

POWELL NEXTGEN ENGINEERING TECHNOLOGY

We're back in the **BALL GAME**

**Complete Quarter
Turn Product Line
NOW AVAILABLE**



POWELL VALVES

www.powellvalves.com

Contact your Powell Representative at 513-852-2000

Improving efficiency & minimising downtime

It's in our DNA



For sixty years our customers have relied on Rotork for innovative and reliable flow control solutions.

Rotork products and services help companies in the oil & gas, water & waste water, power, marine, mining, chemical, pharmaceutical, and food industries around the world.

➔ Rotork Innovation

A Client Support Programme that helps you to:

- Protect your investment
- Increase plant availability
- Maximise productivity
- Reduce cost of ownership
- Protect the environment



Setting the standard for high quality valves in power generation

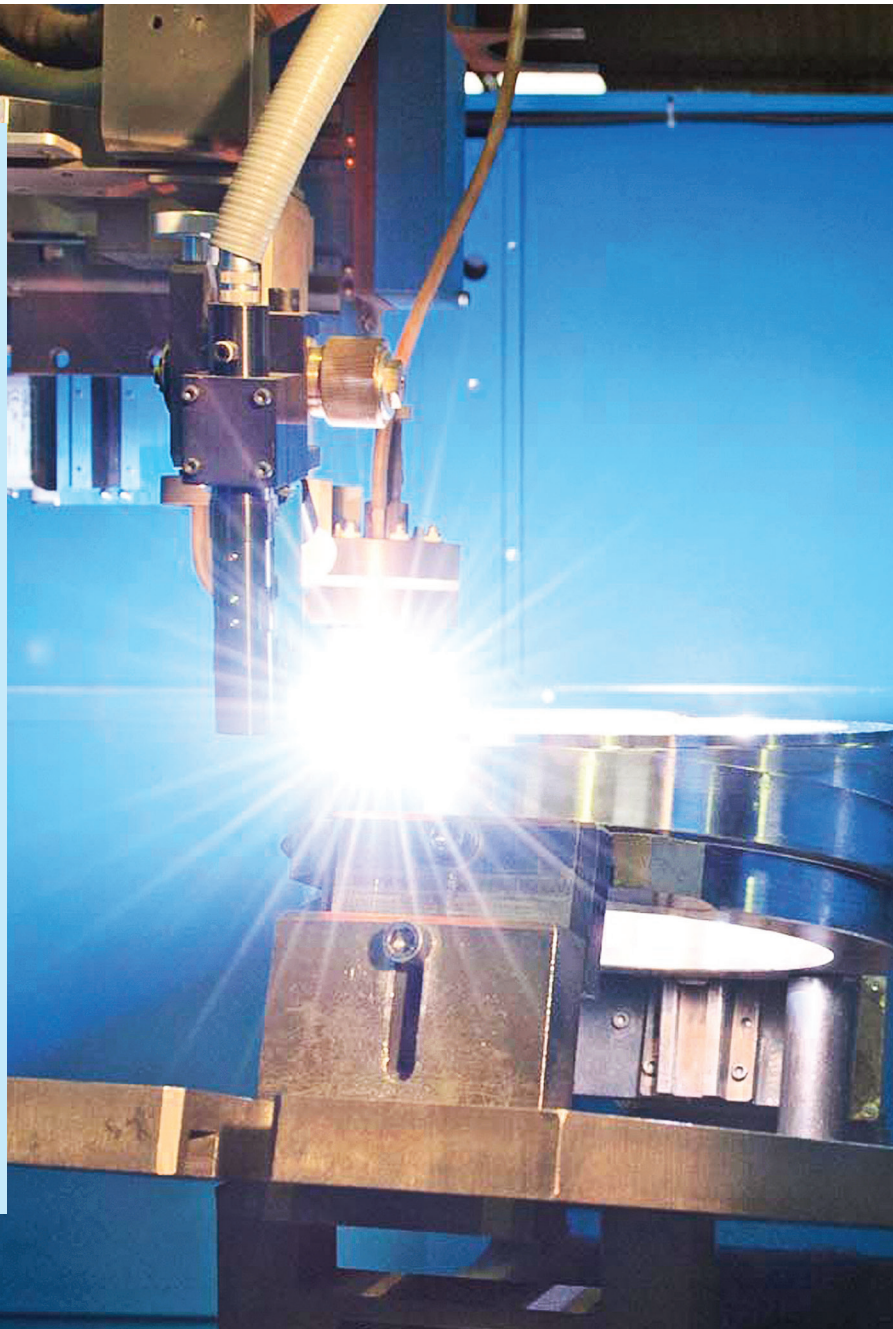


At Velan, we know what it takes to design and manufacture industry-leading valves that stand the test of time. After all, we've been doing just that for over sixty years.

In critical applications, both on the feedwater and steam side, key valve components such as wedges, discs, and seats are coated with a hardfacing material to protect them from the effects of wear, high loads, corrosion, and erosion.

To address the specific industry challenges related to hardfacing for high temperature applications, Velan has developed a set of best practices related to design, material specification and manufacturing processes in collaboration with Electric Power Research Institute (EPRI) and local universities.

We are well positioned to help you protect against the impact of thermal exposure and to be at the forefront of technology by installing Velan pressure seal valves.



+1 514 748 7743
www.velan.com

VELAN
Quality that lasts.

VALVE

MAGAZINE
WINTER 2018 | VOL. 30, NO. 1

26 Are Valves from Low-Cost Countries Getting Better?

Have valves that are partly or wholly made in low-cost areas of the world improved in the last quarter-century? VALVE Magazine asked valve experts their opinions.

BY KATE KUNKEL

14 BACK TO BASICS: VALVES WITH ALL THE TRIMMINGS

Choosing the right trim is vital to ensuring a valve and its parts operate correctly and efficiently.

BY GREG JOHNSON

18 ACHIEVING PREDICTABLE VALVE PERFORMANCE FOR SAFETY APPS

Valve users are collecting more data than ever through testing methods. Root cause analysis of that data can show possible failure for final element assemblies in safety devices.

BY CHRIS O'BRIEN AND LOREN STEWART

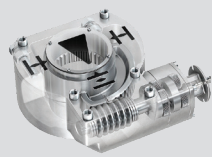
30 INTELLIGENT SERVICING OF VALVES DURING SHUTDOWNS

Aging plants can last a very long time when smart planning goes into shutdowns, turnarounds and outages.

BY JODI JOHNSON AND NAVÉ ORGADÁ

42 Editor's Picks

PRODUCTS



- Pressure Management
- Low-E Packing
- Gearboxes
- Electric-Hydraulic Control
- Automation Technology
- Integrated Seat Ball Valve
- Suspension System

NOW ON... VALVE



Epoxy Coatings for Valves

The waterworks valve industry has adopted some new epoxy coatings as a standard. The result is better protection against corrosion, tuberculation and wear as well as more efficient flow of fluids through piping systems.

- » Valves in Oxygen Service
- » Early IoT adopters Drive Revenue and Quality
- » Valves on Alaska's North Side
- » Is Valve Live Loading an Option?
- » AI, Machine Learning and Human Resources
- » Construction and Mining Outlook
- » Operating in Medium Density Slurry
- » Technology in a Low Price Environment
- » Young Valve Professional: Logan Moore
- » The State of Industrial Distribution 2018

COLUMNS

4 Perspectives
Seeing It All
BY BILL SANDLER

12 Education & Training
Valve Industry Knowledge Forum
BY JESSICA BELLO

34 Maintenance & Repair
Wet Valves
BY KATE KUNKEL

36 Actuators & Controls
Gearboxes 101
BY MARK BUJALSKI

DEPARTMENTS

- Industry Capsules ... 6
- VMA Calendar ... 7
- VMA and VRC Member Roster ... 40
- Index to Advertisers ... 44

EDITORIAL REVIEW BOARD

Justin Ledger
AUMA ACTUATORS, INC.

Lawrence Dec
CAMERON, A SCHLUMBERGER COMPANY

Don Bowers
CONVAL, INC.

Allen Ruef
MOOG, INC.

Ed Holtgraver
OTRCO, INC.

Julie Bodine
VALVTECHNOLOGIES

Neal Clevenger
VICTAULIC

VALVE Magazine (ISSN No. 1057-2813) is the official magazine of the Valve Manufacturers Association of America (VMA) and is published quarterly by VMA, located at 1625 K Street NW, Suite 325, Washington, DC 20006; 202.331.8105; Fax: 202.296.0378.

Advertising queries: 540.374.9100. Periodicals postage paid at Washington, DC, and at additional mailing offices.

POSTMASTER: Send address changes to VALVE Magazine, P.O. Box 1673 Williamsport, PA 17703-1673. Subscriptions are free to qualified readers in the United States and Canada; \$40 per year to unqualified readers in the United States and Canada; \$60 per year for all subscribers outside the United States and Canada.

Statements of fact and opinion made are the responsibility of the authors alone and do not necessarily imply endorsement or agreement on the part of the officers or membership of VMA. Materials may not be reproduced in any form without written permission of VMA.

© Copyright 2018. All rights reserved.

When You Think You've Seen It All....



Having visited over 100 valve, actuator and control plants in the past 40 years and toured the facilities of more than 50 end users of valves (including breweries, power plants, chemical plants, etc.), you would think I'd seen it all. You would be wrong.

During the first week of December, I attended the Power Gen Show in Las Vegas. The staff usually stays at the Bellagio Hotel when attending the show. I have always been fascinated by the hotel's fountains and the musical

shows associated with those fountains. At VMA's Annual Meeting in October, I referenced my upcoming trip in a conversation with VMA's past chairman Bob Kemple of ASCO. Bob informed me that his company's valves were used in those fountains, and he arranged a tour for me to see the internal operations.

Loni Singer, one of the Bellagio fountain managers, met with me and two guests, and then gave us an in-depth tour of the underground facility that helps those fountains run. In doing so, we saw valves and actuators manufactured by many VMA members, and how they control the movements of the fountains to coincide with the music.

Some interesting facts shared about the fountains were:

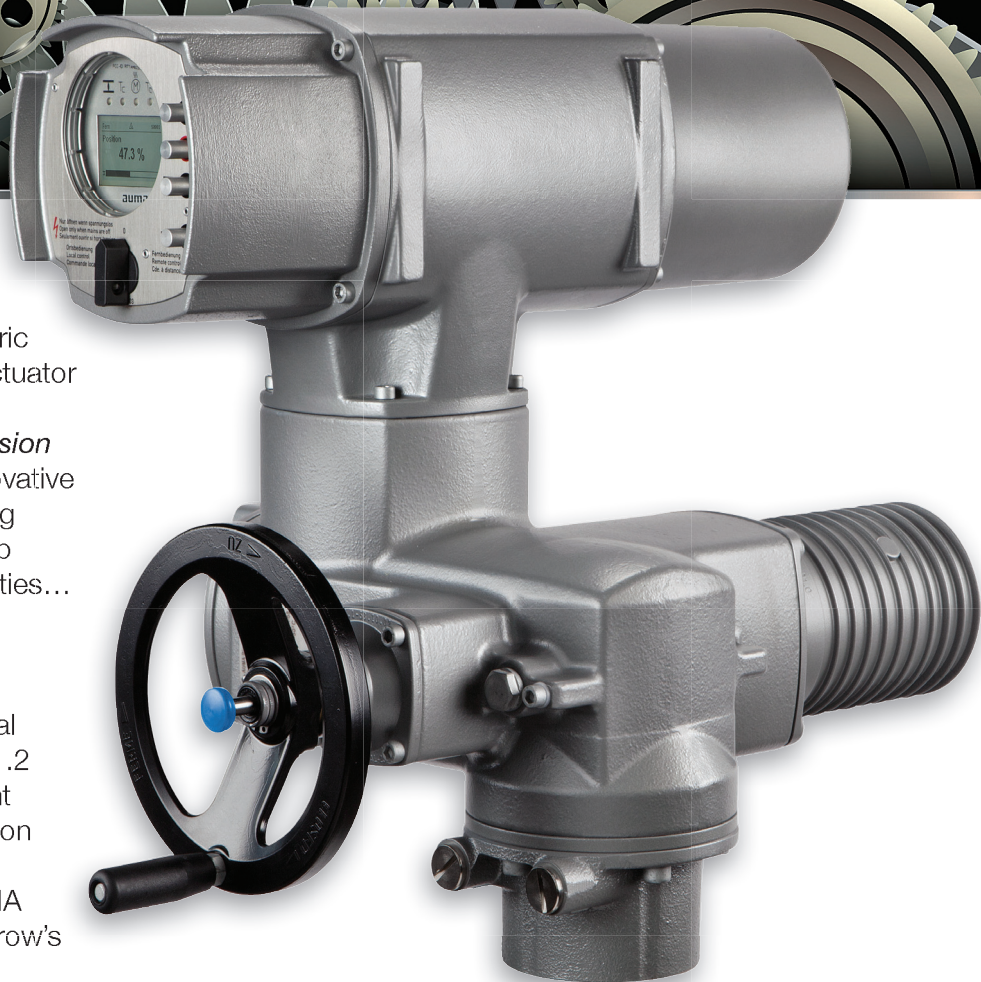
- They started up in 1998.
- There are over 1,200 water-emitting devices in the fountains.
- There are 208 oarsman (one of those water-emitting devices) in the lake with 15 spares.
- There are 791 mini shooters that have pressure to 125 psi and water that rises up to 120 feet high.
- The fountains have 192 super shooters that have 220 psi and rise up to 250 feet high.
- They also have 16 extreme shooters that have 460 psi and go up to 460 feet high.
- Five thousand underwater lights are used.
- Thirty employees maintain the fountains on 2- to 10-hour shifts.

The tour was definitely an eye-opening experience and made me realize that even with my long-term experience with valves, I haven't seen it all; hopefully, I've many other exciting developments to see in the future. **WM**

Bill Sandler

President, Valve Manufacturers Association of America

PRECISION



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

Futuristic design enables identical operation concept to generation .2 multi-turn actuators... Convenient features allow electrical connection via the AUMA plug and socket connector. A wide range of AUMA **actuator models** provides tomorrow's breakthrough technology today for diverse customer applications worldwide.

auma®

Solutions for a world in motion

AUMA Actuators, Inc.
100 Southpointe Blvd.
Canonsburg, PA 15317 USA
Phone: (724) 743-AUMA (2862)
Fax: (724) 743-4711
E-Mail: mailbox@auma-usa.com
Please visit us at our website: www.auma-usa.com

NEW CONTRACTS

MRC Global Renews Shell Framework Agreement

MRC Global (US) Inc. renewed an enterprise framework agreement with Shell Global Solutions International B.V. Under the agreement, MRC Global will stock and distribute mechanical valves for Shell's upstream, midstream and downstream assets used in maintenance, repair and operation and other projects. MRC Global will continue to provide pipe, fittings and flanges to Shell's operations in the U.S. and Canada.

ITT Engineered Valves, REXA Work with Classic Controls

ITT Engineered Valves certified Classic Controls to repair Scotch-brand FM-

approved and general-purpose burner shut-off valves for oil and gas-fired systems.

Meanwhile, REXA, Inc. appointed Classic Controls its exclusive authorized sales representative in the state of Florida. Classic Controls provides industrial process instruments in southern Georgia, Florida and the entire Caribbean.

