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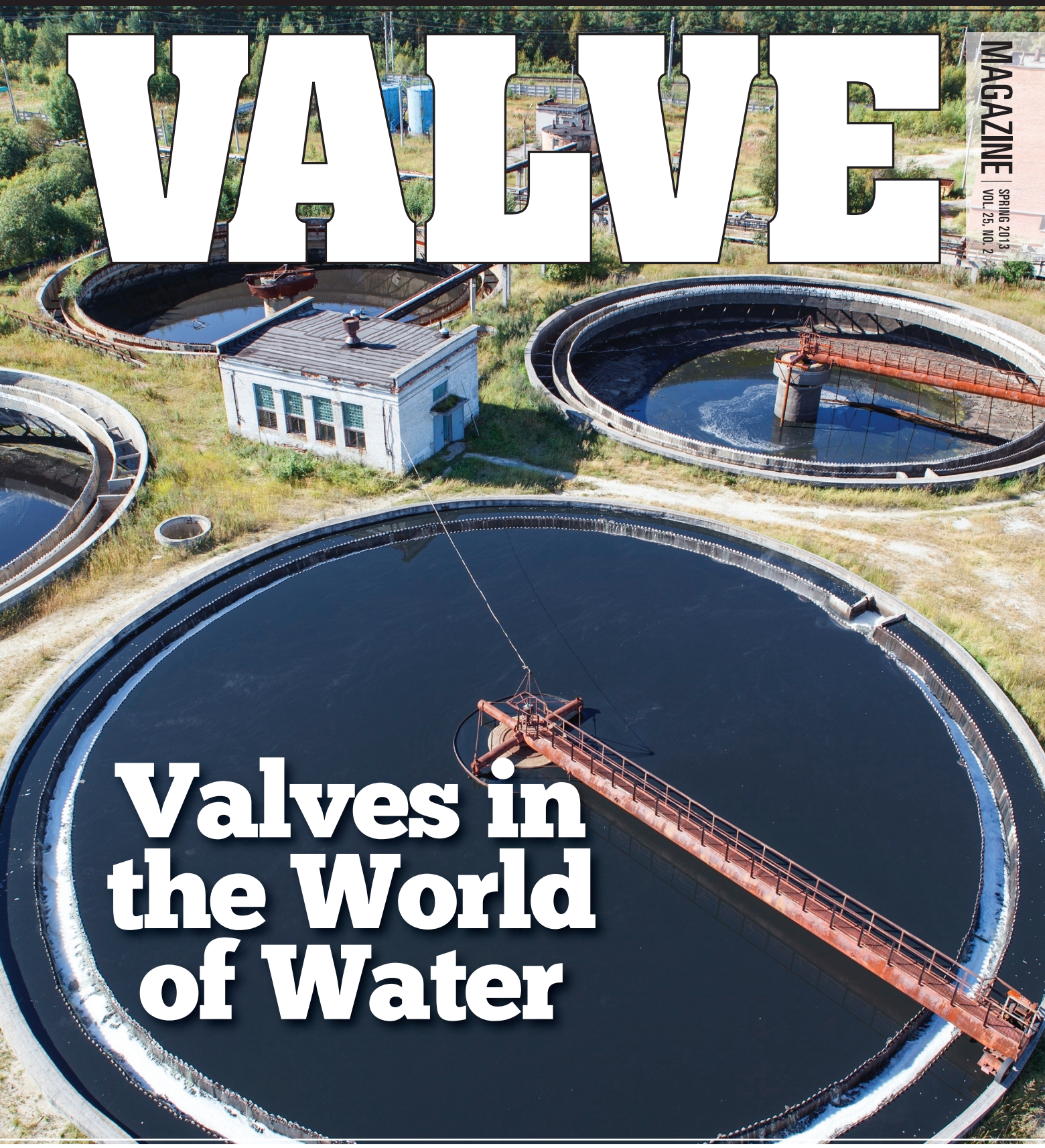
VALVE

MAGAZINE SPRING 2013 VOL. 25, NO. 2



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Rotork CMA actuators increase scope of electric control-valve technology.

Rotork has announced the CMA range of compact, modulating actuators to complement its existing line of CVA electric actuators for control-valve, pump, damper, and other continuous-modulation applications.

CMA actuators offer an economical way for common, everyday process control applications to gain the benefits of accurate and repeatable position control as well as superior robustness – features associated with Rotork CVA electric actuators, which were introduced in 2008 and have proven highly successful in thousands of process control applications throughout the world.

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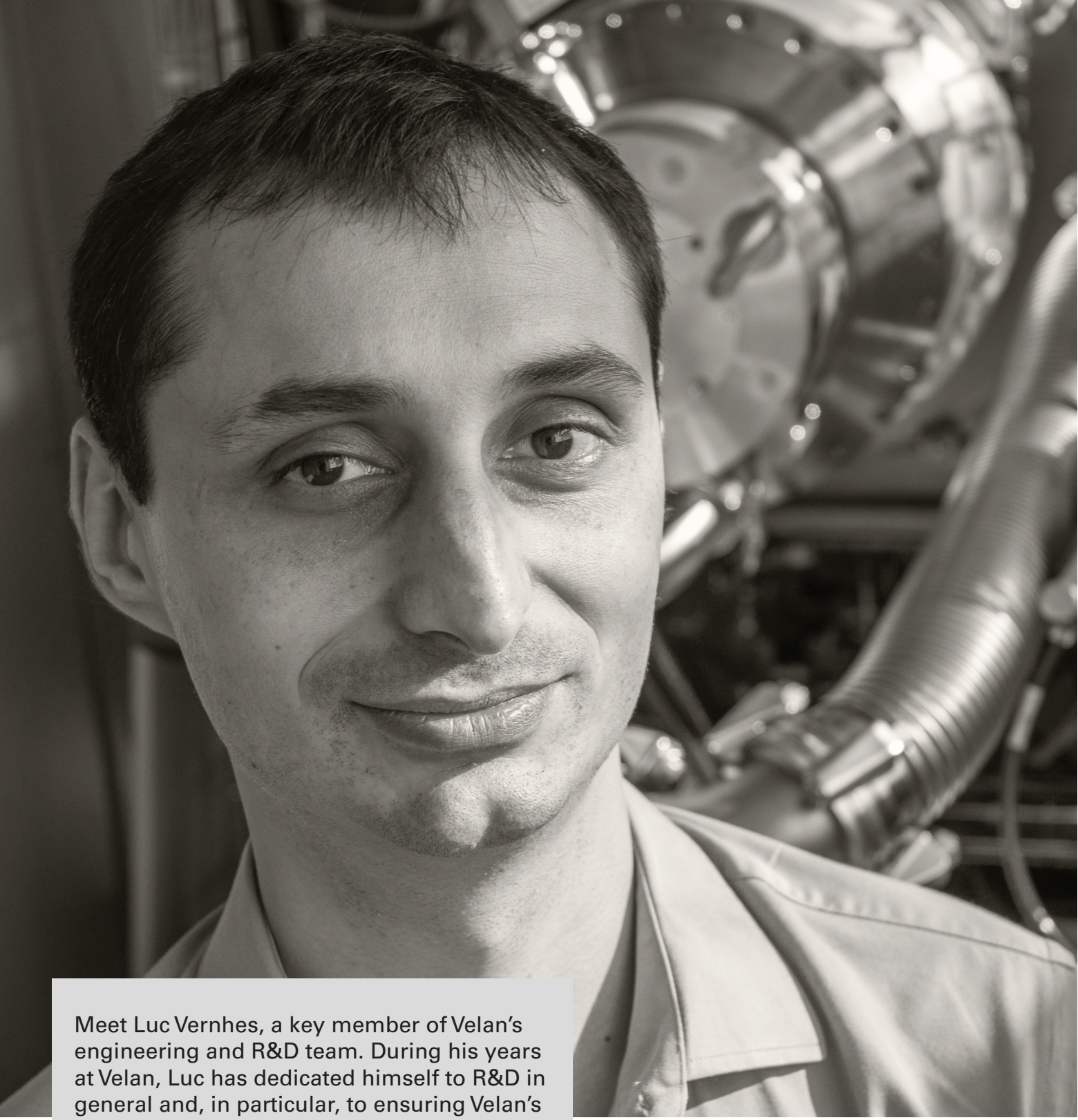

Meet Luc Vernhes, a key member of Velan's engineering and R&D team. During his years at Velan, Luc has dedicated himself to R&D in general and, in particular, to ensuring Velan's coating expertise stays ahead of the curve, working with other likeminded brainiacs across the industry.

What you might not know about Luc is that he may just be the last man on the planet who refuses to have a TV in his house and a car in his driveway.

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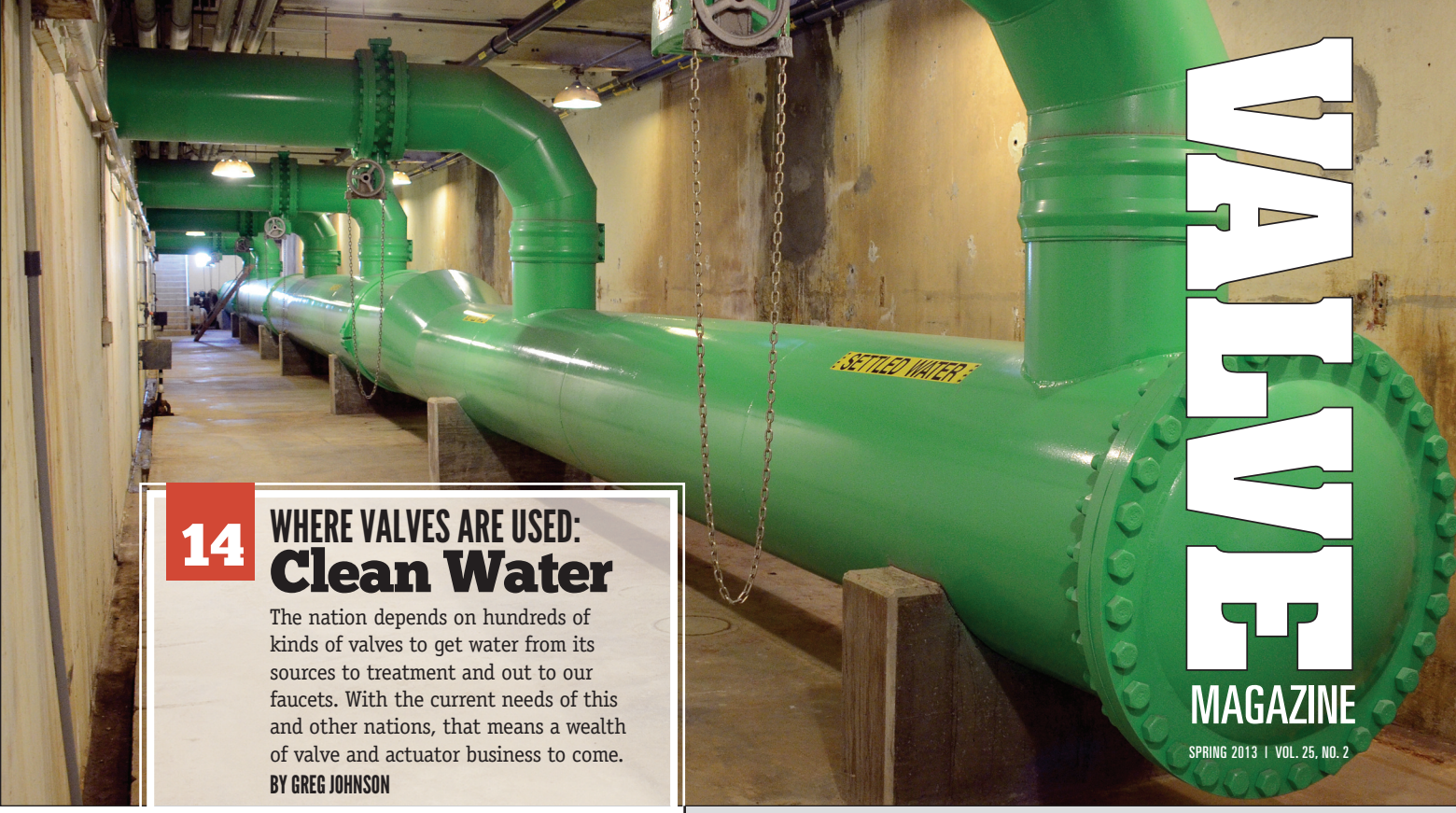
VELAN



VALVE MAGAZINE
SPRING 2013 | VOL. 25, NO. 2

VALVE MAGAZINE

www.VALVEmagazine.com

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VMA 75 YEARS
VALVE MANUFACTURERS ASSOCIATION OF AMERICA
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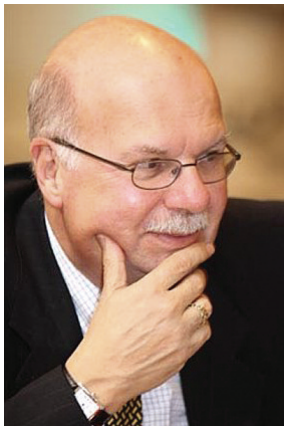
A New Membership Category



VMA Chairman Mark Cordell (Cameron) and I are pleased to announce that VMA's members overwhelmingly approved a change in the VMA constitution to create a new category of member (see VMA News page 10). We expanded our associate membership to include distributors and channel partners serving the industrial valve, actuator and control industry. The VMA Board approved the action at its meeting in January. Because it required a change in our constitution, we needed approval by a simple majority of our 58 full members (in other words, we needed 30 votes). We only received three votes against the change, which means our full membership wholeheartedly approves the new category. The associate membership category will have a five-tier dues structure based on valve, actuator and control sales.

Following the vote, we sent over 80 prospective distributor/channel partner members a mailing on March 1 that included a synopsis of the membership decision, criteria for membership, an application, the 2013 VMA calendar and a copy of our showcase VALVE Magazine.

The constitution change added this language:

Distributor/Channel Partner Membership: Any distributor or channel partner of valves and/or actuators that, at the time of application, is incorporated in the United States or Canada and is engaged in distribution of valves and/or actuators manufactured in a U.S. or Canadian facility, is eligible for distributor/channel partner membership, provided that:

- The company has been a distributor or channel partner of valves and/or actuators for a minimum of three years.
- The company is a distributor or channel partner for at least one VMA member.
- The company's net annual sales of valves and/or actuators manufactured in U.S. and Canadian facilities exceeds $1 million.
- The company's net sales of valves and/or actuators manufactured in U.S. or Canadian facilities in the most recent fiscal year are at least 50% of its total sales of valves and/or actuators.

These are the requirements for membership along with the fact the company cannot be directly related to any full member, but rather "takes title to and stocks valves and/or actuators, and sells such equipment manufactured by at least one full member."

I encourage all distributors and channel partners who meet the criteria above to become a member of VMA so you can network directly with the manufacturers of the products you represent. If you did not receive the March 1 mailing, please contact me at wsandler@vma.org, and I will forward the material to your attention. VM

Bill Sandler
President
Valve Manufacturers Association of America

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CAMERON

MERGERS & ACQUISITIONS

Cameron Announces Joint Venture with CNPC

Cameron has entered into an agreement with CNPC to establish a joint venture for manufacturing pipeline ball valves mainly for CNPC use to support plans to build a pipeline across China over the next decade.

Under the terms of agreement, Cameron will license its technology to the joint venture and establish a full-scale manufacturing operation in Tianjin, China with CNPC Bohai Equipment Manufacturing Co., Ltd. This joint venture will be the exclusive pipeline valve manufacturing entity within CNPC.

Curtiss-Wright Acquires Phönix Group

Curtiss-Wright Corporation has acquired 100% of the shares of Phönix Holding GmbH for about $108 million in cash. Phönix, headquartered in Germany, designs and manufactures high-performance, severe-service valves, valve systems and related support services for the global chemical, petrochemical and power markets. The business will operate within Curtiss-Wright Flow Control.

Rotork Announces Acquisition of Schischek

Rotork p.l.c. has acquired the entire share capital of the operating companies of the Schischek group. Schischek designs, manufactures and sells explosion-proof

MARKET FOCUS: Industrial Valve Shipments

For the fourth consecutive year, valve shipments in the U.S. are forecast to increase—this year by 3% to nearly $4.3 billion, according to statistics from the Valve Manufacturers Association (VMA). VMA released those figures as part of its annual market forecast.

