DIVERSE PROGRAM SET FOR KNOWLEDGE FORUM, APRIL 9-11

VALVE MAGAZINE

WINTER 2019
VOL. 31, NO. 1

The Challenges of Tariffs and Trade Wars

- OIL AND GAS END-USER PERSPECTIVE
- CHANGING AND IMPROVING VALVES
- STEAM-IN-PLACE APPLICATIONS
- CYBERSECURITY FOR TODAY'S PLANTS

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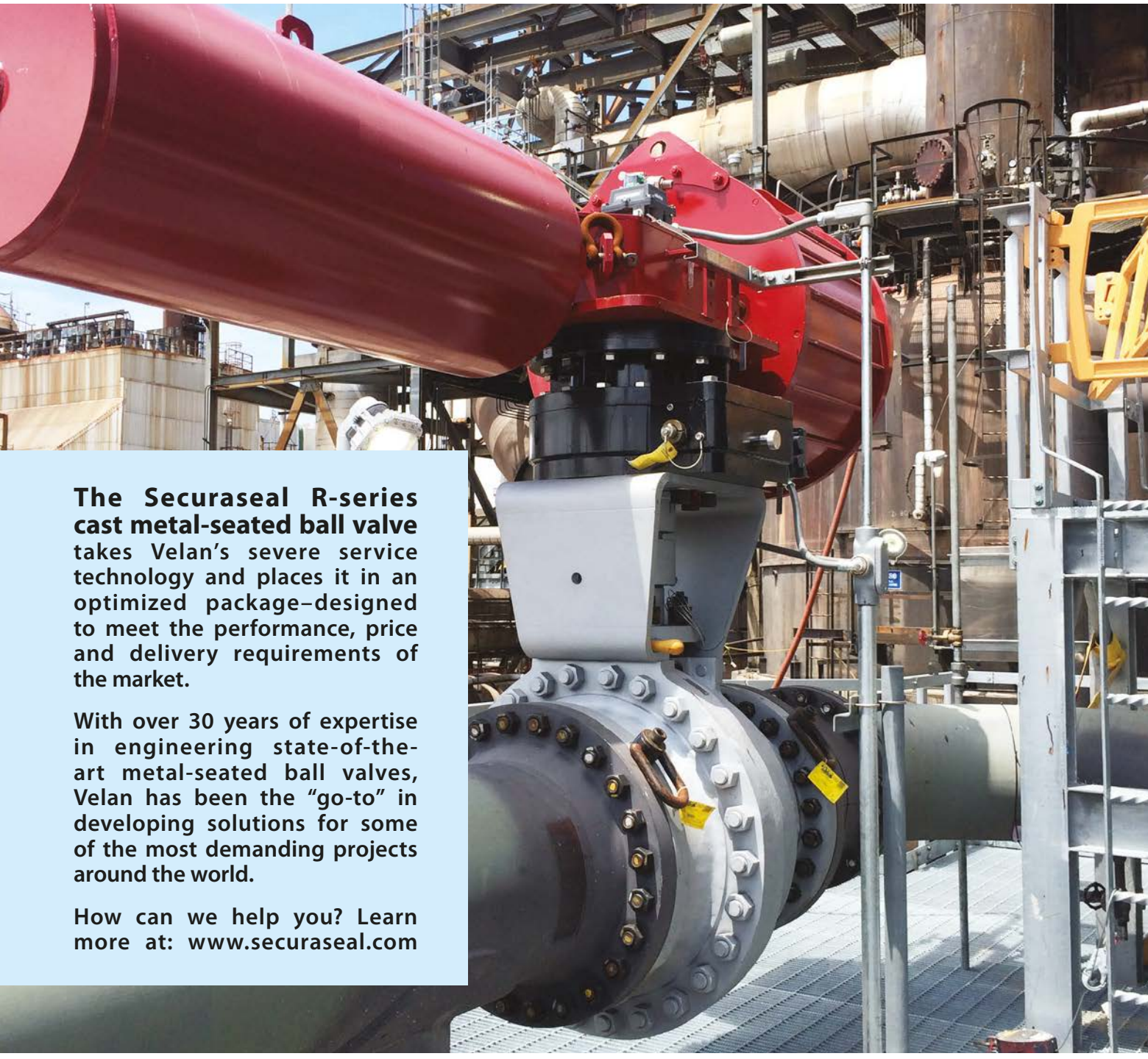

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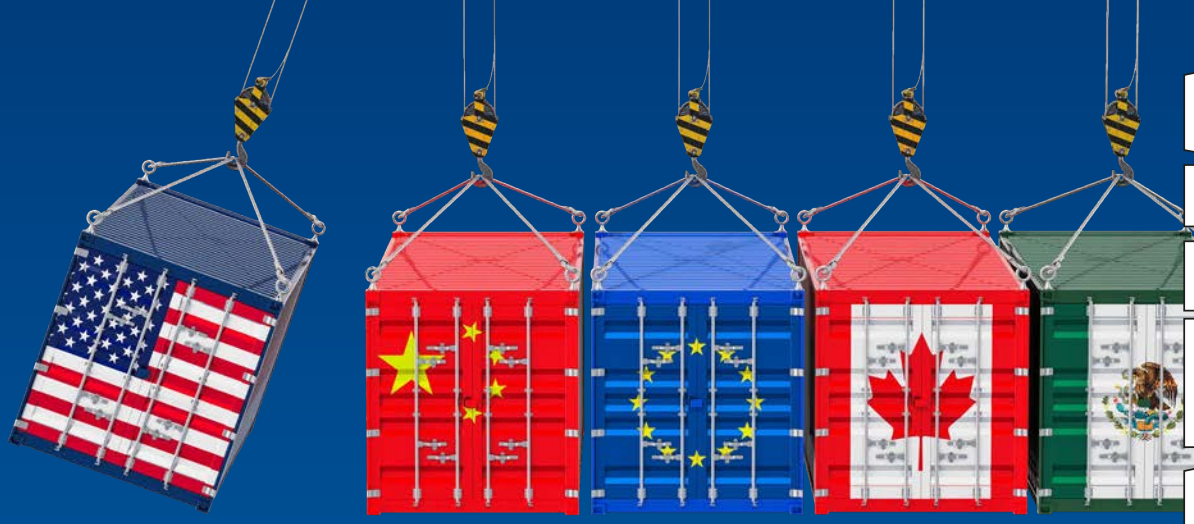

VALVE MAGAZINE
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www.VALVEmagazine.com

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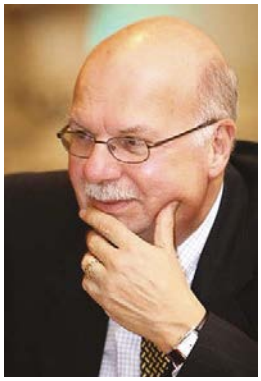
2018: Another Year of the Volunteer



The Valve Manufacturers Association of America continues to be blessed with an exceptional volunteer base. My colleagues at other associations have told me it sometimes takes them weeks to put together a committee of three. Here at VMA, if I put out an email for three volunteers for a new committee project, I have at least five suggestions in two hours. This volunteer base, as well as our 15-member Board of Directors (who are also volunteers), means this was a successful year both in continuing programs and new initiatives. Here's some of what happened in 2018:

- **Seminars and Workshops.** VMA provided its membership six different workshops and seminars this year. The programs for these events were developed by member company volunteers from all four categories of membership: manufacturers, suppliers, distributors and repair facilities. New in 2018 was the Valve Industry Knowledge Forum, a combination of three former meetings (Technical, Manufacturing and Human Resources). Joining them allowed attendees to pick different tracks.
- **Valve Magazine and Online Editorials.** Most articles that appear in the magazine as well as its online site are provided by our membership. A simple call or email to or from a member often results in an article or an idea.
- **Education.** We offered the VMA Valve Basics Seminar & Exhibits, which was moved to a permanent home at the Houston Area Safety Council, Pasadena, TX in 2017. The program is taught exclusively by volunteers. Also volunteering their time and knowledge are the "zookeepers," those who demonstrate at the hands-on "petting zoo." Success and the call for even more knowledge mean we will be expanding to two, back-to-back, two-day programs in 2019.

Some of the above-named programs do not require someone to be a VMA member to attend. We encourage you to spread the word about the Valve Industry Knowledge Forum (April 9-11, 2019) and the Valve Basics Seminar (Nov. 12-15, 2019), which are open to all in the industry.

However, none of what we do would be possible if we did not have the great volunteer base we have. As always, I'm open to suggestions for other activities we might create. Please feel free to contact me directly at wsandler@vma.org. VM

Bill Sandler
President, Valve Manufacturers Association of America

NEED VALVE TRAINING? WE COME TO YOU!

FACT: Experienced personnel are retiring and many newcomers lack basic knowledge about valves and related equipment

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3. With so many newcomers in the industry—and those with decades of experience retiring—**training has never been more critical**.
4. Many manufacturers offer training but **VMA's Valve Ed course is not brand-specific**, providing a well-rounded overview of the products used in our industry.

> **"A lot of the technical training opportunities out there are general and cover a broad range of topics and industries. I especially liked VMA's seminar because it provided in-depth training that was customized to cover topics relevant to our organization (wastewater collection/treatment). Also, VMA brought industry experts from all over the country and each presented information from their respective areas of expertise. That kind of training is hard to find!"**
>
> —Derek Zonderman, Supervising Engineer, Wastewater and Solid Waste Design, Sanitation Districts of Los Angeles County

Visit www.vma.org/CustomTraining for more information or contact Abby Brown (abrown@vma.org).

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NEW CONTRACTS

Setpoint I.S. Expands Clark-Reliance Agreement

Setpoint Integrated Solutions (Setpoint I.S.) will expand its exclusive Clark-Reliance representative contract into Texas. The partnership between the companies dates back to 2000, and Setpoint I.S. continues as the legacy representative in north Texas, Louisiana, Arkansas and the southwest Mississippi territories. The expanded territory will capitalize on the track record of serving end-user needs within the refining, petrochemical and power industries.

Admiral Valve Partners with Exion Asia and Encord

Admiral Valve, LLC dba CPV Manufacturing appointed Exion Asia Pte Ltd (Singapore) and Encord Sdn Bhd (Malaysia) as its authorized representatives in the countries of Singapore, Malaysia, Vietnam, Thailand, Laos, Cambodia and Indonesia. The companies will represent the entire CPV product line for the compressed gas industry, the petrochemical industry, and the oil and gas industry.

Metso Increasing Production Capacity in China

To respond to the growing global valve demand, Metso will invest in a new greenfield valve technology center in Jiaxing, China. The new plant will strengthen Metso's valve and related products production capabilities and increase capacity for customers across various process industries, both in China and globally.

Emerson digitizing FIS manufacturing sites

The new technology center will start operations in spring 2020. In addition to the new center, Metso has a valve technology center in the Waigaoqiao Free Trade Zone in Shanghai, which was inaugurated in 2010.

Emerson Digitizing Manufacturing Sites

Fabbrica Italiana Sintetici (FIS) selected Emerson to digitize operations and work processes at three manufacturing sites in Italy. Emerson will provide automation technology to help create a fully electronic manufacturing environment. Emerson will implement its Syncade manufacturing execution system at the Termoli site, as well as the Montecchio facility, providing automated workflows and paperless procedures and recordkeeping.

Union Tech and Pioneer Industrial Sign Distribution Agreement

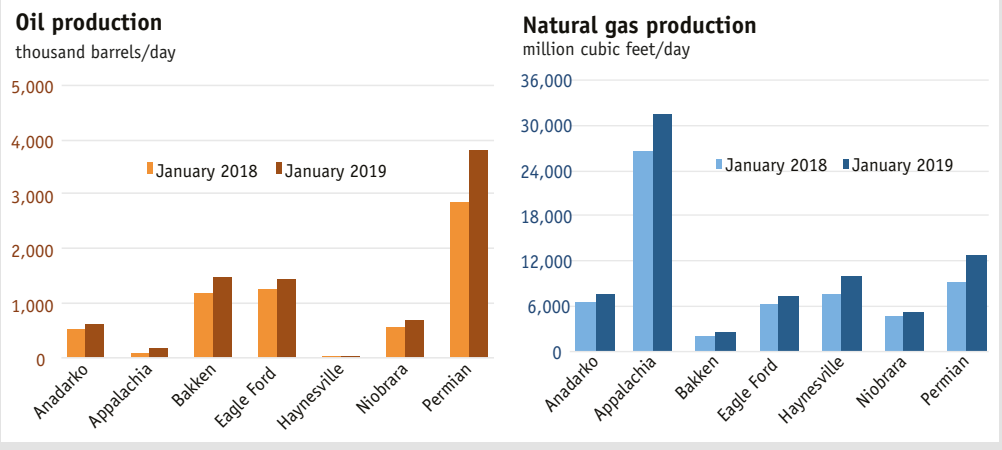
Union Tech and Pioneer Industrial formed an agreement for distribution of Union Tech's severe-service metal-seated ball valves and rising-stem ball valves throughout the Midwestern U.S.

MARKET FOCUS: Shale Production in the U.S. and Elsewhere

The U.S. has surpassed Russia and Saudi Arabia to become the world's largest producer of crude oil for the first time since 1973, according to estimates from the Energy Information Administration (EIA). This is largely because of the U.S. shale boom, reports investment bank Jordan Knauff & Company, a member of the Financial Industry Regulatory Authority. During the period between 2008 and 2015, production in the U.S. increased by about six million barrels per day, the largest in U.S. history, the firm pointed out.

In November 2018, U.S. domestic oil production averaged 11.5 million barrels per day. EIA forecasts for 2019 suggest that the U.S. will produce an average of 12.1 million barrels per day throughout the year, which would continue to top expected output from Russia and Saudi Arabia.

Much of current production growth is centered in the Permian basin of western Texas and eastern New Mexico, the Gulf of Mexico, and the Bakken region in North Dakota and Montana. Texas alone is forecast to produce more oil than Iraq or Iran in 2019, which would make the territory the third-largest producer of crude oil in the world.



Source: EIA Drilling Productivity Report, December 2018

In addition to Union Tech's Z-Series Valves, Pioneer's product portfolio includes other brands such as GE Consolidated, BHGE Masoneilan, Chesterton, Lamons and more.

MERGERS & ACQUISITIONS

Allied Valve Merges with Automation Service

Allied Valve, Inc. completed a merger with St. Louis-based Automation Service, a provider of remanufactured Fisher control valves and actuators as well as remanufactured Rosemount and Foxboro process instrumentation. Allied Valve President and CEO Barry Shoulders has taken over those same roles with Ovation Holdings, Inc., a corporate entity created to own the newly merged companies.

According to Shoulders, the two companies will continue to operate independently, with overlapping services beneficial to processing plants, pipelines and power stations in the petroleum, natural gas, chemical, public utilities, and pulp and paper industries.

Emerson to Buy GE's Intelligent Platforms Business

Emerson has agreed to acquire Intelligent Platforms, a division of General Electric. Terms of the deal were not disclosed. The acquisition expands opportunities for Emerson in machine control and discrete applications across process industries and target hybrid markets, such as metals and mining, life sciences, food and beverage, and packaging.

A-T Controls Buys Mighty Instruments

A-T Controls acquired the assets of Mighty Instruments of Houston. Under the direction of Ryan Hunnicutt, Mighty Instruments is a manufacturer of a multi-functional controller that will add to A-T's capabilities regarding systems, digital controls and connectivity.

Hunnicutt will serve in the new role of director of A-T Systems Group joined by Celso Siado, head design engineer, and Gerry Hannaford, who becomes part of the production team in assembly for the controller as well as all other A-T products. Hunnicutt and his team will form the nucleus of this new A-T Controls Systems group.

Metso Purchases Indian Actuator Company

Metso successfully completed acquisition of the valve automation division of India-based Rotex Manufacturers and Engineers Private Limited (RMEPL), by acquiring all shares in RMEBS Controls Private Limited (RMEBS).

RMEBS is a market-leader in India in the actuator business, offering switches, process valves, and valve automation products and solutions. It employs 330 people and has two manufacturing facilities in the Mumbai area, as well as four sales offices.

