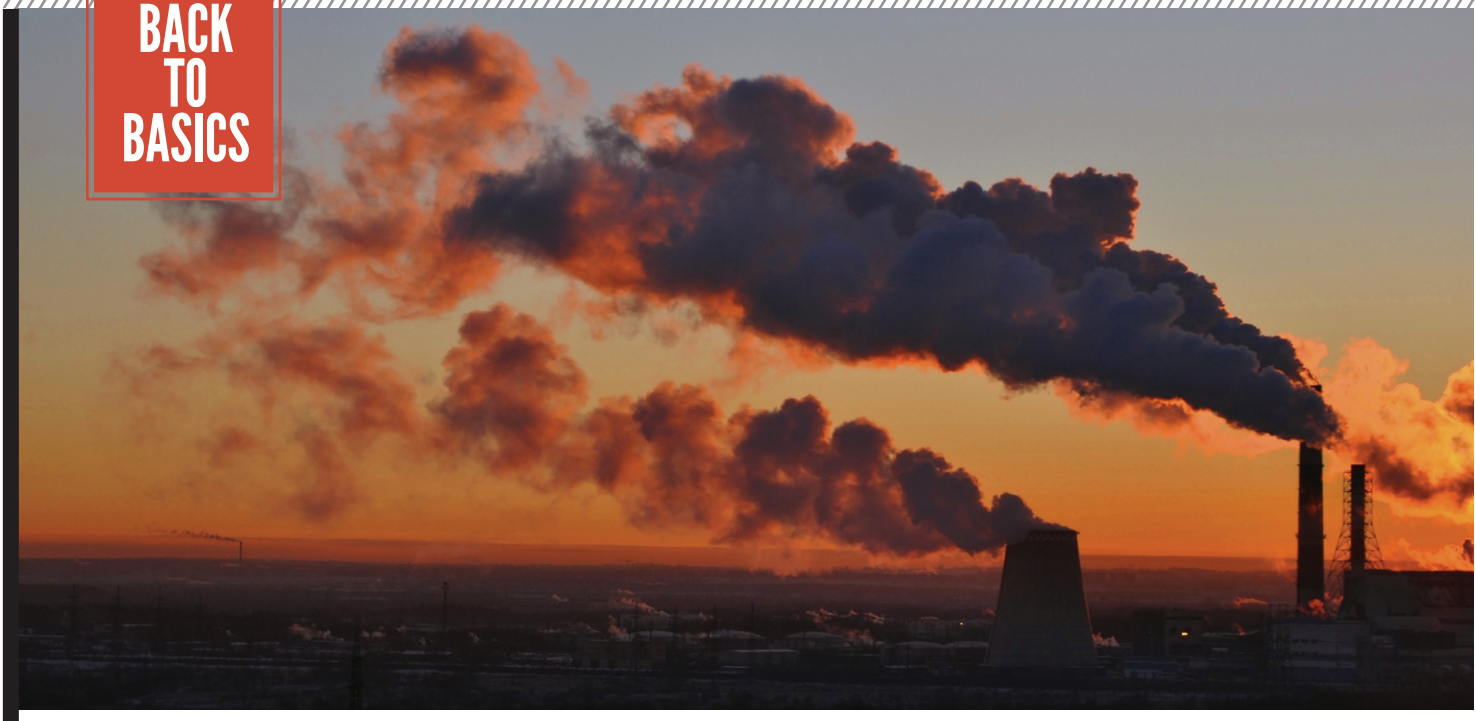


Mechanical and Compression Packing

BY RODNEY ROTH

Mechanical packing dates back more than 5,000 years when horse hair was braided and coated with animal fat for lubrication and additional sealing characteristics. Mechanical and compression packing advanced tremendously in the years since then, but especially so in the past 30 years as environmental concerns about valve leakage and U.S. Environmental Protection Agency (EPA) rules have come to the forefront.

While using valve packing might appear to be a simple topic, many variables come into play when attempting to understand proper use and application of mechanical packing products.

The place to start is by understanding what packing is supposed to do: Packing is designed to control leakage from the stem and bore area of the valve. This affects the seal by completely blocking or reducing the voids between the valve stem and the bore of the stuffing box.

To create an effective seal and prevent leakage, the stress applied to the packing must be greater than the pressure of the media being sealed. The required packing stress is applied by tightening the packing gland against the top ring of packing to transmit lateral force through the packing set and rings. This force creates radial expansion of the packing set and rings against the stuffing box and the valve stem.

For packing to work properly, four conditions should be seen in the design, selection and use of the packing product:

1. Resiliency allows the packing set/rings to deform under load, but also have the ability to recover from compression over the life of the valve.
2. Chemical resistance prevents the packing from attack so it's unaffected by the media being sealed.

Executive Summary

SUBJECT: Understanding the significance of packing requires knowing what goes into the material, how it's put together and how that all fits with the design of the valve.

KEY CONCEPTS:

- What makes packing effective
- What materials are used
- How packing is put together
- How to effectively seal valves

TAKE-AWAY: Packing has taken on even more significance today because of the need to find ways to meet stricter emissions standards.

3. Strength protects the packing from destruction during the valve's operation, when under media pressure and when media states change, such as when crystallization or congealing of fluids occur.
4. Proper installation is essential because whatever packing is chosen for a particular application, it must be installed properly to positively seal valves long term.

PACKING MAKEUP

Mechanical and compression packing consists of various combinations of fibers, yarns and lubricants. Three basic yarn types are made from a variety of fibers. They are: 1) gang spun, which is made by spinning short, non-continuous staple fibers (usually natural fibers); 2) continuous filament, which is manmade fibers of any desired length; and 3) a combination of materials such as graphite and wire or other materials to create yarn with characteristics of the combined components.

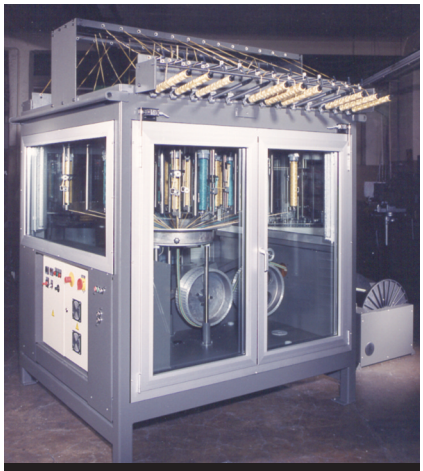
Many yarn types are used to make general packing (e.g., graphite, carbon, PTFE, acrylic, aramid, fiber glass, cotton). However, when considering packing for use in valves, the number of materials is more limited.

One of the most common materials is graphite, which is divided into two categories: flexible graphite and PFTE.

Flexible graphite is pitch-based carbon mined from the earth and made from a process called pyrolization. Base fibers of pitch, rayon and acrylic are thermally treated in the presence of oxygen to drive off impurities. The pitch base then receives an additional chemical exfoliation before it goes through pyrolization.

The yarn made from pitch has to be made with either an internal carrier or external carrier because the pitch-based fibers cannot be made continuous without the use of a carrier. Graphite yarn made from rayon or acrylic is manmade and also can be made into a continuous filament by adding a carrier.

PTFE has a very high resistance to chemicals with exceptionally low friction and adhesion to the valve stem. However, its use is limited to lower temperatures than graphite, and it can be affected by thermal growth.



A braiding machine

BRAIDING

Various types of braiding are employed to create the different braid patterns used in making packing. The machines that manufacture mechanical packing today are inverted, overhead, square, upright and round braiders. The braiding is different for a variety of reasons, some because of the actual packing performance in different applications and others because a certain type offers special ways of applying lubricants and blocking agents needed to effectively seal certain applications.

A HISTORICAL PERSPECTIVE ON EMISSIONS

Packing manufacturers are constantly challenged by end users' increased need for materials that can meet EPA mandates. As these mandates become more stringent, manufacturers are required to improve packing designs to meet customer demands, both technically and commercially.

After the Clean Air Act of 1990, many changes occurred in packing.

When an Electric Power Research Institute study determined the most effective replacement for asbestos was flexible graphite, for example, it became the norm in packing products.

The creation of the Petroleum Environmental Research Forum, which is made up of major end users, created a means to fund development of testing equipment and research into better packing.

But over time, industry itself has had to push for better packing because of EPA consent decrees.

All of these developments have led to additional means for testing and proving packing products.

In 2006, the American Petroleum Institute developed API 622 as a standard for testing packing and valves for effective sealing. With a wide variation in results and no true way to compare those results, API revised 622 to be a test of packing only. The issuance of API 622 Revision 2 in 2011 was quickly followed by the development of API 624, Valve Type Testing with Graphite Packing. API recently released this standard, which requires the use of API 622-tested packing. API 624 requires the valve be tested for 310 mechanical cycles with three thermal cycles from ambient temperature to 500°F (260°C) with leakage not to exceed 100 parts per million (ppm) at any point. No packing re-torque is allowed for the duration of the test. Now that API 624 has been published, other API standards have added the requirement of passing 624 to the valve standard. For example, 624 must be passed for a valve to be labeled an API 600 valve.

API continues to be proactive in developing standards for testing valves and packing for low-emissions requirements and is currently working to develop API 641 for testing quarter-turn valves for compliance.

In addition to the new valve testing standards, repair of valves is also seeing new requirements. API RP621, for example, is currently being revised and now has a section low emissions.

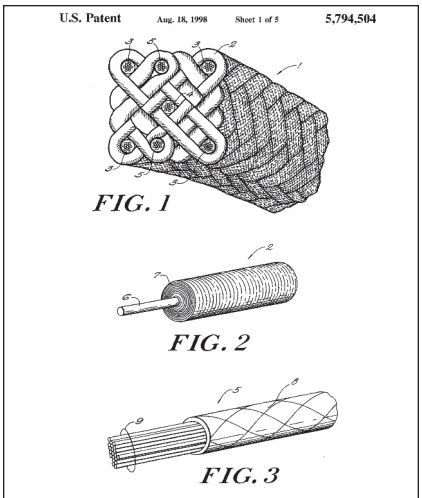
The different braider types also provide the ability to increase or decrease the actual strands of yarn needed for the different cross sections of packing or are made for other, more technical reasons.