The 2013 growth means the industry will surpass its 10-year peak, which occurred in 2008. VMA President William Sandler said the latest statistics are an indication that the industry has completely rebounded from the downturn, "which is a good sign for us and the overall economy. If the end users of our products are ordering from us, then they too are producing," he said.

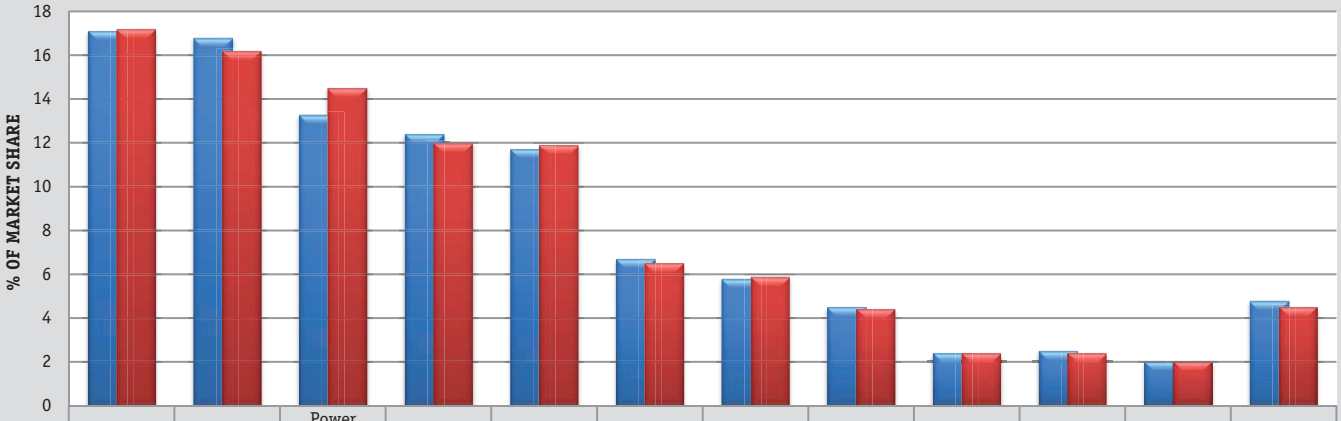
Sandler also said that the year 2012 ended better than initially projected: Valve shipments for 2012 reached $4.15 billion, which represents a 22% growth over the last decade.

As far as end users, power generation is forecast to have the largest increases rising 1 percentage point from 2012 to 2013. Four of the 15 industries that VMA tracks will also have increases of 0.2 or 0.1 percentage points. Meanwhile, water and wastewater is forecast to decline by 0.6 percentage points, and smaller declines are predicted in the other seven industries.

The most popular product last year was automated valves, accounting for nearly $1.3 billion in shipments; ball valves were the next most frequently shipped item, accounting for $760.5 million in shipments. The report also revealed that 21% of shipments are exports, a growing trend as the industry adapts to the opportunities presented by globalization.

End User Industry Share of Market

2012 actual vs. 2013 projected



	Chemical	Water & Sewage	Power Generation & Co-Generation	Petroleum Production	Petroleum Refining	Pulp & Paper	Oil & Gas Trans.	Commercial Const.	Food & Beverage	Gas Distribution	Iron & Steel	Other
2012	17.1	16.8	13.3	12.4	11.7	6.7	5.8	4.5	2.4	2.5	2.0	4.8
2013	17.2	16.2	14.5	12	11.9	6.5	5.9	4.4	2.4	2.4	2.0	4.5

Source: Valve Manufacturers Association (www.vma.org)

electric actuators, principally for the HVAC marketplace.

Schischek's main sites are in Langenzenn near Nuremberg in Southern Germany and Lutzenberg in Switzerland. The company will become part of Rotork's Controls division. Roland Graf, the current managing director of Schischek, will remain in his role.

The purchase price is approximately $53 million. Schischek's operating profit in 2012 is expected to be more than $7.1 million.

AWARDS & MILESTONES

Metso Supplies Power-Gen Bioenergy Project of the Year

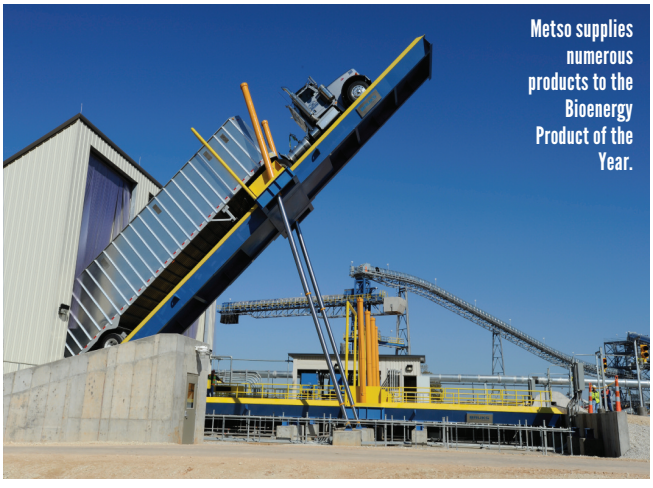
The Nacogdoches Generating Facility in Sacul, TX was awarded the 2012 Project of the Year in the Biomass category by *Power Engineering* at the Power-Gen International Conference in December 2012. The Nacogdoches Project represents a Metso-supplied boiler island with the world's largest BFB boiler. The project also included Metso Automation flow control devices and a Metso DNA plant-wide distributed control system.

Spirax Sarco Wins Breakthrough Product of the Year

Spirax Sarco's VLM10 inline vortex mass flowmeter has been selected as a Breakthrough Product of 2012 by *Processing Magazine*. This award is presented annually to manufacturing facilities with products, services or technologies that have made significant contributions in the processing industries. In picking products for the award, judges examined their significance and uniqueness in the process industries, along with associated innovative technologies and range of application.

Rotork Named One of Britain's Most Admired

Rotork was among the top winners at the annual Britain's Most Admired Companies awards ceremony December 5, 2012 at Claridges Hotel in London. Rotork tied for the top spot in Financial Soundness and in Engineering & Machinery as well as third for Quality of Goods and Services, seventh for Capacity to Innovate and ninth for Use of Corporate Assets, making it the tenth place winner overall.



Metso supplies numerous products to the Bioenergy Product of the Year.

Kennametal, GE Among the World's Most Ethical Companies

Kennametal Inc. has been named one of the World's Most Ethical Companies for the second straight year, while General Electric earns the distinction of making the list all six years since The Ethisphere Institute started it back in 2007. Kennametal Stellite Inc. and GE Energy-Flow and Process Technologies are members of VMA.

This year 145 companies made the cut, a new record, 43 of which are American. The World's Most Ethical (WME) Companies designation recognizes companies that truly go beyond making statements about doing business "ethically" and translate those words into action. WME honorees not only promote ethical business standards and practices internally, they exceed legal compliance minimums and shape future industry standards by introducing best practices today.

Contracts

Emerson Wins Record-Setting Orders for Gas-Leak Detection

Emerson Process Management has received orders totaling about $5.8 million for ultrasonic gas detection technology that will be used to monitor leaks at onshore and offshore liquefied natural gas facilities in Australia. The offshore application is believed to be the world's largest single installation of this technology.

Velan Awarded Nuclear Valve Contracts in China

Velan S.A.S. has been awarded a contract for the supply

CONTINUED ON PAGE 8

MAY

6-9
OTC 2013
Houston
www.otc.com

22-24
AFPM Reliability & Maintenance Conference & Exhibition
Orlando, FL
www.afpm.org

JUNE

9-13
AWWA's ACE 13 Conference & Exhibition
Denver
www.awwa.org

25-26
Valve World Americas Expo & Conference
Houston
www.valveworldexpoamericas.com

AUGUST

8-9
VMA Market Outlook Workshop*
San Diego
www.vma.org

OCTOBER

3-5
VMA/VRC Annual Meeting*
Palm Beach, FL
www.vma.org

5-9
WEFTEC
Chicago
www.weftec.org

NOVEMBER

6-7
Valve Basics Seminar & Exhibits
New Orleans
www.vma.org

12-14
Power-Gen International
Orlando, FL
www.power-gen.com

DECEMBER

10-12
The 2013 Chem Show
New York City
www.chemshow.com

**Open only to VMA/VRC members.*

VALVE MAGAZINE

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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.

of nuclear class control globe valves to China Nuclear Energy Industry Corporation (CNEIC) for the two new VVER (Russian design pressurized water reactor) nuclear power plants of Tianwan Units 3 and 4. The order consists mainly of bellows seal globe control valves, electric operated, for service inside and outside nuclear containment. The two new units will be operated by Jiangsu Nuclear Power Co. in Jiangsu province, China. These valves are scheduled for delivery from 2014 until 2015.

Velan S.A.S. also signed contracts with Nuclear Power Operations Management Co. (CNNP) for the supply of spare parts for Qinshan II units 1-2-3-4. CNNP is the new organization of Chinese National Nuclear Corporation (CNNC).

Combined, the above contracts represent a sales value of about $9.75 million over two years.

NEW FACILITIES

Metso Opens New Automation Service Center in Thailand

Metso has opened a new automation service center in Thailand. The new center is located in Banpong, Ratchaburi, 80 kilometers east from Bangkok close to two of the major Siam Cement Group complexes, Wangsala and Banpong. The new center includes modern training and testing facilities, a valve repair shop and a storage facility for spare parts.

Last spring, Metso Automation opened a valve supply and service center in Vadodara, India.

Allagash International Moves into New Maine Facility

Allagash International has taken over a vacated facility in South Portland, ME once occupied by Portland Valve Co. The 55,000-square-foot building is more than twice the size of the Allagash's previous location in Portland.

The move to South Portland will allow Allagash to manufacture larger valves and places it closer to the Portland waterfront.

PEOPLE IN THE NEWS

CRANE CO... has appointed **Max H. Mitchell** as president and COO. Mitchell has served as executive vice president and COO since May 2011, during a time when Crane delivered record operating results. All segment group presidents will continue to report to him.

Andrew L. Krawitt will leave the company in May 2013 to pursue a doctorate in mathematics. Krawitt has served as vice president and treasurer of Crane Co. since September 2006 and was designated the company's principal financial officer in May 2010. In conjunction with the departure, Crane has appointed **Richard A. Maue** as vice president-finance and CFO.

DeZURIK, INC.... has appointed **Bryan Burns** as president and chief operating officer. As part of a planned DeZURIK leadership transition, **Larry Korf**, chief executive officer, will retain his position as CEO and has accepted a position on the DeZURIK Board of Directors.

Burns joined DeZURIK in 2010 as vice president of operations and was promoted to COO in January 2012. Previously, he was employed by the Brunswick Corporation, where he was president of the Crestliner Division. He is a graduate of Pennsylvania State University and earned his MBA from Duke University.

ENTHONE... Jason Maupin has been promoted to vice president, Americas. Maupin has more than 15 years of experience in sales management and business development. Before his promotion, he was the vice president, sales, Enthone North America.

In a related move, **Terrence Copeland**, previously vice president, Enthone Americas, has been appointed vice president, commercial business development. In this new role, Copeland will be responsible for identifying new business and strategic opportunities.

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Association Comes Full Circle on Membership

VMA's membership voted in favor of a change in the VMA constitution that creates a new addition to the associate member category for the many distributors and channel partners vital to the world of valves, actuators and controls. After preliminary approval by the VMA Board, the membership overwhelmingly approved the new category.

The new Distributor/Channel Partner membership category is open to any company that distributes valves or actuators for at least one VMA member and meets certain criteria. (See "A New Membership Category," on page 4.)

VMA Chairman Mark Cordell of Cameron Valves & Measurement said, "A lot of the valve manufacturers provide products to end users through these channel partners who tend to bundle a variety of different products from different valve manufacturers to the end user. By including the distributors as associate members of the VMA, it fits us all closer together to understanding the needs of the customer and together fulfilling those needs."

Cordell explained how the new category completes the circle for the industry, allowing better networking and planning: "At one end of the chain, we have people who supply products to the valve and actuator manufacturers. Then there are the manufacturers, and then we have the valve repair people. So now, by having the distributors at this end, we have flow from supply through manufacture through distribution. At the end of the day, we're all doing our best to service the end user better."

VMA President Bill Sandler added: "The addition of distributors and channel partners to the VMA family provides the membership and the industry as a whole with the ability to network, face-to-face, with an important segment of our industry, a segment that is the link between our manufacturers and their end users. I encourage all valve and actuator distributors and channel partners to become part of the only association representing the interests of the industrial valve, actuator and control industry in the United States and Canada."

Those who would like to learn more about Distributor/Channel Partner membership should contact Bill Sandler at wsandler@vma.org.

MORE NEW VMA MEMBERS IN 2013

Applications for five new members have been approved by the VMA Board of Directors during the first quarter of 2013.

VMA's new valve manufacturing members are:

- **ChemValve, Inc.** (www.chemvalve), Tomball, TX, has produced fully lined plug and ball check valves since 1987, shipping to locations in the U.S. and Canada.
- **Ladish Valves** (www.ladishvalves.com), Houston, has manufactured stainless-steel and high nickel alloy gate, globe and check valves for the refining, petrochemical, chemical, pulp & paper and power industries for more than 50 years.

Joining as associate (supplier) members are:

- **Bradken-Engineered Products** (www.bradkenamericas. com), Tacoma, WA, produces high-integrity steel castings for international customers from one of the few foundries left in North America qualified to make castings for nuclear applications.
- **Kennametal Stellite Inc.** (www.kennametal.com/stellite), Belleville, Ontario, manufactures valve seats, hardfacing materials, balls/cages and corrosion/erosion/high-temperature wear components.
- **Teadit North America** (www.teadit-na.com), Pasadena, TX, develops and manufactures fluid sealing products used in various industrial markets including chemical, food, pharmaceutical and petrochemical processing.

EVENTS

Second Valve World Americas Reflects 2011 Successes

Planners have built on a successful first event to present the second Valve World Americas Expo & Conference June 25 to 26 in a larger venue: Houston's George R. Brown Convention Center.

The day before the event, June 24, VMA will offer a one-day version of its popular Valves & Actuators 101 course for industry newcomers and others seeking an overview of valves, actuators and controls.

The 2013 Valve World Americas show also brings the talents of organizers of the Valve World Expo in Düsseldorf, Germany to the shores of the United States for the benefit of flow technology companies and professionals from South

CONTINUED ON PAGE 12

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and North America. The goal of the conference is to provide an international, yet American- focused platform for the ongoing technical and commercial exchange of information and experiences on the latest technologies, developments and products. Many of the steering committee members come from VMA member companies and their end-user clients. The exhibit hall is already sold out of space, meaning the expected growth from 2011 (when 93 exhibitors had 1,100 visitors) has already occurred. VMA/VALVE Magazine will have a booth at the event.

In addition to those exhibits, the conference features workshops on hot topics, including material selection, fugitive emissions, fitness for service, updates in cryo technology, unconventional energy and much more. Each day has keynote sessions on topics such as the general outlook on energy and new challenges in the field.

For information and registration details, go to www.valveworldamericas.com.

VALVES & ACTUATORS 101 IN 2013

- AFPM Reliability & Maintenance Conference & Exhibition - May 21 (Orlando)
- Valve World Americas Expo & Conference - June 24 (Houston)
- Valve Basics Seminar & Exhibits - Nov 6-7 (New Orleans)

AFPM Event Addresses Refining Improvements

The 2013 AFPM [American Fuel & Petrochemical Manufacturers] Reliability & Maintenance Conference & Exhibition is the place for people in the refining business to come together to talk about improvements in the field and learn about best practices in performance, productivity, new technologies and workforce development. This year's event, May 21 to 24 at the Orlando Marriott World Conference Center & Resort in Orlando, FL, focuses on "Building the Next Generation."

The general educational program is structured around three areas: maintenance, reliability and turnaround with technical presentations, discussion groups and 40 workshops designed to be interactive and a program designed to allow attendees to concentrate on specific areas. In addition, 220 companies, including VMA members, will be featured in an exhibit that is open for more than 10 hours over three of those days and the conference offers a "face-to-face" fair: complimentary conference registration for qualified personnel in exchange for one hour of face time with scheduled exhibitors.