Mueller to Acquire Krausz Industries

Mueller Water Products, Inc. has signed a definitive agreement to buy Krausz Industries, Ltd. for $140 million in cash. Krausz Industries provides pipe couplings, grips and clamps under the HYMAX brand for the global water and wastewater industries. It had net sales of about $43 million in 2017 with about 75% of its sales generated in North America. Krausz Industries, Ltd. will become part of Mueller Water Products' Infrastructure segment.

NEW FACILITIES

Emerson Opens First Korean Industrial Solutions Center

Emerson opened a new $25 million facility in Jukjeon to serve its Emerson Automation Solutions customers in the region. In addition to advanced system staging, training and servicing capabilities, the new facility will feature Emerson's first fully equipped solutions center in Korea.

The center was designed to help customers understand where and how they can most effectively deploy advanced technologies and experience new ways of working in a digitally transformed plant.

Weir Moves Delta Manufacturing to St. Louis

The Weir Group has integrated its Delta Industrial valve manufacturing operations into its facility in St. Louis. Before this integration, the St. Louis facility solely manufactured Lewis pumps and valves. The strategic decision was made to relocate the manufacturing of Delta Industrial valves to accelerate the growth of both brands, increase production and streamline processes.

MARCH

28-29
Valve Industry Leadership Forum*
Toronto
www.VMA.org/LeadershipForum2019

APRIL

9-11
VMA Valve Industry Knowledge Forum: Conference, Exhibit & Tours
Birmingham, AL
www.vma.org/KnowledgeForum

MAY

6-9
Offshore Technology Conference (OTC) 2019
Houston
www.otcnet.org

JUNE

9-12
ACE19 - AWWA Annual Conference & Exposition
Denver
www.awwa.org

19-20
Valve World Americas Expo & Conference
Houston
www.valveworldexpoamericas.com

AUGUST

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

SEPTEMBER

25-27
VMA/VRC Annual Meeting*
Palm Beach, FL
www.vma.org/AnnualMeeting

NOVEMBER

12-15
Valve Basics Seminar & Exhibits
Houston
www.vma.org/ValveBasics

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

VALVE MAGAZINE

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

DFT Valves' solar panels

DFT Valves Installs Solar Panels

DFT Valves completed installation of roof panels on its facility in Exton, PA that generate about 63% of its annual electricity requirements (304 kilowatts per minute while the sun is shining).

DFT has said that solar makes more financial sense for industrial applications because most factories, warehouses and other facilities have large, flat roofs ideal for these panels.

New AIV Facility Being Built in Houston

AIV, LP will complete construction of its 320,000-square-foot northwest Houston fabrication, warehouse and office campus early in 2019. The facility was built in part to consolidate three area locations into one new campus.

AWARDS & CELEBRATIONS

Emerson Awards 2018 ASCO Engineering Scholarships

Emerson awarded the 2018 recipients of the annual ASCO Engineering Scholarships to two students who will receive $5,000 from Emerson to support their pursuit of a bachelor's degree in engineering.

The ASCO Engineering Scholarship program, now in its 11th year, has awarded a total of $110,000 in merit-based scholarships to 22 students based on their potential for leadership and for making a significant contribution to the industrial automation engineering profession. The company has provided an additional $22,000 in grants to 20 schools of engineering.

Weir Receives 2018 APICS Award of Excellence

Weir was recognized as a standout supply chain organization by the 2018 APICS Awards of Excellence.

Presented by APICS, the association for supply chain management, the awards recognize corporations and individuals demonstrating superior performance. Weir received the education category award for its dedication to advancing supply chain excellence internally and at large.

DeZURIK 90th Anniversary Open House Draws Big Numbers

To celebrate its 90th anniversary, DeZURIK opened its Sartell, MN plant to the public on Sept. 22.

At least 1,750 people lined up for tours at the plant from 10 a.m.–3 p.m. The visitors, including many children, gaped at the giant valves in the plant, one of them 12 feet wide. They also expressed amazement at the sheer size of the DeZURIK plant—more than 400,000 square feet.

Metso Celebrates its 150th

In 2018, Metso celebrated its 150th anniversary. During those years, Metso has been in many businesses, ranging from steam engines, locomotives, car manufacturing, forest machines, and pulp and paper machines, to valves, metal and waste recycling equipment, and solutions for rock and mineral crushing and screening, to name just a few.

DistributionNOW Honored for Cloud Innovation

DistributionNOW was recognized at last year's OpenText user conference, Enterprise World, for outstanding efforts and creative solutions in enterprise information management (EIM). DistributionNOW was runner-up in the Cloud Innovation category.

Victaulic Named for Products of the Year

Victaulic was selected as a Consulting-Specifying Engineer Product of the Year recipient in gold, silver and bronze categories.

The company was a gold award winner in the Plumbing & Water Management category for the system solution for CPVC Pipe; a silver award winner in the Software: Design, Modeling and Analysist category for Tools for Revit 2018; and a bronze award winner in the Fire, Life Safety, Mass

Notification category for FireLock innovative groove system for small-diameter hard-pipe.

ValvTechnologies Tops in Fit Challenge

On Sept. 15, 2018 participants from companies located in the Houston area took part in the Fit Company Challenge, a corporate wellness event hosted by the Fit Company Institute. The challenge provided area companies an opportunity to come together as a team and spend a morning exercising, pushing their physical and mental limits and showing the importance of living a healthy lifestyle. ValvTechnologies finished first in the medium division and had the highest number of points overall.

Weir USA Renews Certificates

Weir Valves & Controls USA renewed its ISO 9001 certificate to the 2015 standard. The Quality Policy Manual and all related procedures were reviewed for compliance, and all employees were trained on the updated quality management system.

The notified body, Advanced Waste Management Systems Inc., evaluated WVC USA for the design, manufacture, assembly and testing of valves and flow control equipment and determined the company to be in conformance with all provisions of the environmental management system. VM

PEOPLE IN THE NEWS


Eric B. Luftig

VICTAULIC... and its vice president and head of marketing **Eric B. Luftig** received a 2018 Spirit of Volunteerism Award from the Volunteer Center of the Lehigh Valley. The awards honor local businesses, individuals or teams who have demonstrated excellence in community service and workplace volunteerism. Luftig serves on the Valley Youth House Board of Directors, as chair of the marketing committee and as a member of the development committee.

GARLOCK... promoted **Michael Faulkner** to president. His predecessor, **Eric Vaillancourt**, was named president of STEMCO, a sister EnPro company.

Faulkner's career at Garlock spans 13 years, most recently as vice president and general manager of GPT (a member of the Garlock family of companies). In his new role, he will be responsible for establishing the strategic direction for the company.

Knowledge Forum Tackles Wide Range of Issues

VMA's 2019 Knowledge Forum will kick off with keynote speaker Pat Toth addressing one of the hottest issues of today: the threat of cyber attacks. Cybersecurity is now one of the major risks facing industrial companies, and Toth will present the latest on what's happening.

The Forum is April 9-11 at the Doubletree Hotel Perimeter Park, Birmingham, AL. The first day of the forum, April 9 is a day of tours and a preconference workshop on ASME B.16.34.

Toth, who is supervisory computer scientist of the Computer Security Division, the National Institute of Standards and Technology, starts off the second day, which is filled with educational sessions.

The educational program combines three tracks of learning that used to be presented at separate meetings: Technical, Manufacturing, and Management & Marketing. The three areas of learning were combined into one meeting to enable attendees to pick and choose different topics of interest, but still meet up with peers in their specific job areas. The goal is to have more meaningful dialogue between the different segments of the industry. Several social events have been planned to allow interaction and a tabletop exhibit of products is open most of the second day.

Some of the other topics and speakers will be:

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- **Effectively digitizing valve performance:** Stan Hale, senior director at MRC Global, will bring attendees up to date on what's happening in today's Industrial Internet of Things, the digital world of smart plants, Industry 4.0 and what promises the new technologies hold.
- **On-line diagnostics of valve assemblies:** Rayaz Ali, senior director, Instrumentation Technology, Emerson Automation Solutions, addresses how today's regulatory requirements and plant maintenance philosophies make being able to predict the health of valves critical to a plant's smooth operation.
- **Fugitive emissions standards and testing:** Matt Wasielewski, president of Yarmouth Research and Technology, reviews the history of testing standards and brings attendees into the present world of published and upcoming revisions to standards.
- **Benefits of robotics in valve manufacturing:** Tom Moylan, regional automation manager for ACIETA, discusses how robots can improve productivity and operator safety on the production line and how they are being used in making valves.
- **Predictive analytics:** Mohamed Abuali, CEO of loT CO, LLC and Edzel Lapira, president and CEO of Predictronics, Inc., will provide a comprehensive understanding of digital transformation and the Industrial Internet of Things as well as how they are being used in the valve industry.
- **Non-disclosure and non-compete:** Jack Wisdom, partner, Martin Disiere, Jefferson & Wisdom will explain these agreements and how they can benefit companies but are sometimes detrimental to employees.
- **Social media tools:** Kelly Watson, CEO, Project1421, will explain what's available for business-to-business enterprises and how companies can benefit.
- **An end-user's perspective on buying:** Ron Merrick, senior fellow, Fluor Enterprises, reports on the factors that go into decisions made by end users to buy or not buy a particular product.

On the last day of the conference, several special sessions are planned that combine different tracks. For example, the technical and manufacturing tracks will have a joint session on Additive Manufacturing that will feature several speakers and will address topics such as the future of the 3D Printing, where it's been and where it's headed.

Early-bird registration is in effect through February 15. Membership is not required to attend; exhibitors that would otherwise be eligible for membership can also participate. For information or to register, go to www.vma.org/KnowledgeForum. VM

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OTC Celebrates 50 years

The Offshore Technology Conference has been around since 1969 and planners will make this year's event a golden celebration of that half century. It takes place May 6-9 at the NRG Park, Houston.

The first event was at the Houston Albert Thomas Convention Center and the organization has grown to become one of the 100 largest tradeshows in the U.S. and among the top 10 in attendance. The number of attendees peaked at 108,300 in 2014 is expected to be over 60,000 this year.

The conference is the world's largest technology event showcasing leading-edge technology for offshore drilling, exploration, production and protection. It brings together engineers, technicians, executives, operators, scientists and managers in the offshore energy sector from more than 100 countries. More than 61,000 attendees came last year as well as 300 journalists.

About 350 peer-selected technical presentations are part of the educational program leveraging expertise from 13 societies that sponsor the event. The sessions cover a wide range of topics from what's new with specific equipment to special drilling challenges and environments, new places for exploration and what's being done in environmental protection.

The giant exhibit hall covers more than 500,000 square feet used by 2,000 companies touting their wares, including valve, actuator and control companies. There also are 23 international pavilions on the exhibit floor. VM

For information, go to www.otc.org.

NEW MEMBERS

Recently the Valve Manufacturers Association of America (VMA) welcomed these new members.

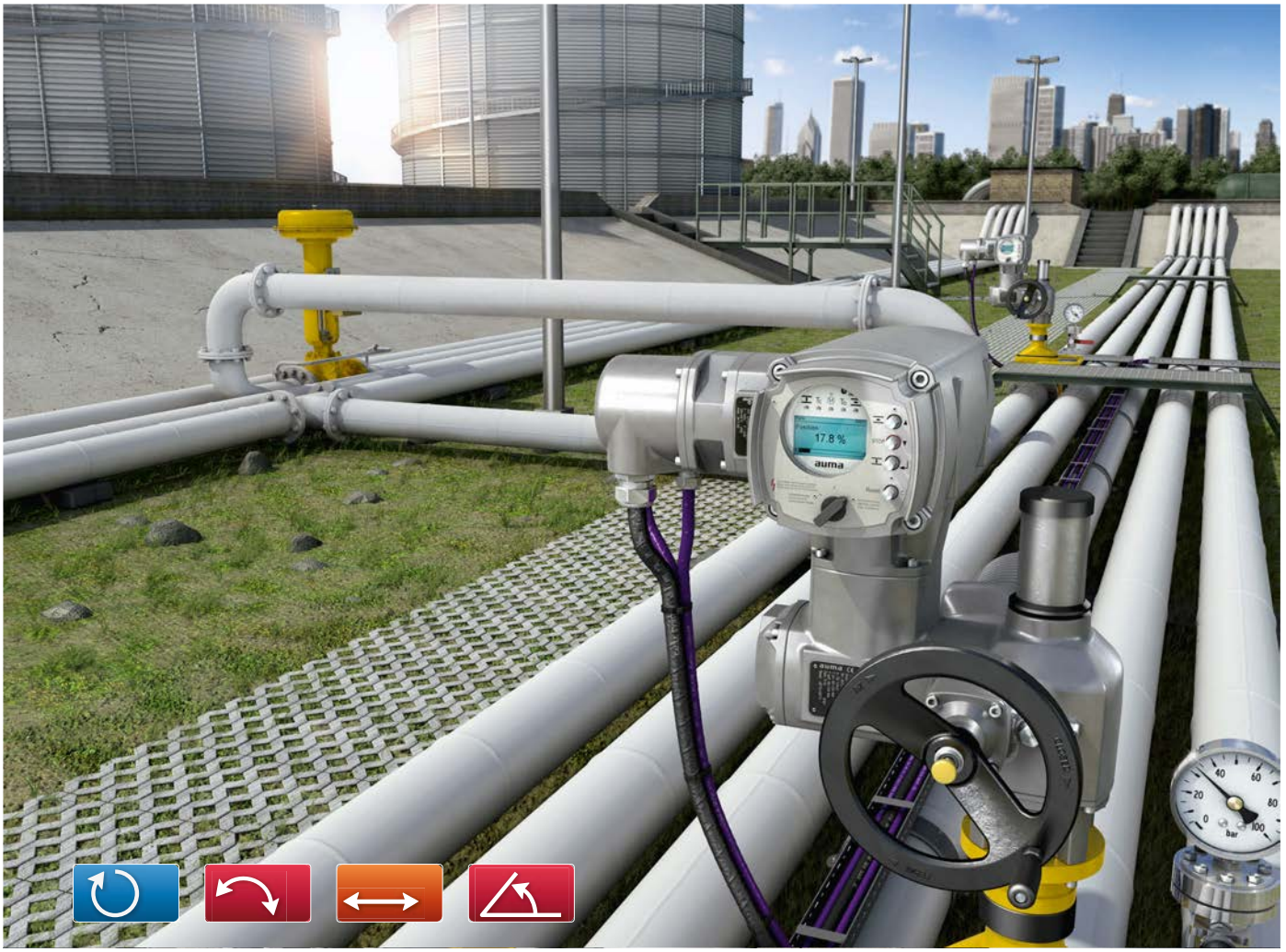
Joining as full members were:

RF Valves, Inc. (www.rfvalve.com) was founded in 1993 in Maryland and Finland. RF Valves caters to large and small operations ranging from massive industrial mines to modest mom-and-pop mills.

Fetterolf Corp. (www.fetterolfvalves.com), Skippack, PA, is a world-wide designer, manufacturer and distributor of specialty valves for the polymer and fine chemicals industry.

Joining as a distributor/channel partner member was:

Advanced Valve and Instrument, Inc. (www.advancedvalve.net; www.digestervalves.com) began in 1994 with a focus on being a short turnaround supplier of automated quarter-turn valves. That has expanded to include instrumentation and valve application seminars, classes and valve application consulting.