The braiders produce various braid types as well. Common braid types include plait, square, round, interbraid, braid-over-core and twisted. The difference in types is related to the material being braided along with the level of sealing needed from a particular packing product. This can be based on pressure, temperature or fugitive emission sealing. For example, many of the products manufactured from flexible graphite yarn that will be used for low-emission sealing are braided using a plait braid and lubricants and blocking agents. This arrangement provides long-term sealability below 100 ppm as required by EPA.

VALVE SEALING

After the materials and processes used to manufacture packing are understood, the next step to consider is valve sealing. Understanding sealing requires some awareness of why leaks occur in the first place.

The first point to consider is proper maintenance. Maintenance of valve packing is critical for minimizing leak-



A patent for an interbraid

age or emissions; so, too is properly trained staff who know the right way to install as well as to maintain both the packing and the valve.

Also critical is the use of packing with corrosion inhibitors, which can extend both the life of the valve and the packing. Corroded or pitted stems, on the other hand, can destroy the packing.

Selecting the right packing for the process application is vital to long-term sealability. That means understanding the pressure, temperature, potential of high cycling and other process conditions that affect which packing materials are appropriate for what application. It also means knowing what valve design requirements will make one packing type attractive over another.

In recommending or designing an effective packing solution, temperature cycling is taken into consideration. Cycling creates some unique issues in valve sealing because expansion or contraction of valve components subject to constant temperature swings can cause many packing styles to leak. By knowing cycling data, a live load system can be added easily to to the gland flange bolts to account for issues caused by increases and decreases of temperature.

Another important factor to consider is the current condition of the valve. When a repack of a valve is done, for example, all of the parts must be in good working order before the repack occurs, including stem finish, bore finish and the gland flange bolt condition.

Other factors to consider in properly sealing valves are the orientation of the valve in the piping system (horizontal or vertical?), vibration and the number of packing rings that will be used (less than five or more than six?).

REVIEW

It is critical when understanding the basics of packing to consider how packing is viewed as part of the larger picture of valves and flow control. In too many instances, packing is an afterthought. For example, when valve repair work is to be performed, rushed decisions are too often made causing installation of the wrong material or bad installations of the right material.

On the other hand, the right packing style used with the right valve design and proper installation is taking on increased significance for industry as EPA places more aggressive regulations on end users. In the end, it is clear that packing will continue to become more and more effective. VM

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After Hurricane Sandy, large portions of Manhattan were without electricity

WIKIPEDIA/HYBIRDD

Turning Back the Tides of a Truly Super Storm

BY PAUL BODGAN

Superstorm Sandy made landfall Oct. 29, 2012 on the eastern seaboard of the United States, resulting in unprecedented flooding in the New York City metropolitan area. Flood levels zoomed past the previous record of 10 feet in the southern portion of Manhattan to reach 14 feet, and wave heights in New York Harbor were measured as high as 32 feet.

Heavy damage was sustained along the coastline and waterways, resulting in the loss of homes and businesses for tens of thousands of people. The facilities located along the coast lines of Manhattan, Queens and Brooklyn that create in-city electric and steam generation supporting the city were damaged by the tidal surge.

Brooklyn Navy Yard Cogeneration Plant (BNYCP) was one of the worst hit. Critical plant infrastructure, including over 100 valves and associated instrumentation, was submersed under 13 feet of water during and after the storm. These critical valve assets had to be repaired or replaced in a safe and timely manner so the facility could be restarted to meet the energy needs of BNYCP's customers.

Executive Summary

SUBJECT: Superstorm Sandy provided challenges no one in the New York City area could have imagined. For a Brooklyn cogeneration plant, that meant a tremendous effort to get this critical source of energy back up and operating for millions of people who relied on its power.

KEY CONCEPTS:

- What happened during the storm
- What needed to be replaced/repaired
- How the team in charge succeeded

TAKE-AWAY: Putting together a good team, seeing that communication flowed freely, and ensuring the right resources were in place and available resulted in a successful on-time and safe restart.

THE PLANT

Located on the shoreline of Brooklyn in an industrial complex site where the U.S. Navy built warships for over 150 years (shipbuilding moved to lower cost areas in the 1960s), BNYCP began commercial plant operations on Nov. 1, 1996. The facility consists of two combustion turbines with two heat recovery steam generators, which supply two steam turbines and have the capacity to produce 300 megawatts (MW) of electricity or 1 million pounds per hour (lbs/hr) of steam. Normal plant energy output is 220 MW for two electricity customers and between 550,000 lbs/hr to 800,000 lbs/hr steam for three steam customers.

BNYCP preparation for the storm began in earnest many days prior to Superstorm Sandy's landfall and included flood gate installations, strategic sandbag placement and emergency supply stockpiling. These plans were made for withstanding and riding out the storm, but no one anticipated the tidal surge and ensuing destruction the storm would bring. To protect critical infrastructure, the BNYCP was shut down the day before Sandy hit. The facility was evacuated of personnel except for 15 management and key craft people.

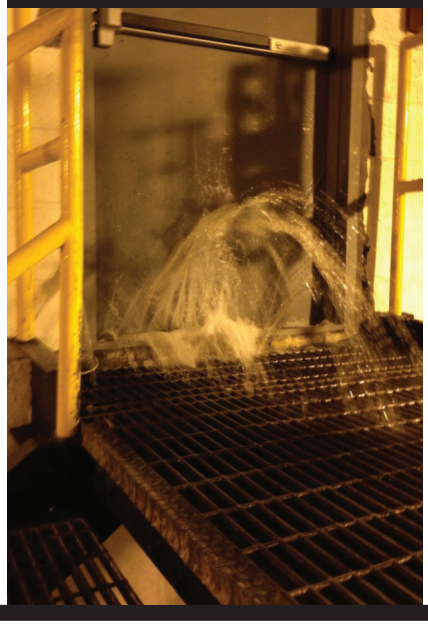
When the storm surge hit, the brackish water of the East River quickly rose above the established flood protection elevation height, overtaking all flood barriers, and compromising the facility. At that time, all electrical feed to the station was disconnected for the safety of plant personnel, leaving the facility in total darkness and without power. As could be expected, the lower elevations of the facility were hardest hit by the storm water, resulting in significant damage to equipment such as gas compressors, air compressors, a demineralization plant, continuous emissions monitoring shelters, switchgears, boiler feed pumps, control valves, automated valves and instruments.

BNYCP personnel immediately recognized the need to rely on their partner distributors, suppliers and consultants to recover from the storm as safely and efficiently as possible. Personnel made contact with the many contractors and professionals required to make the site safe, repair the critical plant assets and start up the facility.

☐ Control Valve Technician Eric Connors performs control valve diagnostics.

Expediency was of the essence because BNYCP is the largest non-utility generator of steam supplying the steam distribution system for New York City. The fall season also was quickly transitioning to the colder days of winter, which meant increased demand for steam for residential and commercial heating. For valve recovery needs, BNYCP chose Control Associates in nearby Allendale, NJ as a primary valve recovery contractor.

☐ An inside exterior door of the BNYCP facility is protected by a flood gate on the exterior of a door during the storm surge.



THE SOLUTIONS

The valve recovery team initiated triage at the site immediately. Because the Gulf Coast region is prone to storm and flooding events, the team reached out to resources in that region for insight and guidance, recovery plan development and execution strategies. The team developed and implemented the following plan:

It assigned dedicated resources to the BNYCP recovery event. Although this seems a simplistic step, it was complicated by the fact that dozens of other facilities in the New York City metropolitan area, including other power plants, refineries, gas utilities, terminals and industrial HVAC accounts, required valve and instrument services for their recovery efforts at the same time as BNYCP.

To ensure the crisis at BNYCP received priority, the dedicated team included an on-site project manager to keep recovery on time and budget, an off-site sales engineer for valve sizing/selection and order processing, four on-site technicians for on-site repairs and replacements, off-site depot repair technicians, an off-site account manager to manage commercial and contractual aspects of the recovery, and numerous off-site administrative personnel.

The team kicked-off the recovery effort by developing a scope of work marked by tag number and locations for valve repair and/or replacement. They ranked criticality of each tag number based on the function of the valve application and the lead time for parts to repair in situ or to replace.

Over 120 control valves and air automated block valves were either repaired or replaced during the recovery effort (about one-third were replaced and two-thirds repaired). This included replacing critical high-, intermediate- and low-pressure drum level control valves that had anti-cavitation trim on both units. Repairs were made both on site at BNYCP and at the Burlington, NJ repair depot, depending on scope, complexity and logistics (e.g., air and power availability, safe access).

It leveraged multiple resources for sourcing parts and new valve replacement assemblies, including traditional

A control valve actuator is replaced in the lower elevation of BNYCP.

control valve manufacturing facilities in Marshalltown, IA and Sherman, TX; local depot repair services in Burlington, NJ; and remanufactured valve assemblies in Burlington, NJ and Gonzalez, LA. Tapping into the company's vast manufacturing and repair network enabled the team to compress the typical months-long lead times to less than two weeks for most valve assemblies, including the critical drum level control valves with anti-cavitation trim.

Communications were daily through hard scheduled cadence calls with key project personnel. This was to track progress, control work flow documents (time sheets, work orders, change orders, invoicing, valve serial card management), and identify and rectify on-site logistical issues (power sources for lighting/tools, compressed air for valve testing, scaffolding for valve accessibility, securing safe access to the tag locations for repair or replacement activities). Daily communication also expedited sub-suppliers, and helped to coordinate with other trades and contractors at the station. The goal of every cadence call was to remain committed to meeting the customer's startup date.

The team conducted startup and commissioning of repaired and replaced valve assets. The scope included valve instrument calibrations, "as-left" diagnostics for valves with smart positioners, and loop checks on all valve analog loops back to plant distributed control systems (with tuning as required). Support for the team in this area included staffing personnel on site and on standby 24-hours, seven days a week at critical times during startup to respond to and rectify valve issues immediately. About 10% of the valves required additional tuning and/or repair during the startup sequence.

The team also reviewed recovery performance with BNYCP after the startup was completed and plant operations returned to near normal to ensure the work scope was met and customer expectations were exceeded.