Emerson to Modernize Controls for Hydro Fleet

Arizona-based Salt River Project (SRP), one of the nation's largest public power utilities, selected Emerson to modernize the controls of multiple hydro-power units and its central service center. SRP provides electricity to 1 million customers in the metropolitan Phoenix area and is also one of the largest raw-

water suppliers in Arizona. Emerson will replace existing PLC-based controls with its proprietary automation platform.

Metso Gets Four Major Chinese Orders

Metso received four major valve orders for the oil and gas industry from Chinese petrochemical customers. All orders are for greenfield investments started during the first quarter of 2017, with subsequent quarterly bookings in 2017 and continuing to 2018. All the companies in China are in the top 10 petrochemical businesses for that country

Rotork Supplying Thomson MRT Line

Following successful completion of a severe fire test, 1,300 Rotork actuators have been ordered for

tunnel ventilation damper control in the latest stage of the Thomson Mass Rapid Transit (MRT) line in Singapore.

The order is from a local damper manufacturer for RC200 high-temperature pneumatic actuators for installation on the fully underground, sixth section of the MRT line. In addition to ventilation, the dampers are designed to provide vital safety-related duties in the event of a fire.

Total Valve Systems Expands into Western U.S.

Total Valve Systems announced a new location in Perryton, TX. This action enables the company to better serve a growing customer base in Western Texas, Oklahoma, Kansas, Southern Colorado and New Mexico.

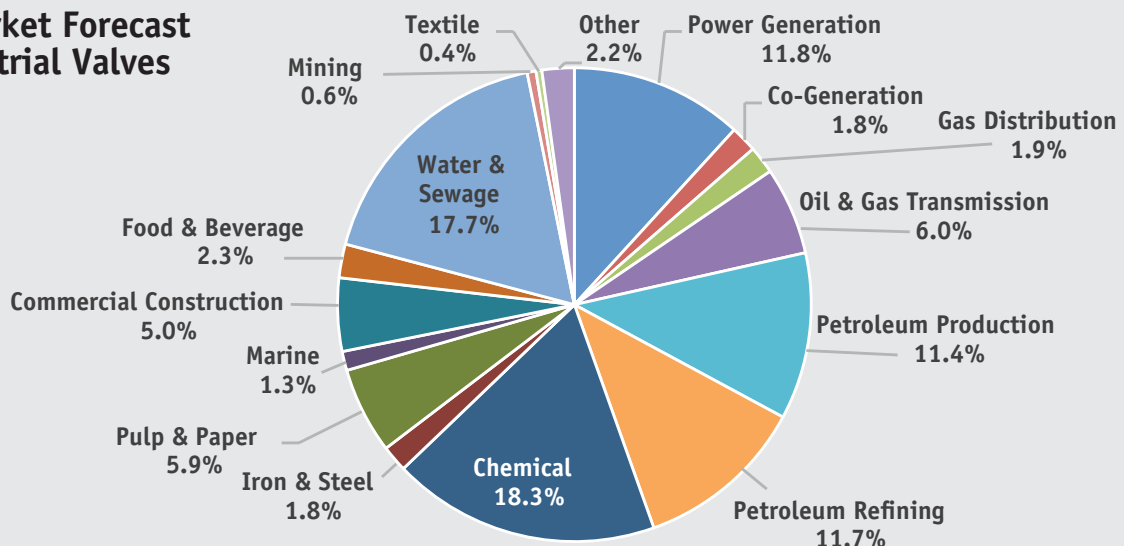
MARKET FOCUS: 2018 U.S. Industrial Valve Shipments Forecast

The valve industry will continue to see some improvement in 2018 with a growth rate of 1.45%, according to VMA's 2018 Market Forecast of Industrial Valve Shipments. While that rate is not as high as 2017's growth of 1.89%, the value of shipments for the year will rise: Shipments out of U.S. facilities will be \$4.615 billion in 2018 compared to \$4.549 billion in 2017.

Meanwhile, some end-user industries, such as petroleum

production and commercial construction, are forecast to increase their market share while others, such as water and wastewater, will lose some ground. Petroleum production will rise to 11.4% of the market from last year's 10.5% and commercial construction is now 5% compared to last year's 4.7%. Water and wastewater, meanwhile, will make up 17.7% compared to 2017's 18.1%.

2018 Market Forecast for Industrial Valves



The 8,000-square-foot shop will house Total Valve's product and service capabilities, focusing on ASME pressure relief devices, control and actuated valves, and API pipeline valves.

ACQUISITIONS & REORGANIZATIONS

Emerson Completes Paradigm Acquisition

Emerson completed the purchase of Paradigm, a provider of software solutions to the oil and gas industry. Paradigm will be combined with Emerson's Roxar software business to create a comprehensive exploration and production software portfolio offering. Paradigm is headquartered in Houston and has more than 500 employees globally.

CIRCOR Completes Colfax Fluid Handling Acquisition

CIRCOR International completed a previously announced acquisition of Fluid Handling from Colfax Corporation for about \$693 million of cash and newly issued CIRCOR shares, and assumption of pension plan liabilities. FH will become a third group within CIRCOR and will be called Pumping Technologies.

Metso to Implement New Operating Model

Metso's Board of Directors approved a new operating model and organization effective Jan. 1, 2018. The new organization will strengthen its service and product businesses in the minerals and flow control markets.

Metso's new business areas will be mining equip-

ment, aggregates equipment, minerals services, minerals consumables, recycling, valves and pumps. The group's current reporting segments, minerals and flow control, remain unchanged.

AWARDS & RECOGNITION

Conval Receives Export Recognition

On Conval's 50th anniversary, the company received an Export Recognition Award from the Connecticut District Export Council and the office of Rep. Joseph Courtney (D-CT).

District Export Councils are organizations of business leaders from local communities, whose knowledge of, and expertise in, international business provides a source of professional advice for a region's local firms.

DeZURIK Valves Operating After 19 Million Cycles

DeZURIK 8-inch Figure 118 valves have operated in a water treatment plant in Tupelo, MS every 45 seconds for 27 years; more than 19 million cycles. The valves have survived with-



□ DeZURIK's long-service valves

out repair all that time. Only the actuators have been repaired or rebuilt.

The valves are connected to the top of an airtight 16-foot-deep chamber with openings underwater. When the valves close, vacuum pumps turn on and raise the water level in the chamber. After 45 seconds, the valves open and let air back into the chambers and allow the water level to drop back to normal, pushing water out of the openings. That action causes a stirring effect in the water tank and keeps solids from settling.

VanAire Celebrates Manufacturing

Delta County, MI K-12 students and parents attended "Industry After Hours" at VanAire to learn more about the high-technology,



□ On hand for the Conval presentation were (from left) Tajah Anderson, representing Rep. Courtney; Don Curtin, president of Conval; John Schuyler, chairman of the Connecticut District Export Council; and Anne Evans, director of the Connecticut District Export Council.

MARCH

19-22
Electric Power Conference & Exhibition
Nashville
2018.electricpowerexpo.com

22-23
VMA Leadership Forum*
Arlington, VA
www.VMA.org/LeadershipForum

APRIL

11-13
VMA Valve Industry Knowledge Forum: Seminar, Exhibits & Tour
Savannah, GA
www.VMA.org/KnowledgeForum

30- MAY 3
OTC18 (Offshore Technology Conference)
Houston
www.otcnet.org

JUNE

6-8
Valve Repair Meeting, Exhibits & Tour
Houston
www.VMA.org/ValveRepair

AUGUST

8-9
VMA Market Outlook Workshop*
Chicago
www.VMA.org/MarketOutlook

SEPTEMBER

25-27
VMA/VRC Annual Meeting*
Lake Tahoe (Truckee), CA

OCTOBER

30-NOV 1
VMA Valve Basics Seminar & Exhibit
Pasadena, TX
www.VMA.org/ValveBasics

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

VALVE MAGAZINE

STAFF

PUBLISHER

William S. Sandler

ASSOCIATE PUBLISHER/
EDITOR-IN-CHIEF

Judy Tibbs

MANAGING EDITOR

Genilee Parente

SENIOR EDITOR

Kate Kunkel

ASSISTANT EDITOR

Chris Guy

CONTRIBUTING EDITOR

Greg Johnson

ART DIRECTOR/
PRODUCTION MANAGER

Michelle Wandres

ADVERTISING DIRECTOR

Sue Partyke

**How to Contact
VALVE Magazine**

EDITORIAL OFFICES

13613 Baycraft Terrace
Midlothian, VA 23112
phone: 804.639.1365
email: jtibbs@vma.org
www.ValveMagazine.com

ADVERTISING SALES

Sue Partyke
145 Harrell Road
Suite 119
Fredericksburg, VA 22405
phone: 540.374.9100
fax: 540.374.9265
email: spartyke@vma.org

CIRCULATION/SUBSCRIPTIONS

phone: 570.567.1193
fax: 570.320.2079
email:
valve@psaemail.com

NEW PRODUCTS, MEDIA AND
INDUSTRY NEWS

Chris Guy
phone: 571.274.5224
email: cguy@vma.org

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.

high-skilled manufacturing jobs that are available. Over 276 participants were treated to a fun, entertaining and informative event that inspired a future generation of manufacturers. During the event, various manufacturing myths, along with pumpkins, were busted by VanAire CEO Steve Soderman and Tony Lambert, vice president of valve automation hardware.

**Annual Big 50 List Includes
VMA Members**

MRC Global (Number 9), NOW Inc. (Number 13) and Wolseley Industrial Group (Number 16) are all on the latest Big 50 List, Industrial Distribution's annual registry of the largest industrial distributors in the world. MRC and Wolseley are VMA associate members, as is DistributionNOW, a subsidiary of NOW Inc.

All Big 50 companies are ranked according to 2016 total worldwide sales from North American operations.

**Emerson Announces ASCO
Scholarship Recipients**

Emerson announced recipients of the ASCO 2017 Engineering Scholarship: Alexandra Lomasney, Peabody, MA; and Richard Hollenbach III, Hatfield, PA. The students were awarded a \$5,000 scholarship to support their pursuit of a bachelor's degree in engineering. Emerson will support the recipients' schools with an additional \$1,000 grant to the engineering departments.

**Spirax Sarco Celebrates Lack
of Lost-Time Accidents**

Spirax Sarco recently reached a safety milestone: 2.4 million man-hours or four years without a lost-

time accident. That means 288 employees did not miss work due to an injury suffered on the job.

NEW FACILITIES**Weir Opening Customer Service
Center**

Weir Oil & Gas broke ground on a 92,000-square-foot customer service center in Midland, TX. The new center consolidates three existing Permian-area service center locations into one central facility. It is scheduled to open by 2019 and will offer pressure pumping and pressure control testing facilities, a central hub for field-service operations, office space, a shop area and a warehouse.

**Emerson Opens Solutions
Center**

Emerson opened a customer-focused Solutions Center at the regional headquarters of its Automation Solutions business in Singapore. The opening is part of the company's drive to make Singapore a hub for delivering Industrial Internet of Things (IoT) technologies and services for customers across Asia Pacific. To mark the opening, the company unveiled a collaborative project signed with Singapore Polytechnic to advance training of the digital workforce of the future. The Emerson Solutions Center in Singapore has collaboration spaces and state-of-the-art multimedia technology, including augmented reality and virtual reality.

**Victaulic Expanding Lehigh
Valley Presence**

Victaulic is planning new investments in 2018 and 2019 in Lehigh Valley, PA.

Victaulic CEO John Malloy made the announcement at the Lehigh Valley Economic Development Corporation's 2017 Fall Signature Event.

Cast-Pac Inc., a manufacturing company Victaulic has partnered with for 20 years, will move its operations to an unbuilt facility in Lower Nazareth Township, PA in 2019. Victaulic is purchasing 28 acres to build a 400,000-square-foot facility where Cast-Pac will operate. Victaulic also is making a capital investment in its existing Lower Macungie Township, PA facility.

NEW CERTIFICATIONS**ValvTechnologies Receives ISO
15848 Certification**

ValvTechnologies' EcoPack technology received ISO 15848-1:2015 certification from Odin Heavy Industries. To earn the certification, ValvTechnologies underwent a stringent evaluation process that included a series of 17 helium leak tests and eight thermal cycles on a fully assembled valve over a period of 100,000 cycles. After test completion, the valve was disassembled and all sealing components were examined.

**Crane ChemPharma & Energy
Announces NSF Certification**

Crane ChemPharma & Energy recently obtained NSF-61 and NSF-372 certification of its Stockham butterfly valves for potable water and lead-free service. Standard 61 ensures a product is safe for use in drinking water and meets the regulatory requirements for the U.S. and Canada

PEOPLE IN THE NEWS

NOW INC.... which operates under the DistributionNOW brand, announced that **Daniel Molinaro** will serve as executive vice president effective Feb. 16, 2018. Molinaro will transition from serving as senior vice president and CFO during this period, and **David Cherechinsky**, currently vice president, corporate controller and chief accounting officer, will succeed Molinaro as CFO. **Mark Johnson**, currently vice president—finance and assistant corporate controller, will succeed Cherechinsky as vice president, corporate controller and chief administrative officer.

ADMIRAL VALVE... named **David S. London** president. London most recently served as vice president of sales and marketing for CPV. Admiral Valve also appointed CFO **Kelly Tomlin** to the expanded role of executive vice-president.

EMERSON... COO **Ed Purvis** retired in 2017 after 34 years with the company. Purvis began his career with Emerson in 1983 as a product planner with Copeland Corporation. **Steve Pelch**, formerly executive vice president of organization planning and development, has succeeded Purvis as executive vice president and COO of the company.

FLOWORKS... promoted **Scott Jackson** to president, assuming the responsibilities of CEO **Frank Riddick** effective immediately. Riddick will remain a member of the board of directors. Jackson became president after serving as president of the Valve and Automation Division.

REXA... President and CEO **Sam Lalos** retired at the end of 2017. During his 40-plus years in the industrial process control equipment manufacturing field, Lalos succeeded in numerous technical, business management and executive functions. **Geoff Hynes** was appointed president and CEO effective Jan. 1, 2018. Hynes has spent his entire career with REXA.

VALVTECHNOLOGIES... appointed **Cliff Horsburgh** regional director, Asia Pacific. A native of Scotland, Horsburgh spent most of his career with the Weir Group, most recently as general manager for South East Asia for Weir Power and Industrial. He also held international sales and general management responsibilities for Africa, the Middle East and Europe.

WEIR... appointed **Mark Claffey** president of Weir Valves & Controls USA Inc. He has been with Weir since August 2013 and most recently acted as interim president. Claffey has over 17 years of experience in the flow control industry.

Chris Toncheff joined Weir Flow Control as vice president of sales and marketing. Toncheff has spent almost 30 years in the flow control industry.

FLOWSERVE... named **Lee Eckert** senior vice president and CFO. Eckert joins Flowserve from CHC Group LLC, a global commercial helicopter service provider to the offshore oil and gas industry, where he served as senior vice president and CFO since 2015.

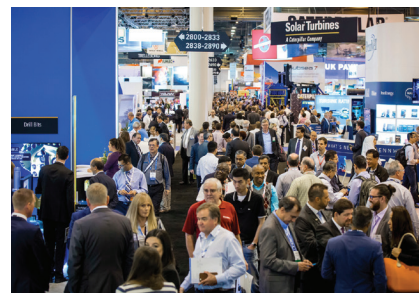
Flowserve also appointed **David Wilson** president, Industrial Products Division (IPD). Wilson succeeds **Tom Pajonas**, executive vice president, Global Operations, and interim president, IPD, who has retired.