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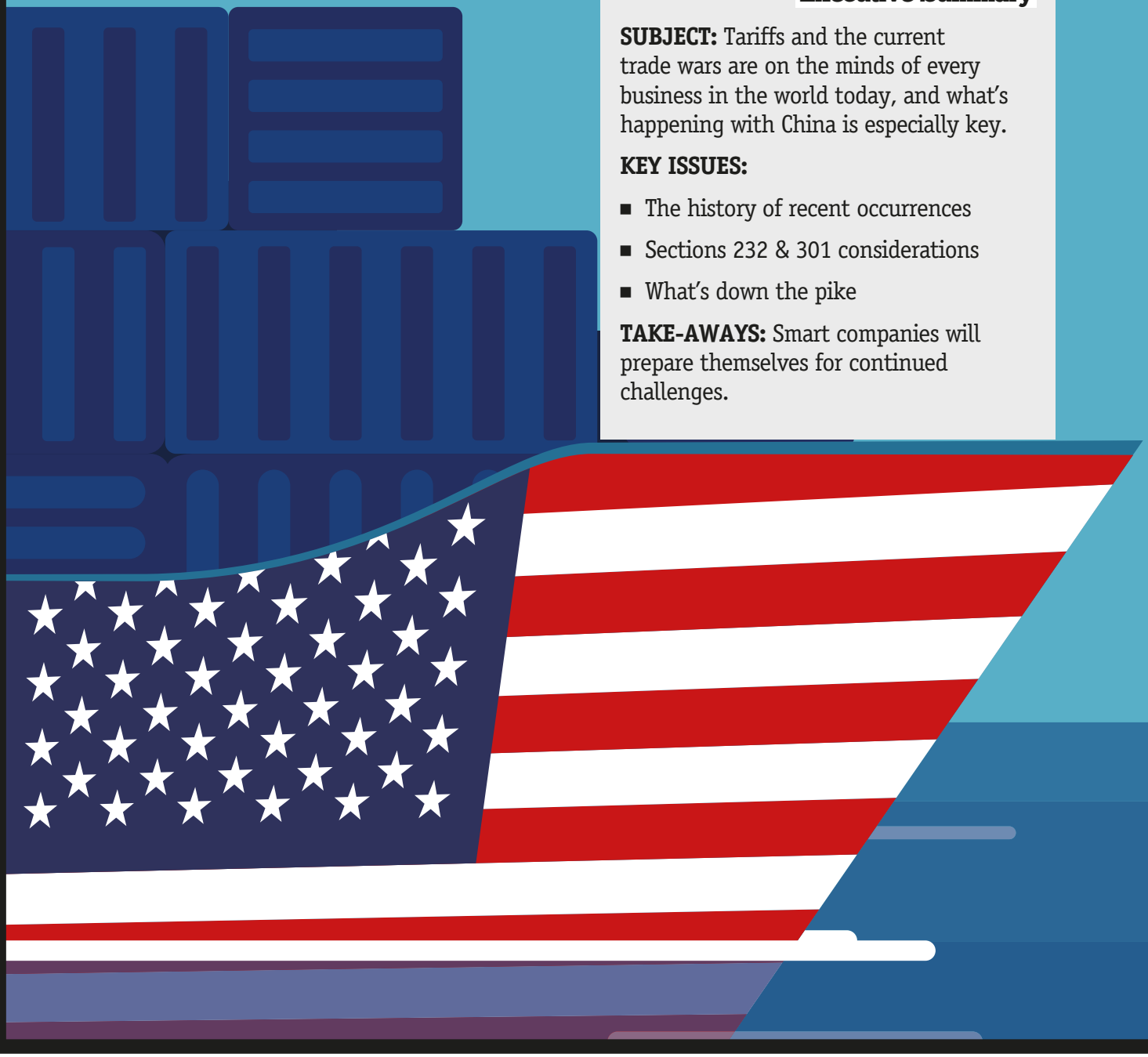
Tariff Pressure Builds on Valve Industry

BY ERIC MCCLAFFERTY AND MAGGIE CROSSWY



Executive Summary

SUBJECT: Tariffs and the current trade wars are on the minds of every business in the world today, and what's happening with China is especially key.

KEY ISSUES:

- The history of recent occurrences
- Sections 232 & 301 considerations
- What's down the pike

TAKE-AWAYS: Smart companies will prepare themselves for continued challenges.

In the last year, one word has dominated U.S. trade policy: tariffs. From the Trump Administration's steel and aluminum tariffs to tariffs on half of the products imported into the U.S. from China to the retaliatory tariffs from a half-dozen governments, few industries have been spared.

The valve industry is no exception. While the U.S. tariffs on Chinese valve products under Section 301 are the main subject of this article, also important to U.S. valve makers is implementation in the U.S. of global Section 232 tariffs on major valve industry inputs (e.g., 25% tariffs on steel and 10% tariffs on aluminum). Some product and country exemptions from those tariffs have occurred, but these measures have placed significant price pressure on industry inputs. Other countries have also retaliated against U.S. products in response to Section 232 steel and aluminum tariffs (e.g., Turkey's tariffs against certain centrifugal pumps). There currently is no end in sight to the effects of Section 232 tariffs.

SECTION 301

In addition to Section 232, the U.S. has implemented tariffs on a wide variety of Chinese products of specific concern to the valve industry under the Administration's Section 301 action against China's intellectual property violations. Currently, more than two dozen valve products either imported from or exported to China are subject to these tariffs, which range from 5–25%. In addition to tariff lines that specifically reference valves, many other products from China that are used in making valves also are subject to Section 301 tariffs.

The future of these tariffs is far from certain. On Dec. 1, President Trump met with Chinese President Xi Jinping during the G20 Leaders' Summit in Argentina and agreed to a temporary "cease fire," which delayed any escalation of the existing tariffs for another three months, but didn't do away with the tariffs that are already in place. Whether 90 days is enough time for China to commit to the trade and economic reforms

sought by the U.S. government as a condition for removing existing Section 301 tariffs remains to be seen, as does how long it may be before changes would be implemented. A variety of potential outcomes is possible; potential paths include long-term continuation of the tariffs on Chinese and U.S. products, an agreement to phase out tariffs over time as Chinese intellectual property practices change, de-escalation in specific industry sectors and more.

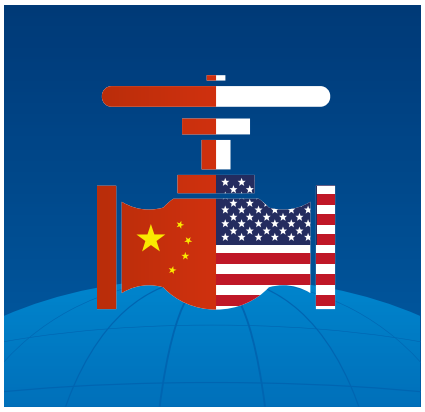
HOW WE GOT HERE

On Aug. 14, 2017, President Trump issued a presidential memorandum to U.S. Trade Representative (USTR) Robert Lighthizer directing him to determine "whether to investigate any of China's laws, policies, practices or actions that may be unreasonable or discriminatory and that may be harming American intellectual property rights, innovation, or technology development."[1]

The initiative was a major component of the President's ongoing efforts to address the nation's trade imbalances, promote reciprocal treatment of American exports and strengthen the domestic manufacturing base. President Trump specifically cited in his memorandum the role of China's practices in inhibiting and undermining American manufacturing, services and innovation.[2]

On Aug. 18, 2017, the USTR office initiated a formal investigation under the Trade Act of 1974 to determine whether China's acts, policies and practices "related to technology transfer, intellectual property and innovation are unreasonable or discriminatory, and burden or restrict U.S. commerce." USTR conducted a seven-month investigation, including consultations with advisory committees as well as a public hearing and comment period. The office issued findings in March 2018, concluding that China:

- Uses foreign ownership restrictions to force technology transfer from U.S. companies;
- Forces U.S. companies to enter into unfavorable licensing agreements;
- Facilitates investment in U.S. companies to acquire cutting edge technologies; and
- Supports unauthorized intrusions into and thefts from U.S. networks.



Potential paths include long-term continuation of the tariffs on Chinese and U.S. products, an agreement to phase out tariffs over time as Chinese intellectual property practices change, de-escalation in specific industry sectors and more.

Specifically, USTR determined that China's actions, policies and practices were actionable under Section 301 of the Trade Act of 1974. Subsequently, on March 22, 2018, President Trump directed a three-pronged response: (1) tariffs on Chinese exports to the United States; (2) the pursuit of dispute settlement proceedings in the World Trade Organization; and (3) restrictions on Chinese investment in the United States.

On April 3, USTR announced $50 billion in proposed tariffs under Section 301. Within 24 hours, the government of China announced $50 billion in proposed retaliatory tariffs, thus beginning a months-long "tit for tat" escalation of both duties and rhetoric.

THE TARIFFS

Since July, the United States has proposed and imposed three separate tranches of Section 301 tariffs (via three lists of products) on a wide range of products imported from China. The tariff proposals have attracted thousands of written comments and about 600 witnesses at public hearings, with both supporters and detractors. The tariffs now cover about $250 billion worth of Chinese imports including:

- A 25% tariff on $34 billion worth of Chinese imports, covering 818 Harmonized Tariff Schedule (HTS, also known as the customs category) subheadings, took effect July 6, 2018;
- A 25% tariff on $16 billion worth of Chinese imports, covering 279 HTS subheadings, took effect Aug. 23, 2018; and
- A 10% tariff on $200 billion worth of Chinese imports, covering 5,745 HTS subheadings, took effect Sept. 24, 2018. [This is the tariff rate that would have increased to 25% on Jan. 1, 2019, a move now on pause for three months while the two governments work toward a comprehensive solution.]

President Trump's threats to impose an additional round of tariffs on about $267 billion worth of Chinese imports, which would result in tariffs on effectively all Chinese imports, is also on pause, but could be put in place if the U.S. does not reach an agreement with China on a path forward.

The Administration's first $50 billion in tariffs targeted what USTR

[1] Presidential Memorandum to the United States Trade Representative: Addressing China's Laws, Policies, Practices, and Actions Related to Intellectual Property, Innovation, and Technology, 82 FR 39007, 17 August 2017. The Office of the United States Trade Representative (USTR) is part of the Executive Office of the President. USTR is responsible for developing and recommending United States trade policy to the President and overseeing trade negotiations with other countries.

[2] Id.

deemed "industrial significant technologies," particularly those that benefit from China's "Made in China 2025" plan and other similar industrial policies. The made in China program is Beijing's 10-year state plan to rapidly develop the country's advanced manufacturing prowess in 10, high-tech industries such as robotics and aerospace. The $200 billion tranche, however—implemented in response to China's retaliatory action—was much broader, targeting a wide-range of industrial products and consumer goods from seafood and steel to baseball mitts and handbags.

With each round of tariffs imposed by the U.S., China has immediately imposed a subsequent round of retaliatory tariffs. To date, China has imposed tariffs on $110 billion worth of U.S. exports to China. Like the U.S. tariffs, the first two rounds of Chinese retaliatory tariffs are at a rate of 25%. For the most-recent round, the tariff rate ranges from 5-10% with a pledge to increase rates when and if the U.S. raises the tariff rate on its most recent tranche. This type of "you punch me, I punch you" behavior is standard trade war practice.

EXCLUSION PROCESS

Shortly after USTR imposed its first tranche of tariffs, the office developed a process to consider excluding particular products within an HTS subheading from the tariffs. It did so in response to concerns raised by domestic industries. USTR said it may consider factors such as whether a product is available from a source outside of China, whether additional duties would cause severe economic harm to U.S. interests and whether a product is strategically important or related to Chinese industrial programs, including "Made in China 2025," among other factors. USTR also provided a process for domestic interests to object to exclusion requests and for requestors to respond to those objections.

The application period for exclusion requests for the first tranche of tariffs ended Oct. 9, 2018, and USTR continues to process requests. As of Nov. 20, 2018, the office had denied about 1,080 and approved none of the 10,650 exclusion requests from that first tranche. At press time (December 2018), USTR had reviewed and posted about 600 requests from the second tranche.

For the third tranche of tariffs, which took effect Sept. 24 and covers 5,745 HTS numbers, an exclusion process is not currently planned. In forestalling an exclusion process, the Trump Administration stressed the need for companies to shift production and supply chains away from China. Not making an exclusion process available has drawn criticism from domestic business interests and some members of Congress. Pressure on the Administration to consider exclusion will likely intensify if the current trade cease fire ends without resolution and tariff rates are set to increase next year.

OPTIONS FOR MANUFACTURERS

USTR's product exclusion request process is one option for domestic interests for whom the additional tariffs would cause economic harm or who may be unable to find alternative sources. However, it is uncertain how liberal USTR will be in granting exclusions. If domestic production of the

Examples of Valve Products Covered by 301 Actions

Various valves and valve parts have appeared on USTR's tariff lists and on China's retaliatory tariff lists and are now subject to additional duties of up to 25%. Below is an illustrative list of covered products.

U.S. Tariffs on Chinese Imports

HTS Code	Product Description	Tariff Rate	Effective Date
8481.10.00	Pressure-reducing valves for pipes, boiler shells, tanks, vats or the like	25%	July 6, 2018
8481.20.00	Valves for oleohydraulic or pneumatic transmissions	25%	July 6, 2018
8481.30.20	Check valves of iron or steel for pipes, boiler shells, tanks, vats or the like	25%	July 6, 2018
8481.30.90	Check valves other than of copper, iron or steel, for pipes, boiler shells, tanks, vats or the like	25%	July 6, 2018
8481.40.00	Safety or relief valves for pipes, boiler shells, tanks, vats or the like	25%	July 6, 2018
8481.90.90	Parts of taps, cocks, valves and similar appliances for pipes, boiler shells, tanks, vats or the like, nesoi	25%	July 6, 2018
8415.10.60	Window or wall air conditioning machines, "split-system," incorporating a refrigerating unit and valve for reversal of cooling/heat cycle	10%	Sept. 24, 2018
8415.81.01	Air conditioning machines incorporating a refrigerating unit and valve for reversal of cooling/heat cycle, not elsewhere specified or included (NESOI)	10%	Sept. 24, 2018
8481.30.10	Check valves of copper for pipes, boiler shells, tanks, vats or the like	10%	Sept. 24, 2018
8481.80.10	Taps, cocks, valves and similar appliances for pipes, boiler shells, tanks, vats or the like, hand operated, of copper, NESOI	10%	Sept. 24, 2018
8481.80.30	Taps, cocks, valves and similar appliances for pipes, boiler shells, tanks, vats or the like, hand operated, of iron or steel, NESOI	10%	Sept. 24, 2018
8481.80.50	Taps, cocks, valves and similar appliances for pipes, boiler shells, tanks, vats or the like, hand operated, not copper, iron or steel, NESOI	10%	Sept. 24, 2018
8481.80.90	Taps, cocks, valves and similar appliances for pipes, boiler shells, tanks, vats or the like, other than hand operated, NESOI	10%	Sept. 24, 2018

Retaliatory Tariffs on U.S. Exports to China

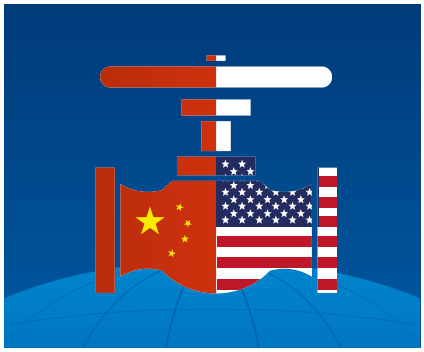
HTS Code	Product Description	Tariff Rate	Effective Date
8481.80.31	Electronic expansion valve	10%	Sept. 24, 2018
8414.90.11	Compressor inlet and outlet valves for refrigeration equipment	10%	Sept. 24, 2018
8481.20.20	Pneumatic transmission valve	10%	Sept. 24, 2018
8481.80.21	Electromagnetic reversing valve	10%	Sept. 24, 2018
8481.10.00	Pressure reducing valve	5%	Sept. 24, 2018
8481.20.10	Hydraulic transmission valve	5%	Sept. 24, 2018
8481.30.00	Check valve	5%	Sept. 24, 2018
8481.80.29	Other reversing valve	5%	Sept. 24, 2018
8481.80.39	Other flow valve	5%	Sept. 24, 2018
8481.80.40	Other valves	5%	Sept. 24, 2018
8481.80.90	Unlisted faucets, cocks and similar devices	5%	Sept. 24, 2018
8481.90.10	Valve parts	5%	Sept. 24, 2018
8481.40.00	Safety valve or relief valve	5%	Sept.24, 2018

**Note: Tariff rates effective Sept. 24, 2018 were scheduled to increase on Jan. 1, 2019. That increase has been delayed at least 90 days following the Dec. 1 meeting between Presidents Trump and Xi. Note also that these charts are illustrative, not comprehensive. It is important to review the published lists in detail and review a company's current and projected import data to start the process of determining tariff effects on a specific company and exploring alternative approaches to dealing with these issues.*

covered items exists and the domestic manufacturer comments in opposition to the exclusion request, chances are not good that an exclusion would be approved. Those companies that manufacture a product in the U.S. on a U.S. list that would like to see that product remain there could consider monitoring the exclusion request lists and objecting to exclusion requests. Note that, as mentioned above, this is not available at press time for products on list 3.