As with most complex power plant outages (whether it's a planned outage, an event caused by equipment malfunction or an event that is unanticipated and unimaginable such as this storm), valve recovery execution was successful by sticking to five C's: Always think like the Customer, always plan for Contingency, always Communicate, always Coordinate, and always Complete tasks in a safe and timely manner.

By planning the work, identifying and overcoming obstacles to success, and managing and communicating BNYCP expectations while maintaining safety as the number one priority, the plant was successfully restarted on time, a significant achievement considering the challenges Superstorm Sandy left in her wake. VM

Paul Bogdan served as project manager for the BNYCP Recovery Project. He is currently the business development manager of Reliability Solutions at Control Associates, Inc., Allendale, NJ. Reach him at Paul.Bogdan@control-associates.com.

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This 3D printer has a build envelope of six by six by three feet. It belongs with a series of machines that uses sound to metallurgically bond thin layers of metal foil in order to 3D-print custom parts.

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Additive Manufacturing: A Game Changer for the Valve Industry?

BY ARIE BREGMAN AND KATE KUNKEL

Additive manufacturing (AM), also called 3D printing, is likely to transform the production of physical goods, including valves and actuators, in the same way the Internet drastically changed the information business model. It is now possible through AM to manufacture goods at locations where they are needed rather than where labor costs are lowest. That kind of model could change the concept of "just-in-time delivery" to "just-in-time manufacture where it is needed."

The challenge for industry is to find the most economically viable fit of processes and products while maintaining quality, safety and design standards essential to the end use.

THE HISTORY OF THE TECHNOLOGY

Generally, AM technologies employ the process of joining materials to make objects from a three-dimensional model, usually adding layer upon layer to create the product, as opposed to the traditional subtractive manufacturing methodologies.

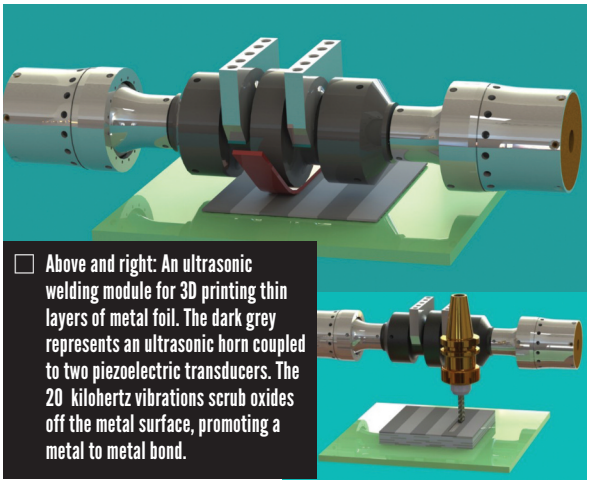
Executive Summary

SUBJECT: Making products through 3D printing presents a new world of possibilities for manufacturers, including valve and actuator companies.

KEY CONCEPTS:

- The technology involved
- What it can do for valves
- The advantages and limitations

TAKE-AWAY: We've not yet reached the point where it's out of the laboratories, but we're getting very close.



Above and right: An ultrasonic welding module for 3D printing thin layers of metal foil. The dark grey represents an ultrasonic horn coupled to two piezoelectric transducers. The 20 kilohertz vibrations scrub oxides off the metal surface, promoting a metal to metal bond.

While the development of inexpensive consumer technologies has brought 3D printing to the consciousness of the general public only in the last decade, the technologies have been around since the early 1980s.

Initially, these technologies were called rapid prototyping, named because the process was originally conceived as a faster and less expensive method for creating prototypes of industrial products. The first patent was issued to inventor Charles Hull in 1986 for a stereolithography apparatus. Hull went on to co-found 3D Systems Corporation, which introduced its first commercial system in 1987. That company is still very active today.

The next patent was awarded to Carl Deckard in 1989 for the process of selective laser sintering (SLS). In that same year, Scott Crump, a co-founder of Stratasys Inc., filed a patent for fused deposition modeling (FDM). Crump's patent was issued in 1992; and the FDM process is still used by many of today's entry-level machines.

Not all of the work in 3D technologies was being done in the U.S., however. Hans Langer formed EOS GmbH in Germany in 1989, a company that sold its first "Stereos" system in 1990. It focused on the laser sintering process, including direct metal laser sintering.

The term "3D printing" is generally associated today with hobbyists and consumer-oriented models that use fused deposition modeling, a special application of plastic extrusion. The term "additive manufacturing" comes into play when people are referring to industrial processes. The two processes are generally the same. Whether polymers or metals are the ingredients, the technologies share the common practice of sequential-layer material addition—a joining throughout a 3D work envelope under automated control.

THE TECHNOLOGIES

The AM process can either result in a finished product so that it qualifies as direct production, or it can result in a mold or product that requires heat, finishing or assembly, which means it's considered indirect production. Within each of these general production types, several technologies are used.

Following are the main production technologies and the applications in which they can be applied:

Powder bed fusion can be used with metal or plastic. This is a layer-additive process using a laser to produce functional parts, complex geometries and end-use production parts.

Material extrusion is when a filament, generally thermoplastic, is fed into a heated liquefier where it is turned into a semi-liquid. The material is then extruded by a nozzle mounted to a mechanical stage, which is moved back and forth on computer-controlled tool paths to build parts. These parts, which can vary in size from microns to meters, are very sturdy and functional and have a high strength-to-weight ratio. In industrial applications, the parts are generally used for prototyping form and fit.

Computer numerical code (CNC) is cast machining of polymer or metal parts to refine shapes or surface finishes or to achieve tighter tolerances. CNC machining is incorporated into a hybrid additive manufacturing process that combines laser processes with a machining process. The chips produced by the machining process are often a size that allows them to be automatically recycled into the laser process. Chips that are larger than allowable for laser sintering are swept aside as the next layer is deposited.

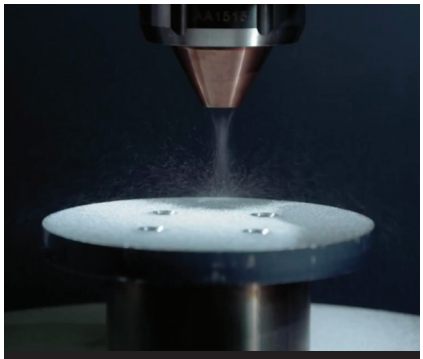


Figure 1. Directed energy deposition

Cast urethane is a process in which liquid silicone rubber is poured around a master pattern. The resulting mold is pulled from the pattern and cured, then subsequently used to cast urethane parts.

Binder jetting involves a machine that distributes a layer of powder onto a build platform. A liquid bonding agent is applied through inkjet print heads to bond together the particles. The build platform is then lowered and the next layer of powder is laid on top. By repeating the process of laying out powder and bonding, the parts are built up in a powder bed. Materials used include plastic, metal, ceramic and sand, which form both parts and molds.

In ***sheet lamination***, sheets of paper, plastic or metal are fused together with glue, heat welding or fasteners (bolts or rivets) to make parts.

Vat photopolymerization is a process in which a pre-deposited photopolymer in a vat is selectively cured by an ultraviolet laser beam. This creates cross linking of adjoining polymer chains. This process is commonly used in medicine and dental appliances such as mouth guards.

Directed energy deposition (Figure 1) is where focused thermal energy is used to fuse materials by melting as the materials are deposited. Wire and powder materials are used, which are fused using lasers or electron beams. This process is effective for adding features to already manufactured parts and for repairs.

☐ Figure 2. Translucent polymers allow the prototype creator to see what's going on inside the valve.

☐ Figure 3. In this scenario, the core was very difficult to manufacture with a conventional core method because of customer requirements. A traditional pattern was made and cores were printed separately.

BENEFITS AND DRAWBACKS

The main advantage of AM over more conventional manufacturing processes for valves is that the need to produce a number of parts using different methods is eliminated. With AM, the entire valve can be produced by the same method so no assembly is necessary. This is possible because AM processes can produce accurate, intricate internal passages and complex geometries.

In a recent presentation, Sheku Kamara, director of the rapid prototyping consortium, the Milwaukee School of Engineering, referred to a fabrication exercise conducted at that university. In 2002, a linear motion valve was designed, then fabricated using AM. The valve's performance was evaluated and compared to that of a traditional gate valve. The test showed that making moving parts, integral O-rings and threaded connections for the valve were feasible, and the entire valve was prototyped in a single build using a vat photopolymerization process. This illustrated that it is possible to directly build functional prototypes of valves using this method.

Also, by building prototypes this way, it is possible to check flow (whether liquid, gas or oil) through the valve by using translucent polymers, which allow the prototype creator to see what's going on inside the valve (Figure 2.)

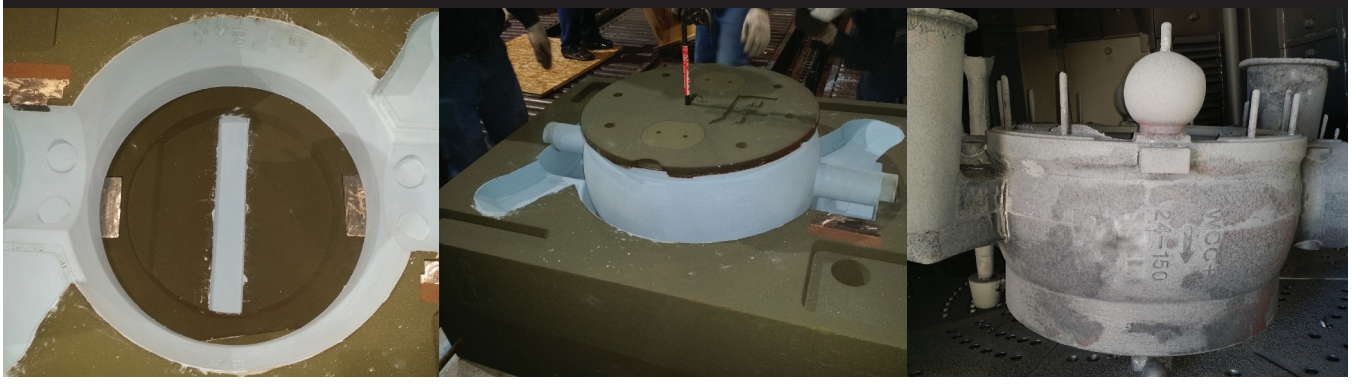
Indirect AM production of valves is also being discussed and used. In fact, Nathan VanBecelaere, manufacturing engineer for the American Foundry Group, says AM manufacturing is the first real innovation for the sand casting process to occur in 200 years (Figures 3-6). While it can be costly in comparison to conventional methods, many steps and much time are taken out of the process.