Because valves play a critical role in reliability and best practices, and to complement the event's "next generation" theme, VMA is offering a one-day Valves & Actuators 101 course in conjunction with the show on May 21 from 9 to 5 p.m.

AFPM is handling registration for VMA's basics course—which is one of several professional development courses being held before the exhibits open. For additional information, go to www.afpm.org.

BARCHFELD CONVENTION PHOTOGRAPHY

OTC 13: 80,000 Attendees Expected

More than 80,000 people from 110 countries are expected to be on hand at the 2013 Offshore Technology Conference, Reliant Park, Houston, May 6-9.

The conference, which was founded in 1969, is the world's foremost event for addressing development of offshore resources in the fields of drilling, exploration, production and environmental protection.

Thirteen sponsoring organizations and societies come together to create a program that offers hundreds of technical and general sessions on the latest technology and concerns of engineers, technicians, executives, operators, scientists and managers in all fields of offshore exploration and production. In addition, the show features one of the world's largest displays of equipment from 2,500 companies, including those that produce or supply valves, actuators and controls.

For information, go to www.otcnet.org.

Conference Covers Array of Water Issues

ACE13, the annual meeting of the American Water Works Association (AWWA), is June 9-13 in the Colorado Convention Center, Denver. AWWA is offering a newly designed professional program that presents solutions to water sector challenges in grouped sessions that span the four days. More than 900 expert presenters are on hand to discuss topics such as financial management, water resource issues, regulation challenges, and environmental and health concerns over the world's water purification and supply industry.

More than 500 exhibitors will feature their products and services in the exhibit hall.

For information, go to www.awwa.org, "ACE."

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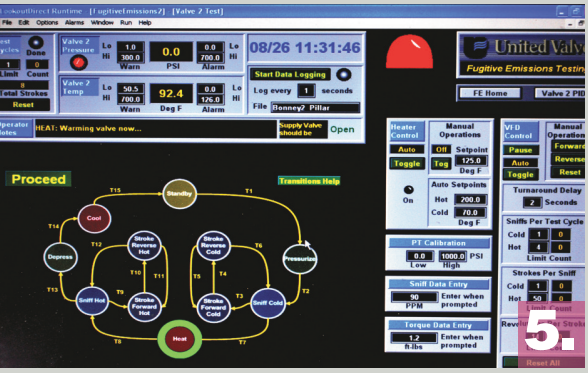

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3. *To ensure that all parts match specifications, an articulated coordinate measuring machine (CMM) is used. The "Faro-Arm" is used with 3D software to create highly detailed 3D views of parts and components.*

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

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WHERE VALVES ARE USED

Keeping Our Water FLOWING

BY GREG JOHNSON

One place where valves are used that touches every one of us every day of our lives is the clean water industry. When we turn on the tap for a drink or open the hydrant to water our roses, we are interacting with the last valve in the clean water pipeline. The valves used in this piping-intensive, complicated industry perform yeoman's duty behind the scenes and often behind security fences—24 hours a day.

AT THE BEGINNING

But where does the pipeline start? Where does the drinking water, also called potable water, come from?

Drinking water comes from two primary sources—surface water (rivers, lakes and ponds) and sub-surface water (wells). In most cases, the easiest water to prepare for human consumption is well water. This is because water from deep-shaft wells is obtained from aquifers that run through acres and acres of subterranean sand and rock. This porous material provides an excellent method of filtering the water to nearly ready-to-drink conditions. All that is needed is a method of pumping the water to the surface. What's more, the free-flowing artesian wells don't even need a pump. Because of retained pressure in the aquifer, this drinking water freely flows to the surface.

Although well water is sometimes consumed as it comes from the ground, when it's used in municipal water systems, the water is usually disinfected with chlorine before traveling down the pipeline.

With surface water, which requires the most effort to get ready for consumption, water purification plants need to treat the water, so the systems are much larger and more complex than those that only treat deep well water.

GETTING TO PURE

The first step in surface water purification is getting the water to the treatment plant or the water works, as some call it. It is always cheaper if the facility is close to the water source and at a lower elevation so that expensive pumping systems don't have to transport the raw water to the treatment plant. The water that is transported to the treatment facility goes through either open canals or closed piping systems. Untreated water is usually not corrosive, so the choice of pipe materials is broad: concrete, iron, polyvinyl chloride (PVC), reinforced concrete pipe (RCP), high-density polyethylene (HDPE) or fiberglass.

Historically, the materials of choice were concrete pipe and iron gate valves. Today, thermoplastics and resin piping materials are most often specified for large outside diameter (OD), low-

Executive Summary

SUBJECT: From source to tap, water uses hundreds of types of valves to keep the nation's water flowing and clean. Different types of materials and products are used in treating the different sources of water.

KEY CONCEPTS:

- Valves used in water systems
- Purification and new materials
- Automation
- Desalination

TAKE-AWAY: Huge infrastructure needs mean the industry will remain a source of valve business for many years.

Some of the redundant, high-capacity piping systems under initial filtration tanks are shown. The valves are motorized butterfly valves connected to the main computer control system.

pressure lines. The on/off valve of choice is the ductile iron, resilient-seated butterfly valve, because it takes up little space, and the iron is slow to rust. However, some systems still are built with large OD ductile iron gate valves for on/off applications. All the valves in this part of the system, as well as most valves in the entire purification plant, are built in accordance with American Water Works Association (AWWA) standards.

Surface water can arrive at the treatment facility containing a large variety of contaminants that must be removed—the term applied to describe these suspended particles is turbidity. The large particles of suspended matter in raw water are removed by allowing them to settle in large, very-low-flow sedimentation basins. However, the smaller ones, which are called nonsettleable solids, require some form of artificial coagulation. These smaller solids must be removed because they consist of bacteria, viruses, protozoans, organic matter and inorganic solids.

The valve of choice in these lines is water purification's most valuable player: the resilient-seated butterfly valve.

The process of coagulation assistance, which is called flocculation, requires injection of special chemicals into the water to help these miniscule contaminants settle out. A typical flocculation chemical formulation is aluminum sulfate with a 2% copper sulfate blend. In smaller to mid-size systems, these chemicals are added to the water by peristaltic pumping systems. These low-pressure systems often use PVC, HDPE or RCP plastic pipe and valves.

The large settling tanks themselves are fed from large OD piping systems. Plastic or fiberglass pipe can be used, but steel, cast iron and even stainless steel is also specified. The valve of choice in these lines is water purification's most valuable player: the resilient-seated butterfly valve.

The piping to and from these tank systems is redundant to allow for periodic shut-down and cleaning of individual tanks to remove the "floc" from the bottom of the system. This floc is a sludge-like material that must be removed and disposed.

After sedimentation, the "cleaner" water is pumped through a large filtration system to remove additional suspended material. Like the sedimentation tanks, the filtration tanks are individually piped to allow frequent cleaning, and there is substantial piping connecting to and bypassing each individual filter tank assembly. The resilient-seated butterfly valve is found here as well.

Following the filtration process, a disinfectant is added to the water. In the United States, the most common disinfectant used is chlorine, and the process is called chlorination. Chlorine is a highly volatile, hazardous fluid that must be handled carefully. The complexity of the chlorine piping depends on the volume of the system. Very large municipalities will have chlorine delivered by railcar, whereas smaller facilities will use pressurized containers delivered by truck.

Chlorine piping systems are designed in accordance with specifications published by The Chlorine Insti-

tute. Because of the high volatility, all chlorine valves should be constructed of materials that will resist corrosion by the specific chlorine product used.

Once water passes through the disinfectant stage, it is ready for distribution. Unless the facility is high above the point of use, the purified water needs to be pressurized for delivery. This is accomplished by pumping systems that will either pump water into a water tower to create "head pressure," (usually about 40 psi) or pumped to pressurize the water mains. Main pressures charged through a pumping system usually range from 50-80 psi. The discharge piping from the treatment plant is often a large OD system, from 36-60 inches (and larger for major municipalities).

Most cities will also incorporate large storage tanks to keep an ample supply of clean water on hand. The piping systems for distribution are also designed and built of materials in accordance with AWWA standards.

AUTOMATION

Although a water purification system could be operated manually, it is much more practical to automate the plant with a Supervisory Control & Data Acquisition (SCADA) system. Using a SCADA system helps the utility keep track of data and eliminates requiring operators to manually read and record information.

The basic processes in a water purification plant are straightforward and can be broken down into a number of separate control loops. As in most control loops, there is a final control element. In this case the final control elements are primarily actuated butterfly valves. Since there are mostly gross flow rates to stop and start, the fine tuning of precise control valves is generally not needed, except perhaps in the case of chemical injection.

ANOTHER SOURCE

Seawater and brackish-water desalination is an underused source of clean water today, although large-scale operations have been in existence for over 50 years. The facilities for desalination are much more complex, and the piping systems more robust than standard water purification plants.

☐ The filtration tanks at a typical water purification facility show how numerous valves interconnect each tank and allow each separate unit to be drained for maintenance purposes.

These additive and sampling lines are low pressure and are constructed of PVC material, including the ball valves.

Congress passed the Saline Water Act in 1952, which provided support for desalination projects. The first large-scale desalination plant was installed in Freeport, TX in 1961 by the Dow Chemical Company. This facility provided over a million gallons of clean water per day for the plant as well as the city of Freeport for many years. Several additional desalination plants are now in the design stage for installations on the east and west coasts as well as the gulf coastline.

Desalination occurs through two major methods: the membrane method and the thermal method. Here in the U.S., the membrane method, which is primarily reverse-osmosis, is the most popular. In other parts of the world, the thermal method, which is heat-based, is more widely used. Both desalination processes require much more energy than conventional water treatment processes. For example, the thermal method, which relies primarily on distillation technology and requires heat generation and heat-transfer equipment, results in facilities that look more like small refineries than water treatment facilities. The reverse osmosis process, on the other hand, requires high-pressure piping systems in the 400-500 psi pressure range, which means piping specifications that are closer to refinery or chemical plant requirements.

Regardless of type, desalination plants offer valve manufacturers and suppliers a good opportunity for diversifying valve sales.

A 72-inch butterfly valve regulates water intake from Lake Michigan in one of the Chicago's water purification plants.

THE STATE OF AFFAIRS

While every municipality in the United States has water systems, some are in better mechanical and financial shape than others. It is generally accepted that updating our nation's water purification systems is part of the huge overall infrastructure improvement that is becoming critical in this country. The American Society of Civil Engineers has looked closely at this aging infrastructure and given drinking water facilities in the U.S. an overall grade of D-. The giant mammal in the room that can't be ignored, however, is the cost for the critically needed work during a time when budgets are already tight.

One of Texas' medium-sized municipalities that serves as a good example for trying to stay ahead of the problem is Beaumont, a petrochemical and refining hub on the Texas Gulf Coast. According to Dr. Hani J. Tohme, that city's water utilities director, the utility infrastructure problem is magnified by a lack of visibility.

"The (water) infrastructure has been neglected in our country [because] you can't see it [the water system]—it is underground—but you can see a pothole," he said. This explains why in some cities asphalt trucks cruising around making repairs to streets are a frequent site, while water main problems go untouched.

Dr. Tohme adds that the solution to

the water utility infrastructure problem is easy to fix: "You have to have rate increases." Beaumont has not been afraid to do that and has also not been afraid to spend: The city spent $11 million on water system upgrades since 2002, which easily accommodates Beaumont's water needs through the next decade. He also says that purchasing quality equipment is important for good stewardship of public funds and to that end, a strong "made in USA only" valve and piping policy is a necessity. "As a municipality there should be support of domestic-made products," he says.

These outlet lines from the final sedimentation tanks are made of carbon steel and are equipped with ductile iron butterfly valves.

FOR THE REST OF US

Staying ahead of costs will be virtually impossible across the country unless more revenue is generated. According to the Environmental Protection Agency, estimates of capital needs for drinking water improvements over the next 20 years are $334 billion, which does not include the costs associated with meeting the Clean Water Act requirements that affect clean water costs.

The positive side to the huge infrastructure needs is that those needs equate to large orders for equipment manufacturers, including those in the valve industry. As long as ample money flows into the fiscal municipal pipeline, much-needed clean water should continue to flow through the valve-laden water pipelines as well. VM

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BACK TO BASICS

The Expanding Reach of Plastic Valves

BY TIM MORAN

Although plastic valves are sometimes seen as a specialty product—a top choice of those who make or design plastic piping products for industrial systems or who must have ultra-clean equipment in place—assuming these valves don't have many general uses is short-sighted. In reality, plastic valves today have a wide range of uses as the expanding types of materials and good designers who need those materials mean more and more ways to use these versatile tools.

PLASTIC'S PROPERTIES

The advantages of thermoplastic valves are wide—corrosion, chemical and abrasion resistance; smooth inside walls; light weight; ease of installation; long-life expectancy; and lower life-cycle cost. These advantages have led to wide acceptance of plastic valves in commercial and industrial applications such as water distribution, wastewater treatment, metal and chemical processing, food and pharmaceuticals, power plants, oil refineries and more.

Executive Summary

SUBJECT: Valves are manufactured in a wide array of thermoplastic materials with special properties. Designers have come up with a variety of ways to use new kinds of plastic valves.

KEY CONCEPTS:

- Thermoplastic materials
- Options in valve types
- What these valves can do
- Design considerations

TAKE-AWAY: These valves are critical in harsh and challenging environments, but perform well in many situations today.

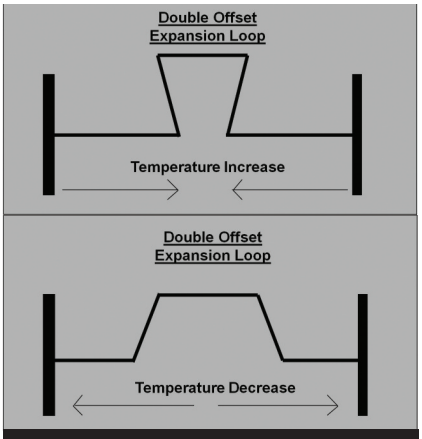
Plastic valves can be manufactured from a number of different materials used in a number of configurations. The most common thermoplastic valves are made of polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC), polypropylene (PP), and polyvinylidene fluoride (PVDF). PVC and CPVC valves are commonly joined to piping systems by solvent cementing socket ends, or threaded and flanged ends; whereas, PP and PVDF require joining of piping system components, either by heat-, butt- or electro-fusion technologies.

Thermoplastic valves excel in corrosive environments, but they are just as useful in general water service because they are lead-free[1], dezincification-resistant and will not rust. PVC and CPVC piping systems and valves should be tested and certified to NSF [National Sanitation Foundation] standard 61 for health effects, including the low lead requirement for Annex G. Choosing the proper material for corrosive fluids can be handled by consulting the manufacturer's chemical resistance guide and understanding the effect that temperature will have upon plastic materials' strength.

Although polypropylene has half the strength of PVC and CPVC, it has the most versatile chemical resistance because there are no known solvents. PP performs well in concentrated acetic acids and hydroxides, and it is also suitable for milder solutions of most acids, alkalis, salts and many organic chemicals.

PP is available as a pigmented or unpigmented (natural) material. Natural PP is severely degraded by ultraviolet (UV) radiation, but compounds that contain more than 2.5% carbon black pigmentation are adequately UV stabilized.

PVDF piping systems are used in a variety of industrial applications from pharmaceutical to mining because of PVDF's strength, working temperature and chemical resistance to salts, strong acids, dilute bases and many organic solvents. Unlike PP, PVDF is not degraded by sunlight; however, the plastic is transparent to sunlight and can expose the fluid to UV radiation. While a natural, unpigmented formulation of PVDF is excellent for high-purity, indoor applications, adding a pigment such as a food-grade red would permit exposure to sunlight with no adverse effect on the fluid medium.



☐ Figure 1. Elongation or contraction occurs when temperature increases or decreases.