Another approach is to take steps to diversify the company's supply chain by finding component sources outside of China. This is often easier said than done because some companies have put in untold hours locating, qualifying and working with Chinese suppliers to get a reliable supply of good products. Other companies have made or established manufacturing facilities of their own in China with significant investments. Beyond major supply chain modifications, other options are available to ameliorate tariff impacts for U.S. manufacturers, including:

- **Country of Origin.** The Section 301 duties are based on country of origin, not country of export. U.S. importers considering further processing of Chinese products in other countries (e.g., moving Chinese-origin products to Canada, Mexico or another destination for further processing before importing into the U.S.) must be careful to comply with U.S. customs laws and avoid accusations of Section 301 evasion. Currently, a dispute has arisen about whether qualification for the North American Free Trade Agreement origin is sufficient to avoid designation as a Chinese-origin item under Section 301. In short, it would be wise not to make assumptions about origin determinations, and qualified trade counsel should be consulted on this issue.
- **Drawback.** The Section 301 duties are eligible for duty drawback, meaning tariffs on imported goods may be refunded if imported products are subsequently exported out of the U.S. Companies that do enough exporting could consider setting up a drawback program. Again, this involves some complex customs so getting assistance is wise.
- **First Sale.** While first sale valuation does not eliminate the additional 301 duties, it can provide duty savings by reducing the value of the product on which the duty is applied. It is important to set up a first sale system the right way.
- **De Minimis.** Finally, small quantities of covered products entered under the Section 321 de minimis exception are not subject to Section 301 duties.
- **Foreign Trade Zones (FTZ).** For goods entered after the effective date, FTZs cannot be used to avoid Section 301 duties.



The Trump Administration has indicated all tariffs could be phased out if China delivers on significant structural reforms.

WHERE TO FROM HERE?

The Trump Administration has repeatedly stated it needs to see major concessions and commitments from the Chinese before it will consider removing the 301 tariffs. Specifically, the United States has purportedly prepared a list of nearly 150 items it wants the Chinese government to address. In addition to pressuring China to stop noneconomic transfers of industrially significant technology and intellectual property to China, the United States wants to see China remove a variety of tariff- and non-tariff barriers that make it difficult for U.S. businesses to operate in China. President Trump also has repeatedly stressed his desire to ensure that tariffs between the two countries are reciprocal in value.

The Dec. 1, 2018 announcement by Presidents Trump and Xi kicked off a 90-day period of trade negotiations that could lead to a more comprehensive deal. In addition to the freeze on existing tariffs and rates, China agreed to purchase what the White House has described as "very substantial" amounts of agricultural, energy, industrial and other products from the United States to reduce its existing trade surplus. The leaders also agreed to begin negotiations at the highest levels of their governments to try to resolve the current trade conflict. Therefore, it appears there is some hope on the horizon. However, numerous unsuccessful efforts to negotiate on these issues in 2018 and so far in 2019 have occurred.

For now, tariffs remain on $250 billion worth of Chinese imports: a 25% tariff on an initial $50 billion in Chinese goods and a 10% tariff on the remaining $200 billion. Chinese retaliatory tariffs also remain in place. The Trump Administration has indicated all tariffs could be phased out if China delivers on significant structural reforms. The details of those reforms and how much substantive change the U.S. will need to see before eliminating any tariffs remains to be seen. If an agreement is not reached by March 1, 2019, President Trump has indicated he is prepared to increase 10% tariff rates on that $200 billion worth of goods to 25%—and could impose additional tariffs on remaining Chinese imports. Given the high degree of uncertainty, companies would be wise to continue preparing for a protracted period of tariffs. VM

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Terry Blackard: Valves Need More Respect

BY KATE KUNKEL

Valves in the oil and gas industry have come a long way in the last four decades, both in terms of higher quality in products and opportunities created by those better products, as Terry Blackard can attest. Blackard has been in the refining/chemical industry for 42 years. The first 40 were with ExxonMobil in Baton Rouge where he was the valve specialist for the complex there. He retired in 2017, then went to work for Becht Engineering as a valve consultant, where he added even more valve challenges to his long career. For the last 16 years, Blackard also has served on the API Subcommittee on Piping and Valves (SCOPV).

That level of longevity and experience makes Blackard an excellent person to ask: How has the industry fared and what challenges have valves and the professionals in the industry faced?

His answers are influenced by a history that goes even further back than his own career. As is the case with many veterans of the industry, Blackard followed in the steps of his father, who worked at Exxon for 37 years before his son joined the company.

According to the junior Blackard: "It's a good career. You might not get rich, but you'll have a satisfying job, a decent salary and a decent retirement."

Executive Summary

SUBJECT: Long-time end-user experts are an excellent source of knowledge when it comes to how the valve world has evolved.

KEY ISSUES:

- Changes in the oil and gas industry
- The challenges faced
- What tomorrow will bring

TAKE-AWAY: The next generation could learn much by listening to those that have come before them.

"Gate valves are still the workhorse in the industry."

VALVE EVOLUTION

When asked how valve quality has improved over the last four decades, Blackard points to upgrades in casting design and quality control, as well as innovations in valve design and materials.

For example, "The old valves [valves of yesteryear] were over-built with extra wall thickness in the bodies, which helped them hold up," he says. "With improvements in finite element analysis and casting modeling, the new designs are much closer to the minimum wall thickness required by standards."

This development has both a positive and a not-so-positive side, he says.

"The plus is reduced weight and material cost while the negative is less metal thickness, so any casting flaws show up quicker," he says.

As far as what's in use today, Blackard notes that while more double- and triple-offset butterfly valves as well as metal-seated ball valves have been put into action over the last decade, gate valves are still the workhorse in the industry.

"I typically recommend using a gate valve unless there is a specific need to change," he says. "The reason is that gate valves are usually available off the shelf and are generally much cheaper while ball and butterfly valves are more expensive with typically longer lead times."

Still, some services will drive a project to use tougher valves. For example, applications with a lot of particulate or coking, where better sealing is needed or where emissions are a challenge lend themselves more towards ball and butterfly valves.

He says that while new and improved valves are constantly in the works, it's not as easy as it used to be for manufacturers to share what they have with the decision makers at refineries.

"This can be a problem because the ability to get into plants is much more difficult since the MARSEC [maritime security] rules were implemented."

It used to be that a rep could go into the plant and meet with engineers on site, he explains. With the new rules, it's more difficult to get into a facility, and many restrictions to access exist.

Blackard recommends that manufacturers facing this issue attend API functions because the major end users are usually there, and those end users are the ones that typically control companies' accepted manufacturers lists (AML).

"If one of these people thinks a manufacturer has a good product, they will usually provide contacts at the local sites," he advises.

Another way for better access would be to work with local suppliers because they usually have contacts in the plants, he adds. Blackard notes that the change from smaller local valve vendors to giant nationwide or worldwide contract holders has affected levels of service.

"Generally, I think it has improved service because the larger suppliers tend to stock a lot more valves," he says. "Also, when they have a large contract, they tend to inventory the type of valves you need," he says.

The downside is they don't stock all manufacturers that might be on the AML so accessibility to some really good valve manufacturers is not as easy as it used to be.

CHALLENGES AND SOLUTIONS

When asked if particular valve types have caused more problems over the years than others in the refineries, Blackard notes that more issues have occurred with gate valves than others. However, that's partly because more gate valves are around than any other type of valve.

"With that said, I have experienced quite a few stem-guided globe valve problems. Failures have ranged from packing leaks to sheared stem failures," he says.

Blackard suggests the reason might be that these valves are put into services that have large pressure drops or they are operated in near-to-close position. The vibration and harmonics experienced during these situations can cause tremendous valve damage, he points out.

"We have tried to train our operators that if a globe valve is experiencing high vibration and making noise, some kind of adjustment needs to be made or the valve needs to be taken out of service," he says.

Another big issue in the industry has been fugitive emissions containment. Although great strides have been made in cleaning up process plant valve emissions in the last 20 years, some areas in an oil refinery still create especially tough challenges.

"Light end units tend to be the toughest units to get a handle on," Blackard notes. "But innovations in valve designs and packing have been the biggest driver of improvements." Better education in the workforce is also a major contributor to less problems.

As an active member of the API's SCOPV for the last 16 years, Blackard has seen great strides in improving valve standards in refineries.

"We have also added new standards like globe valves and standards on testing requirements for packing/emissions," he says.

"The only standard I feel that has gone backwards is API 607 on fire testing. Changes to the 5th edition were a setback in my opinion, and I hope to see this standard improved in the next couple of years," he observes.

UNIQUE SOLUTIONS

When asked if one valve-related problem or issue he helped address stands out among all he saw resolved, Blackard points to a system for stem indication on butterfly and ball valves.

"Stem indication for disc or ball position is typically done with a keyway or marking," he explains.

> *"Valves never get the resources in manpower, planning or maintenance that other equipment tends to get."*

This indication is normally in line with the disc on a butterfly valve and in line with the open ball on a ball valve.

"Nearly all manufacturers do this the same way, but I worked with a couple of manufacturers who did it just the opposite. We actually had an incident of incorrect mounting of an actuator because of this reality," he says.

He had to explain to those manufacturers that, even though they met the standard, they were setting end users up for failure because of their stem indication method.

"Luckily, both manufacturers eventually agreed with me and changed or modified their design to help address this issue."

Blackard says that sometimes the valve problems he's seen have required detective work.

He points to a case where he was dealing with a 20-inch, 600-class gate valve that stuck closed during a unit startup. After some effort, process operators got the valve open, but only about one-third of the way.

"The large actuator looked fine, the stem was checked with a thread gage and it looked okay so there was debate about whether something was stuck in the valve, like maybe a loose or broken seat ring," he recalls.

After more review, the discovery was made that the stem had been stretched during the opening procedure.

"This was undetectable with a thread gage, but if you measured the stem over about nine inches, it was obvious. This large actuator had a large stem nut with about eight inches of thread engagement. We removed two inches of the threads from the coupling and could then operate the valve until we had a repair opportunity," he recalls.

In another situation, Blackard was performing root cause failure analysis on a valve that leaked and contaminated another product line.

"The valve was only eight months old and during the inspection, we noticed the wedge was severely bent. We were scratching our heads because we could not understand the cause and felt certain it was not manufactured this way," he recalls. During discussions with the process team, Blackard learned that the valve was installed several months before, but that the line was just recently put into service. During the valve installation, the capped line had been hydro tested, but because of line orientation, the test water was never drained.

"We had a cold winter, which resulted in this short section freezing the water and bending the wedge, so when the line was put into service, the valve leaked. It taught me to never underestimate the power of freezing water!" Blackard says.

LOOKING FORWARD

When asked if there was anything Blackard wished could be done differently in refining, he says, "I wish we could develop more respect for valves in general. Unfortunately valves never get the resources in manpower, planning or maintenance that other equipment tends to get. People just see a valve and not an engineered piece of equipment that needs to be installed, operated and maintained correctly to achieve safe and reliable operation."

Blackard also offered advice for young people coming into the industry today. "Ask as many questions as you can. Get as much failure data from the old guys as you can," he says.

"Our industry is having a larger turnover as baby boomers like myself retire," he explains. "While we are not any smarter than the people who are replacing us, we have seen a lot of the issues the new group will encounter. It's a shame but I'm sure they will repeat some of the mistakes my predecessors and I have both made." VM

Kate Kunkel served as senior editor of VALVE Magazine from 2012-2018.

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ge Forum


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End users, engineering and consulting firm personnel, distributors, various personnel within manufacturing and supplier firms, and other related industry groups and professionals.

Who Should Exhibit?

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Professional Development Hours

Attendees to the 2019 VMA Valve Industry Knowledge Forum will receive a certificate for twelve (12) Professional Development Hours.

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VMA is offering two optional tours. Attendees may choose to tour either the Honda Manufacturing of Alabama or Kamtek castings facility.

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VMA invites members and non-members to exhibit (table-top exhibits.) We know traffic is important so we've scheduled the attendees, lunch, afternoon break and the Welcome Reception in the exhibit area to guarantee plenty of networking time!

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VMA/VRC Members	**$600** *(through February 15, 2019)*
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A carbon steel valve disc is overlaid with corrosion-resistant 316L stainless steel during a trim change modification.

New Valve Modifications

BY GREG JOHNSON

Valve modification can be defined as: adding value to standard or "commodity" valves by installing actuators, special trims, different end-connections, packing and gaskets, and other accessories or upgrades not provided on the original product. These modifications are primarily for gate, globe, check and ball valves.

Back in the days of black and white television and cars with tailfins, end users usually had a storehouse full of valves commonly used in their plants. This was ideal for both the valve OEM and the distributor: Everything was ordered in advance and the need for expedited-delivery, special valves was a random occurrence. However, belt-tightening measures by those end users lowered their inventories. Combined with the refinery and petrochemical construction boom of the 1970s, this created a situation where the supply capability of domestic manufacturers was exceeded for commodity and particularly for specialized valves.

MODIFICATION BECOMES POPULAR

Faced with the expense of stocking huge varieties of slower-turning special valves, distributors began to stock "vanilla" valves, then have a local valve shop retrim those valves or install new packing and gaskets to meet customer requirements. These modifications soon became more and more popular as the process developed into a win-win-win system for the manufacturer, distributor and end user. Still, OEMs began to be a bit concerned as some unqualified shops were performing shoddy work while the OEMs were being held liable by the end users.

Executive Summary

SUBJECT: Valve modification processes have come a long way from earlier days.

KEY ISSUES:

- History of modification
- How it's now done
- The role of standards in the process

TAKE-AWAY: Today, new valve modifications are an important part of the valve supply chain, benefiting the OEM, the distributor and the end user.

Up until this time, modification of new valves by third-party shops was only tacitly approved by a few OEMs. However, they soon began to see the advantages of authorizing quality valve service facilities to perform alterations on their products. With an official authorization program, the OEM could retain oversight of the aftermarket work performed on their products, plus reduce the number of bogus operations performed on their valves.

This led to a system whereby individual manufacturers audited the facilities performing the modification work and only authorized those companies with the capabilities and quality systems to perform the work correctly.

Today, the OEM authorization system for gate, globe, check and ball valve modification is very strong, and widely used and accepted by OEMs, distributors and end users. However, modification of pressure relief valves almost exclusively consists of OEM parts replacement by an OEM and a National Board-certified facility. The modification of control valves is usually handled by an OEM's own service centers.

MSS MODIFICATION STANDARDS

The Manufacturers Standardization Society (MSS) has accomplished a valuable service for the new valve modification industry by creating a series of standard practices detailing how many popular valve modifications should be performed. The first MSS valve modification document, MSS SP-141, Multi-turn and Check Valve Modifications, was published in 2011. Here is the scope of that document:

1.1 This Standard Practice establishes minimum requirements for the modification of new gate, globe and check valves, which have been manufactured in accordance with recognized national standards and require modification to meet specific end-user requirements.

1.2 The purpose of this Standard Practice is to ensure that the quality of workmanship and materials meet all applicable standards and codes.

SP-141 contains basic instructions, welding criteria and non-destructive testing requirements for many modifications, including trim changes, changing ends from raised-face to butt-weld ends, packing and gasket replacement, bypass installation and NACE International, MR01-03 compliance. The document also calls for OEM parts to be used if readily available.

The following is verbiage from one of the nondestructive evaluation procedures contained in SP-141: dye penetrant (PT) examination.

10.2 Dye Penetrant Examination of Valve Body and Bonnet

10.2.1 Scope—The procedure details the requirements for dye penetrant (PT) examination of bodies and bonnets of assembled valves, as per MSS SP-93 or ASME [American Society of Mechanical Engineers] B16.34. This procedure requires the replacement of the original packing and gasket.

10.2.2 Valves shall be disassembled in accordance with Sections 4.1 and 4.2.

10.2.3 All paint is removed from valve body and bonnet, either by abrasive means (grit or shot blast) or with chemical paint stripper.

10.2.4 All exterior areas as well as accessible interior areas of the body and bonnet are to be examined.

10.2.5 PT inspection is to be performed by personnel certified to Level II, in accordance with ASNT [American Society For Nondestructive Testing] SNT-TC-1A. Level I personnel may perform the inspection under the guidance of an onsite Level II inspector.

10.2.6 PT inspection shall follow the guidelines of MSS SP-93 or ASME B16.34, Appendix III.

☐ A new, one-piece Inconel stem is machined on a CNC turning center and checked for dimensional accuracy.