David Wilson

MUELLER WATER PRODUCTS... announced that **Evan Hart**, senior vice president and CFO, has retired. **Marietta Edmunds Zakas**, who formerly served as senior vice president, strategy, corporate development, human resources and communications, took over as CFO following Hart's retirement.

OTC Conference Focuses on Subsea Equipment



Energy professionals from around the world will convene in Houston for the Offshore Technology Conference (OTC) to discuss the latest tools for advancing offshore operations, including valves and pipeline components, as well as get updates on what's happening in the industry. The event is April 30 to May 3 in Houston's NRG Park.

The OTC conference brings together professionals from more than 120 countries. The event was founded in 1969 and is sponsored by 13 leading industry organizations and societies, which work together on a technical program. The program features top-notch industry expert presentations on subjects such as updates on world projects, strategies for working in a lower-priced environment, new developments in major offshore basins, safety and risk management, renewable energy and more.

Featured in the technical program this year will be ways to more quickly deploy new technologies and decrease costs while improving overall value. Another important highlight focuses on ways that advanced software, nanotechnology and the digital revolution are integrating disciplines and triggering historic transformation in the offshore energy sector.

In addition to the technical program, the exhibit hall features more than 2,500 companies that bring their products and services to the market. Exhibitors include many VMA members.

For information on the conference, go to 2018.otcnet.org.

New Chairman for VMA; Professionals Honored at Annual Meeting

Mark Nahorski, president of PBM, Inc., took over as VMA chairman during the association's annual meeting in October 2017. Nahorski succeeds **James White**, senior general manager, Target Rock Group (a unit of Curtiss-White Valves Group). White now moves to the immediate past chairman spot on the board.

Other officers elected at the meeting included **David Hughes**, director of Global Strategic Accounts for Final Controls (a unit of Emerson Automated Solutions), who serves as vice chairman; and **Bryan Burns**, president and COO of DeZURIK, Inc., who became program chairman.

New to the board this year are **John V. Ballun**, president and CEO, Val-Matic Valve & Mfg. Corporation; **Yves LeDuc**, president and CEO, Velan; and **Matt Thiel**, president, AUMA Actuators. Continuing their terms are **Arie Bregman**, vice president and general manager, DFT Inc.; and **Jim Walther**, president, KITZ Corporation. Board members serve two, three-year terms.

HONORS BESTOWED

At the annual meeting, two retiring board members were honored for service to the association: **Bob Kemple** of ASCO and **Jim Gray** of GE finished the second of three-year terms and were presented plaques in recognition of their service to the association.

Also at the annual meeting, two surprised individuals were recognized for years of service.



□ New VMA 2017/18 Board Chairman Mark Nahorski, PBM Inc., accepts the gavel from outgoing chairman Jim White, Curtiss-Wright.



□ Bill and Ellen Sandler are congratulated by Jim White.



□ Tony Pecora

Receiving the association's prestigious Person of the Year award was **Tony Pecora**, AUMA Actuators. He has been an active member of VMA since his company joined the association in 1993, and he has served on numerous committees over the years, most recently the Nominating Committee and the Program Committee. In presenting the award, outgoing chairman **Jim White** said Pecora "has been a reliable and dedicated member for many years, always willing to serve where asked."

Meanwhile, a special

award was created and presented to **William Sandler**, VMA's longest running president for the association. Sandler was given a "Man for the Decades" award for his 40 years of service to VMA. Bill and his wife **Ellen Sandler** were called to the podium to be recognized by those in attendance. Bill was presented a plaque showcasing a VALVE Magazine article that featured his long service to the industry. Ellen was honored for her contributions to the programs that involve spouses.

Outgoing chairman Jim

White presented the Man for the Decades award and pointed out that Bill Sandler "has guided the VMA and its members through the ever-changing industry and has continuously and honorably represented the organization, always working to provide VMA's members with the highest quality association services possible."

Three individuals were also honored with VMA Service Awards.

- **Dale Friemoth** of Crane, who has been an active member of the Technical Committee for many years. He has also taken the lead to solicit presenters for VMA's Annual Meeting.
- **Mark Novak** of Check-All Valve, who has been instrumental in providing VMA with speakers from various universities across cities that have hosted the Manufacturers Workshop over the past few years, as well as chairing the Manufacturing Committee.
- **Kelly Watson**, formerly of Watson Grinding & Mfg., who has been an integral member of the Communications Committee. Serving as chair this past year, she played a key role in moving the Valve Careers initiative into the forefront and has continuously proven herself a dedicated champion for VMA's communications efforts.

VMA will celebrate its 80th anniversary at the next annual meeting Sept. 25-27 in Lake Tahoe, NV.

Valve Basics: A Top-Notch Facility, a Well-Received Program

Both the new facility—the Houston Area Safety Council—and an expanded “valve petting zoo” received high praise from participants in the latest Valve Basics Seminar & Exhibits, Pasadena, TX. The event was Oct. 3-5.

“This is a great investment in training that will help propel my career forward!” noted an engineer from Newfoundland. She said the course gave her an in-depth view of a wide range of valve/actuation types and provided her with a much better understanding of valves, components, accessories and schematics.

Members of VMA’s Education & Training Committee, chaired by Paul Souza of AUMA Actuators, were particularly pleased with the high proportion of less-experienced professionals who attended the event. This is because such attendees are why the Valve Basics program was created in the first place. About 66% of those attending had either 1-2 years previous experience in the industry, while another 20% had 2-5 years.

Committee members also were pleased with the sizeable number of end users and distributors who were there. Attendance was evenly divided between valve users, engineering, procurement and construction personnel and distributors (50%) and valve manufacturers, suppliers and others (50%).

Souza also said he wasn’t surprised that the overall satisfaction with the event



□ Matt Lovell and Greg Johnson of United Valve instructed attendees in some of the essentials of valve repair.

was rated at 4.8 out of 5.0.

“I’ve been a training manager for many years, and I can usually tell when the course attendees are

tuned in to what you are presenting. We had terrific questions throughout the event. This group was really engaged—from the actual presentations to the exhibits to the hands-on learning portion.”

United Valve’s Greg Johnson, founder of the Valve Ed program and former chair of the VMA Education & Training Committee, also was pleased with the Valve Petting Zoo and the new location for the event: “We tried a new formula,” Johnson explained. “Instead of one, half-day session where attendees went around to 10 different tables featuring products discussed, the round-table sessions were sprinkled throughout, with two one-hour sessions held each day.”

Meanwhile, the Houston Area Safety Council setting included a spacious

workshop where presenters could bring in much larger product samples. These samples can now be stored on site for future basics programs.

“Having been to every petting zoo we’ve had over the years, this format really was the best,” Johnson said. “While it was somewhat of an experiment, it worked out so well, we’ll repeat it when we meet again.”

That meeting will take place this fall, when VMA returns to the Houston Area Safety Council for the next three-day Valve Basics 101 Seminar & Exhibits, Oct. 30-Nov. 1, 2018. Registration for that event opens this summer. More information is available on the VMA website at www.VMA.org/ValveBasics, or contact Abby Brown, VMA education & training coordinator, at abrown@vma.org.

VALVE BASICS 101 LESSONS

- Introduction to the Industry
- Linear (Multi-turn) Valves
- Check Valves
- Quarter-turn Valves
- Pressure-relief Valves
- Electric Actuators
- Actuators – Manual & Fluid Powered
- Control Panels for Fluid Powered Actuators
- Control Valves & Systems
- Packings & Fugitive Emissions
- Valve Materials
- Solenoid Valves
- Critical Service
- Valve Data & Feedback
- Valve Repair

VMA Knowledge Forum Offers New Educational Opportunity

BY JESSICA BELLO

VMA has combined the best of three different VMA meetings into one education-packed event that offers a rich array of knowledge ranging from technical updates to operational tips to staffing and other personnel issues.

The first-ever Valve Industry Knowledge Forum will be April 11-13, 2018 at the DeSoto Hotel in Savannah, GA.

To create the new opportunity, three former VMA events—the Technical Seminar, Manufacturing Workshop and Human Resources Workshop—have been put into one event with three distinct tracks.

Each track offers a range of sessions over a day-and-a half (April 12 and 13). Before this professional program, the conference also offers an optional tour day (April 11). On one of the conference days (April 12), exhibitors will showcase products and services of interest to professionals in those areas of the industry during a tabletop exhibition.

The conference format was chosen to give attendees flexibility to mix and match tracks as well as to share social events to provide broad networking opportunities.

Attendees will receive a certificate for 12 professional development hours. Those who attend a technical track breakout session will also get an additional three hours.

Most importantly, this joint event means a more meaningful dialogue between different segments of the valve industry while expanding the attendee base and the ability for individuals to learn about other areas of the valve business. Here's some of what's being offered:

ADVANCING VALVE INTEGRITY THROUGH TECHNOLOGY

The technical track targets experienced technical and engineering personnel working with valves and

related products. Attendees will hear from two keynote speakers:

Kevin Swift, chief economist for the American Chemical Industry, will discuss economic trends and what the future of the industry might hold. He will provide perspectives on energy and feedstock supply from both basic and specialty chemicals and offer an industry outlook, while assessing implications for capital spending.

Tony Smart, senior mechanical engineer at Shell Global Solutions International, will also keynote for the technical track. With his advanced engineering and corporate background, Smart will deliver a presentation on the International Association of Oil & Gas Producers (IOGP), a worldwide group of major oil companies seeking to simplify and standardize procurement of equipment and services across oil companies. Smart will outline the vision and goals of the group's joint project and explain how that project may impact the valve industry.

Other sessions for the technical track will address hydrogen embrittlement in the oil and gas industry; end-user special applications; advances in welding and manufacturing; minimizing casting issues; control valve diagnostics; bolt tensioning and gaskets; advances in nondestructive testing; early identification of dimensional issues with portable in-process precision 3D laser scanning; review of the IOGP specification S-562 for ball valves; ISA 96 valve automation standards and more. The track will include individual speakers, panel discussions and a breakout session workshop on Grade 91 steel.

COMBATting COMPLACENCY IN MANUFACTURING

The manufacturing track was developed for those who work or supervise

the production and assembly processes for their companies. It kicks off with a session by **Brad Livingston**, a

motivational and safety speaker who was involved in an incident of back-to-back explosions during his career that he reports was 100% preventable. Livingston returns to the VMA podium to share with attendees his personal and emotional story in hopes that others will remember that safety should be every employees' utmost priority, especially in the manufacturing industry.

The manufacturing track also offers a variety of valve manufacturing environment topics, such as: additive manufacturing of valve components; the role of automation in the current economy; the internet of things; motivating employees; and a panel with speakers who will answer questions about the topics discussed in each of the sessions.

IMPROVING THE EMPLOYEE EXPERIENCE

Those in the valve profession in HR departments as well as company leaders who want to hear the latest thinking and legal issues with staffing and personnel can attend the human resources track. The track is designed to provide perspective on how valve manufacturing companies can improve the employee experience—from recruiting to onboarding to mentoring and training.

Mary Ann Pacelli, workforce development program manager for the Manufacturing Extension Partnership (an initiative of the National Institute for Standards and Technology), will open the HR track. Pacelli



brings her lengthy federal experience and manufacturing workforce know-how to the floor to address issues such as how to cultivate a successful workforce development program through building pipelines, networks, partnerships and talent strategies.

Louis Lessig, employment litigator and partner at the law firm of Brown & Connery, LLP, will present two sessions relevant to legal issues in today's workforce. First, he will discuss the outcomes of the top 10 employment cases of the past year and relay what human resources professionals can learn from the situations that created those cases. Lessig also will host an enjoyable, informative Jeopardy-style game covering the Federal Medical Leave Act, the Americans with Disabilities Act and the Fair Labor Standards Act. Attendees will have a chance to "Stump the Lawyer" with their wildest and most challenging legal questions and issues.

Rounding out the track will be speakers discussing topics such as: internal communication and employee engagement; transforming the

candidate and onboarding experience; and professional employer organizations and how they can help businesses. A panel of members will discuss HR challenges, successes and hopes, and roundtable discussions will focus on specific HR topics and findings.

GATHERING KNOWLEDGE THROUGH FACILITY VISITS

Attendees who would like to explore the local industry around Savannah can attend one of two optional tours.

A tour of the Gulfstream Aerospace headquarters and its Gulfstream G650 manufacturing facility will show how state-of-the-art computerized machining dovetails with an assembly process engineered for maximum efficiency. Attendees also have the chance to see the Mitsubishi Hitachi Power Systems' Savannah Machinery Works, where the world's most advanced gas turbines are manufactured in over 500,000 square feet of space. Both these tours are limited so reservations are required and some restrictions apply.

CONCLUSION

Between professional development hours, shared meals and social events, tabletop exhibits, tours and three distinct tracks, the new Knowledge Forum is jam-packed with information, education and networking opportunities. The forum is a unique event aimed at providing a more cohesive, overall educational experience for those who make and use valves, actuators and controls.

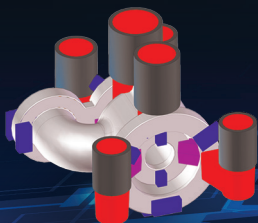
For more information and to see details on sessions and speakers, refer to the official Knowledge Forum program available at VMA.org/KnowledgeForum. The site also contains information on registration fees, how to secure hotel reservations, tour restrictions and links to register online for both attendees and exhibitors.

Those with questions about the forum can also contact Malena Malone-Blevins, VMA meetings manager, at mmaloneblevins@vma.org. **VM**

JESSICA BELLO is VMA's valve careers coordinator. Reach her at jbello@vma.org. For detailed information about VMA's careers initiative, visit ValveCareers.com.

TAKE CONTROL

Highland will take control of "Flow Simulation" so you can concentrate on your "Flow Control"



OUR REPUTATION IS STAINLESS™

Call us for more information at
604.888.8444, info@highlandfoundry.com
Check out our NEW website
www.highlandfoundry.com



Valves with All the Trimmings

BY GREG JOHNSON

The term valve trim has been around for about 150 years—shortened at one point from the word: “trimmings,” a term in vogue until the late 1930s.

What is meant by the term today and how trim materials are different from valve materials is addressed in this article.

WHAT TRIM IS

The Manufacturers Standardization Society (MSS) SP-96, “Guidelines on Terminology for Valves and Fittings” gives this technical definition for trim: *The functional parts of a valve that are exposed to the line fluid and usually refers to the stem, closure member and seating surfaces.*

For some types of valves, the trim is easy to identify and understand, while the trim for other types of valves can be confusing. Although the term “valve trim” is more closely associated with linear and non-return valves, it is also important in quarter-turn valves as well.

The control valve community often takes the definition of trim a bit further by adding guides, bushing and cages to globe-type valve trim descriptions. Additionally, packing system components such as lantern rings (if present) and packing followers are added as well.

Gate valves have been around since the early 1800s, with the earliest examples simple sluice-type devices. On a gate valve, the parts that are trim are easily identified. Those parts are the stem, seating surfaces of the disc and the seats and backseat when present. Aside from being exposed to the fluid under control, trim materials have another common aspect: They face either high-flow velocity or stresses in the form of tensile or compressive loads.