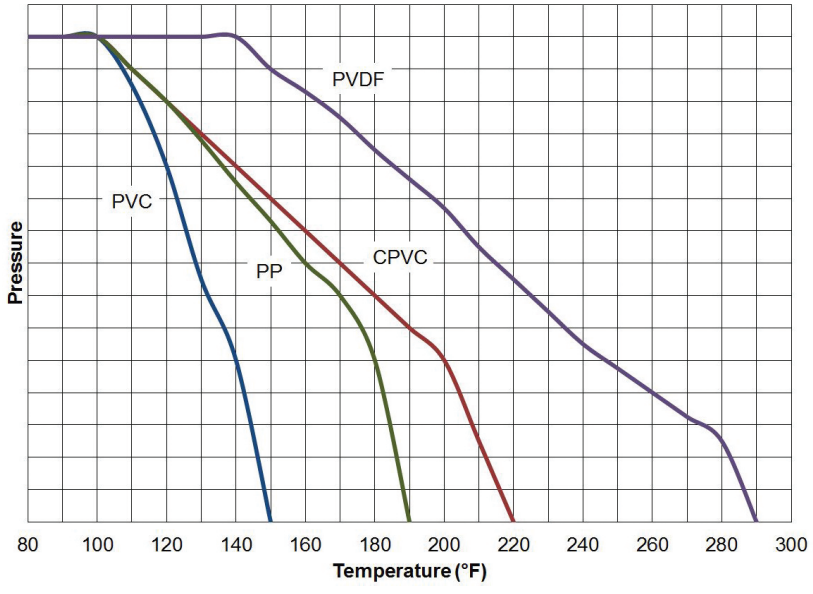
Plastic systems have design challenges, such as sensitivity to temperature and thermal expansion and contraction, but engineers can and have designed long lasting, cost-effective piping systems for general and corrosive environments. The major design consideration is that the coefficient of thermal expansion for plastics is greater than metal—thermoplastic is five to six times that of steel, for example.

When designing piping systems and considering the impact on valve placement and valve supports, an important consideration in thermoplastics is thermal elongation. Stresses and forces that result from thermal expansion and contraction can be reduced or eliminated by providing flexibility in the piping systems through frequent changes in direction or introduction of expansion loops. By providing this flexibility along the piping system, the plastic valve will not be required to absorb as much of the stress (Figure 1).

Because thermoplastics are sensitive to temperature, the pressure rating of a valve decreases as temperature rises. Different plastic materials have corresponding deration with increased temperature. Fluid temperature may not be the only heat source that can affect a plastic valves' pressure rating—maximum external temperature needs to be part of design consideration. In some cases, not designing for the piping external temperature can cause excessive sagging due to lack of pipe supports. PVC has a maximum service temperature of 140°F; CPVC has a maximum of 220°F; PP has a maximum of 180°F; and PVDF valves can maintain a pressure up to 280°F (Figure 2).

On the other end of the temperature scale, most plastic piping systems work quite well in temperatures below freezing. In fact, tensile strength increases in thermoplastic piping as temperature decreases. However, impact resistance

☐ Figure 2. The pressure and temperature differences between plastic materials



[1] Lead Free refers to the wetted surface of pipe, fittings and fixtures in potable water systems that have a weighted average lead content ≤0.25% per the Safe Drinking Water Act (Sec. 1417) amended 1-4-2011 and other equivalent state regulations.

of most plastics decreases as temperature falls, and brittleness appears in affected piping materials. As long as the valves and adjoining piping system are undisturbed, not jeopardized by blows or bumping of objects, and the piping is not dropped during handling, adverse effects to the plastic piping are minimized.

PLASTICS RESOURCES

This article could not cover all of the plastic materials, types of valves, valve options and system requirements available today. However, it illustrates just how broad the market is and what promise it holds. Today, there are many plastics specialty distributors and knowledgeable plastic professionals that can help users discover how plastic valves and piping systems can meet or exceed their needs. Three of those sources are the Plastic Pipe and Fittings Association (www.ppfa.org), International Association of Plastic Distributors (www.iapd.org) and Plastic Piping Institute (www.plasticpipe.org).

TYPES OF THERMOPLASTIC VALVES

Ball valves, check valves, butterfly valves and diaphragm valves are available in each of the different thermoplastic materials for schedule 80 pressure piping systems that also have a multitude of trim options and accessories. The standard ball valve is most commonly found to be a true union design to facilitate valve body removal for maintenance with no disruption of connecting piping. Thermoplastic check valves are available as ball checks, swing checks, y-checks and cone checks. Butterfly valves easily mate with metal flanges because they conform to the bolt holes, bolt circles and overall dimensions of ANSI Class 150. The smooth inside diameter of thermoplastic parts only adds to the precise control of diaphragm valves.

Ball valves in PVC and CPVC are manufactured by several U.S. and foreign companies in sizes 1/2 inch through 6 inches with socket, threaded or flanged connections. The true union design of contemporary ball valves includes two nuts that screw onto the body, compressing elastomeric seals between the body and end connectors. Some manufacturers have maintained the same ball valve laying length and nut threads for decades to allow for easy replacement of older valves without modification to the adjoining piping.

Ball valves with ethylene propylene diene monomer (EPDM) elastomeric seals should be certified to NSF-61G for use in potable water. Fluorocarbon (FKM) elastomeric seals can be used as an alternative for systems where chemical compatibility is a concern. FKM also can be used in most applications involving mineral acids, with the exception of hydrogen chloride, salt solutions, chlorinated hydrocarbons and petroleum oils.

PVC and CPVC ball valves, 1/2-inch through 2 inches, are a viable option for hot and cold water applications where the maximum non-shock water service can be as great as 250 psi at 73°F. Larger ball valves, 2-1/2 inches through 6 inches, will have a lower pressure rating of 150 psi at 73°F. Commonly used in chemical conveyance, PP and PVDF ball valves (Figures 3 and 4), available in sizes 1/2-inch through 4 inches with socket, threaded or flanged-end connections are commonly rated to a maximum non-shock water service of 150 psi at ambient temperature.

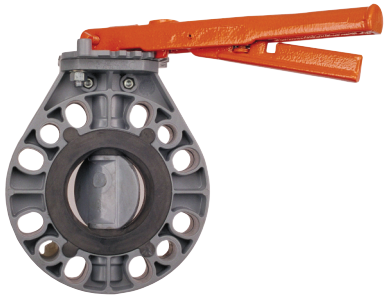
Thermoplastic ball check valves rely on a ball with a specific gravity less than that of water, so that if pressure is lost on the upstream side, the ball will sink back against the sealing surface. These valves can be used in the same service as similar plastic ball valves because they do not introduce new materials to the system. Other types of check valves may include metal springs that may not last in corrosive environments.

The plastic butterfly valve in sizes 2 inches through 24 inches is popular for larger diameter piping systems. Manufacturers of plastic butterfly valves take differing approaches to the construction and sealing surfaces. Some use an elastomeric liner (Figure 5) or O-ring, while others use an elastomeric-coated disc. Some make the body out of one

☐ Figure 3. A flanged ball valve attached to a tank

☐ Figure 4. A ball check valve installed vertically

☐ Figure 5. A butterfly valve with elastomeric liner



material, but the internal, wetted components serve as the system materials, meaning a polypropylene butterfly valve body may contain an EPDM liner and PVC disc or several other configurations with commonly found thermoplastics and elastomeric seals.

Installation of a plastic butterfly valve is straightforward because these valves are manufactured to be wafer style with elastomeric seals designed into the body. They do not require the addition of a gasket. Set between two mating flanges, the bolting down of a plastic butterfly valve must be handled with care by stepping up to the recommended bolt torque in three stages. This is done to ensure an even seal across the surface and that no uneven mechanical stress is applied on the valve.

Metal valve professionals will find the top works of plastic diaphragm valves with the wheel and position indicators familiar (Figure 6); however, the plastic diaphragm valve can include some distinct advantages including the smooth inside walls of the thermoplastic body. Similar to the plastic ball valve, users of these valves have the option to install the true union design, which can be especially useful for maintenance work on the valve. Or, a user can select flanged connections. Because of all the options of body and diaphragm materials, this valve can be used in variety of chemical applications.

Figure 6. A diaphragm valve

Like with any valve, the key to actuating plastic valves is determining the operating requirements such as pneumatic versus electric and DC versus AC power. But with plastic, the designer and user also have to understand what type of environment will surround the actuator. As previously mentioned, plastic valves are a great option for corrosive situations, which include externally corrosive environments. Because of this, the housing material of actuators for plastic valves is an important consideration. Plastic valve manufacturers have options to meet the needs of these corrosive environments in the form of plastic-covered actuators or epoxy-coated metal cases.

As this article shows, plastic valves today offer all sorts of options for new applications and situations. VM

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Finding the Source of All that Noise

BY STEVEN HOCURSCAK AND KYLE RAYHILL

Processing plants today do everything they can to increase efficiency and productivity. Frequently, that involves operating at higher temperatures, pressures and flow rates, which means higher pressure differentials across critical control valves as well other conditions that generate more noise. While this noise has always been a problem, it is even more so in today's high-throughput processing plants.

When this cacophony is generated by air and other gases flowing through valves and piping systems, it is called "aerodynamic noise." Aerodynamic noise is not only annoying, it also presents a health threat that may be subject to a variety of regulations. Most of those regulations limit maximum allowable noise levels to less than 85 decibels (dBA).

Even beyond the health and annoyance factors, aerodynamic noise causes problems. Such noise can generate substantial shock and vibration that can damage or alter the performance of control valves and instrumentation, degrading their performance and shortening maintenance intervals. This damage starts to occur at sound pressure levels in excess of 100 dBA.

Executive Summary

SUBJECT: Aerodynamic noise is more than a nuisance—it has health implications and can cause major damage to processing equipment.

KEY CONCEPTS:

- What is aerodynamic noise?
- Why is it a problem?
- How do you make it go away?

TAKE-AWAY: Recently, progress has been made in developing expert software technology for predicting aerodynamic noise generation and for designing specific valve trim attenuation.

Damage from acoustic shock and vibration can be minimized through the use of robustly designed valves, piping and instrumentation. But even these robust configurations should not be subjected to noise levels predicted to exceed 110 dBA.

In short, aerodynamic noise is a significant problem on many levels that need to be addressed. This can be accomplished by limiting the factors that generate the noise (called a source treatment), dampening the noise that has already been generated or a combination of those two solutions. The most cost-effective approach is to limit the level of noise through meticulous valve sizing and piping configuration design. However, that's not always going to happen—valves are sometimes improperly sized, and unanticipated conditions arise that can result in surprising levels of noise.

When the horse is already out of the barn and making a racket, it may be expedient to use path abatement procedures, rather than trying to redesign the system and replace most of the noise-generating components. If a great deal of noise is generated, however, the best approach might be to determine the most cost-effective combination of source abatement and path dampening. To do this requires finding a way to analyze control loops to accurately determine how much noise will be produced or abated by various source and path treatment options.

SCIENCE OF PREDICTING NOISE LEVEL

Because source reduction is the best way to avoid excessive noise, this article will consider that subject shortly. But first, the issue of how to know if a noise problem will occur in a system must be addressed. The place to start is experience: Professional plant operations personnel know that certain control valve and piping configurations are inherently noisy. Valves in these services need to be sized very carefully with noise attenuation in mind.

Beyond experience, however, is developing an understanding of conditions most likely to generate noise. At low-pressure ratios, for example, the cause of aerodynamic noise is turbulence. At high-pressure ratios, the turbulent interactions of the shock waves become the major source of noise. A very potent determinant of noise is flow velocity because dBA levels increase geometrically (to the fourth, sixth and even eighth power) as flow velocities increase.

While this terse summary provides a simplistic explanation of where noise comes from, predicting noise generation in air and gasses is actually a very complex challenge. For example, scientists study noise at subsonic and supersonic velocities, and for subsonic sources, the noises in processing could be monopole, dipole or quadrapole (measurements of how sound waves radiate), with each of these levels adding more complexity to the equation. Also, noise created by the interplay of shock waves and turbulence can be influenced by the presence and geometry of physical boundaries in the vicinity of these interactions.

Shock waves that are perpendicular to a free jet stream are called normal or direct shocks. A shock wave can also be oblique if the flow passes a wedge or sharp object or if supersonic flow is forced to change direction by a solid boundary. Shock waves can be reflected from solid boundaries and can penetrate one another. A control valve outlet flow stream can create an oscillating chain of compression shock waves with declining cycles and intensity—a very powerful noise source.

With computational fluid dynamics, shock waves can be simulated in different geometries. Normally, super computers with substantial memory and processing power are used because the calculations required are long and complex. The results that these state-of-the-art computer programs produce are used in the design of low-noise trims and attenuators.

EXPERT SIMULATION AND SIZING

The scientific study of what creates noise in process lines is ongoing. However, after decades of research, much has been learned that can translate into equations to predict, with high levels of accuracy, the noise-generating potential for most piping and control valve configurations. These equations are available to process engineers within the International Electrotechnical

Commission and the German Engineering Federation (VDMA) standards.

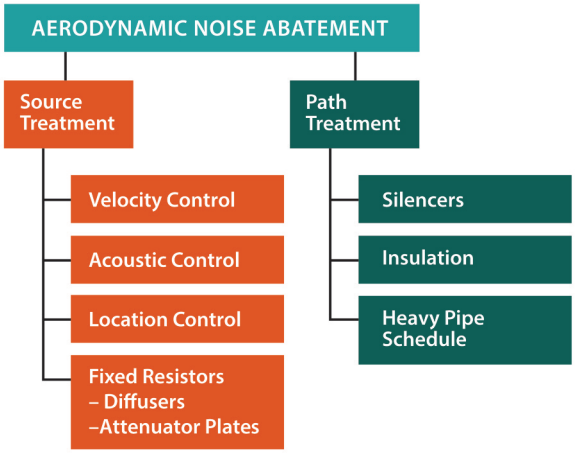
Control valve vendors have specialists who understand these variables and can work with processors to predict and modify the noise-generating characteristics of process loops. Some even have expert software developed to simulate line conditions for making realistic predictions of flow and noise generation. This expert software allows an experienced user to swap valves, trim and other components until the most favorable combination of noise attenuation and process performance has been achieved.

If a control valve vendor can simulate control loops with expert sizing software, it is likely that vendor can detect potential noise generation problems in advance and minimize those noises using cost-effective source treatment approaches. In such cases, high levels of mechanical vibration, which are always associated with noise, can be minimized or eliminated at the outset to ensure greater control reliability and process uptime.

SOURCE TREATMENT

A variety of methods exist that can minimize the potential for noise generation. The most common are acoustic control, velocity control, location control and diffusion. Recently, trim has been defined specifically to address these types of aerodynamic noise.

Acoustic control: Two common methods of minimizing acoustics of control valves are dividing flow into multiple streams and modifying the acoustic field. Flow division into multiple streams is effective because the intensity of noise generated by a single orifice decreases dramatically when hole diameter is decreased. Thus, many small holes will attenuate noise more effectively than one large hole. A rule of thumb is that each doubling of the number of holes reduces noise by 3 dBA.

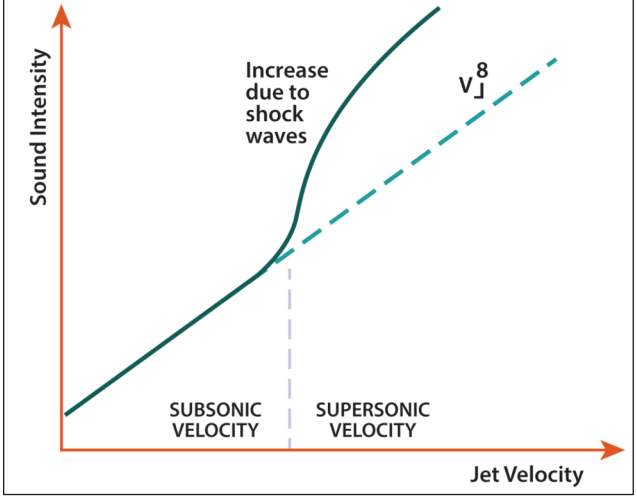


Increasing the number of flow passages by making them smaller also affects noise frequency distribution—the smaller the passage, the higher the noise frequency. The pipe wall easily attenuates high-frequency noise. High frequencies are also less of a problem because they extend beyond the capabilities of the human ear.

Modifying the acoustic field directs the flow path in such a way that the peak noise field is broken up into a more diffused space.

Velocity control: Controlling the maximum fluid velocity inside a control valve trim is an effective way of controlling noise at subsonic flow velocities because the acoustic intensity of a jet is proportional to the sixth power of the flow velocity in a system with solid boundaries, such as valve trim or a pipe. The control valve trim velocity can be controlled most effectively by using a multistage pressure drop and by increasing the valve trim outlet area in a manner in which the flow velocity and pressure at the valve outlet are minimized and gas volume is maximized. The successive stages are spaced so that gas pressure is allowed to recover to an intermediate level and velocity before the next throttling stage. This intermediate recovery of pressure and the resulting velocity reduction prevents the fluid from reaching the velocity of a single-stage pressure drop system.