VanBecelaere points out that there are many advantages to using AM to create molds for casting valves. "There are no restrictions on gating systems, the potential for more feeding capabilities and locations is expanded, and it is more accurate when changing material types," he says. Also, "while the machines are a set size, the size of the product is not limited by machine capacity. The molds can be made in sections and pieced together to become as large as necessary," he says.

However, he also points to limitations. "Insulation cannot be printed, although the foundry can insert insulating sleeves by modeling in a counter-bore in the mold to receive the sleeves," he says. Also, excess sand has to be removed from a mold created with AM, "and, though we are currently undergoing case studies to blend additives with the silica sand, nothing has proven successful yet," he adds.

While the molding process is definitely shorter with AM, prices can be

☐ Figures 4-6. Two of the steps that go into additive manufacturing when making molds for sand casting include: At left, a mold wash (blue paint) is carefully applied to every surface that comes into contact with molten metal. This step is also used for traditional molds, but is crucial in the AM process. At center, a large center core is set by hoisting. At right is the casting being removed from the mold shown in the first two images.



prohibitive. Dean Markle, project manager–foundry specialist, Emerson Process Management, who was involved in foundries for more than 30 years, offered situations in which it could make economic sense, however.

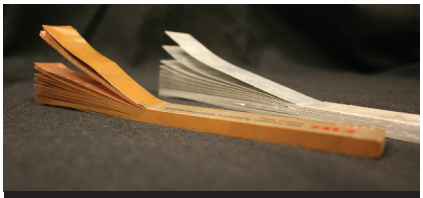
For example, the models are expensive because they are one-off. "However, if you are replacing a valve that hasn't been made for 30 years, and you are only going to need this once, it's much more efficient than conventional manufacture," he points out. Instead of hoping the 2D model exists somewhere, "We can make a 3D model in a few days, rig and gate it," then have the valve made shortly thereafter, Markle said.

AM also makes sense for specialty items that are in locations great distances apart, he says. "You can have the computer file sent to a partnering foundry anywhere in the world that uses AM and have that product built in that location," he says. In other words, "Instead of sending a pattern from foundry to foundry, you have the engineering done in a 3D model and you don't have the transportation fees to get a model to where you need the valve," he points out.

According to David Leigh, senior vice president of Engineering for Stratasys Direct Manufacturing, AM can offer many other benefits, including substantial weight savings for many products. It also can allow consolidation of parts or cost savings for low quantities, one-offs and spares. When parts undergo several revisions or customization, AM can mean substantial savings of time and money, allowing the product to get to market faster.

Leigh also said these products can be easier to use and install. "There is no concern about overhangs, undercuts, gating or venting and products can be designed around functionality, rather than tooling constraints," he says. Because there are no constraints from tooling, "creative contours and internal features can be designed into what can ultimately be a one-part product rather than several parts that have to be assembled," he added.

James Sears, senior mechancial engineer, additive manufacturing laboratory, GE Global Research, pointed out that AM could also reduce energy use



3D-printed copper and aluminum bars built from thin metal foils.

by half, and, since no milling away of excess material occurs, the process can reduce material costs for the right products by up to 90% compared to traditional manufacturing.

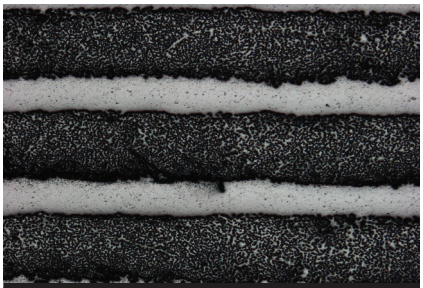
DRAWBACKS

While AM offers many advantages, it also has limitations to its use.

As Leigh pointed out, custom AM machines are expensive, machine producers are small and producers cannot support multiple development efforts. Raw materials are expensive, and the process offers limited recyclability for used material. Also, as-built tolerance is less for AM products than products that are tooled. Processing after production is needed for dimensional tolerance and cosmetics, and there can be anisotropy (the property of being directionally dependent as opposed to isotropy, for which a product has identical properties in all directions).

In the case of "just-in-time manufacture" at locations not owned by a patent holder, there also is the issue of protecting intellectual property. This is because, as with other technologies, advances in AM have come about far faster than legal and societal structures can be created and implemented to protect interested parties.

Sears pointed out that getting materials qualification for created products is expensive, and can take five or more years. He said understanding the interaction between the laser and the material being used is critical. Considerations include the location of maximum power absorption inside the powder bed, the impact of particle size and distribution on melt kinetics, and the percentage of laser power absorbed. With AM, distortion also can occur in the thermal process, which can result in cracks or undesirable shapes and fits.



3D printed metal matrix composite. This structure combines aerospace aluminum with super-high-strength ceramic fibers.

All of these challenges must be weighed against conventional manufacturing, where every part starts with a pre-formed billet that gets reformed and machined. With traditional manufacturing, material properties are known and cannot be changed, whereas with additive manufacturing, the material properties are created as the part is built. That reality can be both positive and negative. In AM, for example, because the properties of the material can be created as the part is built, those properties can be adapted to a specific location.

CONCLUSION

As with cell phones and many other newer technologies of today, AM technology will continue to improve, and the costs will come down. The process has definitely gone past the point of fascination with the technology, but it's still suitable only for the research labs to test. Some applications for the technology make sense and are economically and commercially justifiable. It also is probable that if an article like this one is written a year from now, a few valve and actuator companies will have moved this technology out of the lab and onto their production floors. VM

Editor's Note: Additive manufacturing technologies were discussed by David Leigh, James Sears, Sheku Kamara and Nathan Van Becelaere in presentations at the 2015 VMA Technical Seminar & Exhibits. Dean Markle works closely with VanBecelaere to develop the indirect AM model for sand casting valves.

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A Case Study: Updating a Postwar-Era Potable Water System

BY DERON AUSTIN

END USER: Foss Reservoir/Foss Lake
DATE: Completed in 2014

The Foss Reservoir Master Conservancy District (FRMCD) in southwestern Oklahoma is part of the 8,800-acre Foss Reservoir/Foss Lake. The treatment plant, which is located adjacent to the Foss Dam, pumps water from three pumping stations through 50.8 total miles (81.8 kilometers) of concrete transmission lines. The system was put in from 1958 to 1961 and was in need of an update so that FRMCD could better serve its 17,000 consumers in several towns.

PROBLEM

The concrete bar-wrapped tongue-and-groove pipe transmission lines that carry water to these towns were aging. Like many government-constructed water distribution systems developed in postwar years, FRMCD sorely lacked funding to install main valves in their systems to isolate the towns the district served. With the passage of time, erosion of the concrete pipe caused leakages.

High pressure and reverse flows caused fittings failures; and, until recently, whenever a leak occurred, standard operating procedure meant shutting down the entire system to make repairs. A more effective alternative was needed for uninterrupted water delivery.

SOLUTION

Beginning in late 2013, pipeline repairs were made at FRMCD that included installing 18-, 24- and 30-inch 150 psi butterfly isolation valves at each point where a line enters a city. Designed specifically for the waterworks industry, the butterfly valves were made to be rugged and reliable for buried service. The body-mounted elastomeric seat had ridges that provided multiple sealing lines and permitted higher levels of radial compression. As a result, stress in the seat material was reduced, allowing lower seating torques and optimal sealing action.

☐ Workers replace part of the old piping. While repairs in the past required shutdowns, the new system of valves allowed work on parts of the system.

The aging water towers and water storage tanks at FRMCD also required periodic maintenance, requiring shutdown of each tower's individual supply lines and emptying of the particular vessel. In addition to valve installations at locations where water mains route to the towns FRMCD served, valves also were installed at tees within concrete vaults where transmission lines lead to water towers and tanks. This arrangement permits continual flow of water throughout the rest of the system while supply lines to and from each vessel can be independently closed as needed.

AN ADDITIONAL CHALLENGE

In the past two years, the areas surrounding the reservoir have been plagued by drought, causing a significant portion of Foss Reservoir to run dry. The lake currently is about 16 1/2 feet (5 meters) low and only one of the four intakes is supplying water. Naturally, greater control of water delivery to consumers within the system has become even more critical. However, the system improvements put into place for this update meant no customer is currently without water in the district.

Another significant benefit of this update has been that, even though many projects of this type have required procurement of special projects funding to make repairs and improvements, this update project has been completed on a routine, scheduled basis under the maintenance category, which means funding comes out of the existing maintenance budget.

CONCLUSION

All design and project objectives of the repair and improvements program at FRMCD were met or exceeded. What's more, turnaround times for repairs and installations have been short, and no problematic hitches in the program have occurred. Water is now flowing uninterrupted to FRMCD consumers even when maintenance is performed at points within the system. This kind of success serves as a good example for other water distribution systems that need improvements or updates. VM

Deron Austin is director of marketing and communications, Mueller Co. (www.muellercompany.com). Reach him at daustin@muellercompany.com.

REFERENCES

1. Department of the Interior, Washita Basin Project, 2013
2. Bureau of Reclamation, Washita Basin Project and Foss Dam, March, 2014
3. Oklahoma Department of Environmental Quality, Drinking Water State Revolving Fund, Amendment No. 1, Intended Use Plan, March 2014

Designing for Safety: Failure Modes on Gate Valves

BY ANEIL ALI

For over 100 years, preventing catastrophic failure in the process control industry has been a continuously evolving area of study. To protect life, the environment, reputations and capital investments from compromise, we deliberate over safety and risk in every aspect of a system. As a positive result, systems of designed failure scenarios are strategically located throughout chemical refineries, power plants, floating vessels and offshore rigs. Understanding how process failure modes are achieved and where certain valves and actuation fit into the scenario is key to our efforts.