The most common need for using different trim materials is to enhance the sealability of the valve through

materials that will last longer after they have been rubbed together during every open and closed cycle. Besides the need to extend the efficacy of the sliding seating surfaces, the trim material must also successfully cope with high velocity and potential erosion during opening and closing.

The high-velocity damage concern is based on the law of physics pertaining to high pressure and orifice size: The smaller the orifice, the higher the velocity of flow through that orifice. A pressure washer is a good example of high velocity created by a small orifice.

TRIM BY VALVE TYPE

Different types of trim by valve type include:

Gate valve trim: In the gate valve, the highest velocity occurs as the disc begins to separate from the seats. These surfaces also are where the two seating components slide against each other during valve operation. Because of this, the need for special trim materials is obvious when it comes to valve discs and seats.

In the case of the gate valve stem, the need for protection from erosion

□ The primary components of gate valve trim include: seats, disc and stem (shown). Not pictured here is the backseat bushing, which mates with the angled shoulder midway along the valve stem.



Executive Summary

SUBJECT: What constitutes valve trim and how it should be selected differs according to the type of valve, what the valve must do and what challenges the valve faces.

KEY ISSUES:

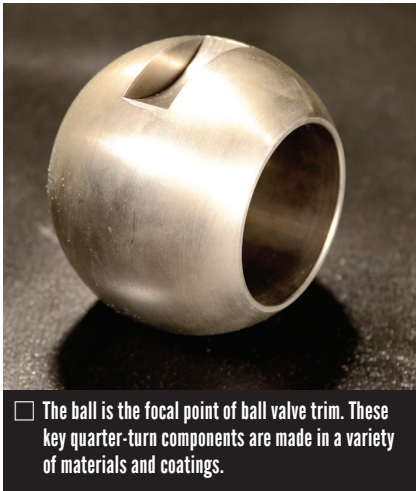
- What constitutes trim
- Different types for different valves
- Materials and standards

TAKE-AWAY: As with any part of a valve, trim choice is crucial to ensuring the valve operates properly and has a long life.

because of high velocity is secondary to the fact the stem is in the presence of the line fluid. Because of that presence, an oftentimes strong tensile load is applied to the stem as the valve moves from a tight valve closed state to fully opened. The possibility of high velocity and subsequent erosion occurs as fluid is forced around the disc and into the body/bonnet cavity during opening of the valve.

A second source of potential high velocity can occur if a gross failure takes place in the packing seal, causing high pressure fluid to exit the valve in the tight path between the backseat bushing and the stem. The backseat bushing is considered a trim component and is a candidate for a higher strength/corrosion-resistant alloy for this reason.

Globe valve trim: The primary trim components for globe valves include the stem, disc and seat, seating surfaces and the backseat, if an operable backseat is installed in the valve. The



□ The ball is the focal point of ball valve trim. These key quarter-turn components are made in a variety of materials and coatings.

area where confusion exists in globe valves concerns the ancillary components such as nuts and washers that help to contain and align the disc. Some manufacturers consider these items trim, while others do not. Alignment cages or seat-guided disc connections are sometimes added to the trim designation list as well.

Check valve trim: Trim components for check valves include the seating surface of the body seat as well as the seating surface on the disc or clapper. While these are the standardized trim components for check valves, sometimes other parts are treated as trim and required or requested to be manufactured from more hearty materials. These components include the hinge pin and disc attachment bolted connection and any washers installed between the disc and disc attachment connection.

Elastomer-seated ball valve trim: Soft-seated trunnion and floating ball valves have a hybrid trim configuration. While the stem and ball usually feature standard metallic materials, the soft seats come in a variety of elastomers.

Metal-seated ball valve trim: Metal-seated ball valves, as the name describes, have metallic ball and seat closure members. These trim components can be manufactured in dozens of materials. In addition to solid components, metal-seated ball valve closure components are often infused with extremely tough metallic coatings such as chrome carbide. These coatings are usually very hard and highly corrosion-resistant.

METALLIC TRIM MATERIALS

Over the past 100 years, trim materials have evolved alongside advances in metallurgy. The first trim material of note for iron valves was brass or bronze. These iron valves with bronze trim are called IBBM valves, which stands for iron-body, bronze-mounted. Also popular early on was tougher bronze alloys substituted for the trim in brass valves. Although the bronze gave some additional improved sealability, the copper-based alloys were not much help in preventing erosion damage.

The next popular trim material to come along, nickel-copper alloys, mitigated the damage of both corrosion and erosion and was in most cases harder than iron and bronze. Some of these alloys were similar to the hardened nickel/copper Monel 500 still in use today.

Following closely behind the copper-nickel alloys was a metal that has maintained its popularity as a valve trim material for over 75 years: air-hardenable, martensitic 11-13% chromium stainless steel. This material is an excellent choice for valve trim because of its corrosion-resistance and ability to be processed to a wide hardness range—from carbon steel soft to harder than cobalt. This stainless-steel trim chemistry is also the most popular material for the construction of kitchen knives.

The top choice for a robust trim material is the cobalt-based material known throughout the industry as



□ Most valve stems are made in computer numeric turning centers such as this one. This 2-inch gate valve stem is being dimensionally checked.



□ Control valve trim comes in a large variety of materials and shapes. The unusual geometry of some control valve trim components aids in the reduction of noise and cavitation.

Stellite. This material is extremely hard and corrosion resistant. Because of its high hardness, it provides excellent abrasion resistance. Stellite trim on seating surfaces is extremely popular in the power industry for high-temperature steam applications.

In the nuclear industry, where cobalt cannot be used because of its susceptibility to irradiation, super-hardfacing materials such as Ultamet and NitroMax are used.

Today, valve design engineers and end users have a multitude of materials to choose from for metallic trim. Many austenitic stainless steels (300 series) are used, from 304ss to stabilized grades such as 347ss and beyond. Some extremely corrosive fluids require even tougher trim materials such as the Inconels and Hastelloys.

While the materials listed above can be used in quarter-turn valves, additional metallic choices for balls and seats exist in the form of metallic coatings. These coatings are used most often in metal-seated ball valves. Some of the popular coating materials include chrome carbide and tungsten carbide.

NON-METALLIC TRIM MATERIALS

The most common non-metallic trim material is polytetrafluoroethylene (PTFE). PTFE is often referred to by its DuPont trade name, Teflon. Pure PTFE is very soft and pliable and

forms a great zero-leakage seal when combined with a smooth metallic mating surface. However, pure PTFE has proven to be too soft for many valve applications. Various reinforced PTFE materials have been developed that include additional strengthening materials such as glass, carbon or graphite.

In addition to PTFEs, other tougher, specialty soft-seating materials such as Nylon, PEEK [polyether etherketone], Kynar and Kalrez are used to beef-up the elastomer-to-metallic sealing system. An important consideration for all these non-metallic materials is their limited upper temperature ceiling. The general range for these materials is between 400°F (204°C) and 450°F (232°C), depending upon the compound.

For valves that only see ambient operating temperatures, such as pipeline valves, O-rings are also popular choices. American Petroleum Institute (API) 6D gate valves often contain O-ring seals that work against a flat disc surface. These soft seats offer zero-leakage performance unless the soft O-ring is torn or otherwise

damaged. Some of the more popular O-rings include Nitrile, Buna and Viton, although there are dozens of specialty compounds from which valve designers choose.

TRIM AND VALVE STANDARDS

Because of the critical nature of valve trim, materials and descriptions are detailed in many codes and standards. The chief repository for this type of data lies in API valve standards. The downstream gate, globe and check valve standards contain trim descriptions and material designations as shown in Table 1.

These API standards detail trim

Table 1. API valve standards with trim designations

Specification	Valve type	# of trims detailed
API 594	Check	11
API 600	Gate	27
API 602	Gate, globe & check	21
API 603	Gate	2
API 623	Globe	20

materials ranging from type 410 stainless steel through superalloys. In addition, the documents detail material combinations such as 316ss to hardface (cobalt-based) or Ni/Cu [nickel-copper] to hardface. Also included in the standards are requirements for the hardness of these trim materials.

CONTROL VALVE TRIM

While control valve final control elements are usually globe, ball or butterfly valves, issues other than material and corrosion resistance come to the forefront when considering trim for these valves. The control of the flow through the valve body (also called the final control element) is important. The geometry of closure components such as the disc or ball are often altered significantly to change the flow characteristics through the valve.

Control of cavitation and noise become paramount issues to address because of the disrupted flow conditions caused by the closure element (disc or ball), which is partially open almost all the time, creating a significant pressure drop within the valve.

MSS Names New Executive Director

MSS announces that their former Director of Standards and Publications, David Thompson, has been appointed Executive Director of the Society. Mr. Thompson has been involved with the standards world for over 15 years and has directed MSS's technical program for over eight years. This change in leadership coincides with the retirement of its previous

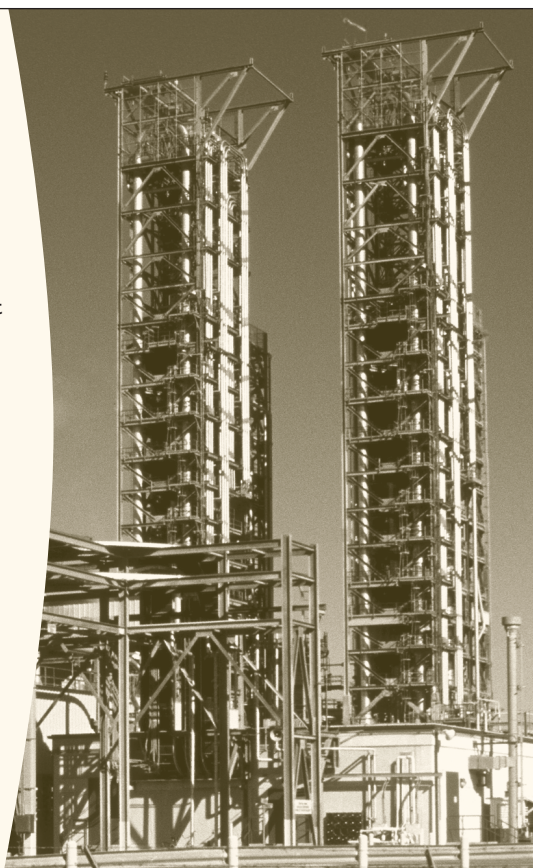
Executive Director, Robert O'Neill on December 29th, 2017.

The Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry is a non-profit technical association organized for development and improvement of industry, national and international codes and standards for Valves, Valve Actuators, Valve Modifications, Pipe Fittings,

Flanges, Pipe Hangers and Supports, and Associated Seals. Since its establishment in 1924, MSS has been dedicated to developing standards for national and global applications, in cooperation with other standardizing bodies and regulatory authorities. MSS is an American National Standards Institute (ANSI)-accredited standards developer.



**The Manufacturers Standardization Society
of the Valve & Fitting Industry**





□ High pressure drop in globe valves can cause extreme cavitation damage such as shown on this globe valve seat. Proper material selection can help mitigate problems such as cavitation.

This partially open condition can create harsh flow conditions that often result in high noise and material-devolving cavitation.

To alleviate these conditions and their damaging effects, special control valve trim geometries have been developed that drastically alter damaging flow conditions through the valve. These anti-cavitation and noise trims are often complex, highly-engineered components that can look radically different than standard trim pieces.

As this shows, the selection of control valve trim is a much more critical and difficult decision than choosing trim materials for on-off block valves.

TRIM MATERIAL CHOICES

Aside from the complexities of control valve trim selection, choosing trim is based upon service conditions. The list of service conditions considered includes fluid chemistry, temperature, operating pressure, flow velocity, presence of suspended solids and how often the valve will be operated.

The first decision usually is based on corrosion resistance. There are many corrosion resistance tables used to determine the suitability of a material to resist corrosion. The second most important consideration is erosion resistance. A material can be extremely resistant to corrosion but not erosion, making it a poor choice for valve trim. Operating temperature is especially important when non-

metallic trims are under consideration.

Other trim material choices are usually based upon the experience of the plant personnel. Some refinery and chemical plant applications that require specific trim selection include hydrofluoric acid, hydrogen sulfide (H_2S or "sour" service) and chlor-alkali (chlorine) processing.

CONCLUSION

Valve trim has come a long way over the years as trim materials advanced from soft brass "trimmings" to highly sophisticated spray-on coatings. Control valve flow control requirements

have resulted in unique trim geometries as well. Because valve components are almost always stressed or subjected to concentrated erosion and corrosion conditions, the need for correct valve trim identification and selection will always be important. ❧

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

THE ORIGINAL CHAINWHEEL COMPANY

Babbitt CHAINWHEELS

WWW.BABBITT.COM

INFO@BABBITT.COM 508-995-9534



Achieving Predictable Valve Performance for Safety Applications

CHRIS O'BRIEN AND
LOREN STEWART

A focus on having the proper specification, design and integration of final elements is key in the actuation of valves for the process industry. As users collect more data through testing methods, they are discovering that final element assemblies are not always performing reliably throughout their mission time. For example, two observed failures are torque/force that is insufficient to move the valve to the safe state and mechanical failure of final element components from stress beyond the element's ultimate strength. These two failure modes are evidence of a lack of robustness in the current process used to specify and design integrated final element assemblies.

WHAT'S HAPPENING

The reliability of process equipment is normally specified assuming "typical" application conditions. International standards specify industrial environmental operating conditions, but many variations exist, and not all environmental stress variables are covered.

A typical application environment should not exceed the operational limits of the device or any of the components within that device. In other words, the stresses experienced by the device

Executive Summary

SUBJECT: Data now available has shown final element assemblies don't always perform as expected or needed. Application requirements, such as mission torque, are contributing to that picture.

KEY ISSUES:

- Why this happens
- What guidance is available
- What can be done

TAKE-AWAY: Performing root cause analysis helps in understanding steps needed to eliminate sources of failure.

should be lower than what it's designed to handle. Often, process conditions introduce additional stress on the device in question. In such cases, it's important to ensure that selected equipment is suitable for the application.

Also, even when the device is deemed suitable, it still may be necessary to account for the effects of the application by increasing the device's failure rate or reducing its useful life. Common application considerations include:

- Continuous versus on/off service
- Leakage requirements
- Process materials
- Flow characteristics
- Pressure
- Temperature
- Mission torque requirements

To judge the suitability of a product, several sources of information should be reviewed including manufacturer's operation guides and material compatibility guides. The most reliable indication of suitability is previous plant experience for that equipment in similar applications.

Pressure

Pressure often impacts valve performance when used for a safety-instrumented function. Depending on the design of the valve, higher pressures may assist in sealing. A pressure-energized design will tend to seal better as pressure increases. Valves that rely only on mechanical sealing may perform better at lower pressures. But they may not have sufficient sealing forces at higher pressures.

In general, butterfly valves are thought to be capable of sealing at low pressures if they can seal at high pressures. Ball valves can generally seal at high pressures if they can seal at low pressure. However, this is a common over-simplification and should be analyzed more closely.

Some valve designs, such as those for unbalanced globe and triple-offset butterflies, will have an asymmetrical pressure energization. Pressure in one direction assists in closing and sealing the valve while pressure in the opposite direction has the reverse effect. The direction from which the valve experiences the pressure, coupled with the level of pressure, will impact the operating force required to move the valve. This is because of contact friction and the differential pressure across the operating members.