This figure shows that sound intensity increases faster as velocity of the stream increases. When the velocity passes into the supersonic range, shock waves increase and noise levels spike. If the increase in noise remained proportional it would have followed the green dotted line.



Location control: Two major sources of noise are turbulence that forms in the mixing region between where the jet exits from an orifice and the gas flows at the outlet region and attachment, and the interaction of shock waves. The piping system should be designed following documented best piping practices. Such practices specify factors such as the distance from transition pieces to valves for the purpose of delivering flow in as laminar a condition as possible (thereby limiting turbulence). Location control is employed to make sure the jet streams within and departing from the trim are located and shaped to minimize the potential for noise generation. One way to do this is to smooth the velocity profile of the jet by introducing a lower velocity gas stream alongside the jet.

Diffusers: Diffusers have fixed area flow resistances and are custom-made for a particular flow condition. Dividing the pressure drop between a control valve and a downstream diffuser provides an effective way to further increase the noise attenuation in cases where the control valve has a constant, high-pressure drop, and the flow rate is relatively constant.

Aerodynamically specific trim: Typically, source treatment approaches applied within and around the control valve can solve most noise generation issues. Valve manufacturers have been studying and refining approaches to

noise and anti-cavitation trim for decades now. As a result, combinations of all of the commonly used source treatment approaches can be applied to noise attenuation within a single device.

Figure 1 shows a rotary control ball valve with a trim design that incorporates pressure staging, flow division, peak frequency shifting and velocity control within one rotary control device, in this case a ball valve. This design concept, which was introduced more than two decades ago, has been refined recently to provide greater precision in attenuating high aerodynamic noise levels in gas and steam applications. The result is noise attenuation that is increased from 15 dBA to 30 dBA. Users with noise control issues within gas and steam control loops should be aware that new trim technology addresses aerodynamic noise specifically.

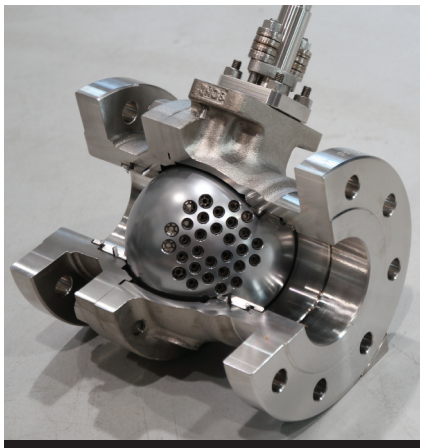


Figure 1. Trim designed to reduce aerodynamic noise

PATH TREATMENT

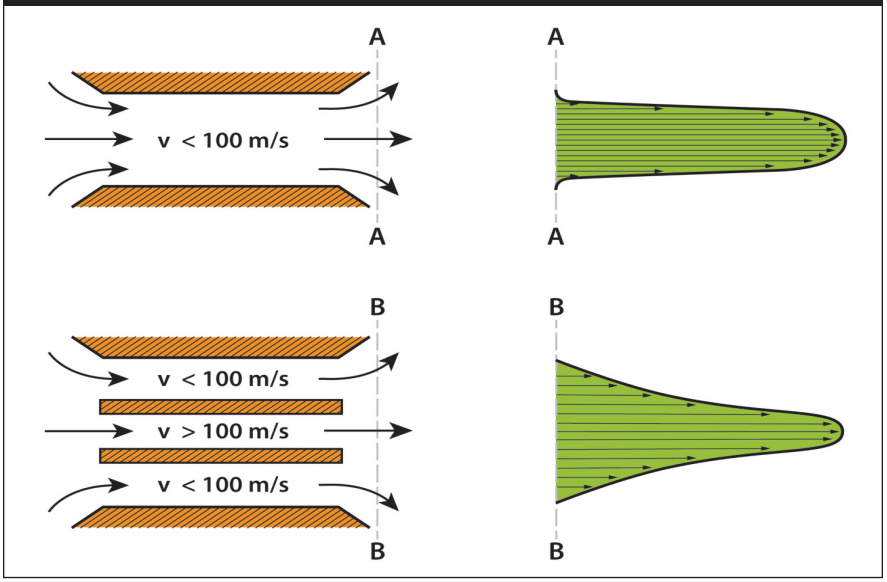
The path treatment for noise, i.e. suppressing the transmission of excessive noise levels along the path, can be performed by using at least three different tools: silencers, insulation and heavier pipe schedule. While less than ideal, path treatment is an approach that can be considered when vibration levels are not high enough to damage or inhibit the performance of the control loop or if source treatment alone could not bring noise generation down to acceptable levels.

Silencers: Silencers are mufflers used inline or at an outlet leading to the atmosphere to dampen the noise produced. Reactive silencers create frequency interactions to dampen noise; whereas dissipative silencers use sound-absorbing materials such as glass-fiber to dampen the noise. The main use for silencers is on outlets for gas or steam. Typically, a combination of reactive and dissipative methods is used in atmospheric vent silencers.

Insulation: Pipe insulation may be used to dampen noise in gas and steam lines, particularly in steam lines, where there is already thermal lagging. Thermal insulation can dampen noise 1-2 dBA per 10 millimeters (mm) of insulation thickness (3 to 5 dBA per inch). The maximum is about 12 dBA because of leaks and acoustic bridges. Special acoustic insulation reduces noise up to 4 dBA per 10 mm of insulation thickness (10 dBA per inch). The maximum attenuation for acoustic insulation is 20-25 dBA.

Heavy downstream pipe schedule: A heavier downstream pipe schedule can be used to dampen noise because vibrating pipe wall generates part of that noise. The heavier the pipe wall (the bigger the schedule), the less that wall will vibrate. Note that the noise level inside the pipe does not decrease with a heavier wall pipe. Because of this, the heavier wall pipe should be used for the whole downstream piping to avoid recurrence of the high noise level further down the line, which can be very costly in the case of long pipe runs.

Figure 2. Jet velocity profile modification: The formation of turbulence in the mixing region between where the jet exits from an orifice and the gas flow at the outlet region as well as attachment and interaction of shock waves (generated during throttling if the flow reaches sonic velocity in the valve) are major sources of noise that can be controlled to an extent by intelligent valve trim design. One way to do this is to smooth the velocity profile of the jet by introducing a lower velocity gas stream alongside the jet, as shown here.



CONCLUSION

Effective aerodynamic noise reduction in pipelines and control loops has become an important consideration for many industries. This is because control of such noise ensures a safe working environment, protects process and plant surroundings, enables stable process control, extends maintenance intervals and ensures legal obligations are met.

While noise can be suppressed after it is generated through path treatment, a generally more effective and less expensive alternative is source treatment. Much progress has been made recently in developing expert software technology for predicting noise generation under actual line conditions and for designing specific valve trim attenuation for aerodynamic noise. Processors who deal with air and gas control applications that have a tendency to generate noise should seek the assistance of control valve vendors that understand and can suggest these technologies. VM

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Figure 1. API valve being set up for emissions testing

The Tie Between FUGITIVE EMISSIONS and MARKET DYNAMICS

Executive Summary

SUBJECT: Environmental issues drive the focus on reduced fugitive emissions. However, emissions control, when viewed as part of life-cycle cost issues, can be seen as a value proposition.

KEY CONCEPTS:

- Emissions issues
- New EPA standards
- Industry reactions
- Sustainability as a strategy

TAKE-AWAY: The winners in the emissions control environment will be those able to reflect the true cost of better valves and equipment.

BY SCOTT BOYSON

Winners and losers in the world of valves, like in most industries today, are created as the players react to a constantly changing environment and marketplace.

The winners are the companies that constantly ask, "What can I do to create greater value for our customers? What future needs can I meet and how can I deliver what customers need better and earlier than everyone else?"

In other words, they are the companies that find ways to measure value proposition. One area in the valve world today that can offer value proposition is decreasing and eliminating fugitive emissions.

VALUE PROPOSITION DYNAMICS

In the area of emissions control, end users want better long-term leak tightness, greater reliability at higher pressures and temperatures, improved stem sealing, lower friction, reduced wear rates and improved process controls. To achieve this, they will focus on developing approved material listings and driving compliance to their requirements through their various organizational divisions. By focusing on the total life-cycle costs of valves, companies can more accurately measure and show the positive impact meeting user needs will have on products.

Certainly, there will always be pressure to keep costs of valve acquisition as low as possible—but the recognition of what those valves cost over their lives will begin to impact decisions. As end users strive to operate more efficiently, they will use their extensive databases to determine the total costs associated with valves, including:

- Transaction cost
- Inventory cost
- Installation cost
- Emissions performance
- Leakage cost
- Sealant injection costs
- Packing adjustment costs
- Lubrication costs
- Preventative maintenance costs
- Periodic inspection costs
- Seat leakage costs
- Process control impacts

In the coming years, as valve asset management programs become better able to analyze the total cost of ownership, this broader view of costs will accelerate.

As allowable emissions levels decrease, the total cost of plants' valve populations will increase.

THE EFFECTS ON EMISSIONS ISSUES

One area where total cost and performance over time affects valves is fugitive emissions sealing. While pumps, flanges and fittings also affect fugitive emissions, their effects are much lower. In fact, the U.S. Environmental Protection Agency (EPA) estimates that over 60% of fugitive emissions emanate from the valves themselves.

Because of this high percentage, the EPA is using its enforcement powers to negotiate consent decrees in refineries and chemical plants and has stepped up enforcement on chemical plants in the last few years. In fact, over 85% of U.S. refineries are now operating under consent decrees, and more are in the midst of negotiations. These agreements commit plants to many specific actions they must take to improve environmental performance. Part of these consent decrees includes enhanced leak detection and repair (LDAR) requirements for valves. Many of the recent consent decrees include moving plants from the former 500 parts per million (ppm) emissions acceptable performance levels to 100 ppm.

As allowable emissions levels decrease, the total cost of plants' valve populations will increase. More valves will need to be maintained, injected, removed, repaired and reinstalled to meet requirements. In some cases, the consent decrees are also requiring greater frequency of leak detection.

At the same time, the average mean time between emissions failure for valves for the existing valve population decreases because so many of those valves will fail at 100 ppm. Consent decree decisions sometimes mean delay of repair schedules for valves are reduced, which means more valves will be injected online with sealants, which adds cost and can affect process control. As the total cost of valve ownership increases, acquisition cost as percentage of total cost is reduced.

Corporations and their plants are now evaluating the performance of technologies available to meet current and future requirements. Also, even though many recent consent decrees require emissions testing and certification for valves and valve packing to remain below 100 ppm for at least five years, end users want the equipment to last longer.

CERTIFIED VALVES AND TECHNOLOGY

Market dynamics are also affected by new terminology that consent decrees have introduced, such as "Certified Low-Leaking Valves" and "Certified Low-Leaking Valve Packing Technology." These terms not only define performance parameters but require a written guarantee from valve and packing manufacturers.

For example, according to recent consent decrees, Certified Low-Leaking Valve Packing Technology means technology for which a manufacturer has issued either: 1) a written guarantee that the valve packing technology will not leak above 100 ppm for five years or 2) a written guarantee, certification or equivalent documentation that the valve packing technology has been tested to generally accepted good engineering practices and has been found to be leaking at no greater than 100 ppm.

Similarly, Certified Low-Leaking Valves are valves under the same conditions (a written guarantee that the valve will not leak above 100 ppm for five years or documentation that the valve has been tested to good engineering practices and found leaking at no greater than 100 ppm).

Many test protocols exist to measure the emissions performance of valves and packing products. The two most commonly used protocols are the American Petroleum Institute (API) 622 and International Standards Organization (ISO) 15848-1 standards. The API standards use methane as the test media and EPA Method 21 to measure emissions. The ISO tests use helium as the test medium with vacuum as the leak detection method. (It is important to note the EPA only recognizes methane emissions testing conducted using Method 21.)

API 622/API 624

For many users in the United States, API 622 2nd Edition has become the new standard for measuring emission per-

formance for valve packing. Since the EPA only recognizes test results performed using Method 21, API 622 2nd Edition, which addresses that method, is a logical choice. This performance test allows users to review detailed performance results for leakage (Figure 1). Using these criteria, users determine what leakage safety factor to apply to selection criteria for sealing the thousands of valves they have in their plants required to be less than 100 ppm. For instance, a packing that requires additional gland tightening to seal during the API 622 test and averages 65 ppm leakage may not be the best choice when compared to packing that requires no gland adjustment but seals below 20 ppm.

In addition, the API 622 standard requires corrosion performance testing. This testing examines the amount of galvanic corrosion that occurs between the packing and valve stem, a factor that is often a source of premature failure. As end-users look at root causes of failure and the requirements for long life beyond the five-year minimum, corrosion testing will become much more important.

For identifying low-leaking valves, the API 624 test standard will soon be published. API 624 will require the use of API 622 packing tested with the maximum allowable leakage of 100 ppm without a packing adjustment. The API 622 leakage and corrosion test will be a part of the API 624 documentation package. The corrosion tests can yield varying results for low emission packing (Figures 2 and 3).

Valve and packing manufacturers will need to evaluate the performance of existing designs and technology in response to EPA mandates as well the anticipated API 624 requirement. All types of valves, including on/off, control, motor- and air-operated valves are impacted by low emission mandates. The API 622 and 624 standards are based on graphitic packing in rising stem or rotating and rising stem block valves. Components of the test are already in use to test quarter-turn valves, control valves, polytetrafluoroethylene packings, engineered sealing arrangements, etc. to comply with the generally accepted engineering test standards EPA requires.

Valve manufacturers also will need to determine if these tests will be a regular offering for their products or an area of specialty. Specialization keeps manufacturers' supply costs down since more commodity packing arrangements can be used. Some manufacturers will conduct testing that just meets the EPA mandates, but offer that as standard. Still others will see the value proposition in tougher testing and reducing total life-cycle costs for their product as opportunity.

The EPA's consent decrees are focused on past transgressions, and the agency expects plants to become more proactive. EPA will expect performance data to be analyzed, best practices to be migrated throughout organizations, engineering standards to reflect current technology, and training for employees and contractors that has a goal of delivering better performance. Suppliers, manufacturers and service companies can assist those plants in looking at the total cost factors involved in plants getting to where the EPA expects them to be.

Meanwhile, this is not just occurring in North America—other parts of the world also are focusing on emission reduction. The International Pollution Prevention and Control directive, Best Achievable Techniques (BAT), are identi-

☐ Figure 2. Less than 1% stem corrosion

☐ Figure 3. Greater than 10% stem corrosion

fied as proactive environmental programs for fugitive emissions control. Companies in Europe and elsewhere are putting leak detection and repair programs in place and using smart LDAR cameras to detect areas of pronounced fugitive emission leakage. Asian refiners are visiting the U.S. and Europe to assist in developing environmental programs with a view towards meeting BAT. Programs also are developing for highlighted applications such as Benzene, Toluene, Xylene performance. Recently, the Chinese government shut down plants around Beijing because of dangerous smog levels that overwhelmed the population. Meanwhile, multinational corporations are increasingly inserting their influence to decrease risks in joint ventures.

SUSTAINABILITY—A STRATEGIC DIRECTION

Many corporations have a substantial impact on the communities that surround their sites and know they need to develop policies that show their corporate responsibility, attention to "green" and how to be a "good neighbor." However, trying to define and measure social responsibility is difficult and especially hard for processing plants. Many large corporations use the term "sustainability" as a driver of high level decision-making and expect the plants to comply with those decisions.

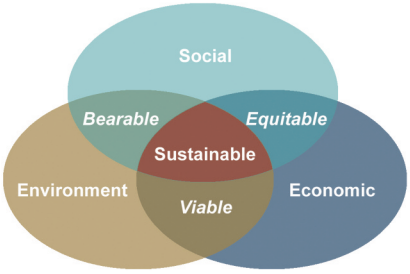

Figure 4. Sustainability considerations

Sustainability could be defined as actions that 1) use economic considerations combined with 2) social and environmental elements to 3) identify the best solutions for the corporation and its surrounding community. The best decisions are made when all three of these areas—economic, social and environmental—are evaluated. While many actions taken by a plant or corporation might involve only one or two of those elements, the best practices and decisions involve all three (Figure 4).