FAIL-SAFE AND ACTUATION

Within designed fail-safe systems, industrial process control valves are complexly categorized by the method by which each piece of equipment interacts with a process fluid. The flow of that process can be cut, choked, throttled and pinched. From an actuation and controls perspective, valves are more simply categorized by the method of actuation required to operate that valve: rotary and rising stem.

This article focuses on the latter.

Different rising stem alternatives include gate, globe, choke and pinch valves. Each have unique operating characteristics that lend themselves to preferred applications. For example, globe valves are suitable for throttling applications where flow of a process must be precisely controlled. The primary purpose of gate valves is to permit or prevent flow of processes. Pinch valves are ideal for slurry processes that contain solids such as pellets, powders and granules.

Let's look closer at failure options for gate valves.

When specifying a gate valve failure scenario, we have three options: fail open to permit flow, fail close to prevent flow and fail in last position. The first two options are active failure positions, whereas the third option is a passive failure position. Bear in mind that valve stems on most gate valves experience linear translation during operation to open and close. An engineer is most likely to specify an active failure position with an intention of controlling the process.

The ability to predict behavior and flow of a process during failure is advantageous in scenarios where pressure relief and pipeline isolation are critical to system integrity. In many cases, availability of electricity, pressurized air and pressurized hydraulic fluid dictates the method of actuation used in achieving a failure position. For purposes of this article, we will assume an ideal scenario where all sources of power are available. Let's zoom in to look at the actuation and controls required to achieve an active failure position on a gate valve.

A gate valve with a pneumatic linear valve actuator

The engineer has five options when considering a valve actuator solution:

- Multi-turn electric with auxiliary power source
- Spring-loaded diaphragm
- Spring-loaded piston
- Double-acting diaphragm with power storage tank
- Double-acting piston with power storage tank

These systems are all capable of storing potential energy to aid in achieving an active failure position. Let's take a moment to understand the four presented methods of storing potential energy and their effects on system reliability.

Coiled springs serve as an integral component of the valve/actuator assembly. Springs are a reliable and resilient method of storing potential energy. They act independently of electricity, pipe/connection leakage, severe temperatures and most other types of non-destructive interaction. Tight shut-off applications require springs with large thrusts, which increases the size needed to overcome initial spring forces. Using a coiled spring to increase system reliability demands an increase in actuator size. The attractive feature of spring-loaded systems is that they can store potential energy for extended periods of time with near zero loss.

Hydraulic accumulators are supplementary devices to the main actuator/valve system. This type of system is susceptible to pressure fluctuations in severe temperature variances because pressurized gases are used in maintaining hydraulic pressure. Also, the potential for loss of stored power exists through piping leakage. Aside from these few vulnerabilities, hydraulic accumulators are a reliable method of storing pressurized hydraulic fluid because of their relatively classic concept and design.

Air receivers also serve as supple-

mentary devices to the main actuator/valve system. In these systems, stored compressed air is subject to fluctuations in pressure (stored power) with large temperature variations, while the potential for loss of stored power exists through piping leakage. Aside from the large system footprint of these systems, they are highly reliable with routine maintenance and particularly advantageous in maintaining the ability to alternate between fail-open and fail-closed modes with simple piping changes.

Lead-acid batteries, supercapacitors and backup generators are auxiliary components of the valve/actuator assembly. Backup generators are a reliable source of power supply open to continuous monitoring and commonly found on large tank farms and applications where space is limited at the valve point. Generators provide a single point of backup power supply that can be centrally located while serving multiple valve actuators.

EMERGENCY SHUTDOWN

Let's consider the application of an emergency shutdown valve/actuator system intended for a low-pressure pipeline crossing a water stream. This system would be designed to isolate fluid supply if a predetermined pressure drop between two points is sensed (pipeline rupture). An automated gate valve would be a critical component in safeguarding the integrity of the surrounding community, wildlife and environment. The demanding failure-mode characteristics shown below should be taken into consideration when selecting an actuator solution for this situation.

- Trip criteria: When pipeline pressure, electricity or pneumatic pressure is lost.
- Active failure position: Closed (preventing flow)
- Sensing reaction speed: 1 second
- Failure position speed: 6 seconds

These constraints are a common system design scenario experienced by engineers at organizations around the world. Although many end users value the peace of mind provided with spring-return actuators, space and weight constraints occasionally make it more beneficial to use lighter and more compact systems with air receivers or backup power supplies. As a result, the engineer is often tasked with specifying an optimized combination of failure scenario, weight, equipment size, safety, materials and system reliability. After many years of research, investigation, testing and design, a universal process control solution refuses to present itself. However, industry continually improves established codes, best-practices, standards and proven technologies. With careful design consideration, any combination of the previously mentioned actuator and power storage solutions can be deemed safe and suitable for use. VM

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Training Is a Crucial Part of the Picture

BY JIM SULLIVAN

A swiftly growing fire erupts from a piece of malfunctioning equipment at a plant that has a reputation for reliable operations and very few workplace accidents. On this day, however, black smoke quickly begins to billow from the plant as employees scatter—some to get fire extinguishers and some to evacuate guests unaware of the danger that is unfolding.

This fire, which occurred on a seemingly normal day for plant operations, wreaked havoc on plant equipment and its personnel. It caused the entire plant to shut down and cost thousands of dollars of revenue because of one malfunctioning product that caused a piece of equipment to catch fire. But who among us is prepared to handle something like this? Such incidents show why everyone who works with plants needs to have good training programs in place for employees; those training programs should provide a solid working knowledge of what might happen to the valves and related equipment in any scenario. Distributors can be one of the resources to help provide that training.

David Scott (standing) of Samson Controls demonstrates how control valves work to attendees at VMA's Valves, Actuators & Controls 101 course.

THE CHALLENGES

In the worst of situations, a plant can experience loss of life from a plant accident. However, though milder in consequence, we also need to prepare for unscheduled facility shutdowns. Plants face lawsuits, fines and public perception issues when any malfunction or operational error occurs, especially if it leads to workplace injury.

Having plant personnel properly trained in valve components and their functions, valve maintenance and valve integrity can greatly reduce the chances of dire consequences.

As plants work to update and maintain their facilities and operations, they are faced with the challenge of having access to adequate training resources to ensure that plant personnel are well-equipped to choose and maintain valves.

But the landscape of today's plant workforce coupled with evolving valve specifications create new challenges in ensuring that plant personnel is well-equipped to perform preventative valve maintenance and make well-informed purchasing decisions.

These challenges include:

- ***Retiring workforce:*** According to data from the Pew Research Center, 10,000 baby boomers will reach age 65 (the typical age for retirement) every day through 2029.

  A 2012 survey conducted by the Society of Human Resources and AARP found that, despite the data supporting the increase in this large, aging population, many U.S. organizations are mostly unprepared for the "brain drain and skills void" these experienced, retiring workers will leave.
- ***Fewer employees:*** Plants are now automating many of their processes with new technology and software. Automation allows plants to run more efficiently and keep operating costs in-line with global competition. However, it also means plants can operate with fewer employees. Maintenance and engineering departments have fewer human resources, restricting the number of people available to troubleshoot valve issues and train new associates on valve procedures.
- ***Complicated selection process:*** Evaluating valve criteria can be a complicated and confusing process. However, it is necessary to choose the right valve for each application and to understand how to properly maintain that valve during operations.

A sample of the valve criteria that must be considered includes:

- ***Valve size:*** Control valves should be sized based on desired flow rates, not pipeline size. Often control valves are one size smaller than the pipeline to provide optimal control. Most isolation valves, such as a gate, ball, butterfly or plug, will match the pipeline size.
- ***Pressure and temperature:*** Valves are designed to meet certain pressure and temperature ratings. Selecting the proper valve materials of construction (body, seat, packing, plug/disc/ball, gaskets) for each application is important to

ensure the valve will withstand the design pressures and temperatures.

- ***Actuation method:*** Understanding the method by which a valve mechanism moves (handle, gear operator, pneumatic, electric or hydraulic) is a vital component in ensuring that valves are operated safely and properly. For instance, small manual valves typically come with a handle to open and close the valve. As valve sizes and pressures increase, customers should opt for gear operators for ease in operating valves.
- ***Flow rate:*** Each valve manufacturer will provide flow rates (CV) for specific products. For example, control valves are commonly sized to control the amount of flow based on various conditions (normal, minimum and maximum). Over-sizing control valves can lead to cavitation, valve damage and costly repairs.
- ***Media:*** Selecting the proper compatible materials of construction for the media running through the valve is a key component when making valve purchasing decisions. As an example, a high-performance butterfly valve's body, disc, stem, seat and packing will all need to be compatible with the media. One wrong determination can lead to valve failure and potential safety hazards. In some cases, multiple materials will work with the media, and cost must be considered in the evaluation process. Many manufacturers provide corrosion guides to select valve component materials for specific applications.
- ***End connection:*** End connections (flanged, threaded, socket weld and butt weld) are designed to match the pipe connections. For example, many manufacturers have specific instructions for welding socket or butt weld valves to minimize the potential for damage to the valve seats. Overheating the welds at high temperatures could damage soft goods within valve designs and cause premature valve failure.
- ***Delivery requirements:*** Some valves are readily available while others have long lead times. Process valves are made to order based upon many different applications. Distributors will attempt to stock commonly used products to reduce lead times for their customers and keep plants operating.

TRAINING RESOURCES

Training programs can be costly, so some plants turn to the supply chain to mitigate those costs and provide technical expertise. A few cost-effective ways for plants to provide valuable training to their employees while keeping costs down include using:

- ***Experienced employees:*** Plants can use their retiring workforce to help fill the knowledge gap before those employees completely exit the workforce. Some ways baby boomers can be used to ensure their experience is not completely lost include: 1) Increasing training and cross-training with newer employees and developing a succession plan for younger workers who will fill key operation roles; 2) Hiring retired employees as consultants or temporary workers; and 3) Offering flexible work arrangements and part-time positions to keep baby boomer employees on the job longer.
- ***Valve Manufacturers Association of America (VMA):*** VMA offers several training resources available to plant associates including: 1) The Valve Basics course: A three-day valve, actuator and control education program that includes a "Valve Petting Zoo" to provide hands-on experience with products covered during the course; 2) Valve Basics Online Training: An online training course offered to those who are unable to attend live seminars; and 3) VALVE Magazine and VALVEmagazine.com, which include a wealth of information from past articles and Web content contributed by end users, specifiers, distributors, manufacturers and valve repair and service firms.
- ***Distributor on- or off-site training:*** Distributors often offer on- or off-site training for plant personnel to demonstrate valve technology and provide technical expertise. Distributors act as a liaison between a plant and a manufacturer, and they are able to request a manufacturer's support and assistance for specific applications. Plants should use distributors to stay current on products and new technologies.
- ***Manufacturer plant training and online resources:*** In the past, manufacturers provided product catalogues with information regarding their products, specification adherence, operating, installation and maintenance instructions. Over the years, those resources have moved online so that manufacturers can make timely updates when there are product changes. Plant operators have access to a variety of online training resources provided by manufacturers to keep their personnel up to date on understanding, purchasing and maintaining valves in this new environment.