MISSION TORQUE REQUIREMENTS

Valve and actuator suppliers typically specify torque for rotary devices and base forces for linear devices on reference conditions. (For purposes of this article, we use the term torque to address both linear force requirements and rotary torque requirements). This information is important; but it is only a starting point and does not fully document the requirements for the lifetime of the final element subsystem.

Mission torque requirements go beyond the base-line analysis to include changes in torque overtime and through the operating profile of the final element assembly. Contributors to torque requirements can be grouped into those that are design dependent, those that are



A-T CONTROLS

— your complete
quarter-turn supplier

Whether you need one valve, or valves for complete Chemical Processing and Recovery Systems, **A-T Controls** is *the trusted source* for all your quarter-turn valve and automation needs.

Our exclusive **Pyramidal Stem Seal** design provides ball valves which meet the latest emission standards including both **TA-Luft** and the most recent **API-641 EPA method 21** requirements. Contact us today for the best in Quarter-Turn Valves and Automation in the industry.

Photo courtesy of
Eco-Tec Inc.
Ontario, Canada



A-T Controls, Inc.

9955 International Blvd. | Cincinnati, OH 45246
513.247.5465 | www.atcontrols.com

dynamically generated, those that are time dependent and those that are application dependent. Each of these categories should be considered when designing a final element that will work correctly. Contributors to mission torque (along with some of the underlying drivers) are:

- Design dependent (friction based)
- Dynamic (pressure or flow induced)
- Time dependent (stiction)
- Application dependent (physical/chemical)

The American Water Works Association (AWWA) has published an excellent guide¹ providing design guidance on calculating valve torque requirements. The guide is written for analyzing torque requirements for steel valves used in water and wastewater applications. While the process industry must address the design of final elements for many different process fluids and valve materials, this guide provides an excellent starting point for understanding the factors that contribute to torque requirements.

The AWWA guide defines two critical parameters for proper final element design. These are:

- MRST: minimum required shaft torque
- AST: actuator sizing torque

The MRST is based on the sum of the design-dependent and dynamic torque requirements. The AWWA guide provides calculation methods to determine this for the defined application requirements.

It should be noted that, when dealing with AST, different industries may have different parameters for sizing.

Design Dependent Torque Requirements

The most readily observable contributor to overall torque is the design-dependent torque. This torque is a function of the bearings and the mass of the valve components as well as the packings. The bearing design, mass, installation orientation and packing



tightness have the most significant impact on the installed design-dependent torque. This is typically provided by the manufacturer and is included in published torque of force requirements.

Dynamic Torque Requirements

Dynamic torque requirements are generated by the flow of process fluid through the valve body or changes in the static line pressure. At times, the flow of fluid can act to open or close the valve obturator depending on obturator design and position. In general, higher static line pressure results in higher torque requirements. Dynamic torque is a function of the valve design and can be measured and specified by the valve manufacturer.

Time-Dependent Torque Requirements

Time-dependent torque is not as well defined or available as design dependent of dynamic requirements.

Where time-dependent torque requirements become more evident is in taking a closer look at the different types of applications. Those application types are static and dynamic. That means:

- Static applications, also known as “stationary or fixed,” are low-demand-mode operations.
- Dynamic applications, also

called “energetic, capable of action, change or forceful,” are high- or continuous-mode operations.

Low-demand applications can become hazardous because they can generate types of failures that high-demand applications cannot develop. When an inactive state is experienced for long periods of time, issues such as stiction, corrosion, cold welding, breakdown of lubrication, buildup of deposits and breakdown of the sealing components can transpire.

It is useful to define time-dependent torque requirements as only those resulting from movement or lack of movement of the device in question. This allows accounting for cycle frequency in the analysis of the valve’s reliability. Currently, this type of torque is accounted for in analyzing static and dynamic applications, including different failure rates in failure mode effects and diagnostic analysis (FMEDAs) and safety-instrumented function calculations.

Application-Dependent Torque Requirements

Application-dependent torque requirements can be the most difficult issue to identify and properly address. The requirements stem from the chemical and physical changes that occur in each given application. Since changes are unique to each final element and installation, modeling is difficult because of lack of actual field performance data.

Studies² have indicated that both material selection and process variations can cause failure mechanisms that lead to additional torque requirements for moving mechanical devices. These mechanisms include formation of oxide from temperature levels rising that results from temporary, random process upsets and galvanic corrosion. These conditions can result from dissimilar metals in the presence of electrolytic fluids. This is because the changes are unique to each final element, and modeling installation is difficult without actual field testing data. Software programs greatly facilitate the collection of this data. (Figure 1)

ROOT CAUSE ANALYSIS

Performing root cause analysis helps in understanding what steps are needed to eliminate sources of failure for final element assemblies. Several valid techniques for conducting a root cause analysis exist, including using a fishbone diagram. Figure 2 shows a fishbone diagram of dangerous final element failures.

The failures shown here are not from lack of understanding of the basic failure modes or of the performance of devices in the field, which leads to the question: "Why are these weaknesses making their way into SIL-rated assemblies?"

CAPTURING FINAL ELEMENT REQUIREMENTS

The requirements for a final element often are not specified with sufficient clarity and detail, which are needed to facilitate a well-designed and verifiable subsystem. Some have argued a gap in the coverage of IEC [International Electrotechnical Commission] 61511 and IEC 61508 exists that leaves final elements in a no-man's land zone between the standards. Another potential cause is familiarity that leads to overconfidence in know-

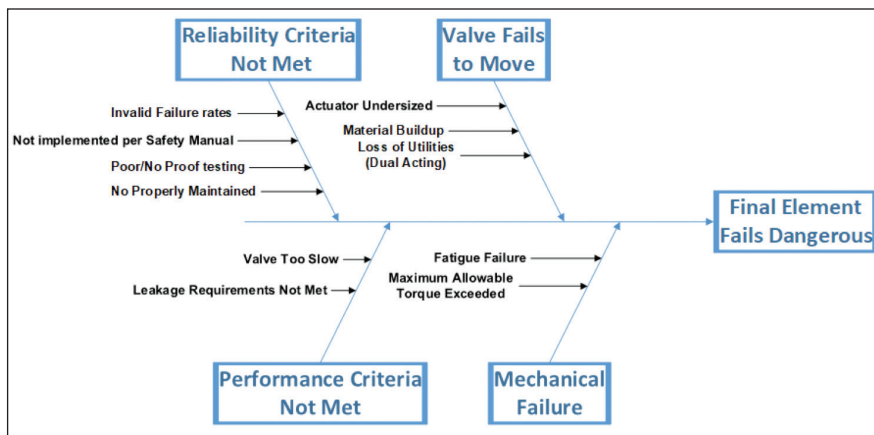


Figure 2. Fishbone (Ishikawa) diagram of final element failures

ing what needs to be documented and evaluated for final elements. This second cause stems from a general understanding of what can fail in final elements and the feeling that too much focus on specification and testing is not a good use of time and resources.

Examining how IEC 61511 and IEC 61508 are typically used in relationship to integrated final elements shows that such action can lead to under-specification of final elements. IEC 61508 is used extensively to evaluate the suitability of devices for safety-related applications. In this

context, the focus is on ensuring devices can perform in accordance with published or agreed-upon product functions and performance specifications.

IEC 61511 typically is used to specify the functional and integrity requirements from an operational level. These requirements are high level and can include factors such as:

- Valve will close on trip
- Valve will have a leakage of Class III or less
- Valve will close in one second

CONTINUED ON PAGE 24



CHAMPION VALVES INC.
COMMITMENT VALUE INNOVATION™

THE CHAMPION NZW™ SERIES

- AXIAL FLOW DESIGN
- REPLACEMENT FOR ANY API 594 CHECK VALVE
- RETAINERLESS DESIGN CUTS FUGITIVE EMISSIONS TO ZERO
- DUAL RATED TO ASME 150/300
- US PATENT PENDING



WWW.WAFERCHECK.COM
P: 910.794.5547 SALES@WAFERCHECK.COM



Valve Manufacturers Association

Valve Industry Knowledge Forum

CONFERENCE, EXHIBITS & TOURS

TECHNICAL | MANUFACTURING | HUMAN RESOURCES

April 11-13, 2018 | The DeSoto Hotel | Savannah, GA

NEW

The new 2018 Valve Industry Knowledge Forum combines the best of three different VMA meetings to create one education-packed event with three distinct educational tracks and a exhibits program.



TECHNICAL

Advancing Valve Integrity through Technology

Subject matter specifically targeted to experienced technical and engineering personnel working with valves and related products.



MANUFACTURING

Combating Complacency in Manufacturing: Safety, Customer Focus and Technology

Developed for those who work or supervise the production and assembly process in their companies.

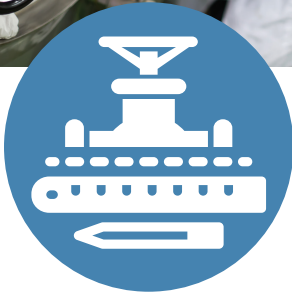


HUMAN RESOURCES

From Hello to Goodbye: Improving the Employee Experience

Programming created for the HR professional as well as company leaders who wish to hear the latest thinking on HR topics and legal issues.

A joint event means more meaningful dialogue between different segments of our industry, an expansion of the attendee base and the ability for individuals to learn about various areas of the valve business. **Attendance is open to both VMA members and non-members!**



WWW.VMA.ORG/KNOWLEDGEFORUM

TOURS

Attendees and exhibitors are welcome to participate in a tour of the Gulfstream Aerospace or the Mitsubishi Hitachi Power Systems on April 11th.

EXHIBIT PROGRAM

The Valve Manufacturers Association invites companies that sell or provide services to valve manufacturers and end users to participate in our 2018 Knowledge Forum. The exhibits portion of this Forum takes place on April 12th. We know that traffic is important so we've scheduled the attendee lunch, afternoon break and welcome reception in the exhibit area to guarantee maximum exposure for your company.

WHO SHOULD ATTEND?

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?

Companies that sell or provide services to the valve manufacturers and end-users. You do not have to be a member of VMA/VRC to exhibit.

WHAT ARE THE COSTS TO ATTEND?

Early Bird Registration available through February 23, 2018

VMA/VRC Members **\$545** (through February 23, 2018)
\$595 (after February 23, 2018)

Non-Member **\$595** (through February 23, 2018)
\$645 (after February 23, 2018)

Additional Registrants

Discounts apply when registering more than one person from a member or non-member company.

VMA/VRC Members **\$445** (through February 23, 2018)
\$495 (after February 23, 2018)

Non-Member **\$495** (through February 23, 2018)
\$545 (after February 23, 2018)

PROFESSIONAL DEVELOPMENT HOURS

Those attending the 2018 VMA Valve Industry Knowledge Forum will receive a certificate for twelve (12) Professional Development Hours (PDHs) for attending.

QUESTIONS

Malena Malone Blevins
mmaloneblevins@vma.org or
202-331-8105 ext. 310



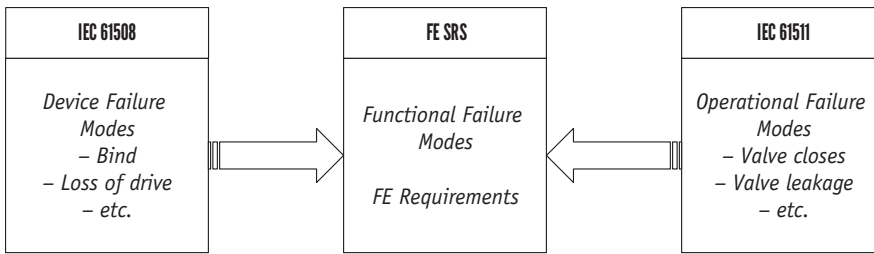


Figure 3. Final element SRS

IEC 61508 addresses the device failure modes while IEC 61511 addresses the operational failure modes. Either of the standards can be implemented in a way that captures the functional failure modes or the under-specified area between what the end user or the equipment supplier specifies.

What's needed is treatment of final elements as bespoke systems—the choice of which standard applies is a secondary consideration since either of them can be applied in a way that will improve the safety reliability of integrated assemblies. Figure 3 shows how the final element safety requirement specifications (SRS) can bridge the gap between two standards.

The final element SRS needs include the steps for specifying, designing and validating the safety

critical final element. In addition to the functional and performance requirements, this element should ensure that the required steps performed include:

- Final element requirements
- Final element subsystem design
- Device requirements
- Integration
- Factory acceptance testing
- Site integration testing/site acceptance testing
- Operations and maintenance guidance

Figure 4 depicts the steps for the final element bespoke system.

CONCLUSION

While challenges exist in achieving

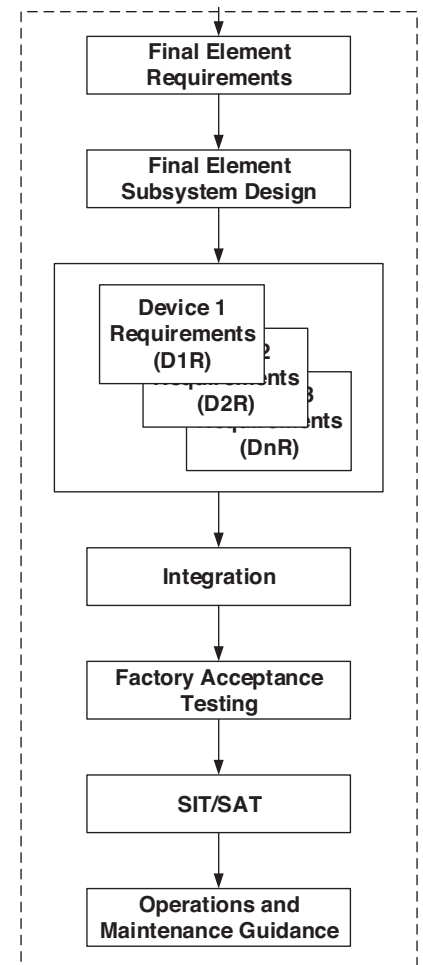


Figure 4. Final element bespoke system steps

the high reliability required in safety applications, the industrial world is making steady progress towards reaching that goal. Through a combination of increased understanding of true torque requirements and better specification and validation of final element performance requirements, significant progress can be made. VM

CHRIS O'BRIEN is executive vice president for exida.com LLC (www.exida.com). Reach him at cobrien@exida.com. **Loren Stewart** is senior safety engineer for exida. Reach her at lstewart@exida.com.

The information in this article will be included in an upcoming book: *Final Elements in Safety Instrumented Systems; IEC 61511 Compliant Systems and IEC 61508 Compliant Products*, which is written by O'Brien and Stewart.

References

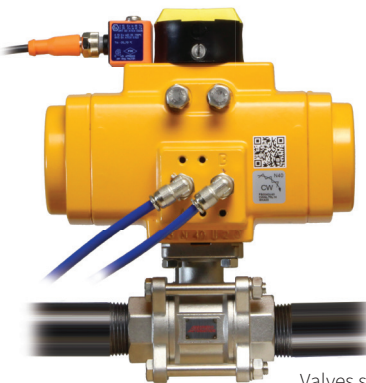
1. Benjes, Henry H., Operator Torques for Butterfly Valves www.awwa.org
2. Bulowski, Julia V., Documentation of Recommended Revisions to Failure Rates and Modes Database in Support of Product FMEDAs, exida.com LLC, Sellersville, PA, December 2018



We Make Valve Automation Easy!