☐ Valves that have been disassembled during the modification process are retested in accordance with the appropriate testing standard.

Acceptance criteria shall be in accordance with the respective test specification.

Since publication of SP-141, a standard practice for waterworks has been to follow the published MSS SP-153. MSS will also publish a modification standard for quarter-turn valves in 2019.

While the MSS standards are helpful, it is important to remember that this is new valve modification, which means that the original design standards must be maintained unless superseded by an owner/end user's specific request for variance. When performing modification work, it is imperative that an inventory of current valve design standards, such as ASME B16.34, American Petroleum Institute (API) 600 or API 594 be maintained. Additionally, a modifier is responsible for any necessary design calculations, such as those needed for substituting a stronger stem material for a weaker material (e.g., 410ss to 316ss). Bonnet extensions for cryogenic applications or extension tubes for buried pipeline service also require competent design work.

☐ The seats of a 30-inch gate valve are machined before weld overlay for a hardfacing modification.

Today's valve modification service providers are a far cry from the blacksmith-like valve shops of the 1930s, 40s and 50s. Since the modification shop often must respond quickly, vertical integration is critical to the overall success of the shop. Walking through the doors of the highest caliber facilities today, visitors would find CNC [computer numerical control] machine tools, 3D CAD software, coordinate measuring machines, semi-automatic, submerged-arc and fluxed-core welding, heat treatment furnaces of all sizes, in-house nondestructive evaluation and elaborate pressure-testing facilities, all tied together via sophisticated computer tracking systems. In-house engineering is also important, and mechanical, industrial and welding engineers are likely to be found in many of these shops as well.

☐ A coordinate measuring machine is used to verify that modified valve components meet OEM drawing dimensions.

A gate valve has been modified by welding multiple drains on the body. The discoloration is a sign that the body has been stress-relieved after welding

OEM SUPPORT IS VITAL

OEM support is critical to the success of an authorized modification facility. Good communication between the OEM and the modification facility engineering departments is also a must. A level of trust and confidence must be built up between the modification shop and the OEM for the system to function effectively, and timely engineering data and drawings (if required) are important. But the stream of valuable information flows back to the OEM as well.

Modification shops are a valuable source of valve quality feedback to the OEM. On the floor of a typical shop, thousands of valves are tested and inspected each year. These secondary inspections can provide valuable data to the OEM if nonconformances are found.

The valve shop also serves as a second "final inspection point" for OEM products. Defects have been discovered by modification facilities that could have had dire consequences for the manufacturer had they failed in service.

THE WARRANTY

The question of warranties often comes up when discussing modification shops and OEMs. Generally, a manufacturer warrants the work for which they are responsible, while the modification shop warrants only the work for which it is responsible. For example, a stem failure on a flanged valve that received only a ring-type joint modification by the modification shop would be covered by the OEM. However, a poor weld in the weld built-up ring-joint area that failed end-user hydrostatic testing would be the responsibility of the modification shop.

Although some manufacturers have set up service centers to repair and modify their products, the majority of valve modification work is still performed by independent valve modification shops. These independent shops usually have an edge in service and order turnaround because they are not encumbered by a large OEM bureaucracy that rightly prefers mass production of new valves over specialized valves.

Valve modification facilities provide an important service to end users, distributors and OEMs. The OEM benefits by being able to concentrate on high production items, rather than late-ordered specials that often slow assembly lines down. The distributor benefits by spending less money stocking slow-moving special valves. The end user benefits by receiving critical, special valves on time and at a reasonable price, which lowers total cost of ownership. VM

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The Challenges of Creating Super-clean

BY KARL J. LUTKEWITTE

Because biopharmaceuticals are produced using living organisms, and the drugs produced are used in humans and animals, the cost of contamination is very high, and sterilization of the process system is critical.

To ensure sterilization, temperature measurement and control practices are employed that verify steam sterilization occurs on time without fail. If the temperature is not within predetermined limits, temperature validation alarms occur. How does thermostatic steam trap operation affect the occurrence of temperature validation faults? What new technologies are available to mitigate common SIP problems?

Such questions are addressed in this article.

WHAT GOES INTO SIP

To begin, let's briefly review some fundamentals of process equipment SIP and the operating principles of sanitary balanced port thermostatic steam traps.

SIP is a timed sterilization of the upstream and downstream biopharmaceutical production train using clean steam. It is part of a five-step sanitization routine that occurs after every production batch (Figure 1).

SIP ensures every square inch of the production train that comes into contact with drug substance inputs, the drug substance itself and the final drug product is "sterilized" to ensure no microbiological activity exists in the system.

Executive Summary

SUBJECT: Steam-in-place (SIP) is a sterilization process used in the biopharmaceutical and parenteral drug industry where cleanliness is critical.

KEY ISSUES:

- Understanding SIP
- Understanding temperature validation
- Clean steam trap operation
- Problem remediation

TAKE-AWAY: Manufacturers have come up with innovations that can keep operating and installation costs down while increasing efficiencies.

Clean steam, which is created using ultra-purified water, is circulated through all the process tubing and equipment during SIP, entering large vessels through spray balls embedded in the vessels' ceilings.

SIP is a temperature-validated process, meaning that the sterilization event must be proven by measuring the temperature and recording that data. The minimum sterilization regimen requires injecting clean steam into all piping and vessels for at least one-half hour after that equipment reaches a minimum temperature of 250°F (121°C). If the temperature ever falls below that minimum during this temperature hold period, a temperature validation fault is recorded, the fault remediated, and SIP procedures must be repeated.

Validation temperature sensors (usually resistance temperature detectors) are placed at the condensate outlets (drain lines) at the bottom of process equipment skids to make sure the sterilization temperature meets the specific regimen designed for the process system. The sensing elements are most frequently designed with integral sheathes and tri-clamp connections and inserted into a mating tri-clamp connection on a tee in the drain line. Normally, the sensors are located 12–18 inches (300–450 millimeters) upstream of the clean steam trap where the condensate exits the piping or vessel (Figure 2).

Recorded time/temperature data

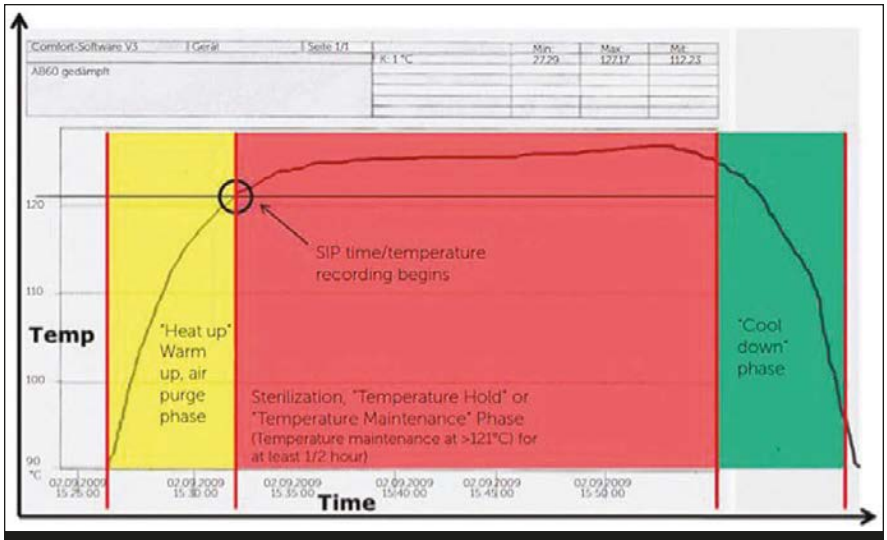


Figure 1. Time and temperature graph showing phases of sterilization

(Figure 1) is stored in a programmable logic controller, distributed control system or stand-alone database for later use by company quality engineers and auditors.

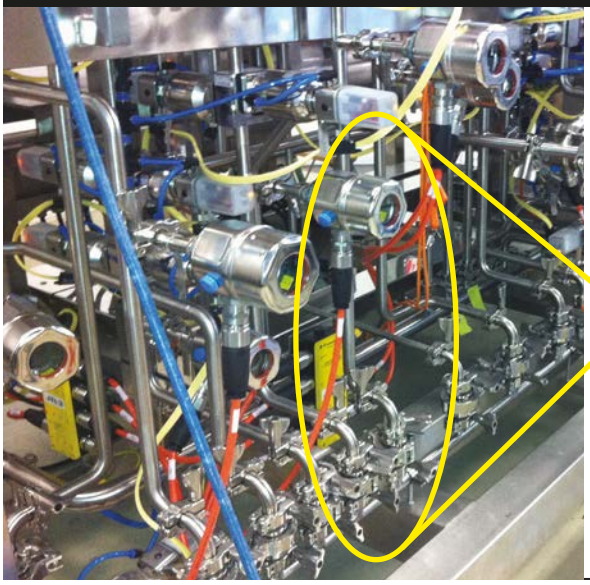
THERMOSTATIC STEAM TRAP OPERATION

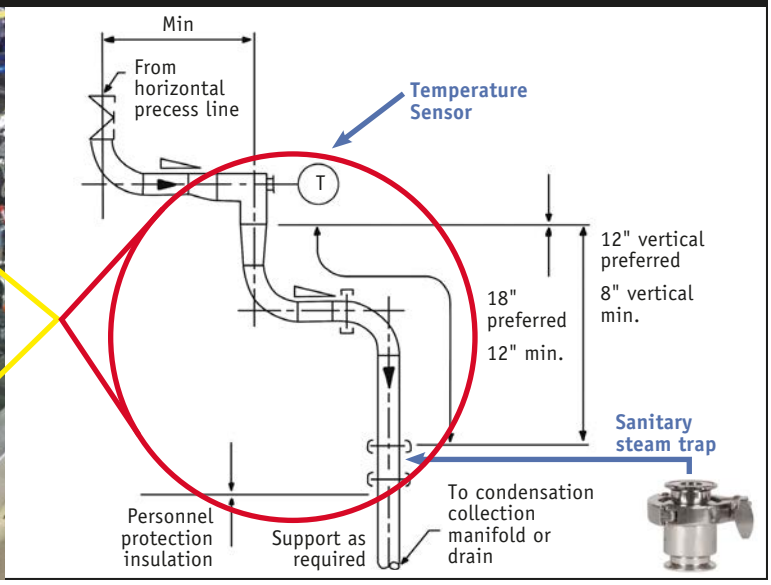
Thermostatic traps operate like a thermostat (Figure 3). As such, they are designed to close when the bellows senses saturated clean steam temperatures, preventing steam from passing through the trap. Hence the name thermostatic "steam trap." The closure occurs because the proprietary liquid/alcohol mixture inside the bellows vaporizes when exposed to clean steam temperatures. Pressure builds up inside the bellows, expanding and driving the attached plug (ball or conical tip) into the orifice at the trap outlet. The trap will stay in that closed position until the bellows temperature falls below steam saturation temperature. When it does, the bellows contracts as the alcohol vapor condenses, lifting the plug off the seat and releasing any clean steam condensate that has collected upstream of the trap.

The temperature of the condensate

Figure 3. Cutaway showing clean steam trap construction

Figure 2. Typical temperature validated condensate drain with steam trap





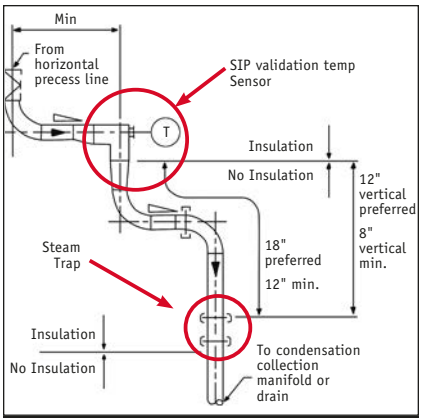


Figure 4. Typical clean steam drain piping

when the bellows begins to contract and the trap begins to open is critical. That temperature, subtracted from the clean-steam saturation temperature is called the trap's subcool temperature. Subcooling (in this context) is defined as the number of degrees below saturation temperature that the trap begins to open. The lower the number, the better it is for the process because a lower number means less condensate will accumulate upstream of the trap. (Figure 4 is a typical clean steam drain piping illustration.)

VALIDATION TEMPERATURE ALARMS

A validation temperature alarm occurs if the temperature measured in the condensate drain line (Figure 4) ever falls below 250°F (121°C). If that occurs, SIP must be stopped and the root cause of the temperature deviation corrected. Most validation temperature alarms can be traced to two root causes. They are both related to condensate back-up upstream of the steam trap.

All sanitary thermostatic traps require installation of a minimum length of tubing between the trap inlet and the validation temperature sensor to account for this buildup of condensate (Figure 4). If a thermostatic trap requires significant subcooling before the bellows begins to contract and open the trap, clean steam condensate will back up in the tubing upstream of the first trap and may wet and cool the validation temperature sensor. If that occurs during temperature maintenance (in other words, after the system heats up to at least 250°F (121°C)), a temperature validation alarm occurs when the sensor is cooled below that value.

Note that condensate backup is a common occurrence during heat-up (before the tubing is heated to the minimum 250°F (121°C)) because the amount of condensate produced can be significant. However, temperature validation does not officially begin until after the system being sterilized reaches its validation design temperature above the minimum temperature. At that point, the amount of steam required to keep the system at temperature and the associated condensate load is dramatically less. This is why it's important to choose a trap that has enough capacity to handle the larger heat-up loads but with a low enough subcooling operation that condensate is never allowed to build in the tubing during temperature maintenance.

High subcooling trap operation (Figure 5) is one of the two most frequent causes of validation temperature alarms.

HIGH SUBCOOLING TRAP ALARMS

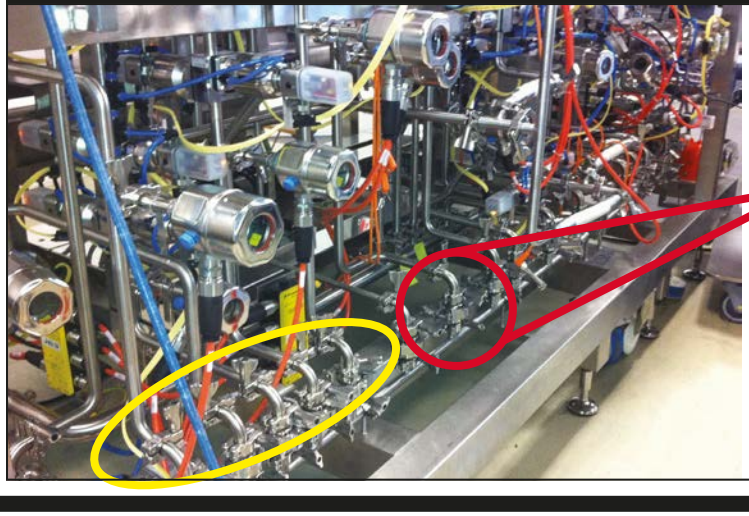
Another common cause for condensate back up and validation temperature alarms is failure of an adjacent trap on a common condensate header.

Balanced port thermostatic traps fail open when the stainless-steel bellows develops a leak and the fill escapes. Without its proprietary alcohol fill, the bellows can never expand to close the trap when exposed to steam temperature. The trap will remain open, allowing clean steam to pass through the trap into the condensate header. This is especially problematic during temperature hold (low condensate creation), because the increase in condensate header pressure can cause one or more adjacent traps to back up condensate. This backup occurs because the differential pressure across all of the traps connected to that header will be reduced (Figure 5). Reduced differential pressure will result in reduced flow in one or more of the adjacent traps on the common header. In smaller volume condensate headers (inner diameter is less than an inch), this low differential-induced capacity reduction can cause condensate backup significant enough to wet the sensor and cause a validation temperature alarm. (This is the reason that safety factors should be used when sizing clean condensate headers, i.e., they should be oversized.)

SIP PROBLEM REMEDIATION

Three common problems are encountered during SIP:

Figure 5. High subcooling trap operation



Sanitary thermostatic traps fail in the open position.

If this trap fails open, saturated clean steam will enter the condensate header during temperature hold. Header pressure will rise, lowering the system differential pressure across, and flow through the other traps tied to that header.

1) Temperature hold validation alarms
2) Slow condensate drainage
3) Not getting up to temperature or not getting up to temperature fast enough (slow heat-up)

These problems are significant because each one delays completion of the sanitization regimen and therefore delays the productive utilization of the asset being sanitized. In other words, these problems cause lower annual production and revenue. (The potential loss is greatest in downstream purification and formulation assets because their batch cycle times are much shorter and usually more frequent.)