Visiting a manufacturer's website is often the most direct way to access valve specifications and operating instructions. Some manufacturers now demonstrate how their valves operate on their websites and how to maintain and repair products through online videos. Plants also can now find video operational instructions on manufacturer websites and online video platforms such as YouTube to view product demonstrations and repair techniques.

Manufacturers also still visit plants to demonstrate products or have operators visit their facilities for training.

SUMMARY

The make-up of the plant workforce continues to change and valve technology continues to evolve. Plants cannot rely solely on experienced employees to train new hires on valve selection, maintenance and repair. Having a comprehensive training program in place and using existing resources, including distributors, suppliers and manufacturers, will help reduce plant downtime and workforce injuries. VM

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New, Surplus, Repaired or Rebuilt?

BY GREG JOHNSON

If you've been around valves for a while, you've likely heard the term "new surplus," plus a few other saltier descriptions for valves that are offered for sale. A joke in the industry concerning the phrase "new surplus valves" goes like this: In describing his valve product, the shifty valve salesman said it is new surplus: "surplus to me and new to you."

But despite this joke, the history of new surplus valves is aboveboard and honest. The term was coined in the late 1940s to describe valves purchased for government-contracted purposes during World War II, but never used. In 1945, the end of the war still seemed years away, and the huge industrial pipeline was spewing forth material of all kinds, including piping, valves and fittings. A slowdown in production and cancellation of orders did not occur until the fall of 1945.

The extra unneeded valves were stockpiled at depots and holding areas around the country. The newly formed "War Assets Administration" was set up to dispose of these surplus items. Regional auctions and government sales were held from the late 1940s through the mid-1950s, during which brand-new unused surplus valves, along with many other items, were sold for pennies on the dollar, which placed huge amounts of near-perfect valves on the market. An interesting fact is that to be an eligible buyer at most of these sales, you had to be a military veteran.

These were the days before traceability issues came to the forefront; the well-known name brand on the side of the valve was its traceability. The stocking and resale of these valves helped foster the creation of many new pipes/valves/fitting supply houses, because the new surplus valves (and fittings) were well-received and readily purchased by industry, particularly on the Texas Gulf Coast.

Unfortunately, the reputation of new surplus valves soon became tarnished by dishonest valve repair entrepreneurs who rebuilt used valves, attached new counterfeit OEM tags to those valves and sold them as new surplus.

Most of the crooks are now gone, and quality new surplus valves are still available for sale on the market today. These are extras or overages that were not needed for a particular project. Many of them have all of the correct traceability paperwork. There also are many companies that have huge stocks of unused new surplus valves for sale. The only thing that is usually missing is the traceability paperwork.

So just what do the terms associated with rebuilt, repaired and new surplus really mean?

New: A new OEM-manufactured product that is sold through official distributor channels with all traceability paperwork available with the valve.

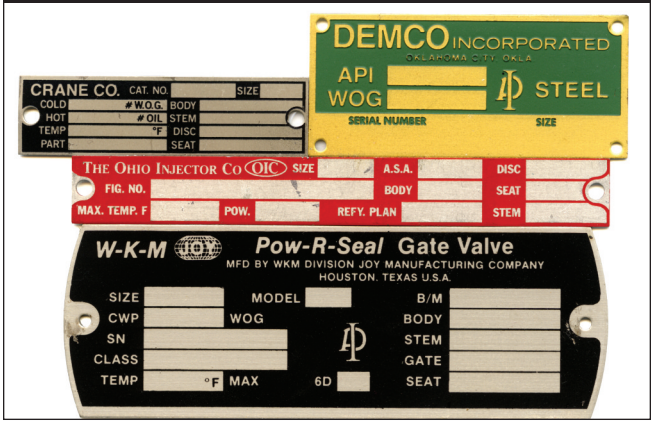
These are examples of obscure but still new surplus valves awaiting a call to duty that probably will never come.

Surplus or New Surplus: Usually, valves that have never been installed and are purchased from an end-user or contractor who failed to use them on a construction project. In some cases, a surplus valve might have received a post-factory hydrostatic test, either in the field or at a valve service center. These valves may or may not have the requisite traceability paperwork.

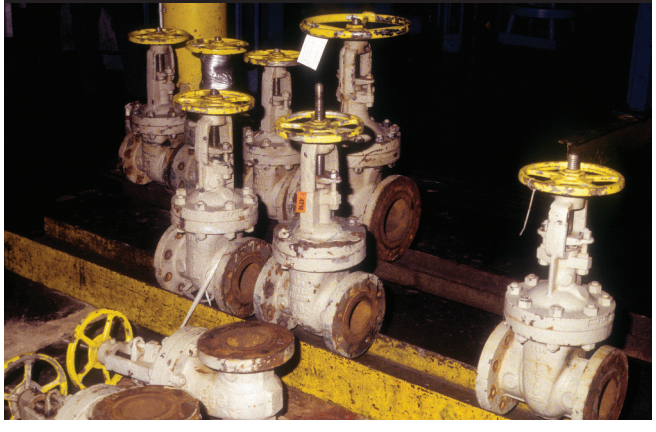
Rebuilt: Valves that are completely disassembled and refurbished. These valves may be processed with the knowledge and support of the OEM, or they may be processed by anyone with the right tools and a garage. The process becomes dishonest if the rebuilder does not put his "rebuilt by" tag on the valve.

Repaired: Valves that have been

Dishonest companies at one time created counterfeit OEM tags for so-called "new surplus" valves that were really rebuilt and re-tagged. The tags pictured here were discovered in a box at a valve repair company auction many years ago.



If users have confidence in a repair shop, they may elect to repair instead of replace. These are valves awaiting the "tear down and inspection" process to see if they are economical to repair.



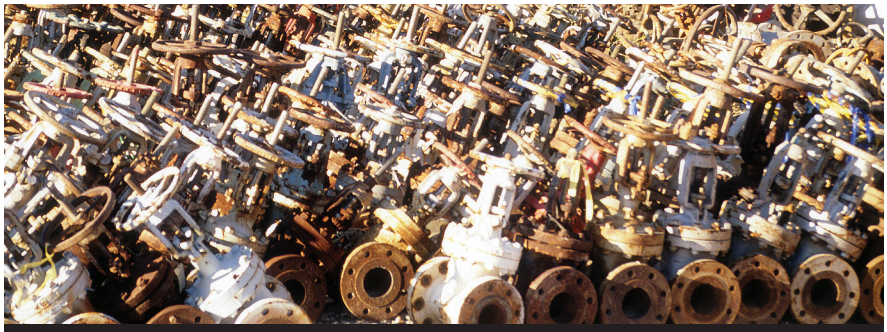
sent to a repair facility by the valve owner for refurbishment. These facilities are almost always authorized by specific manufacturers to repair and service their products. The key to the definition is that the valve owner is sending its valves to be repaired and returned to its company.

As-is or Raw Valves: These are valves that have been in service and bought from a plant after they were replaced by new ones. They are usually rusty and raw and in need of major repair. Oftentimes the only place to find a rare valve to meet an emergency need is searching through raw valve inventory. Some valve repair facilities have boneyards of these valves, which are used for parts in repairs.

Sometimes a difficult-to-find valve is needed to get a plant back up and running, particularly during an unanticipated outage, which too often occurs on Saturday night or Christmas Eve (or both). The particular valve may not be available from new distributor stock or the old one may not be repairable. This requires both the repair facility and the end user to step out of their normal paths of procurement and solve a problem by finding a suitable new surplus valve or raw valve to rebuild.

End users often question whether they should purchase a rebuilt valve instead of a repaired valve. The answer is that it depends upon the user's confidence in the rebuilder and the amount of inspection and quality evaluation he or she is willing to have the rebuilder perform. Often, valves can be rebuilt and repaired to standards that exceeded the original manufacturing process, particularly if the valve was built decades ago.

Other end users wonder when they should purchase a new surplus valve. Still others are not allowed to have valves in their plants without the requisite OEM paperwork because of liability issues and OSHA 1910 Process Safety paperwork requirements. However, if there is no other choice and the rebuilt valve is the only one available, an intensive testing regimen can be performed to provide confidence and a pile of quality assurance paperwork for the purchaser. This can include disassembly and inspection of all key parts, thorough wall thickness inspection, radiography, positive material identification of key components (pressure-containing parts and trim) and hydrostatic testing with extended testing times or with an inert gas such as helium.



☐ These raw valves already have seen years of heavy flow-control action, but their cores are still valuable in a pinch, particularly some of the hard-to-replace items.

To have confidence in general repair work or in purchasing a rebuilt or specially tested surplus valve, a close trusting relationship with a reputable valve service company is needed. The first filter in selecting that valve service company should be to ask if they are members of the Valve Repair Council, an adjunct organization to VMA.

There are always times when the normal rules of valve repair must be bent a little to solve seemingly unsolvable valve repair issues. Dealing with an experienced, quality valve service facility can greatly mitigate the risks of these situations. An oft-used World War II motto aptly applies to these situations as well as these repair facilities: "The difficult we do today, the impossible takes a little longer." VM

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Q: In two Materials Q&A columns back in Winter 2010 and Spring 2010, you discussed making flanges from forged bar, and in the Spring column you indicated that it would be interesting to submit an inquiry to ASME regarding the conflicting requirements in the Section II material specifications vs. Section VIII Appendix 2. Was that ever done?