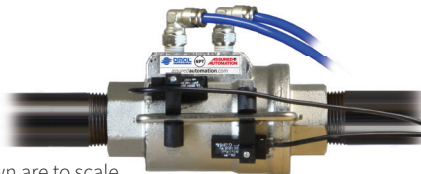
Downsize Your On/Off Valves

(Typical Ball Valve)



VA Series Compact On/Off Valves

- Smaller
- Higher Cycle-Life
- Faster
- Less Expensive
- Lighter
- Safer



Valves shown are to scale.

This is an accurate size comparison of:
pneumatically actuated 1" NPT On/Off valves with
dual (open/closed) proximity sensor limit switches

1-800-899-0553

assuredautomation.com

PRODUCTS YOU NEED FROM THE PEOPLE YOU TRUST

We deliver peace of mind through our rigorous inspection, assessment and audit process.

With best in class quality assurance, you can have the confidence in quality, safety and integrity of the products you receive.



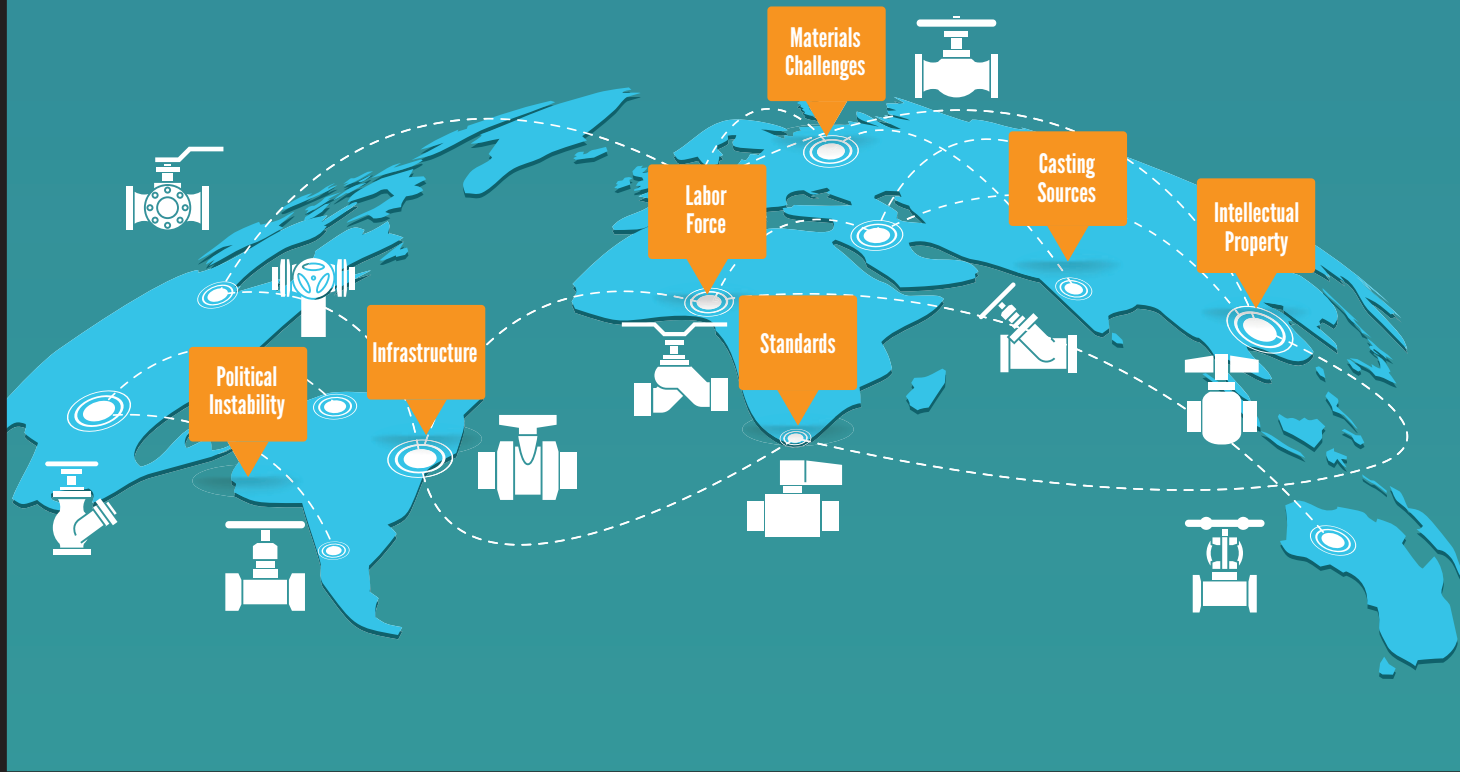
ACTUATION | MODIFICATION | TECHNICAL ASSISTANCE | ON-SITE SERVICE & REPAIR

WOLSELEY
INDUSTRIAL GROUP

With 160 locations and 25 Valve Automation Service Centers strategically located around the United States, we hold extensive inventory of Pipe, Valves & Fittings, and are a one-stop shop to accommodate large and small projects and critical plant shutdowns. We evaluate, test calibrate and document all automation packages.

For more information on our products, services and capabilities, visit us at WOLSELEYINDUSTRIALGROUP.COM

Trust Earned Through Performance



Are Valves from Low-Cost Countries Getting Better?

BY KATE KUNKEL

The last 25 years have seen standards created and implemented to increase the quality and repeatability of valves procured from low-cost manufacturing sources around the world. As part of the process, potential sellers into the U.S. market have reportedly spent millions of dollars improving facilities and processes.

But what's the consensus: has it worked?

VALVE Magazine reached out to the valve manufacturing community to get reactions to the question of whether they feel that valves manufactured partly or fully in countries with lower costs are better now than a quarter century ago.

Most respondents agreed that in some ways, these valves are better. But problems still exist.

Bert Evans, manager of Educational Services, Final Control at Emerson Automation Solutions, said that, "Improvement has come by developing, then enforcing, comprehensive specifications that include such things as vendor qualification, weld procedures, inspection and testing, and compliance certificates."

WHAT'S HAPPENED

In earlier days, many overseas companies were certified to quality standards such as ISO [International Organization for Standards] 9001 by their governments with no accreditation and little attention to process control, valve professionals explained.

Executive Summary

SUBJECT: Much of the industrial world is wondering if a quarter-century of dealing with problems and challenges stemming from using products or parts from low-cost manufacturing areas of the world has changed.

KEY ISSUES:

- What the past concerns were
- How they were addressed
- What's currently happening

TAKE-AWAY: While many issues have been addressed, intellectual property protection and loss of tribal knowledge continue to be huge concerns for valve manufacturers and end users.

But as more and more OEMs demanded proper certification, the quality processes and equipment improved, says John Ballun, president and CEO, Val-Matic.

It also was common in some foreign companies to publish counterfeit industry certifications such as American Petroleum Institute approval in literature with no basis in reality. Hopefully, those times are behind us, VALVE Magazine respondents said.

Carlos Davila, product manager, Crane, noted that two types of low-cost manufacturers are involved—U.S. companies operating in the other countries and companies that are strictly local manufacturers. What's happened with each depends on which type.

"U.S. manufacturers did not go to LCMs [low cost manufacturing areas] for quality, but for cost," he pointed out. Yet they maintained a presence in these countries to make sure the quality was upheld.

"This was at additional cost, but essential to keep their names free of failures," he explained.

Local manufacturers didn't have that incentive.

Meanwhile, some valve professionals do not think quality from low-cost areas of the world has changed that much.

David Bayreuther, vice-president of engineering at Metso, said quality still runs the range of top-of-the-line products from good companies to "downright disgraceful" from bad-quality providers.

"What I am seeing is that the purchasers are getting wiser and taking more care to ensure they get the level of quality they need," he says. That means fewer poor-quality items are entering the global market from some areas, "but it is still possible to get very poor quality."

PROBLEMS AND PROGRESS

According to Jim Barker, director of Customer Order Management and Field Service at DeZURIK, one of the most significant concerns over the 25 years from lower-cost sources is casting quality, a sentiment mentioned by every person who responded to

As more and more OEMs demanded proper certification, the quality processes and equipment improved.

VALVE Magazine's call for comments on this area.

As Ballun explained, "Castings would have internal defects such as porosity and external defects such as inclusions and extreme surface roughness."

One source, who asked for anonymity because of confidentiality issues, related instances of castings from India that fractured during hydrotest due to incorrect heat treatment. He also saw radiographic-tested castings with holes large enough "to put your fist through" when defects were excavated and said through-wall leakage on machined castings that had already been "tested" was not uncommon.

As a result of what was coming this way, "U.S. manufacturers were forced to rigorously inspect and ultimately eliminate multiple suppliers over the years," Ballun said. Meanwhile, some foreign markets simply accepted this level of quality at the time and some of that poor workmanship still exists.

Evans pointed out that machining accuracy was frequently problematic.

The problems "were caught by inspection and testing, but received high rejection rates of as-cast or post-machined valve bodies," he said.

Also, consistency varied considerably from area to area, which meant monitoring and inspection was vital for the entire process, according to Howard Williams, group sales manager for Rotork North America.

Any companies sourcing from LCMs needed "feet on the ground at the point of supply" to constantly monitor the manufacturers and ensure quality all the time, he said.

Although casting was a pressing concern, it wasn't the only one. Bayreuther noted that material quality was one of the most significant issues.

He also said that over the years,

the need to compete by price resulted in degradation in quality and longer delivery times. Also, low-cost supply bases had less product knowledge and experience, leading to additional quality challenges.

That having been said, there have been substantial gains in the past 25 years, most respondents said. When asked what issues appear to have been effectively addressed, Barker felt that casting quality and product quality in general has improved while Williams noted that good suppliers who can be relied upon for consistent quality have started to emerge in many areas of the world.

Another movement forward has resulted from awareness of counterfeit valves and parts from overseas factories.

Ballun stressed, however, that with counterfeiting, "It is imperative that the valve industry maintain vigilance in stopping this practice."

Bayreuther noted significant improvements in sealing performance as well as material quality over the last few decades.

"Emissions performance has improved due to better designs," he said, and better gasket and sealing materials are being used. Material quality for low-cost regions has also improved based on lessons learned and implementation of increased quality oversight.

NEW CONCERNS

While gains have been seen, several issues need to be addressed more fully.

The top concern mentioned by several people was the loss of intellectual property.

"As technical designs, processes, and technology are shared with factories overseas, it is difficult to secure the information for the exclusive use of the sponsoring valve manufacturer," Ballun said.

His company was advised to duplicate its patents in China as a defensive measure to prevent Chinese businesses from patenting its products.

"It would be impractical to defend intellectual breaches in foreign courts," he pointed out.

Barker also mentioned concern about the integrity of certifications

and quality programs while Williams raised concerns about health and safety issues as well as general labor practices and laws within LCM countries.

Meanwhile, Bayreuther said he believes that while most of the challenges have been addressed and risks reduced, he feels the most significant issue may be what the whole industrial world is facing: loss of tribal knowledge.

"Most end users and manufacturers have an aging work force nearing retirement," he warned. In this country, for example, U.S. Bureau of Labor statistics show that the number of new entries into the metal manufacturing industry is low.

"The loss of product knowledge and application experience is happening in many companies today. Product knowledge and experience takes many years to develop, usually by making mistakes and learning from them. I hope our industry can react in time to avoid any significant mistakes," he pointed out.

Still, in general, end users around the world appear to be more comfortable with today's valve quality, including from low-cost areas. Ballun gave credit to the adoption of quality and industrial valve standards and the introduction of robotic computer numeric coding and welding equipment, which have contributed to improved manufacturing processes.

Williams observed that, "It is inevitable that anything that is manufactured today will have some material content that's 'globally sourced'."

End users today, however, are more trustworthy of brand name manufacturers that know how to demand quality from LCM vendors, he added.

Davila, on the other hand, pointed out that some end users are still not comfortable purchasing from LCM countries. They may have good working relationships with any U.S. manufacturer on their approved manufacturers list "but still not accept material from some low-cost countries," he said.

Evans and Bayreuther felt that end users are more comfortable with products from LCM countries, "provided the valve supplier can demonstrate a

rigorous and comprehensive quality specification," Evans said. Bayreuther noted that the comfort level is also rising.

"Ultimately, it is not the low-cost countries that establish the product quality; it is the manufacturer's responsibility to ensure they are purchasing quality material and delivering quality valves," he said. "Manufacturers have adapted their quality processes and purchasing methods to help eliminate the risks," he added.

PLAYING CATCH-UP?

There is also speculation that some areas of the world considered low-cost in previous years (India and China, for example), are now in a process of losing that status.

Costs in those two countries are rising rapidly so many manufacturers and end users are looking around for other areas where "lower costs" might still be active.

Williams observed that, "The last time I read about this topic, it was Vietnam that was fast emerging [as low-cost], but I am sure things are moving on."

What's more, "one thing you cannot expect to get from a country such as Vietnam when compared to China or India is scale and scope of operations," he said.

Eventually the world will run out of LCM countries, but technology will continue to evolve so that "some of the traditional methods of manufacturing will be replaced by simpler and more efficient processes," he said.

Meanwhile, some developing countries are going through their industrial revolution now, "which in turn will raise costs as the skilled workforce becomes more demanding," Williams said.

Barker and Bayreuther noted that Africa is frequently mentioned as a source for low cost possibilities because of its large labor force.

However, "it is lacking the material production facilities for castings and machining, as well as transportation," Bayreuther said.

Those three conditions: a large, low-cost labor force, facilities for casting/machinery and transportation access are key to finding sources.

"China and India were the last untapped regions with all these capabilities," Bayreuther said. As they expand, their costs are leveling out.

"My current thinking is that automation or production will minimize the labor cost differences and enable production to move close to supply and customer bases," he said.

Ballun pointed out that, over the last half century, companies have traveled from Japan, to Taiwan, to China, and to South America in search of the lowest cost labor and resources.

"There is no telling where future opportunities will appear given the unstable governments around the globe," he said.

No matter where the next LCM country is, however, there will be a learning and relationship-building curve. Does that mean the parties that go there will need to start from scratch in the new areas?

Ballun observed that, while many of the lessons learned in China and South America will be applicable to future locations, "Learning to interface with the individual governments will always be unique and challenging."

Davila pointed out that, in many instances, end users must approve all manufacturing locations, and audits are required at great expense to the manufacturer. Because of that reality, any future LCM country will have to prove promising to take the financial risk involved.

On the other hand, Evans didn't think manufacturers would be back at the starting gate. "Valve manufacturers' quality standards are much more mature today than 25 years ago, so they should be easier to apply with new vendor qualifications," he said.

Bayreuther does not think the next region will bring new types of problems, but will instead face the same challenge all the industrial world is facing: lack of experienced labor. He said his hope is that automation will enable production to return to North America and Europe, which means finding low-cost sources won't be as critical. **VM**

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



High Flow, No Worries

New ASCO™ 362 and 562 Series Spool Valves maximize performance and reliability. With the highest flow per pipe size, the ASCO 362 and 562 Series Spool valves give you unmatched design and installation options. You can increase throughput from a given pipe size, or you can downsize both pipe and valve, reducing cost and saving space while maintaining flow. The ASCO 362 and 562 Series make both options possible. And these 3- and 4-way stainless steel or brass valves all rely on ASCO's solenoid valve technology—the industry standard for reliability in the field.