By using a total life-cycle cost approach, valve manufacturers and their partners can align themselves with the strategic direction of end-users focused on sustainability. All parties can also begin to work towards a proactive approach to emissions. In other words, by enhancing valve-sealing performance and simultaneously lowering a plant's total costs, a sustainability value proposition is developed.

The reality is that corporations must be in good financial condition to have a positive impact; they must be profitable to invest in infrastructure improvements and create value for shareholders. At the same time, environmental sustainability focuses on actions that do not deplete resources—which leave the world in a better place for generations to come. Plants often focus on reducing emissions and minimizing or eliminating waste to get to that point.

Meanwhile, social responsibility encompasses the idea that corporations have a responsibility to help the people they affect, which includes focusing on health and safety of employees. Companies look to best practices and technology to reduce workplace risks and those risks include leaks of dangerous fluids or emissions. Educating employees on best available techniques is another way the valve industry can offer end-users value proposition from emissions considerations.

Sustainability decision-making combines all three aspects of the equation—it enhances economic opportunity and community well-being while protecting and restoring the natural environment.

In the valve world, the companies that can anticipate and develop areas that address the total cost of valves and incorporate the benefits of sustainability can position themselves as knowledge providers. In other words, they can offer a value proposition to end users that will create much greater returns for all. VM

Scott Boyson has been directing Chesterton's (www.chesterton.com) efforts to meet the stringent sealing requirements facing industry. He is responsible for developing new valve packing products and programs to meet these challenges. He has published and presented technical papers, is a member of the Fluid Sealing Association and is an active participant on multiple standards disscussions. Reach him at BoysonS@Chesterton.com.

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Trends in Independent Valve Pressure Testing

BY DOUG O'NEILL

Before the industry slowdown of 2008, some end users performed third-party pressure testing of valves for use in critical service according to the acceptance criteria of ASME B16.34, API-598, API-6D, etc.

However, since that time, requests for independent valve pressure testing have increased greatly. This increase has been noted on non-destructive evaluations (NDE) such as radiographic testing (RT), magnetic particle inspection, liquid penetrant inspection (Figure 1) and visual inspection of valve body castings to meet customer specific requirements or industry standards such as ASME B16.34 Section 8 for special class services.

Performing NDE such as RT on a valve body/bonnet casting requires the full disassembly of the valve to gain unobstructed access to critical areas of the casting. Once an RT is complete and the castings verified as defect-free or the castings weld-repaired to meet industry codes, the valves can then be assembled, bolting torqued to OEM specification and the valve fully pressure-tested to ensure no seat or shell (atmospheric) leaks. The increased volume of RT inspections thus means an increased volume of valve pressure testing.

The world has become more environmentally conscious and the additional valve NDE can be seen as a result of this. This increase in NDE volume has meant addition of personnel and equipment; however, this is a positive sign for testers because it means increased work load.

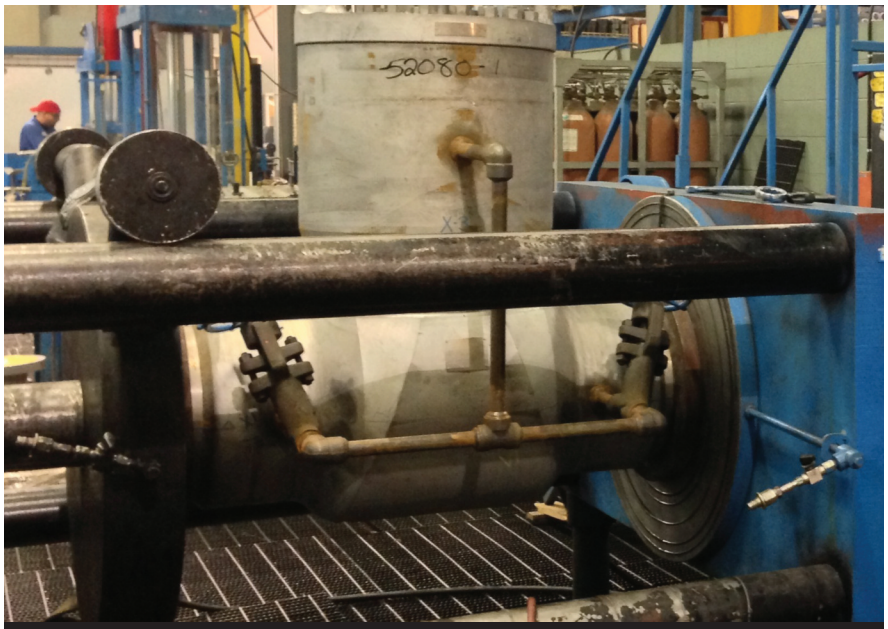

Figure 1. A pressure seal gate valve in an 800-ton hydrostatic test stand

TESTING BUTTWELD END VALVES

To perform a pressure test of a buttweld end valve on site requires the valve to be welded into a piping system or caps welded to the valve buttweld ends. Seat leaks detected on a valve body once a valve is installed in a piping system can be very expensive since the valve needs to be cut from the line and sent to a repair facility. Because of this, many end users request that buttweld valves for critical service have an independent pressure test performed to ensure the valves meet respective design pressure test requirements.

Valve manufacturers and repair/modification facilities use hydrostatic test stands that can seal buttweld end valves by using test plate adapters to seal the buttweld ends through a retained O-ring seal (Figure 2). These test plates are energized by means of a hydraulic ram. As the internal hydrostatic valve pressure is increased, hydraulic ram pressure also is increased on the test plates to equalize the external force against the valve buttweld ends with the internal valve hydrostatic force. This means an independent pressure test can be performed on a buttweld-type valve to ensure no defects without having the expense of finding a leak after it has been welded in a piping system.

Figure 2. A test plate adapter sealing the buttweld end of a pressure seal gate valve in a hydrostatic test stand

SHELL PRESSURE TESTING

An aspect of pressure testing that has only become apparent in the past few years is the requirement to perform a 10-minute shell pressure test only on valves and fittings. The odd part of such a test is that the client only seeks a shell pressure test, not seat leakage testing. This would seem to imply that valves will be going into a piping system and that the client wants to meet the 10-minute pressure test requirements of ASTM B31.3 for process piping. Some clients have even requested testing forged flanges and fittings with a 10-minute hold.

A misconception of this test is that the fabricator still needs to perform a full shell pressure test on the piping system as a whole to ensure joints and connections are examined for leaks.

Valves manufactured to meet ASME B16.34 will have a factory pressure test done that ensures the valve itself is leak tight. Most American Society of Mechanical Engineers (ASME), American Petroleum Institute (API) and Manufacturers Standardization Society documents that apply to valve pressure testing have much shorter test duration than process piping standard B31.3. In some cases though, depending on the test standard the valve manufacturer follows, the valve may meet or exceed the 10-minute shell pressure test duration. An example would be valves 12 inches in diameter and larger that are factory pressure tested per CSA [Canadian Standards Association] Z245.15.

The problem rests in the interpretation of the ASME B31.3 code—in particular, in the following areas:

The second paragraph within ASME B31.3, 326.3 states *"The design, materials, fabrication, assembly, examination, inspection, and testing requirements of this Code are not applicable to components manufactured in accordance with the documents listed in Table 326.1, unless specifically stated in this Code, or listed document."* This poses the question: would a valve manufactured to meet the requirements of ASME B16.34 and pressure-tested at factory to API-598 criteria be exempt from a pressure test required by ASME B31.3? The answer is "yes," in the context that the valve would have been tested to ensure no body seat leaks and no atmospheric shell leaks at the factory to meet the design criteria requirements of B16.34. However, the answer is "no," in the context that paragraph 345.1 of B31.3 states that *"each piping system shall be tested to ensure tightness."* Furthermore, Paragraph 345.2.2 (a) states *"Examination for Leaks. A leak test shall be maintained for at least 10 minutes, and all joints and connections shall be examined for leaks."* The only way to satisfy this requirement would be to have the spool pressure-tested by the fabricator with the individual valves, fittings, pipe, etc. assembled as a complete unit and then pressure-tested as a whole to prove that the component joints (connection ends) are free from atmospheric leaks.

To conclude, a customer that wants to do an additional 10-minute pressure test on a valve to ensure no atmospheric leaks at an extended duration time compared to what the factory would have done is no problem. An extended duration test, however, does not relieve the fabricator from the requirements of ASME B31.3 to prove that the final joints and end connections that connect the valve to the piping system are to be examined for leaks. This growing trend towards such testing shows that users are increasing efforts to prove functional assurance of components provided through global supply, not to imply replacement of final testing required by ASME B31.3. VM

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VALVE {Ed}

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Greater Plant Efficiency through Positioner Innovation

BY LEO MINERVINI

Plant operators across the world are tasked with maximizing efficiency and output from existing facilities, which can be a major challenge when there are many valves and actuators. Plant management strategy to accomplish this task includes developing a better understanding of how valve and control assets perform in the field and to adopt preventative maintenance to minimize plant downtime. Valve positioner technology today has evolved to help plant managers with this major challenge.

Figure 1. Installation of intelligent positioners with remote mount capability at an ethanol production plant in the U.S.

VALVE POSITIONER TECHNOLOGY

The valve positioner market has grown significantly in recent years to about $1 billion globally. The technology grew from the need to maintain a steady control state for process valves such as globe, high-performance butterfly, ball and plug valves used to throttle or regulate a process within a plant. As plant network technology and infrastructure developed, so, too have innovations in valve positioners.

Three technology options are available to plant engineers looking to integrate a valve positioner solution:

Mechanical: A positioner is connected to the valve stem so that the position can be compared with that dictated by the controller via a force-balanced arm.

Electro-pneumatic: These positioners are based on the same force-balance principle as mechanical positioners, but the technology operates on a current-to-pressure transducer signal, typically 4-20mA, which then relays the valve position to the actuator. These systems are mounted directly and axially to the actuator stem and are suited to quarter-turn rotary actuator applications.

Smart/digital positioners: With built-in microprocessors, this positioner option allows greater, more precise control over plant assets and can also offer diagnostic data, which provides input for predictive maintenance schedules.

SMARTER TECHNOLOGY

Over the last 10 years, developments in smart and digital valve positioners have outpaced the performance capabilities of mechanical and electro-pneumatic systems. Advancements in digital communications protocols have allowed smart controller technology to evolve, integrating more sophisticated functionality. Such innovations have led to digital valve positioners that operate as mini-steady-state controllers, enabling field level automatic controls.

For example, if an operator wants to send a signal to a valve to throttle by X degrees of rotation to a specific position for purposes of achieving a desired set point, the actuator applies only enough torque to move the valve Y degrees of rotation. The smart positioner can send a larger torque until the required set point has been achieved. Microprocessor-based technology gives the opportunity to make these necessary adjustments in the field. Unlike conventional mechanical and electro-pneumatic positioners, digital controllers develop accurate valve position feedback without the need for linkages, levers, and rotary or linear seals. Position sensing is performed totally by non-contacting means, which enables the use of advanced control strategies.

Figure 2. Above: a pneumatic positioner for rotary valves. Right: a smart digital positioner for rotary and linear valves.

By accurately measuring and recording valve stem position, input signal and actuator pressure, smart positioners can provide information for control valve signature generation. These capabilities can be further enhanced with wireless technology to provide immediate status reports to engineers in the field, removing the need to access valves and actuators in difficult-to-reach or hazardous locations. This allows a plant to introduce predictive maintenance methodologies that can lead to better performance, improved safety and reduced inefficiencies

through unnecessary downtime and subsequent costs.

Smart valve positioner technology introduces additional capabilities to plant operators over conventional valve controllers. For example, a smart positioner can use non-contact feedback to control the valve position, enabling the positioner to be mounted remotely from the valve. This offers benefits to plants where the control valve is located either in a high-vibration or corrosive environment.

In addition to rotary valve applications, the position-sensing performance and microprocessor technology of the smart valve positioner mean a single device can be used for rotary and linear valve control and non-valve applications.

DEVELOPMENTS IN PROTOCOLS

The HART communications protocol was an early implementation of a digital industrial automation protocol built on the common 4-20mA wiring infrastructure installed throughout the world. This allowed the protocol to offer a transition solution to many plant operators who were comfortable with the 4-20mA analog signal, yet wanted to implement a "smart" protocol.

As plant operators became more familiar with industrial automation protocols, the digital communication protocols emerged, such as FOUNDATION Fieldbus (FF) and PROFIBUS PA (Process Automation), which offered greater functionality and enhanced diagnostics.

FF is a powerful networking solution that reduces the cost and time required to install and wire industrial automation devices. With the capability to interconnect both complex and simple devices from multiple vendors on the same network, FF supports distributed control allowing for the configuration of devices for local control in the field, in the host or for both sources.

Developed from the PROFIBUS DP (Decentralized Peripherals) variation, PROFIBUS PA monitors measuring equipment via a process control system in process automation applications. PA uses the same data format as the much faster DP protocol, enabling easy and seamless integration between devices on both networks. As

with FF, remote configuration, asset management and predictive maintenance scheduling are all possible with the PROFIBUS system.

In addition to offering greater functionality and enhanced diagnostics, FF and PA protocols have a distinct advantage when considering power availability compared to HART, allowing positioners to run processors faster, increasing communication performance.

RESPONDING TO CHANGING APPLICATIONS

Many oil & gas, petrochemical and process engineering plants are now operating with wide ranges of temperatures, pressures and flow rates. Harsh environments require valve and control products to function in severe service applications, requiring tougher and more reliable components with the ability to withstand extreme temperature or pressure fluctuations and maintain chemical and corrosion resistance.

Plant operators now look to control and monitoring solutions that can cross multiple applications. For valve positioner technology, developments in construction materials have needed to keep pace with these changing application requirements.

The valve position and control market is largely driven by changes in customer requirements, which then impact system design, enclosure construction or performance capability. In hazardous zones, for example, stainless steel has replaced aluminum in the construction of valve positioner enclosures—an innovation driven by customer requirements in the oil and gas industry.

Figure 3. Remote cabinet installation of intelligent valve positioners at an ethanol production plant in the U.S.

VALVE POSITIONER SPECIFICATION

A key consideration for plant operators looking to specify and engineer a valve positioner solution is system integration with existing plant network infrastructure. Host neutrality, which allows integration with a digital control system and local plant infrastructure, ensures engineers can achieve quick calibration and integration without the need for major system investment.

Valve positioner technology that integrates innovative digital communications provides plant operators with greater visibility and control over plant assets. Smart valve positioners offer enhanced capability and practical benefits to plant operators in relation to improved plant performance and greater operational efficiencies. Many of the products available today provide features such as advanced auto-calibration and single design for linear and rotary applications, as well as spring return and double-acting actuators to reduce plant inventory requirements.

Remote mount capability and different materials of construction—such as engineered resin, aluminium and stainless steel—as well as the ability to operate in low- and high-flow capacities enables smart valve positioner technology to meet the needs of demanding plant applications. The enhanced performance available today, when combined with valuable diagnostic data and robust communications protocols, ensure plant operators can benefit from the latest innovations in plant control technology. VM

Leo Minervini is general manager, Westlock Controls Global (www.westlockcontrols.com).