BY DON BUSH

A: Yes, it was, and a little over 2 1/2 years later, a partial response was received.

The inquiry questions and replies were as follows:

1. **Question:** Is it acceptable to machine hubbed flanges from forged bar that meets the requirements for a material specified in SA-105, SA-181, SA-350, SA-182, or SA-522?
   Reply: A revision record has been opened to address your inquiry regarding UG-14.
   Note: UG-14 covers the material form "Rods and Bars."
2. **Question:** If the answer to question number 1 is "Yes," then is it acceptable to certify that the flanges machined from such forged bar are compliant with the pertinent material specification, even though the material specification prohibits machining flanges from forged bar?
   Reply: No reply was required, because the reply to the previous question was not "Yes."
3. **Question:** From the standpoint of Section VIII Division 1 Appendix 2 Paragraph 2-2 (d) (1), is radially-forged bar considered to be forged bar?
   Reply: Yes.
4. **Question:** Is there a specific definition of hot-rolled billet to distinguish it from hot-rolled bar with respect to Section VIII Division 1 Appendix 2 Paragraph 2-2 (d) (1)?
   Reply: Yes. Definitions for billets and blooms exist in SA-788.
5. **Question:** If the answer to question number 5 is "No," then should a definition be developed and added to Section VIII Division 1 Appendix 2 Paragraph 2-2 (d)?
   Reply: No reply was required, because the reply to the previous question was "Yes."

The ASME responses to the first two questions didn't help to resolve this situation, at least in the short term. It's assumed that the aforementioned revisions to the Section II specifications and/or revisions to Section VIII will eventually resolve the issue.

The response to the third question simply confirmed that radially-forged bar is considered forged bar, which helps alleviate concerns that it might be necessary to compress a bar shape in the longitudinal direction in order for it to be considered "forged." We now know that is not necessary.

Regarding the response to question 4, following are the paragraphs from ASME SA-788 regarding billets and blooms:

> *3.3 Billets and Blooms—Interchangeable terms representing hot-worked semi-finished product intended as a starting stock for making forgings.*
> *3.3.1 Discussion—No size limitations are assumed for either term. Cast shapes produced by a continuous casting process, without subsequent work, are considered to be ingots for the purposes of this specification, and if supplied as billets or blooms must carry the descriptor Cast Billet or Cast Bloom.*

What this means is that hot-worked billets and blooms are distinguished from hot-rolled bar by:

- the fact that they are semi-finished, and
- their intended use (as a starting stock for making forgings).

Note that there are no physical criteria, such as size restrictions or reduction ratios from the original ingot cross-sectional area, etc. This seems problematic because anyone could consider a large hot-rolled bar to be semi-finished, and claim it was intended to be used as a starting stock for making forgings, qualifying it as a hot-worked billet or bloom. It could then be machined into a hubbed flange under the rules of Section VIII Appendix 2.

After further investigation, including discussions with code specialists, customers and authorized code inspectors, a better understanding of this situation has been established.

As stated in previous columns, Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code specifically allows the use of hubbed flanges machined from forged bar in accordance with the following statement from Mandatory Appendix 2, paragraph 2.2 (d) (1):

> *"Hubbed flanges may be machined from a hot-rolled or forged billet or forged bar. The axis of the finished flange shall be parallel to the long axis of the original billet or bar."*

Although this appendix allows the use of forged bar, it doesn't state the specifications and grades that can be used, and it doesn't mention the ASTM or ASME standards commonly used to cover forged flanges. In other words, it says you can make hubbed flanges out of forged bar, but it doesn't provide any indication about how those hubbed flanges should be certified.

It would be ideal if there were ASTM or ASME specifications covering forged bar, but there aren't. There are specifications covering some grades of bar that correspond with the ASTM and ASME standards and grades commonly used to cover forged items (Table 1).

Unfortunately, none of these covers forged bar specifically. SA-479 covers hot-finished (which would include, but not require, hot-forging), cold-finished and extruded material. SA-696 and SA-739 cover "hot-wrought" material,

Table 1

Specification	Type of Material	Bar Grades Covered
ASME SA-479	Stainless Steels	Wide variety of grades, including all common grades
ASME SA-696	Carbon Steel	Two grades—one (Grade C) roughly equivalent to SA-105
ASME SA-739	Alloy Steels	Two grades—B11 and B22, roughly equivalent to SA-182 F11 Class 2 and F22 Class 3

which would include, but not require, hot-forging. Since none of these specifications include a standard grade, class, form or other option to indicate that the bar is to be forged, the requirements for a forged bar version of each of these materials would need to be covered by an additional specification.

In addition, a number of steel grades are not covered under either SA-696 or SA-739. For example, there is no coverage for an impact-tested, low-temperature carbon steel (analogous to ASME SA-350 LF2 Class 1). SA-739 includes no coverage for a grade 91 material analogous to ASME SA-182 F91. Therefore, user specifications covering the compositions, manufacturing requirements, heat treatment requirements, mechanical testing requirements, certification requirements, etc., would need to be developed for any grades that are not specifically covered.

Another issue to consider is the acceptability of these materials under the various ASME codes. For example, according to Section II Part D, ASME SA-696 Grade C is acceptable per Section III, but not per Section I or Section VIII Division 1. ASME SA-739 B22 is acceptable per Section III and Section VIII Division 1, but not per Section I. In contrast, actual forged flanges compliant with SA-105 and SA-182 F22 Class 3 are acceptable under all of these codes.

So, in a nutshell, the situation can be summarized as follows:

- Section VIII Division 1 allows hubbed flanges designed in accordance with its own rules to be machined from forged bar.
- Such flanges machined from forged bar cannot be certified to be compliant with SA-105, SA-181, SA-182 nor SA-350. They must be certified to be compliant with some other specification.
- ASME specifications exist for wrought bar, but must be modified by user specifications to cover forged bar.
- Some material grades are simply not covered in these bar specifications, so user specifications would need to be developed to cover these "missing" grades.
- Not all ASME codes allow the use of SA-696 and SA-739, so the applicability of materials covered by these specifications, as well as by user specifications, might be prohibited under certain code sections. VM

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Balluff has expanded its innovative SmartLight product family, the industry's first all LED tower light. It is a fully programmable multi-purpose light that offers up to three modes of operations: stack light, level indicator and run light.

The light's modes of operation can be switched on-demand based on programmed conditions to provide process feedback such as cell operation status, tank fill levels, operator progress along an assembly line or to serve as an alarm for unsafe conditions.

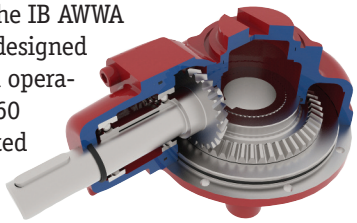
AUMA has developed new actuation solutions for a range of specialized oil and gas applications, including an innovative approach for lift plug valves.

Within the lift plug valve, different movements have to be coordinated during operation from one end position to the other: the closing element must first be lifted from its seat, then rotated by 90 degrees from close to open or vice versa, and finally lowered back into the valve seat.

AUMA's new approach uses two actuators, one designated to be responsible for lifting/lowering while the other controls part-turn movement.

Flowserve announces the launch of the Limitorque Pneumatic Compact (LPC) Scotch yoke actuator, which is complementary to the Limitorque Pneumatic Scotch yoke (LPS) model. The LPC applies similar design philosophy for long operational life and reliability, but in a more compact, lower-cost package.

The LPC is a robust yet lightweight, pneumatically driven, piston-type design that delivers torque up to 1,600 Nm (1,180 foot pounds), a maximum allowable working pressure (MAWP) of 174 psig (12 barg), and quick stroking times of less than 0.5 seconds. It is available in single-acting spring return or double-acting configurations and can operate from -76°F (-60°C) to 320°F (160°C).



Rotork Gears is offering the IB AWWA series of bevel gearboxes, designed specifically for the manual operation of AWWA standard C560 cast iron and C561 fabricated stainless steel gate valves.

Developed from the Rotork IB multi-turn gearbox range, the AWWA series features a fully sealed cast or SG iron enclosure that is grease filled for life and certified as watertight to IP68 as standard. Precision engineered input pinion and output bevel gears with low-friction hub bearings provide an extended service life to operate under high-load conditions.

The standard operating temperature range is -40° to +250°F (-40 to +121°C), with other temperature ranges available on request. Further options include auxiliary spur, bevel or two-speed input drive reducers, a mechanical dial position indicator and flexible extensions.

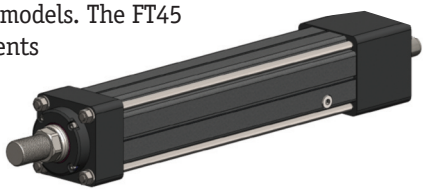
Emerson Process Management introduces the Micro Motion Heavy Fuel Viscosity Meter (HFVM) Viscomaster. The HFVM incorporates a new robust low friction Diamond-like Carbon coating that is ideal for tackling the most demanding of process applications such as marine heavy fuel oil combustion control, marine-gas-oil viscosity control and land-based fired heaters.

The head-mounted transmitter is hazardous-area-approved and has the flexibility to connect to control systems via a wide range of digital and analog protocols.

Curtiss-Wright announces expansion of its Exlar FT Series universal electric rod-style linear actuator product line with the release of the FT45 model.

The FT Series roller screw-driven actuators offer high thrust, high speed and high robustness in a compact form factor.

The new actuator has a continuous force rating of 10,000 pound-force (44.5 kN), filling the gap between the existing FT35 and FT60 models. The FT45 features key enhancements over the existing FT Series frame size designs, including the largest FT80 model.