No worries about Delivery either.

Many ASCO 362 and 562 Series valves are available through the ASCO Express Program which offers same- and five-day shipping.

For more information:
www.asco.com

ASCO™


EMERSON™

The Emerson logo is a trademark and service mark of Emerson Electric Co. The ASCO trademark is registered in the U.S. and other countries. © 2018 ASCO L.P.

CONSIDER IT SOLVED™



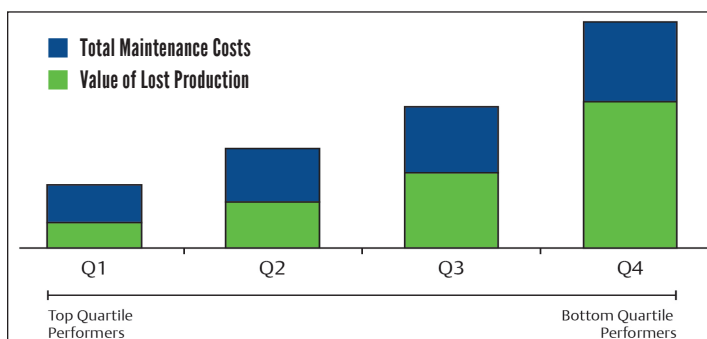
Intelligent Servicing of Valves During Aging Plant Shutdowns

BY JODI JOHNSON
AND NAVÉ ORGAD

Shutdowns, turnarounds and outages (STOs) play a major role in plant safety, performance, reliability and profitability. However, they take

time and resources.

Industrial facility owners and operators that achieve operations and capital performance in the top 25% of peer companies (the top quartile performers) experience lower maintenance costs and have optimized production by reducing downtime in the STO process. (See Figure 1, below).



Source: Solomon Associates

Figure 1. Top quartile performers versus bottom quartile performers

Executive Summary

SUBJECT: Top plant performers spend less on maintenance costs, experience much less lost production and have higher mechanical availability and lower turnaround downtime. To accomplish this requires planning and the proper tools.

KEY ISSUES:

- The need for STO planning
- Tools used
- Successful results

TAKE-AWAY: Asset integrity management solutions and working with a quality supplier can ensure smooth processes.

AGING PLANTS

More than half of plants in the world are older than 20 years; 40% are older than 30 years; and 30% are older than 40 years. By comparison, in the mature industrial region of Europe, the statistics show that 60% of plants are older than 20 years; half are older than 30 years; and 40% are older than 40 years. (Source: Industrial Info Resources).

Maintenance and service personnel in all these plants face numerous challenges, especially in aging facilities. Those challenges include:

- Reducing operational expenses
- Improving safety and reliability (to avoid unplanned shutdowns)
- Adhering to stringent emissions regulations
- Addressing the decline in personnel experience and capabilities
- How to improve the productivity of aging assets
- Loss of meaningful data through lack of quality maintenance records
- The obsolescence of products and difficulty in obtaining spares
- The lack of standardization among manufacturers and products.

Intelligent servicing of valves and controls can overcome many of the issues these aging plants face.

CRITICAL FACTORS FOR SUCCESS

According to data provided by Asset Performance Network, two-thirds of STOs are unsuccessful, meaning they result in cost overruns and lost production. Among the key factors that cause these problems is lack of detailed planning, a scope of work that is too broad and poor STO execution because of the lack of skills and inadequate documentation.

End users can overcome these issues with help from qualified suppliers through data-driven planning, use of mobility tools and asset integrity management.

Mobility tools provide easily accessible centralized data, which enables safer, more efficient STO. What's more,

combining high-level, in-person service with dynamic mobile applications allows plant personnel to optimize the time and budget allocated for STOs. This is because the mobility tools eliminate or reduce the need for paper recordkeeping while equipping plant personnel with an easier, more efficient way to store, access and analyze the data. Armed with quality data, the end user is better prepared to make informed decisions and take calculated actions.

The process begins with a thorough walk down, which is key to defining and prioritizing STO scope. Walk-down applications now offered by many reputable suppliers leverage mobile workflow technology to improve asset data collection from a variety of devices. Such applications also evaluate the overall health of assets while revealing ways to improve field service productivity. Using such applications is not essential; in fact, many plants still use spreadsheets for the walk-down process. However, applications allow the data to be digitized and centralized for easier analysis. They also allow quicker access to historical tag information, which can include equipment health conditions. Such access allows more data-driven decisions to occur. Whichever method is used, assessing the condition of the valves through the walk-down process is a critical step in effective STO planning.

TRACKING/MANAGING ASSETS

Asset tagging allows safe, fast identification during walk downs. Plant personnel can track their assets with an intrinsically safe (FM-, CSA- and ATEX-certified) rugged radio frequency identification tag affixed to valves and other equipment. These tags keep workers at a safe distance from hot or other challenging process conditions while gathering information digitally instead of requiring scaffolding climbing or entry into confined and hazardous spaces. The tags contain key service information—for example, the date the equipment was last serviced or inspected as well as when it's due to be serviced or inspected again. Meanwhile, end users can optimize asset management by tracking equipment locations and recording repair

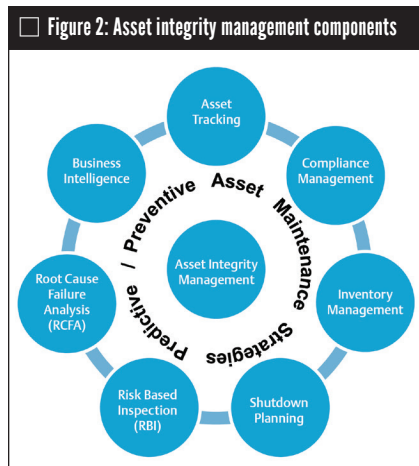
notes from these tags. They also can update information as components and service requirements change.

To integrate the information, the practice of asset integrity management can be used. This practice is an integrated solution that allows monitoring and managing of all assets (including valves, actuators and controls) from one point. This helps plant personnel mitigate risks, reduce costs and optimize performance during STOs.

Key components of an asset integrity management solution include inventory management, shutdown planning and risk-based inspections (RBI). It also can include compliance management data, asset tracking information, business intelligence and root cause failure analyses. By using asset integrity management, end users have visibility into all assets from a single point with 24-hour access. Those with access can diagnose failures and take corrective actions and support STO planning. (See Figure 2, below.)

SHUTDOWN PLANNING

Predictive and preventive maintenance needs are addressed through the powerful tool of shutdown planning. As part of that process, plant personnel work with suppliers to lay out each of the activities that will be performed during a turnaround. These activities can include defining the scope of work, scheduling the STO activities that are needed, and procuring the parts and replacements that will be required for maintenance and repair.



The scope of work is determined through the previously addressed walk-down process. Planning for the shutdown then allows more knowledge-based purchasing of parts or replacement parts.

RBI is the methodology used to determine optimal repair cycles for each asset. It's based on an asset failure probability/consequence matrix. RBI calculations use historic repair observations to accurately determine failure probability. They link customer-defined failure consequences with the asset failure probability to derive repair cycles, then repair cycles are extended or shortened as appropriate.

The result is a reduction of risks because repair or replacement happens before failure and a reduction in costs that might result from extended repair intervals.

CASE STUDIES

Case Study One: Fifty-year old refinery in the United Kingdom

A half-century-old, mid-sized refinery

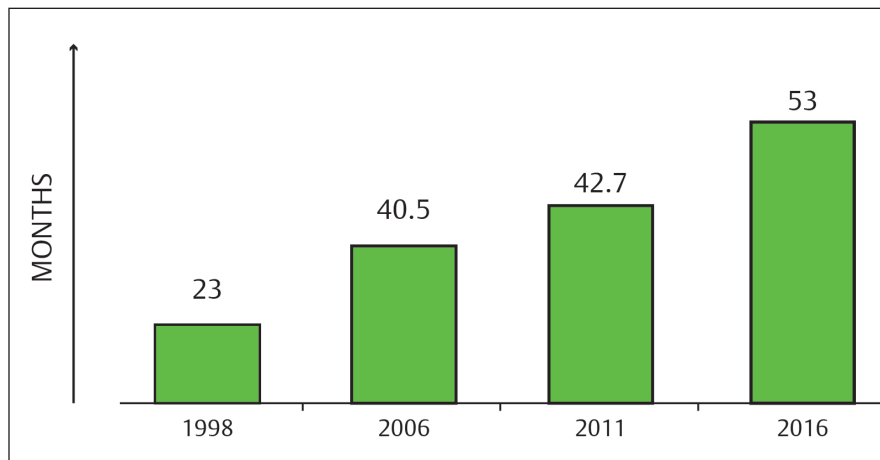


Figure 3. Pressure-relief valve reduction in maintenance interval times for plant in case study one

in the United Kingdom was able to extend its repair intervals on pressure-relief valves (PRVs) from every 23 months to 53 months using asset integrity management and risk-based inspection. The end user had 3,000 PRVs that used an asset integrity management solution starting in 1998. RBI and root cause failure analysis processes effectively managed valve repair frequency.

Besides extending repair from 23 to

53 months, key results were a reduction in the number of repairs by 18%, a 35% reduction in annual PRV repair and optimization of PRV spare parts inventory through effective predictive maintenance strategies. (Figures 3 and 4)

Case Study Two: Turnaround in four-decades-old chemical plant

A chemical plant in Europe was in operation for about 40 years. In 2016,

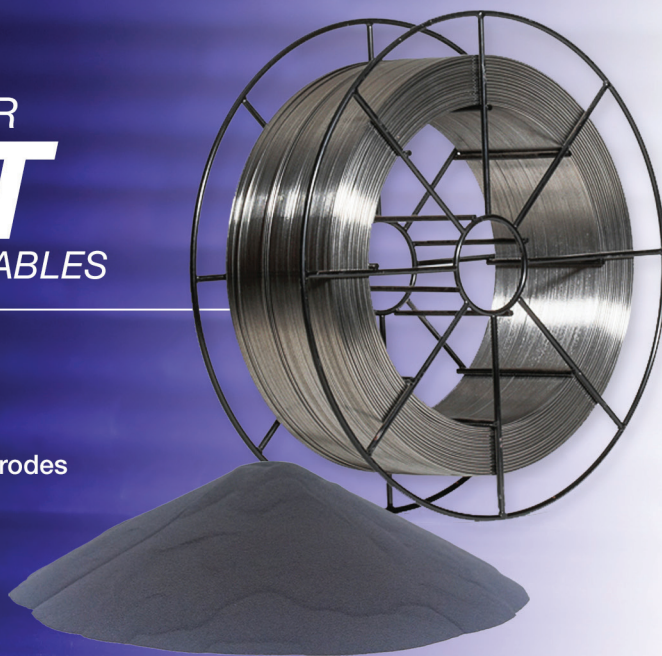
YOUR NEW SOURCE_{FOR} COBALT HARDFACING CONSUMABLES

Make the switch to **POLYSEL**
cobalt alloys 1, 6, 12 & 21

- Solid and cored wire
- Coated electrodes
- Cast rod
- PTA powder

Polymet

polymet.us
1.888.765.9638



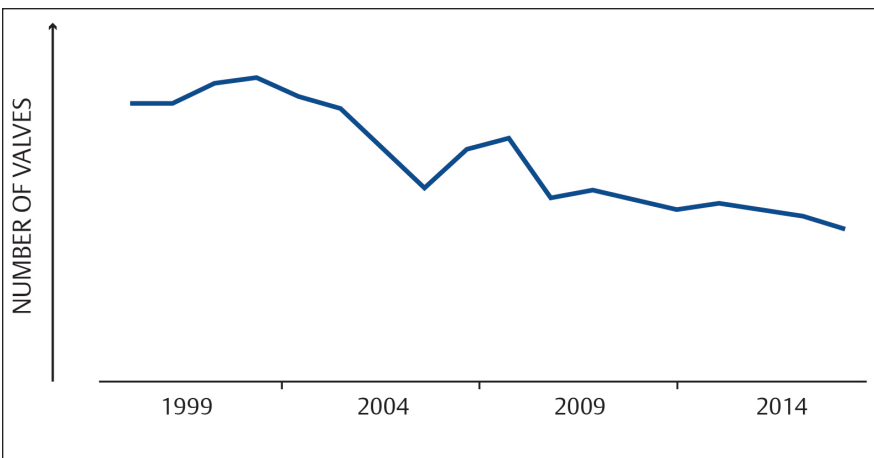


Figure 4. Number of pressure relief valves repaired over time for plant in case study one

the end user faced its largest STO in five years. Many of the plant's valves were old, worn, damaged or obsolete. The plant needed to address repair, maintenance or replacement of 250 safety relief valves, 180 control valves and 80 manual valves.

The asset integrity management deployment in the plant proved to be effective in allowing plant personnel and the supplier of choice to know the asset repair history and current

conditions of this equipment, identifying old or obsolete valves and procuring replacement products. It also allowed preparation for extra activities needed such as welding, workshop repairs and other activities and built an awareness of valves that will need to be replaced at the next STO, thus establishing a continuous improvement STO process.

The end user achieved completion of 100% of the planned work as well

as 100% health, safety and environmental compliance, zero reworking and on-schedule completion of the process.

CONCLUSION

End users that adopt a best practices approach to intelligent servicing of valves can better achieve STO goals and secure a solid position as a top quartile performer. Effective planning and thoroughly defining the scope of work between the user and a chosen supplier are keys to STO success.

Asset integrity management improves plant knowledge and reliability and allows planning for successful STOs as well as a reduction in unplanned shutdowns.

When the right tools are used to manage and maintain equipment effectively, aging plants can perform as well as newer plants. ■

JODI JOHNSON is perfect execution director at Emerson Automation Solutions (www.emerson.com). Reach her at Jodi.Johnson@Emerson.com. **NAVE ORGAD** is lifecycle services marketing director at Emerson Automation Solutions. Reach him at Nave.Orgad@Emerson.com.

INNOVATIVE AND TIMELY ENGINEERED BUTTERFLY VALVE SOLUTIONS

TRICENTRIC® Triple Offset Manufacturer Since 1998, Specializing in North American Design and Distribution

- 3" to 96"
- CL150 to CL1500
- Temperature range: -423°F to +1500°F
- Application of all materials from carbon steel to titanium
- Jacketed body and disc; heat, cryo, and actuator extension; specialty bearings and packing; block and bleed; 3-way and splined connection; controlled orifice disc and plates; spools; NDE, weld-metalurgy, heat treatment, NACE; BAM certification; replaceable and LOX/LH2 seat, CCW to close, audited cleaning to O2, CL2, H2O2; pickled and passivated; testing API607, cryogenic BS6364 and aerospace, fugitive emissions

TRICENTRIC® Triple and HIGHSEAL® Double Offset Butterfly Valve Inventory

- 3" to 36"
- CL150 to CL600
- Wafer, Lug, DF
- WCB and CF8M
- Cryo extension
- Steam jacket-traced
- Live-loading
- Gear operated

25 years of experience exceeding our customers' expectations - whatever the technical complexity.