Most temperature hold validation alarms can be corrected or prevented by doing one or more of the following:

1) Installing properly sized, low-subcooling traps in temperature-validated drain lines to minimize condensate backup
2) Ensuring about 12–18 inches (300–450 millimeter) of three-quarter-inch uninsulated tubing is between the trap and temperature sensor to hold condensate backup.
3) Properly sizing condensate headers so they can accommodate failed traps
4) Immediately replacing failed traps on trap condensate headers. (An ultrasonic leak detector should be used periodically to test for and find failed traps during temperature hold.)

However, there are some installations where the solutions above are impossible to implement. For example, compact installations occur, particularly under vessels and equipment where there is not enough space to install a vertical and horizontal downcomber (drip leg) of sufficient length to prevent condensate from backing up and wetting the sensor. There also are some installations where unforeseen condensate load variations occur that overwhelm the condensate leg and the trap.

In those situations, two potential solutions can help:

1) If the installation height for the required run of vertical tubing is not possible, the horizontal distance can be increased. Adding horizontal tubing distance provides volumetric cushion to prevent condensate from reaching the sensor. As long as some vertical tubing is immediately below the sensor to provide drainage, an increase in the length of slightly sloped horizontal tubing will provide the volume cushion needed to prevent sensor wetting and temperature validation alarms. (See ASME [American Society of Mechanical Engineers] BPE 2016 section SD-2.4.3 for drainability and slope recommendations.)

Condensate Temp Below Saturation (Subcooled Temp)	Capacity - lbs/hr (kg/hr) @ Differential Pressure - psi (bar)					
	10 (0,69)	20 (1,38)	30 (2,07)	50 (3,45)	75 (5,17)	90 (6,21)
5°F lbs/hr	195 (88,5)	373 (169)	3549 (249)	870 (395)	1012 (459)	1165 (528)
10°F lbs/hr	490 (222)	813 (369)	1142 (518)	1715 (778)	2207 (1001)	2437 (1105)
20°F lbs/hr	1127 (511)	1697 (770)	2202 (999)	3074 (1394)	3932 (1784)	4139 (1877)
Cold Water lbs/hr	2580 (1170)	3648 (1655)	4468 (2027)	5768 (2616)	6944 (3150)	7504 (3404)

Figure 8. Clean steam trap capacity table

Figure 6. View of a model with single section

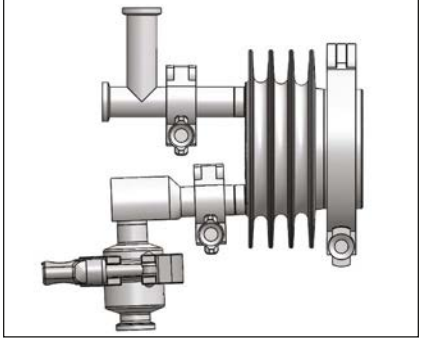
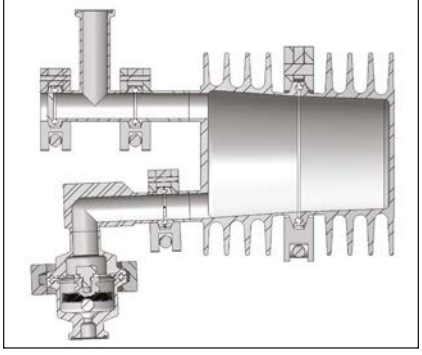


Figure 7. Cutaway view of a model with double section



2) If the height or horizontal space to install any significant horizontal or vertical tubing is not there (or not desired), then a subcooled condenser can be used to eliminate validation temperature alarms and improve condensate drainage during all phases of SIP.

SANITARY SUBCOOLED CONDENSER

A sanitary subcooled condenser is a compact, finned, gravity drainable, condensate-holding chamber installed immediately downstream of the temperature validation sensor and upstream of the trap. In addition to optimizing installation space, it eliminates the possibility for validation temperature alarms and improves condensate drainage (Figures 6 and 7).

There are three significant benefits to these condensers:

1) They allow the installation of temperature validated sensor/drip leg/trap assemblies in tight places, where there isn't enough room to install the traditional 12–18 inches (300–460 millimeters) drip leg between the validation sensor and trap.
2) The large chamber of the finned, volume collection chamber eliminates the possibility that condensate will back up and wet and cool the temperature sensor.
3) The condensate is subcooled before it enters the thermostatic steam trap, contracting the bellows and further opening the trap orifice, thereby significantly increasing the trap's ability to drain condensate quickly and lessening heat-up time.

Condensate Temp Below Saturation (Subcooled Temp)	Capacity - lbs/hr (kg/hr) @ Differential Pressure - psi (bar)					
	10 (0,69)	20 (1,38)	30 (2,07)	50 (3,45)	75 (5,17)	90 (6,21)
5°F lbs/hr	195 (88,5)	373 (169)	3549 (249)	870 (395)	1012 (459)	1165 (528)
10°F lbs/hr	490 (222)	813 (369)	1142 (518)	1715 (778)	2207 (1001)	2437 (1105)
20°F lbs/hr	1127 (511)	1697 (770)	2202 (999)	3074 (1394)	3932 (1784)	4139 (1877)
Cold Water lbs/hr	2580 (1170)	3648 (1655)	4468 (2027)	5768 (2616)	6944 (3150)	7504 (3404)

Figure 9. Standard capacity trap

Condensate Temp Below Saturation (Subcooled Temp)	Capacity - lbs/hr (kg/hr) @ Differential Pressure - psi (bar)				
	10 (0,69)	20 (1,38)	30 (2,07)	40 (2,76)	50 (3,45)
5°F lbs/hr	1490 (677)	1980 (900)	2705 (1230)	3355 (1525)	3750 (1705)
10°F lbs/hr	2410 (1096)	3370 (1532)	4310 (1959)	5080 (2309)	5675 (2580)
20°F lbs/hr	4090 (1859)	5510 (2505)	6585 (2993)	7910 (3596)	8630 (3923)
Cold Water lbs/hr	6460 (2936)	9110 (4141)	11550 (52502)	12800 (5818)	14410 (6550)

Figure 10. Typical high capacity trap

The sanitary subcooled condenser has five times more radiant surface area than an 18-inch downcomber. The fins allow ambient air to completely enfold the condenser. The air is heated, rises and is displaced by cooler air from below. The radiant and convective heat loss combine to drastically sub-cool entering condensate by about 30°F (about 16,6°C temperature differential). The temperature difference causes the trap bellows to contract further, allowing a substantial increase in flow.

Looking at a clean steam trap capacity table (Figure 8) we can see trap capacity difference between 20°F (-7°C) subcooled condensate and 5°F (-15°C) at a trap differential pressure of 20 psi (1,4 bar). When condensate is cooled just an additional 15°F (-9°C), trap capacity increases 1,432 pounds per hour (lb/hr) (601 kilogams per hour (kg/hr)).

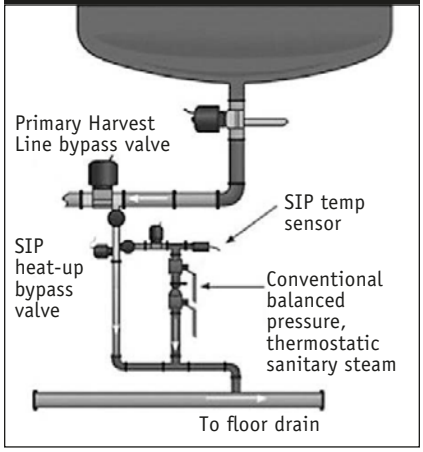
This significant increase in draining capacity lessens heat-up time.

SIP FOR LARGE VESSELS

Biopharm International addressed the subject of vessel steam sterilization and vessel SIP tubing design in an article published in 2003 (Designing a Shorter Vertical Leg for Sanitary Steam Traps, Sept. 01, 2006, by Richard Kal, George W. Page, Jr. Bio-Pharm International Volume 19, Issue 9). The article discusses the amount of clean steam required to heat up and hold sterilization temperature in various sizes of process vessels. It explains:

- A 40,000-liter (10,500-plus gallon) biopharmaceutical vessel may produce about 2500 lbs/hr (1134 kg/hr) of peak condensate during SIP heat-up and about 27 lbs/hr (12 kgs/hr) during SIP temperature hold.
- By contrast, a 600-liter (158-plus gallons) vessel will only produce about 100 lbs/hr (45,4 kg/hr) of peak condensate during heat-up and about 2 lbs/hr (0,91 kg/hr) during temperature hold.

Figure 11. Configuration of conventional bypass system



While 2,500 lbs/hr (1,134 kgs/hr) is within the load capacity of most standard steam traps (at normal SIP differential pressures), those traps can only handle that load at very high levels of subcooling (Figure 9). If the condensate is subcooled to the point where its temperature is 20°F (-7°C) or cooler than the steam saturation temperature, it is significantly backing up in the drain line upstream of the trap.

Most high capacity traps can handle large vessel heat-up loads at lower levels of subcooling (Figure 10) but they still drain slowly because the condensate will be subcooled 10°F (-12°C) at that load.

Since these high-condensate loads only occur during heat-up, there is no worry about validation alarms. However, it may manifest as slower heat-up time.

Removing condensate efficiently from vessels during SIP is important, but it's not the only job a trap has to do. Clean steam traps also have to handle the large volume of air that will be displaced at the beginning of SIP.

For example, a 15,000-liter (about 4,000-gallon) biopharmaceutical vessel holds that same amount of air. As a general design rule, air should be removed in the first five minutes of SIP to minimize heat-up time (air acts as an insulator in steam tubing and vessels). Design should facilitate the removal of that air.

Lastly, during heat-up, air and condensate do not drain independent of each other. Both combine in a mixed phase flow that can further complicate draining and heat-up.

DESIGNING FOR SIZE

To drain liquids and expedite air and condensate flow out of larger vessels (usually greater than 600 liters (158-plus gallons)), most process design-

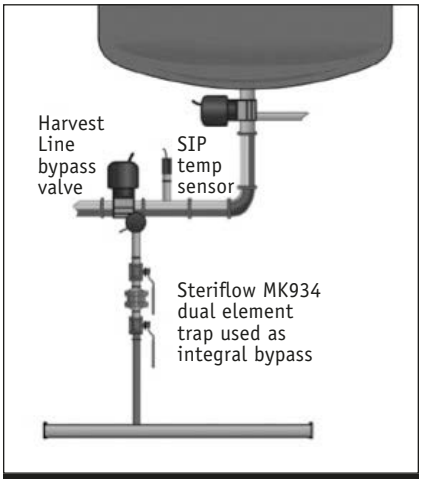


Figure 12. Ultra-capacity trap without bypass used for all sanitization flows (CIP, rinse, and SIP)

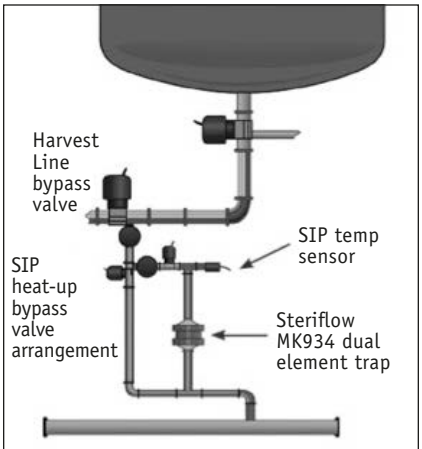


Figure 13. Ultra-capacity for SIP flows for only CIP and rinse handled by bypass to drain.

ers include a 1-inch primary bypass from the tank outlet directly to the drain (Figure 11). When heat-up is completed (a few minutes before temperature hold starts), a secondary bypass valve diverts the flow from the bypass drain line through a conventional steam trap and back to drain.

During SIP heat-up, air and condensate are diverted through the primary harvest line 3-way bypass valve directly to the drain.

When the SIP temperature sensor reaches about 203°F (95°C), the primary bypass closes, and the secondary bypass valve opens to direct the lighter condensate load through the steam trap.

CHALLENGES WITH CONVENTIONAL DESIGN

The piping bypass arrangement discussed in the previous section effectively handles fluids, air and condensate. However, two problems are associated with bypass use:

1) Inefficient use of clean steam and slow pressure build-up because of live steam loss. This results in longer SIP heat-up times and higher operating expense. During the typical 10-15 minutes of heat-up, the 1-inch bypass is wide open to drain, resulting in slow pressure/temperature buildup. After the initial expulsion of air, a significant amount of clean steam is lost to drain, resulting in longer than required heat-up and higher operating expense.
2) High initial capital cost is involved: a conventional bypass loop consists of the components and labor shown in Table 1 above for a total installation expense of about $5,800.

Table 1. Bill of Material: Bypass Loop

QTY	MATERIAL DESCRIPTION	UNIT COST ($)	TOTAL COST ($)
1	1" automated diaphragm valve fab assy with inlet bypass	1,800	1,800
2	panel mounted solenoid for air control to 3-way valve	174	348
1	20" control air tubing	20	20
1	1" BPE 90° T-clamp elbow	73	73
2	1" x 26" BPE tubing	30	60
2	BPE Tee, 2: tube end run x 1" T-clamp branch	212	424
1	1" sanitary steam trap, std. capacity	535	535
2	1" sanitary ball valves	155	310
4	Qty 1, 1" T-clamp ferrule, short	23	94
1	Qty 1, I/O port	250	250
	TOTAL MATERIAL COST		**$3,914**

Labor

HRS	LABOR DESCRIPTION (Field OH rates)	UNIT COST ($)	TOTAL COST ($)
3.5	cut and fit	80	280
4	orbital welds 8	80	320
4	polishing	80	320
1	control air tubing	60	60
1	stringing landing wire	60	60
1	configuring DCS/PLC I/O	100	100
3	commissioning	120	360
3	validation	160	450
	TOTAL LABOR COST		**$1,950**
	TOTAL CAPITAL COST		**$5,864**

A NEW SOLUTION

The problems associated with conventional bypass piping design resulted in creation of an ultra-capacity, dual element clean steam trap (Figures 12 and 13). It operates like this:

- Two bellows assemblies work together to handle sanitization liquids (rinse/CIP/rinse) and the heat-up and maintenance loads of larger vessels.
- During heat-up, both bellows are open, providing excellent capacity for eliminating air and condensate.
- The higher capacity bellows is designed to close when the vessel temperature is between 194°F and 212°F (90°C and 100°C). This allows the smaller, sanitary trap bellows to handle the smaller loads generated during temperature maintenance.
- No clean steam is lost during operation of the trap. Both bellows will close when the bellows sense saturated steam temperatures.

Innovations such as this by manufacturers will continue to improve the efficiencies of the SIP process. VM

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Keeping MSIVs in Top Condition

BY FELIX COULTER

Because of the critical function of main steam isolation valves (MSIVs) in nuclear applications, keeping these valves running at optimum performance levels is vital. This article covers what a good service team will do to ensure that happens.

MSIV'S ROLE

MSIVs are designed to close quickly and seal tightly in high-pressure steam service within power plants. In nuclear power, MSIVs are installed in the main steam line that runs from the reactor vessel in a boiling water reactor and from the main steam line of the steam generator in a pressurized water reactor. These valves are designed for fail-safe operating reliability during a loss of coolant accident necessitating closure within three to five seconds. They also must have design simplicity, tight shut-off, low-pressure drop and the ability to open against differential pressure.

Because providing continued optimum performance is so important, MSIV manufacturers have developed technical bulletins that outline recommended maintenance frequency and extensive procedures on how to perform work during a full service outage. For each such outage, a procedure is developed based on the specific plant's maintenance protocols and the OEM's valve drawing and specifications. Also addressed are the important safety factors involved based on the power plant's tools and operational setup.

Whether a full service outage occurs or a valve modification project to install upgrades is underway, the field service team interfaces on a daily basis with the valve OEM. The team works through every detail of the manufacturer's and the utility's safety procedures to ensure that everyone involved stays safe while the service work is performed and also to ensure the customer's expectations are understood and met. This preparation work is conducted prior to a service job and can take weeks. A pre-outage checklist is developed to cover every detail required to perform a safe and efficient service job in the field.