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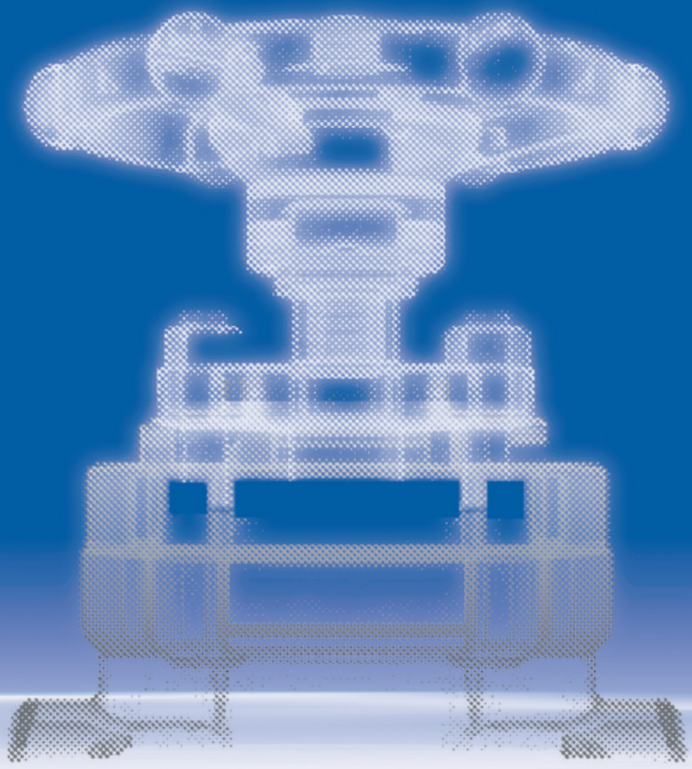

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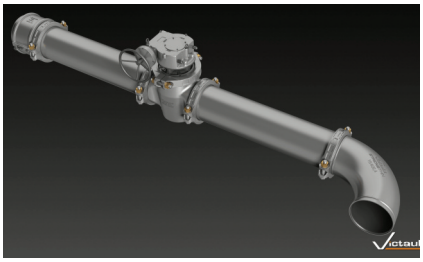

Victaulic has updated its StrengThin Piping System with the addition of the Series 466 plug valve and the redesigned Style D08 coupling. The high-pressure piping system is for balance-of-plant applications in desalination facilities. It enables direct pipe-end preparation of schedule 10S and schedule 20 super austenitic, duplex and super duplex stainless steel pipe, reducing the need for welding and flanging.

Designed for on/off and control services, the Series 466 plug valve features an increased flow area and smaller end-to-end dimensions.

Crane ChemPharma & Energy introduces the Saunders I-VUE, an intelligent valve sensor designed specifically for aseptic diaphragm valve applications in the Life Science industry. Compatible with Point-to-Point (P2P), AS-i and DeviceNet control systems, the Saunders I-VUE offers substantial benefits over standard switch controls.

It is a completely contactless valve sensor, and unlike traditional sensors with multiple components in constant contact, the I-VUE eliminates concern over failure caused by wearing parts. Lower maintenance costs are achieved by applying factory or user-defined device settings to monitor valve cycle count and end point tolerance limits.

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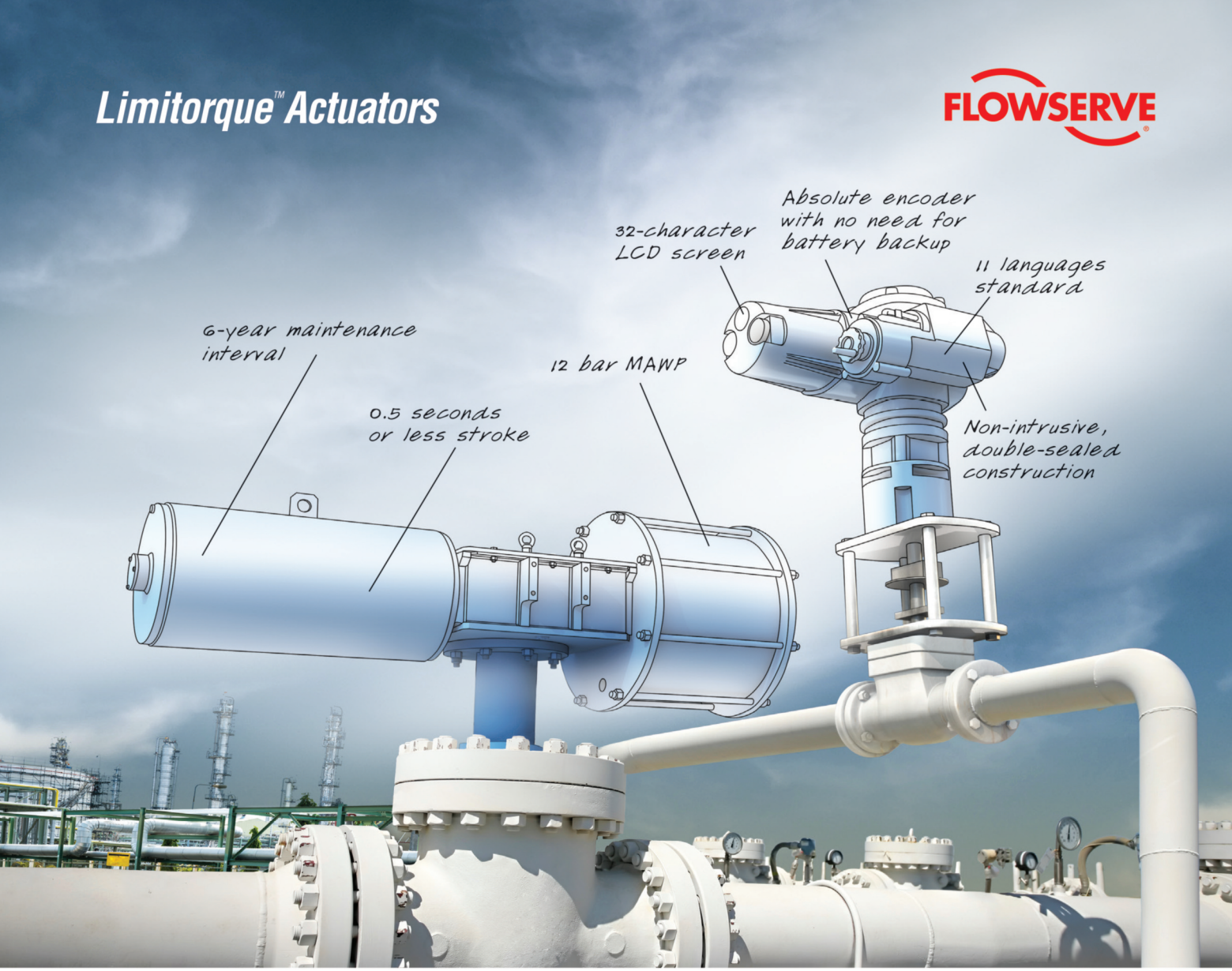

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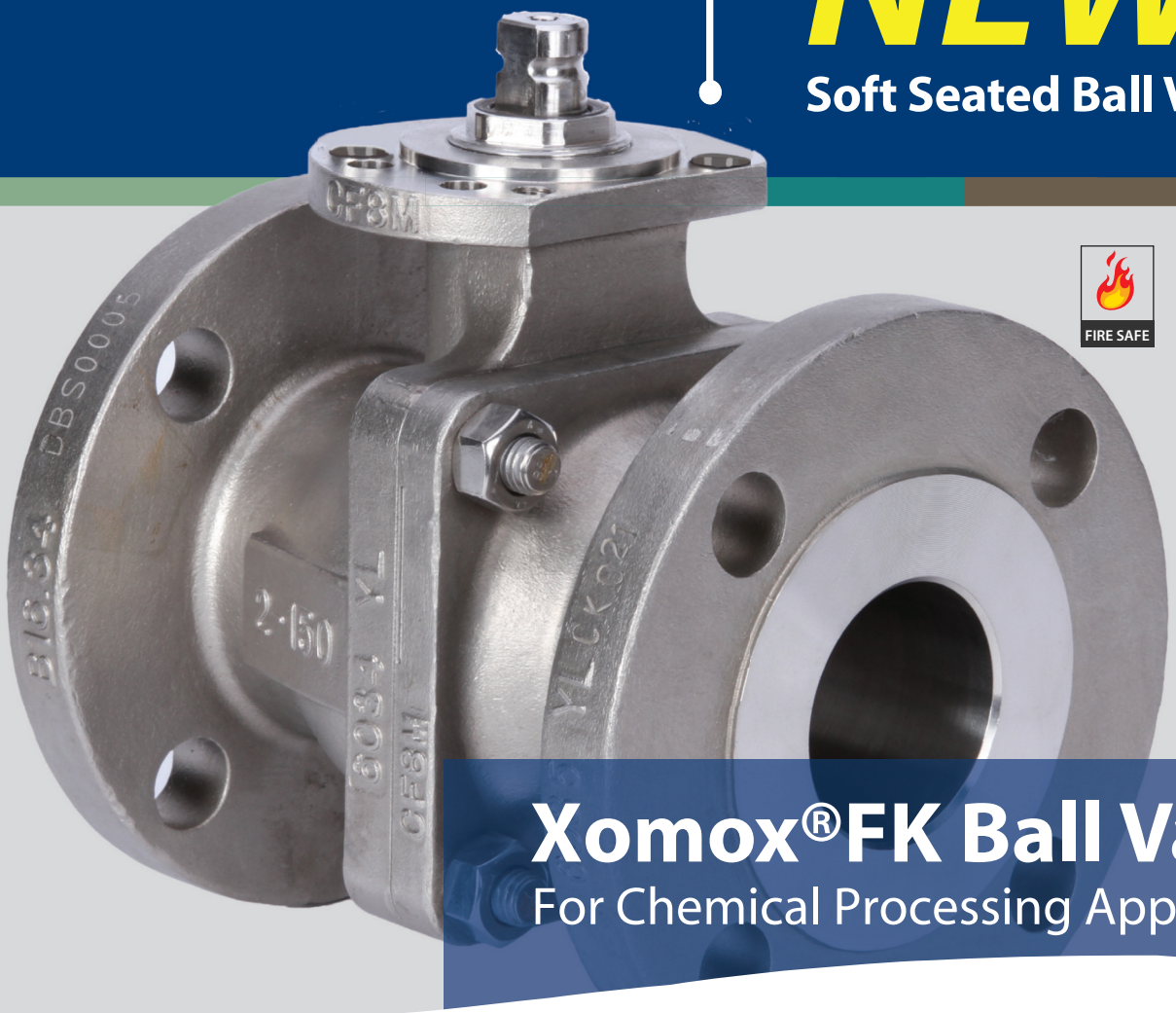

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