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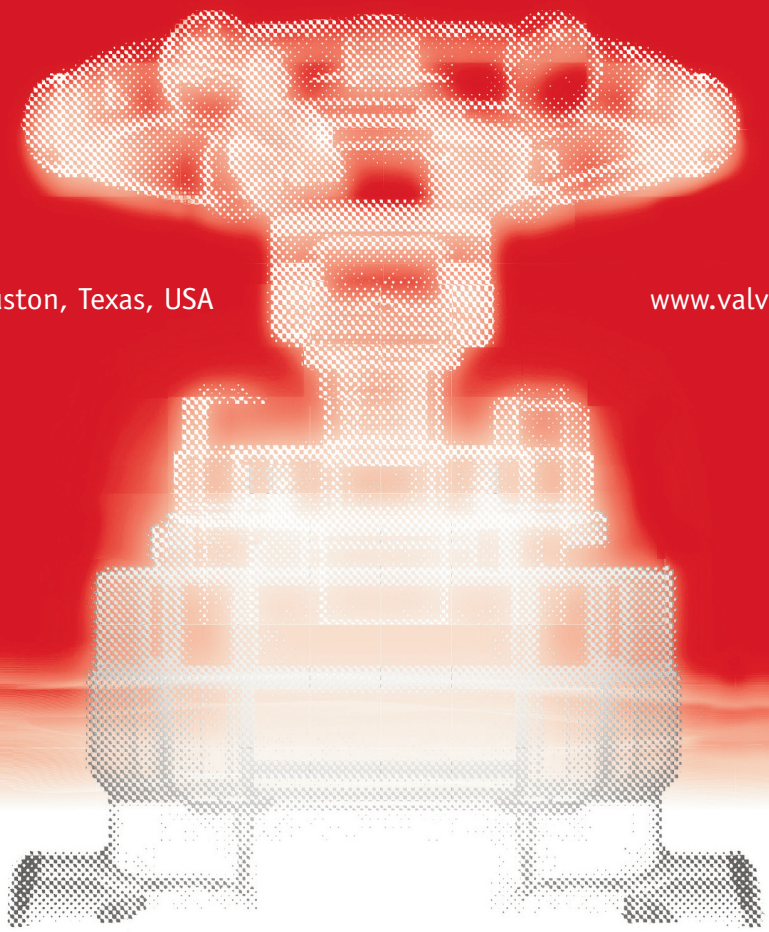

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When are Manual Actuators Best?

BY ED HOLTGRAVER

Actuators come in many shapes, sizes and types, but all of them require input from a source that will cause the valve to move. One of the first such sources ever used—manual input—has been eclipsed in some cases by new sources of powering the valve. But it is still the best choice in certain situations.

TYPES OF ACTUATORS

The sources of input for actuators today include compressed air (pneumatic), pressurized oil (hydraulic), electricity (electric), pipe media (self-regulating) or operator power (manual). This article addresses that last source: manual actuators that require operator force input to cause linear or rotary valve motion. It does not address devices integral to the valve such as buttons and knobs on smaller valves.

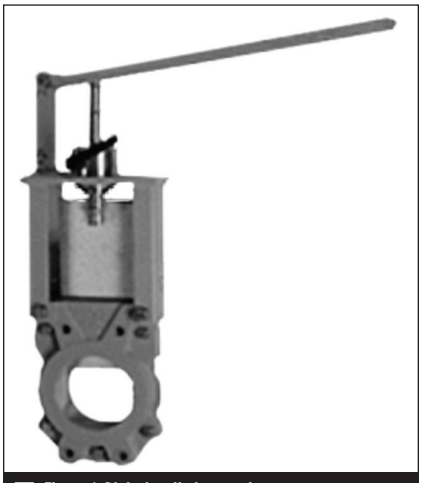
A quick distinction is an order: An "operator" is a human; the actuator is the device.

In talking about when manual actuation is suitable, a number of considerations come into play. When the absolute lowest acquisition price is required, no other option can compete. If operator input requirements are reasonable, the valve quantity is low, the access to the device is unrestricted and when use is infrequent, the atmosphere safe, the operating speed is not critical and actuator materials can handle any corrosive effect from the surroundings, then the selection of manual actuation is certainly rational.

When might you *not* want to select manual actuation? Obviously, if any of the above are not applicable. If factors such as cost of operation, control of process, available manpower and emergency response must be taken into consideration—manual actuation would be inappropriate.

THE DIFFERENT TYPES

Types of manual actuators include plain handles (Figure 1), latching handles (Figure 2), locking handles (Figure 3), self-locking handwheels (Figure 4), gear boxes with handwheels (Figures 5 and 6), gear boxes with spur gears and handwheels (Figure 7), declutchable gear boxes (Figure 8), chain wheels (in place of handwheels) (Figure 9) and impact chainwheels (Figure 10).



☐ Figure 1. Plain-handled manual actuator

☐ Figure 2. Latching handle

☐ Figure 3. Locking handle

☐ Figure 4. Self-locking handwheel

☐ Figure 5. Gear boxes with handwheels

Plain handles are simple, effective and inexpensive. However, if you need a large quantity or they will be used frequently, the cost of manpower may well override the initial low cost. Another consideration is operator input. If a valve is large, the force required may be more than one should expect from an operator. As for locking, the simple sluice gate valve (Figure 1) will likely only need to be locked in the open position as gravity tends to make the valve self-locking in the closed position.

The locking handle shown on a ball valve (Figure 3) locks only in the fully closed and open positions. Ball valves, especially small sizes, tend to remain in the position in which they are placed. In this valve's case, locking is provided to prevent unauthorized operation. But another consideration is speed of operation and operator training. Consider a liquid media flowing through the valve. Rapid valve closure could cause water hammer in the piping. Like a car hitting a wall at high speed, damaging stresses can occur in the valve and in the pipe. Unlike the car, however, the stress-causing pressure wave reverses direction to also impart high stress on upstream piping and components.

The opposite of water hammer is flow stoppage-induced vacuum downstream of the valve. When the valve is closed too fast, that flowing liquid wants to continue its forward motion, creating a vacuum downstream of the valve. This vacuum may cause collapse of pressure-sensitive downstream equipment.

The latching handle is most common (Figure 2), but not exclusive, to quarter-turn butterfly valves. Typically, latching is in 10-degree increments, allowing some manual flow control.

Needless to say, effective communication and awareness regarding flow rates is important, and as with all handles, operator training is critical if any possibility of water hammer exists.

Another factor to consider is that higher flow rates through butterfly valves can cause high dynamic torques. In this case, the direction (opening or closing) is dependent on the particular valve geometry. An operator opening a valve may find this torque strongly resists handle movement, but the

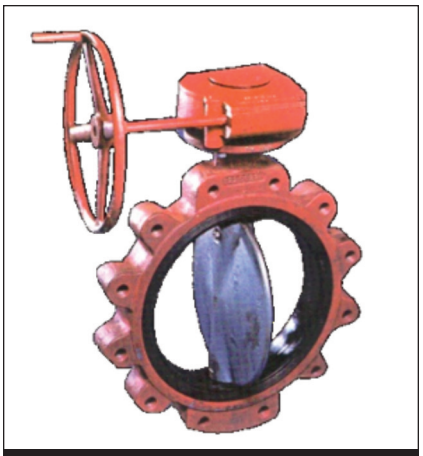


Figure 6. Gear box actuator

Figure 7. Gear box actuator with spur gear

Figure 8. Gear box actuator

operator may be able to set the desired travel position. A problem arises, however, when the next operator releases the latching mechanism and the high dynamic torque causes sudden and forceful movement of the handle. The result could be injury to the unsuspecting operator, and the process flow can be disrupted and piping damaged by water hammer. For this reason, the Manufacturer's Standardization Society (MSS) in MSS SP91, recommends a maximum size and torque for handle-actuated valves.

A problem arises, however, when the next operator releases the latching mechanism and the high dynamic torque causes sudden and forceful movement of the handle.

Gear box actuators (Figures 5, 6, 7, 8) normally have handwheels for input. The gear boxes are used to multiply the operator input. Again, MSS has recommended limits for input force requirements. Because numerous rotations of the handwheel are required for full valve travel, valve motion is slower than with handles, usually eliminating water hammer considerations.

When operator input requirements

Figure 9. Chainwheel add-on

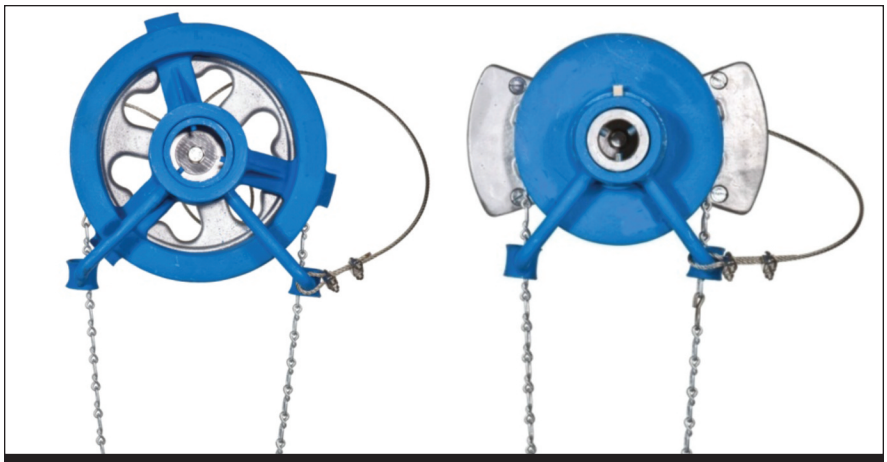


Figure 10. Chainwheel with impact device

are high, it is common to add a spur gear (Figure 7). More revolutions are required but operator force requirements are reduced. Technically, the size of valve that can be driven by a gear box with spur gearing is unlimited. However, two important factors here are consideration of operator stamina and time for operation.

If the manual gear box actuator is appropriate but located above an operator's reach, it is common to employ a chainwheel add-on (Figure 9). While designs incorporate guides and guards, effective maintenance is required to assure proper attachment to the gear box shaft. Also, input forces are usually limited to an operator's weight. In those instances where a valve may show a tendency to resist initial movement, an impact device (Figure 10) may be used that consists of a weighted chainwheel that allows accelerated motion before applying torque to the input shaft (thereby magnifying the operator's input sufficiently to break the valve free.)

Manual actuators are simple devices for operating valves. However, care in selection helps to assure effective and safe operation. VM

Ed Holtgraver is designer, founder and CEO of QTRCO, Inc. (www.qtrco.com), Tomball, TX. He holds numerous valve and actuator patents with more in the application stage. Holtgraver is a member of the VMA Board of Directors, Education and Training Committee and VALVE Magazine's editorial review board. Reach him at ed@qtrco.com.

Issues in Leak Detection

BY MARC BRACKEN

To pinpoint leak location and isolate areas of a pipeline for leak repair, utilities managers need to know valve locations, how valves operate and the condition of those valves. This article looks at why leak detection is critical, explains why valve location and condition assessment is vital and introduces new technologies that can determine the overall condition of water pipelines.

THE WATER SITUATION

The deteriorating condition of the nation's water infrastructure is well-documented. Findings in the American Water Works Association (AWWA) State of the Industry Report 2011 suggest that water utility budgets will continue to be tight in 2013. That report, which is based on responses from nearly 2,100 water industry professionals, found that only 11% of respondents felt their existing plans will cover infrastructure funding needs and nearly a quarter felt that less than 20% of their needs will be met.

Water leaks and main breaks are steeply increasing in frequency as years of unchecked deterioration take their toll on a water infrastructure that, in places, dates back to the second half of the 19th century.

For example, in February 2011, news outlets reported that Kansas City, MO, experienced 467 main breaks in that one winter—a 73% increase from 2010. Montgomery and Prince George's Counties in Maryland also made news headlines that year for major breaks in their water systems, which deliver service to 1.8 million people. Both counties set a record in December 2010 for having the largest number of water main breaks in a single month—647. The very next month, Prince George's County experienced a 54-inch water main break that leaked an estimated 50 million gallons of water. These kinds of stories show why 15-30% of treated potable water that is lost—is lost through leaks.

A repair worker locates the source of a water main break.

Leaks like this have been making major headlines across the country.

The nation's water infrastructure is feeling its age and the lack of sufficient funding.

In addition to these high profile water main breaks, recent studies by American Water indicate that the average leak runs undetected for more than six months before it surfaces. Leaks on larger transmission mains may never surface, and many instances have occurred where large leaks result when water finds a path of escape, resulting in a problem going undetected until catastrophic failure of a main.

ASSESSING VALVES

Valve assessment is an essential component of effective distribution system management. Malfunctioning, closed, "frozen" and valves lost in the system make isolating a specific area of distribution for emergency or routine repairs difficult, time consuming and on occasion, impossible.

Initial distribution system valve assessment followed by annual system-wide valve maintenance enhances a utility operator's capability to effectively control the flow of water within the distribution system. Assessment and maintenance also prolong the life of valves and ensure that those valves can be located, accessed and operated when needed. Assessment also allows a utility to better plan and schedule system repairs and improvements. Assessing valves and identifying their exact location on a geographic information system can help utilities' reaction times and limit damage to surrounding infrastructure in the event of a water main break.

Historically, leak noise correlators, while effective on small-diameter metallic mains, have had difficulty doing the jobs for plastic and large-diameter transmission mains. They've also been difficult to operate, and training has concentrated more on equipment instruction than learning how to effectively find leaks. Leak detection equipment traditionally provides information only about the current state of the pipe with no information on the overall condition of the infrastructure.

However, advancements in acoustic leak detection and pipe condition assessment methods now help utilities to cost-effectively and efficiently detect leaks in difficult pipe types such as plastic. They also can help prioritize water system repairs and replacement without breaking ground or disrupting service. These new methods rely on measuring how quickly an acoustical signal is transmitted along a section of pipe using vibration sensors and acoustic correlators. The process is completely non-invasive; devices are attached to a section of pipe using standard appurtenances such as valves, hydrants or direct attachments to the pipe's outer wall.

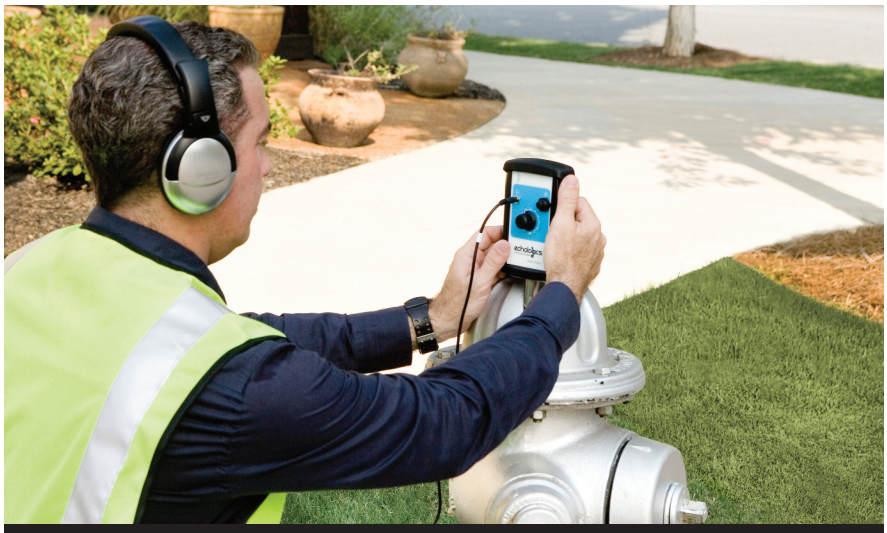
HOW THEY WORK

An acoustic signal is induced into the pipe and changes to the signal, specifically changes to its transmission or propagation velocity, can be related to changes in pipe wall structural integrity. This yields a highly accurate measurement of the remaining (or effective) structural integrity of selected pipes while simultaneously detecting and locating leaks. Also, because of advances in sensor designs and signal processing technologies, significant improvements have been made in the ability of such systems to resolve leak noise in the presence of ambient background noise often created by running water, traffic or pumps. Because of all this, utilities can detect leaks and assess the condition of pipes of all sizes and materials—including ductile and cast iron, concrete, plastic and asbestos cement—as well as pipes that are located in noisy, high-traffic environments.

The use of such technology is increasing among water service providers across North America and in Europe, South Africa, Singapore and Australia because of its accuracy and cost advantages over traditional methods.

A recent example of how this works can be seen at the Sewerage and Water Board of New Orleans (SWBNO). Following Hurricane Katrina, SWBNO adopted an acoustic-based pipe condition assessment system that helped to reduce water loss and efficiently prioritize replacement of pipes based on the extent of deterioration of those pipes. As a result, the city has been able to pinpoint water main leaks and measure the remaining wall thickness of pipes without having to undergo expensive and disruptive excavations. The SWBNO credited this process with locating numerous leaks in its mains that were causing between 75,000 and 100,000 gallons of water loss per day (the equivalent to filling one Olympic swimming pool every six days).

The Las Vegas Valley Water District (LVVWD) is taking a similar approach. While this district has a relatively young water infrastructure that experiences very few main breaks per mile as compared to other major utilities, some of its pipes have started to fail. A particularly troublesome section of pipe was part of a 6.5-mile span of 16- to 36-inch mortar-lined, steel cylinder pipeline that ran underneath some of the city's most popular thoroughfares.