☐ Service crew training on how to remove poppet

This checklist development process confirms the job's scope and schedule, reviews the training requirements and rigging qualifications of the crew, verifies the use of special equipment such as respirators and scaffolds and outlines which personnel will hold the tags to lock-out or tag-out equipment.

The service team then sends a list of the minimum required rigging and tooling needed and identifies the proper personal protective equipment needed. To accomplish this, crew members could be asked to complete a personal history questionnaire and respirator training. The service team reviews the safety procedures of the valve OEM and a job safety analysis with the crew. They also review all plant safety procedures and have the crew members review the plant MSIV procedures and work orders. Job permits for rigging plans and con-

☐ Example of an MSIV

☐ Clean internals of an MSIV

fined spaces must be obtained when applicable. The team then reviews the plant's specific MSIV operating experience with the crew.

KEY CONCERNS

Important safety concerns when working on a MSIV include factors such as knowing the exact weight of each component before trying to lift or remove that component from the valve. This may seem obvious to a service person, but when safety is at stake, no guessing should be involved. The weights need to be verified by reviewing a drawing or by consultation with the manufacturer.

The focus of the process also goes beyond the need for safety. Service technicians need to be vigilant about how they handle the different valve components because of the expense of what's involved. If a part is damaged during disassembly or reassembly, thousands of dollars are involved for replacement costs and schedule delays can occur, which also means an extension of anticipated plant downtime. That's why a service team is diligent with pre-outage checklists and extremely methodical in how a job is planned and executed.

Parts are labeled and match-marked during disassembly to assure proper reassembly as well as conformance to design requirements. Once the valve is apart, it's meticulously vacuumed, wiped down, cleaned and the interior of the valve is inspected to ensure foreign material exclusion requirements are maintained. The entire job must be "white glove perfect" before the valve poppet assembly is reinstalled. Sometimes it can take four hours just to clean a valve body.

The orientation of the Y-globe MSIV body cover bore requires that the valve poppet assembly be removed and reinstalled at an exact 45-degree angle. A magnetized torpedo level enables the 45-degree rigging angle of the valve poppet to be maintained during removal and installation. If the 45-degree rigging angle is not precisely maintained, it could cause the poppet to jam in the body bore, which would damage the valve interior that a team may have spent those four hours cleaning. It also could introduce foreign material into the valve assembly.

As the valve is disassembled, spring stops are installed to ensure personnel safety. The air actuator and hydraulic cylinder are removed, followed by the spring hold-down bolts that unload the large springs for removal. Once the bonnet nuts are removed, the valve stem and poppet assembly can be removed, disassembled and inspected. The stem and poppet assembly is then reassembled and installed in the valve (after the inspection and cleaning of the valve body is completed). The bonnet and new packing are installed, followed by the upper structure, springs, hydraulic cylinder and air cylinder.

When the valve assembly is completed, the valve is opened and closed to verify proper operation and stem travel. Once the service crew is finished with all this, the plant's diagnostic crew checks the valve operation and makes any adjustments before the job is considered completed.

These are just a few highlights of the multitude of details involved in a full MSIV service job. (This column is intended to provide a general overview and should not be construed as a full list of safety concerns or a complete description of all work performed.)

Every plant involved with maintenance considerations for MSIVs should contact the OEM for a full evaluation of the valves in their specific plant as well as that plant's specific maintenance requirements.

Taking the types of steps outlined here, working directly with OEMs and understanding the specific challenges of a plant ensures nuclear plant personnel will be kept safe and service jobs can be completed to everyone's satisfaction. VM

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MAINTENANCE RECOMMENDATIONS

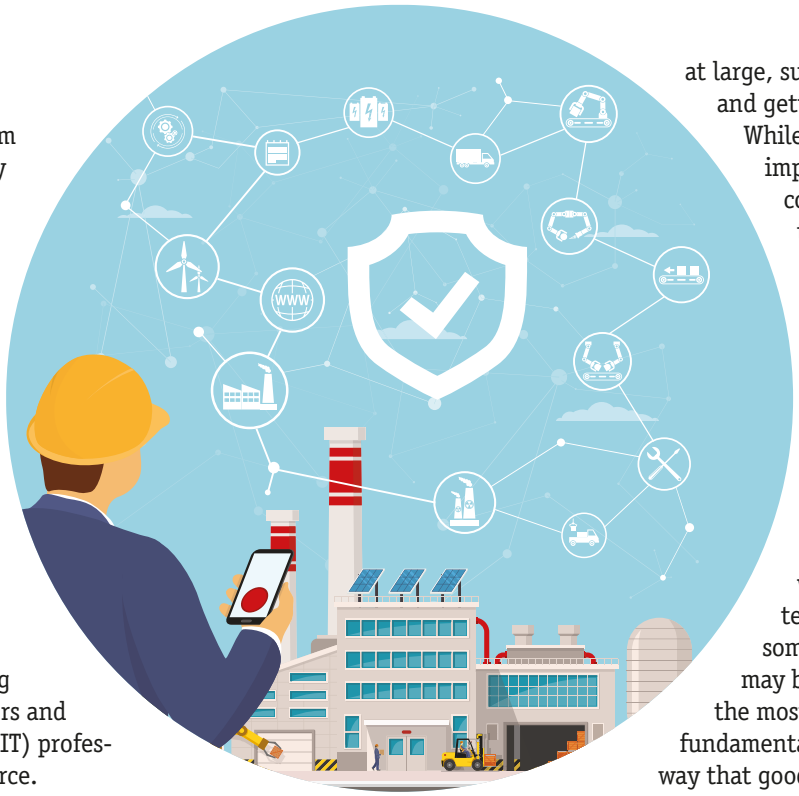
The following is a list of steps that should be taken for MSIVs during every refuel outage. It's based on years of experience derived from technical phone support, utility feedback, engineering design knowledge and onsite field representation:

- Inspect valve-stem for scoring and cleanliness with the valve-stem in the open (actuator retracted) position.
- Inspect the air cylinder, control panel and air supply lines for leakage with the valve-stem in the open (actuator retracted) position.
- Verify tightness of valve-stem jam nut.
- Inspect closing springs for cracks or signs of deformation.
- Ensure all external bolting is secure.
- Measure packing gland plate for proper alignment and look for signs of leakage.
- Measure lower spring plate alignment and guide pin clearance.
- Inspect cover-to-body flange joint for indications of leakage.
- Look for oil leaks around the hydraulic dashpot cylinder, piping and speed control valves.
- Check limit switches for proper contact and operation.
- Perform valve closure and observe for smooth operation.
- Measure valve stroke (time and distance).

Also, standard replacement parts should be on hand including cover gaskets, packing sets, locking tabs or plates, and stem and poppet assembly. Maintenance personnel must be well versed and trained in the MSIV's details to ensure safety for the crew and plant staff.

Essentials of Cybersecurity for Process Controls

BY MAURICE UENUMA



What used to be a problem for someone else to worry about is proving to be a concern that can no longer be ignored by anyone.

Cybersecurity is now one of the major risks facing the valve industry, and it is not a problem that can merely be solved by other parties besides the intended victim. Like industrial safety, addressing cybersecurity must be enterprise-wide to be effective—involving business leaders, engineers and information technology (IT) professionals across the workforce.

The accelerated convergence of IT with operational technology (OT) has introduced new cyber risks into process control environments, opening up the possibility of remote actors stealing data, disrupting processes and causing physical harm to machines and the people around them. Alongside the many operational, economic and safety benefits of interconnectivity, new vulnerabilities mean an enterprise cannot simply rely on an "air gap" to keep a plant isolated from external threats.

Meanwhile, growing threats from increasingly capable nation state-backed hackers, organized crime syndicates, terrorist networks, political agitators and common criminals seek to steal intellectual property, compromise business data, capture sensitive employee data and in some cases, undermine safety-instrumented systems to make a variety of physically dangerous attacks possible. This upward trend is undeniable: the Industrial Control Systems (ICS)—Cyber Emergency Response Team at the U.S. Department of Homeland Security reports a 210% increase in security events targeting ICS systems in three years. Meanwhile, the 2018 Verizon Data Breach Investigations Report showed that in the manufacturing sector, 86% of breaches are targeted attacks, suggesting they are the work of sophisticated attackers, who are less likely to be dissuaded by the costs involved. This is a much higher percentage than is found in other industries.

DEMYSTIFYING CYBERSECURITY

A significant roadblock in cybersecurity has been the common misperception it is a technology problem looking for a technology solution. With this view, cybersecurity matters would be handled by technologists in the IT department, who are expected to find technical solutions to a technical problem. In other words, the thinking is that if the technology was fixed, the problem would go away.

The disconnect here is analogous to believing that an epidemic is contained by deploying more doctors (after all, this is a medical problem, right?), when in fact the most significant countermeasures are hygienic behaviors exercised by the population at large, such as washing hands and getting immunizations. While doctors play a critically important role, they cannot contain an epidemic by themselves.

Similarly, cybersecurity is an ecosystem challenge looking for an ecosystem response. As such, many of the security measures necessary to protect the enterprise (including ICS) are adjacent to, integrated with, and reinforcing technical measures. While some technical measures may be sophisticated, many of the most effective measures are fundamental to security in the same way that good hygiene is fundamental to biomedical security.

EXCELLENCE IN ESSENTIALS

The confusion around cybersecurity is understandable, particularly given the relative newness of the topic for most working professionals. There is also a lot of noise to process in the form of news reports, regulatory requirements, products and services, internal policies and the countless options available for the budget-constrained businesses.

As it turns out, however, the data consistently yields common themes for how organizations are compromised and what needs to be done to prevent breaches. For example, the vast majority (nearly 85%) of cyber incidents reviewed by another recent Verizon report (2016 Data Breach Investigations Report) exploited known vulnerabilities for which there are known solutions. This means attackers compromised the business by exploiting a publicly known software vulnerability for which a patch was available (in 71% of cases, the patch was available for over a year). Another regular problem is the weakness of configurations, which are soft-

ware settings left in an exposed state, rather than modified to reduce the likelihood of compromise. According to a Dimensional Research study commissioned by Tripwire, 60% of respondents are not using common hardening standards from authoritative sources such as the Center for Internet Security (CIS) or Defense Information Systems Agency. Finally, humans remain the most common avenue of attack through social engineering tactics such as phishing emails designed to trick a user into performing tasks the attackers desire (e.g., clicking a link or opening an attachment.)

For these reasons, cybersecurity frameworks such as the CIS Controls and National Institute of Standards and Technology (NIST) Cyber Security Framework exist. These outline the foundational security controls every enterprise needs to implement. For security of industrial automation and control systems, a well-developed set of guidelines is available in the form of ISA/IEC-62443 [International Society of Automation/International Electrotechnical Commission] publications.

The fact is that these frameworks have been available for many years, but organizations still struggle to implement basic security measures, which underscores the importance of excellence in the essentials: focusing on mastering the foundational basics of security as the main effort, then building upon those basics with supplemental or more advanced capabilities as time and resources allow. This back-to-basics approach requires discipline and focus. Leaders must understand the importance of, and hold their teams accountable for, implementing, security frameworks. It also requires making the important trade-off decisions in favor of better-performing essentials, rather than chasing the mirage of a technological panacea (often in the seductive form of new tools). First and foremost, technological innovations should reinforce foundational security controls.

To assist with this approach, the security team at Belden, an industrial and enterprise connectivity firm, advises a 1-2-3 approach to industrial cybersecurity. First, organizations must secure industrial networks. This includes proper segmentation and zoning. A reference architecture for this is the Purdue Model, which delineates levels based on function and security risk. Second, organizations should secure industrial endpoints, which include workstations, human-machine interfaces and data historians (a common operating system in these environments is Windows XP, which has been out of support for years and is highly vulnerable). Third, industrial controllers must be secured.

By emphasizing excellence in these essentials, the owner-operator of a process control environment can remain focused on implementation of foundational cybersecurity frameworks and avoid the many pitfalls of chasing quick fixes that do not align with the disciplined work necessary for effective cybersecurity.

PEOPLE PROTECTING

Needless to say, excellence in the essentials includes the most important component of any organization—its people. Humans remain the greatest vulnerability of any business, but also its greatest asset. They are necessary to design, build and manage process control systems, and human behavior has a greater impact on the state of security than any other factor.

This is why cybersecurity is an enterprise-wide challenge requiring a cross-functional, interdisciplinary response. Everyone in an organization should be performing basic security-oriented tasks. For example, all employees should protect their authentication into enterprise systems. This means using unique, work-specific passphrases for important accounts; and, when possible, using multi-factor authentication (such as biometrics or one-time use codes). It also includes measures to protect sensitive information by sharing only what is necessary with authorized individuals, using encryption for transmitting information and being watchful for common phishing techniques via email. A working group under the National Initiative for Cybersecurity Education at NIST recently published a guidebook, *Cybersecurity is Everyone's Job*, that outlines essential tasks for individuals based on their job function within an enterprise. These guidelines serve as a good starting point for non-technical, non-security professionals.

Much of security is guided by mindset. Awareness, caution and reporting of suspicious behavior can have a tremendous impact on the state of security across an enterprise. Ultimately, human behavior is a cultural phenomenon, as culture (including organizational culture within a business) establishes values that drive behavior and define acceptable norms. To build a cybersecurity-oriented culture, then, the organization must engage in proactive culture-building. This requires strong leadership, reinforced by effective governance, performance management, training, education and collective learning from mistakes. Occupational safety is a fundamental component of organizational culture in sectors with process control systems. In much the same way that human behavior has become more safety-oriented in recent decades, so can human behavior become more cyber-secure.

TAKE-AWAYS

Cybersecurity is a clear and present challenge for organizations in the valve industry; but it is not an insurmountable one. By implementing excellence in the foundational security controls of human behavior essentials, an organization can substantially improve its security posture and build greater resilience.

Leaders can take steps to understand cybersecurity well enough to make informed executive decisions, integrate cyber risks into the broader enterprise risk management process, build a cyber-secure culture, hire the right people and drive cross-functional collaboration. Even in automated environments, nothing happens on its own. Process control environments require careful planning and execution, and so do the cybersecurity measures needed to operate successfully in the modern world of converged IT and OT. VM

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Solenoid Valves: Direct Acting vs. Pilot-Operated

BY JOHN MOLLOY

While presenting at a recent VMA Valve Basics 101 Course in Houston, I found myself in a familiar role: explaining solenoid valves (SOVs) to attendees. (I work with solenoids so much that one VMA member at that conference joked that I needed to be wearing an I Heart Solenoids t-shirt). During the hands-on "petting zoo" portion of the program, which involves smaller groups of attendees, one of the most frequently asked questions I get from people came up: What's the difference between direct-acting and pilot-operated SOVs, and how do we make a choice?

First, let's remember when discussing SOVs, the solenoid coil is the electrical apparatus of the valve. Think of it as the actuator with the balance of the valve being mechanical. With that in mind, a prescribed voltage would be required to energize the SOV to make it fully functional.

Direct acting is the type of SOV with the least amount of moving mechanical parts. Typically, a movable core (or plunger), spring and/or fulcrum lever are found inside the valve body. Once the SOV is energized, the magnetic field created in the solenoid coil attracts the movable core towards the coil's center.

The movable core, which was sealing an orifice, now allows for media (air/inert-gas, water or oil) to flow through the SOV from inlet to outlet (downstream). Note that all this "work" is a result of the fact the mechanical parts responding to the flux of the magnetic force are on or off.

A pilot-operated SOV also uses its coil to lift a movable core, but these valves have a pilot and bleed orifice that enables them to use a fraction of the line pressure from the media source to assist in the lift of either a diaphragm or piston. (Features that are not included in a direct-acting SOV).

John Molloy explains solenoid valves to a recent VMA Basics Seminar and Exhibits audience.

But why are there differences? Direct-acting SOVs, by design, are a zero minimum pounds per square inch gauge (psig); in fact, most can handle a vacuum pressure of -14.7 psig and also much higher pressure ranges. There are several tradeoffs associated with this. The main orifice size must remain smaller because if a larger pipe size is allowed, the coil would need to be larger to create more power to pull the moving plunger through the greater volume of media.