A water service employee uses the new technology to assess a neighborhood's condition.

The pipe was installed in the 1950s without any cathodic protection or corrosion control and had experienced three main breaks over a five-year period. LVVWD expected to have to replace the entire span of pipe—a major expense that could have cost as much as $300 per foot while disrupting busy roadways. However, using non-invasive acoustics, the entire six and a half miles was surveyed in only two weeks and LVVWD found that the majority of the pipeline was still in good structural condition. Rehabilitation money was then prioritized to areas with the greatest need.

While constrained budgets continue to present difficult challenges for utilities, they have alternatives that mean they may not have to place efforts to reduce water loss and prioritize repairs on hold. Non-invasive acoustics can provide those utilities an alternative to the expensive and time-consuming processes associated with traditional leak detection methods. VM

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Acoustic leak detection offers a non-invasive detection method.

The Intriguing Story of the Pressure Seal Valve

BY GREG JOHNSON

In a quest for more efficient power generation, power plants in the 1930s continued pushing the pressure-temperature envelope. For piping component manufacturers, that meant requirements kept increasing and designs needed to be brought up to date. Classes 900 and 1500 surpassed the Class 600, once deemed "very high-pressure."

For the valve manufacturer, building the large bolted bonnet high-pressure valves required for the new levels of power was not difficult; however, the new designs required large quantities of metal in the large castings to accommodate the large body/bonnet flanges. Also, gasket leakage cases were increasing because of bolt relaxation as well as the limited amount of fastener research available at the time.

Some valve manufacturers began to experiment with a welded bonnet design for various sizes of valves that relied on a mechanical connection to handle the greatest amount of pressure load. The connection worked in conjunction with a pressure-containing seal-weld to keep the joint from leaking. The technology was sound; however, repair and maintenance on these large valves was costly and difficult.

The perfect solution would be a gasket seal that became tighter as the internal pressure increased. This innovative sealing concept had been used in high-pressure research, but it had not yet been applied to valve production. The heart of the seal in this case used a tapered ring of soft steel wedging against the side of the pressure vessel body. However, a prolific mechanical engineer by the name of James C. Hobbs tried to single-handedly change the situation.

Hobbs approached several U.S. manufacturers to offer to license "his" pressure seal valve design. The valve companies could see the benefit of building these "pressure-sealed" valves, so they were all ears to the sales pitch. Several manufacturers cooperated with Hobbs and gave him a royalty percentage. There was one manufacturer from Cincinnati, Ohio, however, that did not listen to Hobb's sales appeals.

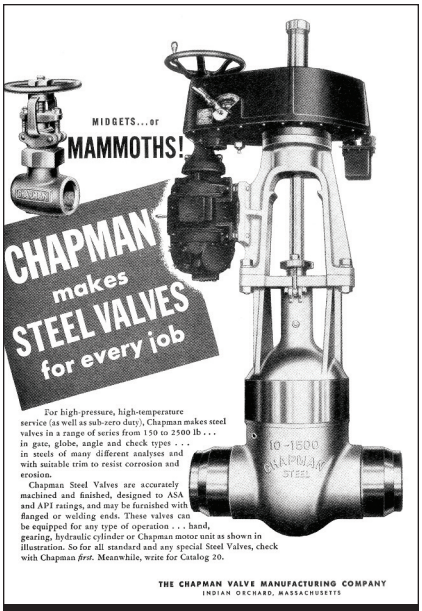
A 1952 Crane ad promises "a radically new idea in valve design," an idea that was based upon design principles that were a quarter century old.

ANOTHER DESIGN

The Cincinnati firm was working with an inventor from Germany named Kurt Bredtschneider, who patented a pressure-seal joint in 1932. Working with Bredtschneider, The William Powell Company proceeded to build an order of pressure-seal-designed valves for Diamond Alkali and for Wisconsin Power and Light. The products were installed in 1939.

At about the same time, information surfaced about another European inventor, Friedrich Uhde, who designed and built a pressure seal valve sold to Universal Oil Products in 1935 for use in a high-pressure autoclave. Because of all this, as the storm clouds of World War II began to gather, the claim to the pressure-seal design was also getting more and more cloudy.

Another stalwart U.S. manufacturer, Crane, designed and built pressure sealed valves installed in a monitored high-pressure boiler, which operated throughout the war. Because the War Production Board regulated wartime valve construction activities, the pressure seal design issue took a backseat to other priorities. However, as soon as hostilities stopped, the rush to product development was on again.



Prior to the introduction of pressure-seal technology for valves, several manufacturers provided welded bonnet valve designs in all size ranges to eliminate any gasket seal flow path. This design worked well, but resulted in large valves that were very difficult and expensive to repair and maintain.

REAPING GERMAN KNOW-HOW

As part of the spoils of war, the United States instituted "Operation Paperclip," a harvesting of as much German engineering knowledge as possible. Results of this dragnet included Dr. Werner Von Braun, who jump-started the U.S. missile and space program. Another interesting catch for the paperclip collections was a physics expert by the name of Kurt Bredtschneider—the same Bredtschneider who tried to offer his pressure-seal technology to the U.S. industry eight years before. As part of his post-war agreement with the United States government, the esteemed physics professor had only two requests: "that his sister be allowed to immigrate to the U.S. and that he have all the coffee that he could drink."

After the U.S. government got the information they wanted from Bredtschneider, the professor began to pursue his previous pressure-seal venture within the U.S. valve industry. He was a guest of Crane, where he was shown the "newest" (it was 1945) pressure-seal design they possessed. After examining the product, Bredtschneider was quoted saying, "If you are using my design, the least you could do is use it right!" Apparently Crane agreed because they hired him, and he became a valuable part of the Crane engineering department for the next 15 years.

A SIGNIFICANT CASE

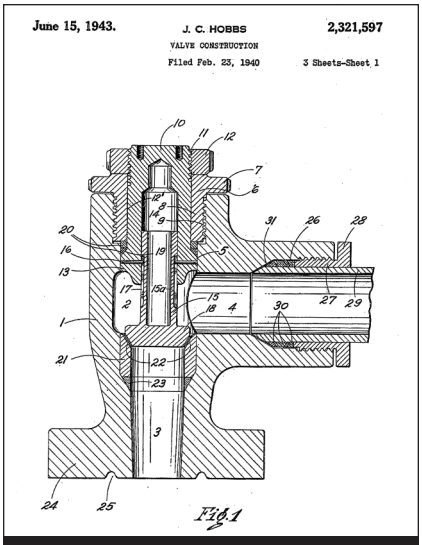
As the 1940s ended and the 1950s began, some of the Hobbs licensees stopped paying him royalties. This obviously did not sit well with Hobbs who had no desire to take a vacation from engineering design work and what it paid. Hobbs resorted to a lawsuit against Wisconsin Power & Light and Powell. The lawsuit was initially won by Hobbs; however it was eventually overturned by the Court of Appeals for the Seventh Circuit in 1957. The case is now famous and is referenced often in the field of patent law.

What transpired from the proceedings was that Hobbs had no right to the technology because it was in the public domain at the time of his involvement. The technology had in fact been perfected by Dr. Percy W. Bridgman from 1905 to 1908. Bridgman developed the seal by necessity as an adjunct to his ultra-high-pressure research. He detailed his joint in his book, *The Physics of High Pressure*, published in 1931. The pressure-seal joint he developed as applied to pressure vessels and pipe connections was referred to as the "Bridgman Joint" as late as the 1950s and 1960s.

A BOON TO HIGH PRESSURE

The pressure seal valve was truly a problem-solver for the high-pressure steam industry. It was the perfect technological match for the welding expertise that now made excellent, high-integrity butt-weld ends commonplace.

This Powell pressure-seal fixture dates back to 1938, when the company began its first pressure-seal valve experiments.



This is the original Hobbs patent filed in February of 1940. Although Hobbs would lose a lawsuit based upon this patent, he would be successful in legal actions involving other valve design patent infringements.

Up until this time, valve design and pressure ratings were derived from the existing flange standards, primarily the American Society of Mechanical Engineers (ASME) B16.5, Pipe Flanges and Flanged Fittings. Since the pressure seal valves had no body/bonnet flanges, a new standard for pressure temperature ratings was needed. This standard was developed by the Manufacturers Standardization Society as SP-66, Design and Ratings of Steel Butt-weld End Valves, in 1964. It would serve as the design standard for pressure seal valves until the development of ASME B16.34, Valves Flanged Threaded and Welding End, in 1974.

Today, pressure seal valves are manufactured of low carbon steel, chrome/moly and austenitic stainless steel in pressure classes up to 4500. Pressure seal design today is fairly standardized by manufacturers all over the world. This current calm attitude of universal pressure seal design acceptance is a far cry from the battles waged in the power houses and court houses of 50 years ago…all over a tapered ring of soft steel. VM

Greg Johnson is president of United Valve (www.unitedvalve.com), Houston, and is a contributing editor to VALVE Magazine. He serves as chairman of VMA's Education & Training Committee, is a member of the VMA Communications Committee and is president of the Manufacturers Standardization Society. Reach him at greg1950@unitedvalve.com.

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For information on joining the Valve Manufacturers Association, contact Bill Sandler at 202.331.8105 (wsandler@vma.org).

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

MSS Publishes New Standard for Pressure Seal Bonnet Valves

The Manufacturers Standardization Society (MSS) has announced a new standard for MSS SP-144-2013, Pressure Seal Bonnet Valves.

This Standard Practice establishes construction requirements for steel and alloy valves having pressure seal bonnets in the size range of NPS 2 (DN 50) through NPS 50 (DN 1250) and Pressure Classes 600, 900, 1500, 2500 and 4500. The new standard applies to gate, globe and check valves and may be used in conjunction with other valve-specific standards, including those identified in this Standard Practice as parent valve standards. In addition, the standard includes additional construction detail requirements specifically related to parent standard valves modified with pressure seal bonnets.

KINGSTON VALVES announced release of its new safety valve series: the Kingston Model 710, the company's first remote-discharge design certified for ASME Section VIII Air/Gas/Steam applications. This is Kingston's entry into the mid-sized valve market.

The Model 710 integrates a fully guided stem and seat pocket for superior re-seating accuracy. Its full lift performance design allows higher flow capacities that meet or exceed most comparable side outlet relief valves. A fixed optimized blowdown takes advantage of a reduced parts count making it a cost-effective alternative for OEMs considering more complicated, expensive solutions. The Model 710 Series also has many configuration options that give design engineers the flexibility to use this valve in a wide range of applications.

RUPTURE PIN TECHNOLOGY introduces a new nylon valve that can be designed to sense upstream, downstream or differential pressure, as well as low and pulsating pressure. The pin buckles at a specific pressure with a standard accuracy of +/- 5%. The valve's operation can be determined either visually or remotely by using a proximity switch. The pin is external to the flow and the line does not need to be opened to change the pin. The valves are used in refineries, chemical plants, pharmaceutical and laboratories.

GARLOCK SEALING TECHNOLOGIES introduces the Style 204 EPS Expansion Joint designed for longevity in extreme conditions. The Style 204 EPS (extreme pressure service) is a fully customizable abrupt arched expansion joint for rigid piping systems. This expansion joint is for applications where necessary rated pressures exceed those of the Garlock Style 204 & 204HP designs. Style 204 EPS is available in concentric or eccentric designs. The joint is particularly effective in extreme industrial applications such as mining, nuclear power facilities, off shore oil rigs—everywhere longevity and sealing integrity are essential.

EMERSON's new FIELDVUE DVC6200 SIS digital valve controller responds to safety demands and features partial stroke and position monitoring capabilities for the final control element in a safety instrumented system (SIS). Intelligent automatic partial stroke valve testing provides improved safety and reliability versus traditional pneumatic and jammer partial stroke methods.

The DVC6200 SIS combines the field-proven linkage-less, non-contact feedback design of the DVC6200 and DVC2000 platforms with the safety demand and automatic partial stroke testing capability of the DVC6000 SIS. The DVC6200 SIS has been evaluated to the latest version of IEC 61508 (2010) and is certified as a SIL 3 capable device for both 4 or 20mA and 0 or 24Vdc power settings.

CONVAL offers Clampseal Blowdown Service Valves to provide necessary control for continuous or tandem boiler or turbine blowdown and bottom blow-off service. For continuous service, blowdown valves are available in 3/4-inch through 3-inch sizes with butt or socket weld ends in ASME through 4500. Standard material is Low Alloy SA 182-F22 and F91. For tandem service, blowdown valves are available through 3-inch sizes with butt or socket weld and flanged ends, in ASME Class through 4500. Standard materials are Carbon Steel A105, Low Alloy F22 or F91. For both applications, other materials are available upon request.

Clampseal blowdown valves are fully serviceable in-line using standard Conval tools. The valves feature a uniform one-piece gland, which eliminates the potential for stem damage or

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For more information, email VMA President Bill Sandler at wsandler@vma.org.

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packing leaks from gland cocking. With pressure-assisted bonnet seal, the cartridge-style packing chamber allows rapid access to valve trim for inspection and maintenance.

SPIRAX SARCO has released the CS10 Clean Steam Separator with an enhanced surface finish as standard. The innovative separator has been engineered to overcome problems associated with wet steam and ensure the correct quality of steam is supplied to the point of use, preventing damage to control valves and inability to meet steam sterilization requirements.

Constructed of 316L stainless steel, the CS10 is fully traceable, ensuring steam integrity. It is designed to exceed the steam dryness value of 0.95 and features a removable internal baffle to facilitate periodic de-rouging and inspection.

BECK's new Group 75 Compact Rotary Actuators combines performance, reliability and control with efficient and flexible form factor. The design is smaller and lighter than the Group 11 and more robust than the Group 31. It also incorporates technologies that allow for an optional high temperature version rated for 250˚F (120˚C). This far exceeds Beck's standard ratings of 185˚F (85˚C) for the Group 11 and 150˚F for the Group 31. The Group 75 is also well suited to small rotary valve applications in tight spaces. VM

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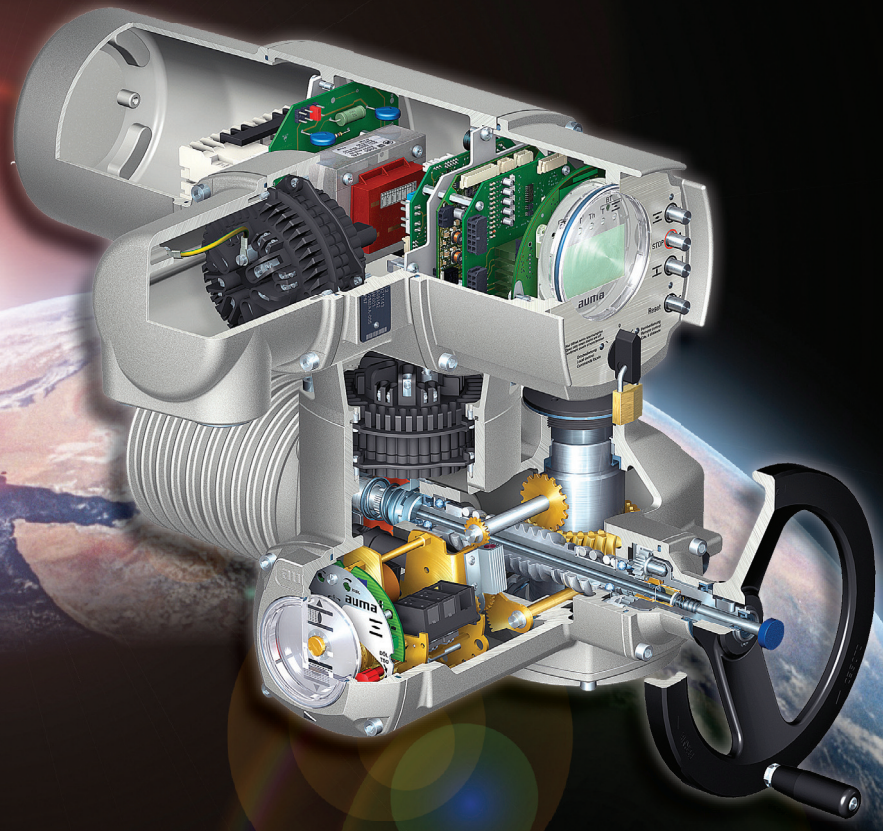

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