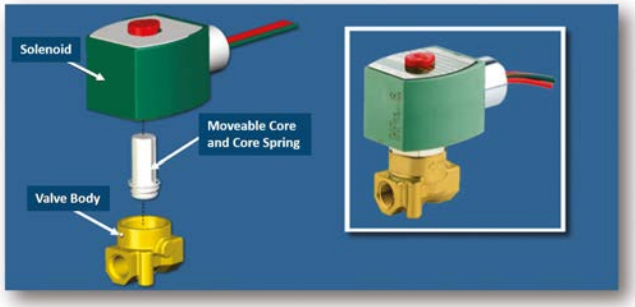
Conversely (internal) pilot-operated SOV, which is 'borrowing' from the media at the inlet, will also lift a diaphragm or move the piston enough to allow media to flow through a larger orifice, thus allowing pipe sizes to be greater than the direct acting. Additionally, the coil is doing less work, using less power draw or wattage (in most cases). This SOV with larger pipe sizes will be able to achieve higher Cv (Kv), therefore, greater standard cubic feet per minute or gallons per minute—generally more flow where necessary.

So again, what are the tradeoffs here? Pilot operated can also be zero minimum pilot pressure while maintaining the larger Cv. Flow ratings, added springs, and other mechanical attributes of the diaphragms or pistons will mean more movable parts, reducing maximum pressure rating, greater wattage usage from the coil and usually more cost per unit.

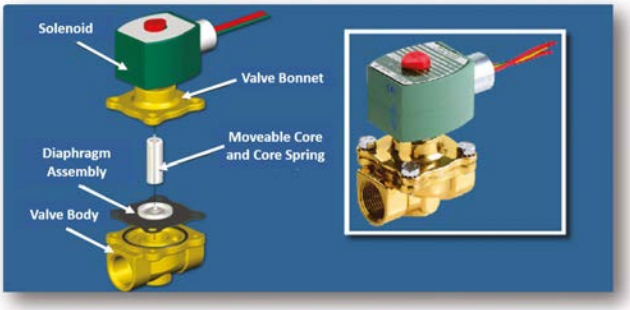
There are circumstances where the choice between a direct acting or pilot operated will overlap on pipe sizes. Using most of the information above, the end user must decide the best flow factor Cv (Kv), minimum pressure in the line, maximum pressure in the line, wattage consumption and cost of ownership (preventive maintenance, repair or replacement).

The topic of direct acting vs. pilot operated will be suitable across nearly all SOV types and configurations. For users, this may require 2-way, 3-way, or 4 way, direct-acting or pilot-operated SOVs; as with most equipment, the application will work best with the right educated choice. VM

JOHN MOLLOY is ASCO Training Manager for Emerson. Look for him at the next Valve Basics event, where he'll probably be wearing an I ♡ Solenoids t-shirt. Reach him at John.Molloy@emerson.com.



Schematic of the inside of a direct-acting SOV



Schematic of the inside of a pilot-operated SOV

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Why Check Valves Slam

BY JOHN V. BALLUN, P.E.

Check valves are important in water and wastewater pumping systems: They automatically open to allow forward flow and automatically close to prevent reverse flow when the pumps are not in operation.

The valves need to be low cost, and they should minimize energy consumption and require minimum maintenance. But most importantly, they should not slam and generate damaging pressure surges in the piping system.

☐ Figure 1. Multiple pumping system with resilient hinge check valves

CHECK VALVE SLAM

Check valve slam occurs after pump stoppage when reverse flow passes by the check valve disc before the valve is fully closed. The reverse flow is stopped instantaneously by the closed check valve, which causes a loud shock wave as well as water hammer in the pipe (Figure 2). The noise associated with the slam is not due to the impact of the disc slamming into the seat, but rather the rapid stretching of the pipe from the water hammer. Surprisingly, a resilient-seated check valve can make the same metallic slam sound as a metal-seated valve.

To prevent slam, a check valve must either be able to close in a fraction of a second or be fitted with oil dashpot devices or actuators to control its closure over several seconds or (depending on the length of the piping system) minutes. The dynamics of the pumping system (i.e., deceleration of the velocity from head, slope and pipe friction) dictates the necessary closure time. Systems with high head, steep slope, vertical pipe or surge tanks require the check valves to close rapidly (e.g., 20 milliseconds) versus a low-head, relatively flat system where a closure time of one second might suffice. This article provides an understanding of how the design and geometry of check valves affect their closure speeds.

A LOOK AT VALVE DESIGN

Laboratory tests and flow simulations have demonstrated that, to close rapidly, a check valve should contain the following design characteristics (Thorley, 1991):

- The disc should have low inertia and friction.
- The travel of the disc should be short.
- The motion should be assisted with springs.

With these three characteristics in mind, we can predict the closure speed of various waterworks check valve designs.

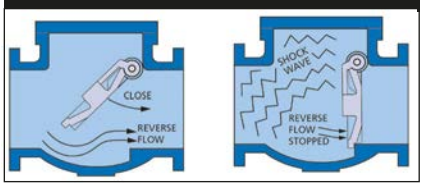
A ball check valve (Figure 3) is simple, compact and commonly used on small water or wastewater pumps where economy is important. Such valves consist of a threaded or flanged body with internal features that guide a rubber-coated ball in and out of the seat as the flow goes forward and reverses. Because the ball has high inertia, it must travel a long distance and it employs no spring, the valve closes slowly and often slams. Because of this, the valves should only be used in single-pump and low-head systems such as small lift stations.

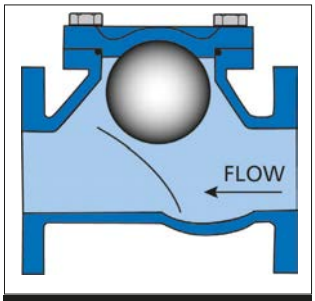
Similarly, the traditional swing check valve (Figure 4) described in AWWA C508 swings through a 90-degree stroke and is typically provided with a lever and weight. Again, because of the long stroke, inertia of the disc and weight, as well as the friction in the packing, the valve will close slowly and may slam in multiple-pump and vertical-pipe installations.

Ironically, it might be assumed that the weight makes the valve close faster. In actuality, it reduces slamming by limiting the stroke of the disc, but in return, may cause a significant increase in headloss. The valve closure is also slowed by the inertia of the friction in the stem packing. Slamming can be minimized by removing the weight and adding an external spring.

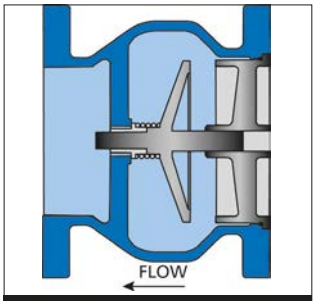
Conversely, silent check valves (Figure 5) do not slam and are commonly used in high-rise buildings where slamming sounds would be objectionable. When the flow is initiated, the disc is pushed to the left to allow forward flow. When the pump is stopped, the compression spring in the valve rapidly forces the valve closed before the flow reverses, which

☐ Figure 2. Slam is caused by reverse flow through the check valve.

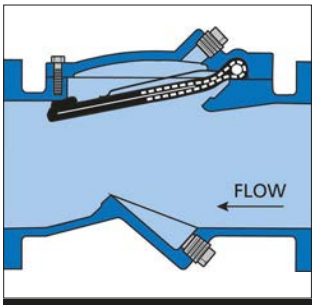




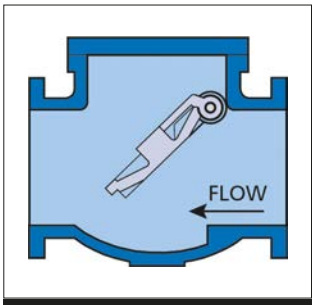
☐ Figure 3. Ball check valve



☐ Figure 4. Swing check valve



☐ Figure 5. Silent check valve



☐ Figure 6. Resilient Hinge check valve

provides silent closure.

Silent check valves close very quickly (i.e., in about one tenth of a second) because of their short linear stroke and strong spring. Unfortunately, because the disc remains in the flow stream, a silent check valve has high head loss and is mostly used for clean water applications with high head.

The newest type of check valve described in AWWA C508 and the valve having the greatest impact in the water/wastewater industry today is the resilient hinge check valve (Figure 6). As the name implies, the swing occurs from flex action in the rubber molded disc instead of rotation about a hinge pin. This valve has a short, 35-degree stroke, a spring and low inertia, which results in rapid closure similar to a silent check valve but without the head loss.

DYNAMIC CHARACTERISTICS OF CHECK VALVES

The valves presented above have varying degrees of closure speed. But how fast is fast enough?

Significant research has been undertaken to understand the dynamic closing characteristics of various check valves with the goal of predicting check valve slam (Ballun 2007). Figure 7 was developed to depict graphically the slam potential of various 8-inch waterworks check valves. The chart is based on measuring the reverse velocity through the check valve in a laboratory just before closing while exposed to varying ranges of system dynamics. The valves with a high potential to slam are presented on the left side. The horizontal axis displays the system deceleration (i.e., the speed at which the water column stops after pump stoppage).

In practical terms, a single lift pump system operating at 50 psig may have a deceleration of only 5 feet per second squared (ft/sec^2) and a ball or swing check may operate without a severe slam. But if a parallel pump system such as the one shown in Figure 1 is operating at higher pressures, then the deceleration may be 30 ft/sec^2, and a faster closing check valve is needed such as the resilient hinge check valve with spring.

The dynamic characteristics of the valves depend on valve size but no data is available at this time to predict the exact effect of size. Larger valves have heavier discs and longer strokes and will likely produce higher reverse velocities than predicted in Figure 7. A valve manufacturer should also be consulted for the potential impact of orientation and size on the performance of the selected valve.

SUMMARY

Every valve design has unique and predictable closing characteristics. Dynamic characteristic data for check valves offers the designer the tools necessary to evaluate the non-slam characteristics of various check valves. This information, combined with other readily available valve characteristics such as headloss, laying length, waterway design for fluids containing solids and cost will provide the designer with all the tools necessary to make reliable valve selections. VM

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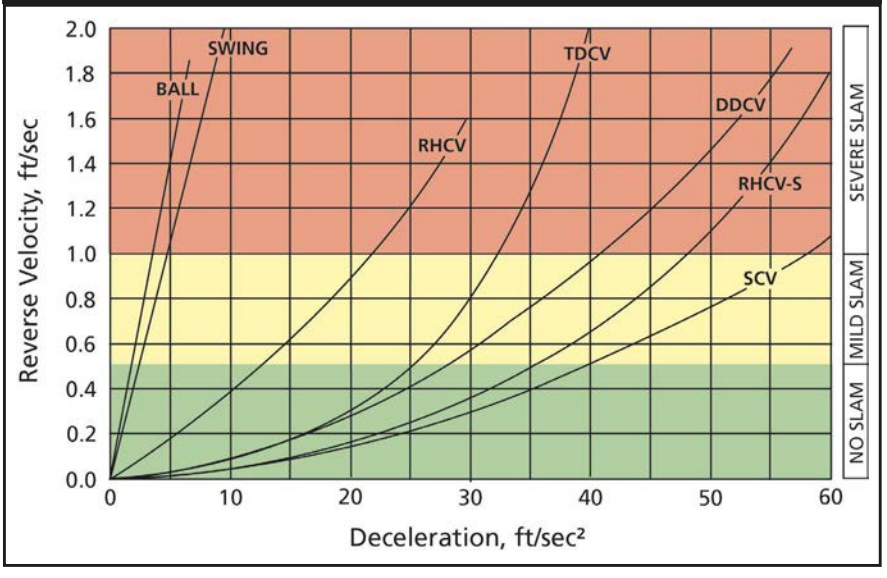
REFERENCES

1. American Water Works Association (2017), AWWA C508, "Swing-Check Valves for Waterworks Service, 2-In. Through 48-In. (50-mm Through 1,200-mm) NPS." Denver, CO.
2. Ballun, John V., (2007). "A Methodology for Predicting Check Valve Slam," Journal AWWA, March 2007, Denver, CO., 60-65.
3. Thorley, A.R.D., (1991). Fluid Transients in Pipeline Systems, D&L George Ltd, Hadley Wood, England, 22-23.

☐ Figure 7. Characteristic data for 8-inch ball, swing, resilient hinge (RHCV), tilted disc (TDCV), double disc (DDCV), RHCV with spring (RHCV-S), and silent check (SCV) valves



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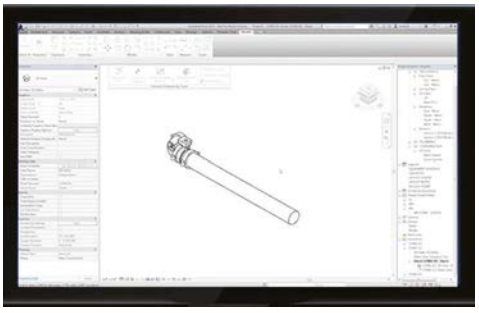
Victaulic released new features for Victaulic Tools for Revit. They include a component bank that captures an entire selection within a model, allowing users to save and recall selections from project to project. They also include a tap creator allowing complicated tap configurations based on user defined presets, and project maintenance, a way to transfer system families and loadable families into a project with a click. A free trial is available for download at www.victaulicsoftware.com.



A.W. Chesterton Company introduced Chesterton ViewIn Technology, a mechanical seal innovation that facilitates seal identification and maintenance.

Each seal is equipped with RFID tags that can be read using a Bluetooth-connected RFID reader to retrieve pertinent information, sealing device drawings, pressure test reports, materials of construction and supplementary items. The web/mobile application can be downloaded for free from the Apple Store or Google Play. Seal information also can be entered and accessed at viewin.chesterton.com.

Rotork extended its range of compact modulating actuators with new sizes specifically designed for reliable automation of larger linear control valves. A new actuator can reach up to 4,500 pound force (lbf) (20 kilonewton or kN) seating thrust. New sizes increase the CMA range modulating thrust performance to 3,000 lbf (13 kN) with a 4.5-inch (114.3 millimeters) stroke length for the automation of larger valves with higher pressure ratings.

Garlock launched ABRASHIELD, a proprietary expansion joint liner material designed for abrasion resistance and sustainability in demanding high temperature operating conditions. The product will be an option for use with several expansion joint products Garlock offers, including styles 204, 206, 7250, 8400 and 9394. The hydrogenated nitrile butadiene rubber used in the new liner performs significantly better than common abrasion resistant solutions, with an operating temperature range up to 300°F.

Crane released the XOMOX XP3 designed to comply with API 64. It is the first sleeved plug valve capable of passing five thermal cycles without any packing adjustments, in accordance with ISO 15848-1 BH CO3 SSO. Available for use in U.S. chemical and refining markets, this valve features a live-loaded design that optimizes seal performance, ensuring the seal integrity to atmosphere.

Emerson is expanding its ASCO Series 385 solenoid-operated rocker isolation valves to include new connection formats that provide greater installation flexibility, enabling improved machine design and simplifying assembly. The series' 3-way valves control the flow of aggressive, high-purity fluids in clinical diagnostic technologies and bioinstrumentation, including hematology platforms. The valve design features hermetic separation of the control mechanism and fluid-preventing particulate contamination.

AUMA has expanded its digital services portfolio with the new AUMA Cloud, a free and secure cloud-based solution for cost-effective asset management and condition-based predictive maintenance. The product provides an easy-to-use interactive platform to collect and assess detailed device information on all AUMA actuators in a plant. It allows plant operators to detect excessive loads or other problems at an early stage and take remedial action in time to prevent potential failures. VM

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—Robert Kemple, Jr.,
Executive Vice President, ASCO-Emerson

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To determine if your company meets the criteria for membership, visit VMA.org › Members for information on Qualifications, Benefits and Dues, and then apply Online.

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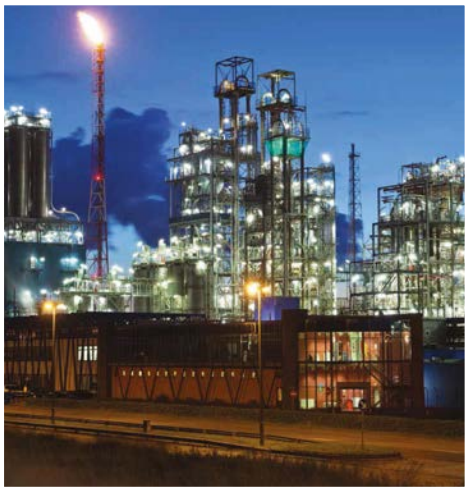

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