SCORE
VALVES



SCOREVALVES.COM

9821 - 41 Avenue NW | Edmonton, Alberta | T6E 0A2
P 780.466.6782 | F 780.465.6979 | SALES@SCOREVALVES.COM

When Valves Get Wet

BY KATE KUNKEL

Hurricane Harvey stalled over Houston in August 2017 creating what has been called the most extreme rain event in U.S. history. The storm dropped more than 50 inches of water on the city. What's more, it was the third 500-year flood Houston experienced in as many years, and while much of the city is well into the rebuilding process, it will no doubt take years for the damage to homes and businesses to be fully calculated and corrected.

Among the millions of damaged components in homes, factories, refineries and petrochemical plants are valves and the actuators and controls that manage their operation. The city's woes undoubtedly provide a very good lesson in what happens when valves get wet.

VALVES, ACTUATORS AND CONTROLS IN SERVICE

Many of the valves in service handle material much more dangerous than water, Mitch Copeland, business development manager of United Valve, pointed out. Those valves might not be directly affected by an influx of water that, through water ingress, can threaten both the externals and internals of other valves.

The same cannot be said of actuators and controls, however.

If not properly installed, "Electric actuators if they are submerged could be at risk," Copeland said. "I know of one company that had a local actuator company pulling and going through more than 150 actuators [after the flood]. Most of these needed motor rewinding due to the flooding."

The loss of electricity during flooding is another big problem for electric actuators, said John Barr, metallurgist with Watson Grinding & Mfg.

"You lose the ability to open and close the valve," he pointed out.

On the other hand, when pneumatic actuators are in place, no real problem exists if the actuators have a receiver with enough air to cause



The Brays Bayou rushing water in Houston on April 18, 2015.

the valve to open or close when the air supply "fails" or is shut off. "The valves themselves do not care if they are dry or wet to my knowledge," he added. Meanwhile, "Internally they are wet with product, which can be vastly more severe than water!"

Still, in many cases water can cause significant damage to valve internals.

When valves and controls are handling natural gas or propane, a slightly different story exists. According to the Pennsylvania Department of Environmental Protection (EPA), natural gas furnaces and boilers all have gas valves and controls that are especially vulnerable to water damage from floods.

"Corrosion begins inside the valves and controls, and damage may not be readily visible even if the outside of the device is clean and dry. At a minimum, this damage can result in reliability problems. More severe consequences could be fire or explosion," according to Pennsylvania's EPA. The department's recommendation is that all gas valves and controls be replaced if they are flooded.

When asked about possible danger if flood waters meet various chemicals in valves already in service, Ron

Rayman, lead engineer at Watson, explained that, "Flood waters meeting various chemicals could cause some problems, depending upon what level of concentration may develop."

Still, "if valves in service are designed for severe service, they should withstand any attacks by chemical mixtures," he added.

He also noted that, when valves have been flooded, his company performs standard tests, then repairs or replaces parts as dictated by the valve's performance in the test. The main test his company is called upon to use is API [American Petroleum Institute] Standard 598-Valve Inspection and Testing. Once tested and repaired, the life of the valves shouldn't be affected by the water influx, Rayman pointed out.

Meanwhile, when a flood alert comes in, all electrical and pneumatic actuation should be moved to a location that would not be affected by the flood waters, he warned. If they are flooded, they must be totally rebuilt, he pointed out.

United Valve's Copeland noted that, with respect to valves carrying chemicals, "Only water-sensitive applications would be affected."

Still, even in this situation, valves covered with water and not dried out promptly are threatened by rust, which “would set in fairly quickly,” meaning sealing areas may have to be re-machined.

VALVES IN STORAGE

For valves not yet in service that are stored in a warehouse or plant, damage can occur to all exposed surfaces. For example, what happens with seats or seals is a real concern when flooding occurs.

Donald Polasek, a member of the Valve Repair Council and North American Service Manager for ValvTechnologies, explained that, “As one will quickly learn when speaking to a valve manufacturer, repair shop or modification shop, valves that spend time in storage before they are placed into service do not always get the best care or remain protected with end protection installed prior to shipment.”

Why is this important in regard to flood situations?

“When valves are readied for assembly, whether it be at the manufacturer, repair or modification shop, the internals are cleaned to remove all dirt, grit, shavings, oils, etc., that will cause damage to the seating surfaces,” he explained.

These surfaces in many valves are made with some type of hard material or metal that can handle high friction loads when fully seated against the seat (which is flat polished or lapped surfaces.)

Because of this configuration, “Foreign material entering the valve and getting on the seating surfaces can and will cause scratches or galling, resulting in seat leaks,” he pointed out.

Valves that were flooded in storage will likely have foreign material that is not supposed to be in the valve, leading to seat leakage, he said. Also, the largest population of valves are made of some form of carbon steel, which leads to concern about oxidation of the valve internals that over time, can cause rust particles that get large enough to come loose and damage the seat.

Polasek recommended that valves subjected to flood waters be disassembled and inspected for damage. “Any

oxidation will need to be cleaned prior to re-assembly and testing to verify the valve performs as designed,” he said.

He suggested contacting any Valve Repair Council member company [or the valve manufacturer] for guidance on a particular type of valve.

ANOTHER RUST CONCERN

After the waters receded from Houston, Watson Grinding and Mfg. received several valves that had been flooded in storage at a refinery. While some of the valves were undamaged or suffered minor damage by the flood waters, the company found that plastic protectors were missing on a few flanged valves. In those cases, the unprotected equipment’s raised face on the carbon steel body was already rusting. In another case, even though the plastic protector was partially open, flood media was able to exit, and very little damage was apparent.

Assuming all the submitted valves were stored in the same way, it may be best to remove a cap on the valve end and leave the other one partially open to allow flood media to escape, Watson suggested. However, that would also potentially allow ingress of foreign particles so it’s not a permanent solution.

That having been said, it is difficult to make any kind of conclusive statement as to the best way to protect valves in storage, except to move them to a safer, drier place.

CONCLUSION

While most valves in service are not going to be rendered useless by flood waters, actuators and controls are very susceptible to damage. Also, most valves in natural gas or propane service will likely need to be replaced. For valves in storage, ideally, they could be moved to higher ground. However, this may not always be possible.

If the Houston and other recent floods accomplished anything, it was to throw even more questions into the picture—questions that can only be answered by studying what happened. **WM**

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

**REDUCE
FUGITIVE
EMISSIONS**

**LIVE LOAD WITH SOLON®
BELLEVILLE SPRINGS**

**PERFORMANCE
UNDER
PRESSURE**

**WITH SOLON®
PRESSURE SWITCHES**

**Control & Monitor Operating
Conditions Critical in Fluid
or Gas Control**

ISO 9001 CERTIFIED

www.solonmfg.com

800.323.9717

Gearboxes 101

BY MARK BUJALSKI

Gears have a long history and have been used for many purposes throughout civilization. By starting with an initial source of motion and force, then combining that with intermediate gearing, engineers and designers throughout time have created functions that result in output of desired motion and force for purposes of performing many different functions. Many forms of gearboxes exist that incorporate different features, depending on the manufacturer. The intent of this article is to touch on a few and provide a generalized overview of gearbox function and features.

HISTORY

The earliest preserved gears in Europe were the Antikythera mechanisms, which go back as far as 150-100 BC. This gear was an intricate device designed to calculate astronomical positions (Figure 1). Gears appeared in China around 200-265 AD as a differential in a chariot, then as the drivers of the first mechanical clocks in 725 AD.

The first industrial mills appeared in Medieval Europe between 770-1443 AD. Grist mills, flax, saw and cotton mills all employed gears to convert input energy from waterwheels, wind blades or work animals into specific work.

The first patent for gear hobbing, the process of cutting gear teeth, was granted to the English inventor John Whitworth in 1835.



One of the earliest uses for gears in an industrial situation was for mills. This is the Glade Creek Grist Mill in Babcock State Park, WV.

Throughout the industrial revolution and up to the present, gears have continued to serve a vital role in developing humankind's methodologies for accomplishing tasks, and they continue to evolve and improve in the way they provide brute force as well as delicate positioning (Figures 2 and 3).

TODAY'S GEARS

Some of the forms of gears today include spur, helical, double helical,

bevel, worm, epicyclic, rack and pinion. All of these gears are used for transmitting either rotary or linear motion, for multiplying force (torque being a rotary force), for increasing or decreasing rotational speed or for intricate position synchronization.

By definition, a gearbox is a set of gears within a casing. In the realm of actuation, that definition fits: a box (casing) contains gearing with the typical purpose of increasing the amount of input torque applied as an output to impart rotational movement.

Changes in rotational direction between the input and output of the gearbox and the number of rotations

Figure 1. The Antikythera mechanism fragment



Figure 2. An early giant



Figure 3. A tinier model

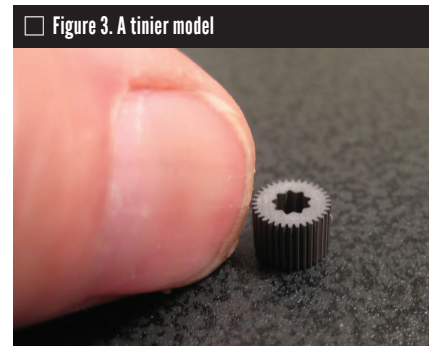




Figure 4. Handwheel

between the input and output are functions of the configuration of the gears and applied gear ratios. Products that require actuation and typically employ one form of gearbox or another include, but are not limited to: valves, slide gates, drum gates, dampers, skim troughs, and any other form of equipment that requires a rotational input to perform its intended function.

Gearboxes can be operated either manually or coupled to an electric actuator. For manual operation, a handwheel or chainwheel acts as the means of input force into the gearbox (Figure 4). For gearboxes used with actuators, the actuator acts as the means of input torque. In that case, the gearbox increases the overall output torque of the combination and can convert a multi-turn electric actuator output to a quarter-turn output.

The advantage of coupling a gearbox with an electric actuator is an increase in output torque because of the mechanical advantage of the gearbox. This allows a cost-effective solution through use of a smaller electric actuator as compared to a stand-alone electric actuator of comparable torque output.

Gearboxes use different gears depending on the output needed and the direction of the output axis. One type of gearbox that accepts a multi-turn input and provides a multi-turn output is the bevel gearbox (Figure 5) because the internal gears are beveled gears. The output of the gearbox is located at 90 degrees from the input of the gearbox.

This type of gearbox also can incorporate a base to allow the acceptance of thrust that results from the actuation in a threaded rising stem design valve or gate. The threaded stem of the valve or gate mates with a removable output drive nut, which is machined to the same thread of the stem.

When the input shaft of the gearbox is turned, either manually or by electric actuation, the output drive nut is rotated in the same direction as the input rotation (as viewed from the top of the gearbox). This imparts linear movement of the threaded stem. The drive nut is housed in a hollow shaft of the gearbox, which is open to the atmosphere, allowing the threaded stem to pass through the gearbox for long linear stroke applications.

The advantage of coupling a gearbox with an electric actuator is an increase in output torque because of the mechanical advantage of the gearbox.

Another form of gearbox that accepts a multi-turn input and provides a multi-turn output is a spur gear (Figure 6). This form of design incorporates internal gears and results in the output of the gearbox remaining in the same plane as the input of the gearbox. The spur gear has an overall larger envelope than a bevel gearbox because of the orientation of multiple spur gears needed to attain a mechanical advantage. The same linear movement of a threaded stem, possible thrust base and hollow shaft of the bevel gear can apply to the spur gear.

A worm gearbox accepts a multi-

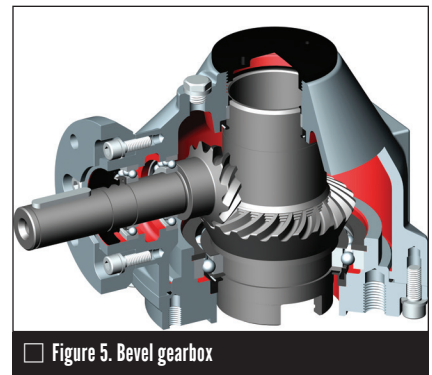


Figure 5. Bevel gearbox

turn input and provides a partial turn output, typically a nominal 90-degree rotation. This type of gearbox is intended for quarter-turn valves such as butterfly, plug or ball valves, or dampers. The output connection is typically a removable splined coupling, bored and keyed to match the stem of the valve or damper.

A spline connection of the coupling within the gearbox allows available positioning increments of the gearbox based on the number of splines provided in the 360-degree connection. A spline connection is a manufacturer-specific feature—not all gearboxes offer this method of connection to the operating stem. This eliminates the need for machining a special keyway position in the gearbox to accommodate the directional rotation needed between the open and closed positions of the valve. It also eliminates the mounting orientation of the gearbox needed when the stem bore and keyway have to be machined directly in the worm wheel of the gearbox. Integral position indication is provided by an adjustable pointer cover for the full-open and full-closed positions.

One variation of a worm gearbox is accomplished by adding a lever on the output drive and a mounting bracket to position the gearbox horizontally, a special configuration for damper applications that operate by a linkage connection (Figure 7).

Gearboxes are constructed to provide a mechanical advantage between the input and output force. For manual operation, this would be taking an achievable human-derived handwheel rim pull and increasing the force to an output torque capable of operating the intended device.

Over its life cycle, a gearbox is

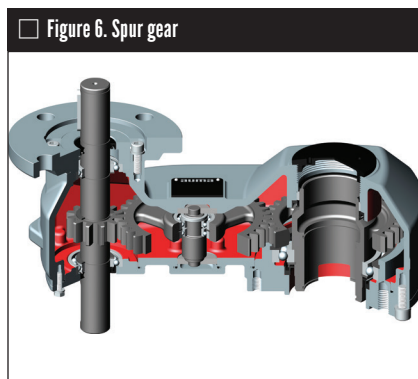
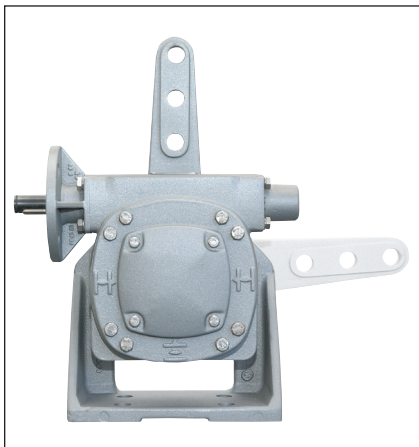


Figure 6. Spur gear



□ Figure 7. Worm gearbox with lever

expected to face numerous harsh conditions without failure of the gears or compromise of the enclosure case. This is because failure of either of these components is simply unacceptable.

INHERENT COMMONALITIES

A number of common inherent properties of gearboxes are addressed differently by different manufacturers and can be considered when choosing the best overall gearbox for an application. All these properties are manufacturer specific.

Backlash is an inherent property of gears—in new gears, this results from the manufacturing process, and in existing gears, this results from wear. The amount of clearance existing between a gear tooth space and a mating gear tooth width represents the amount of backlash present. This is the amount that either of the mating gears can rotate while its mate is stationary. The greater the backlash, the less the ability to maintain a position. Manufacturers incorporate precise machining (hobbing) and tight tolerances to minimize gear backlash.

A desirable feature for gearboxes is a self-locking ability. This is the inability of the gear to be driven from the rotational output end of the gearbox. In other words, torque applied to the output of the gearbox will not result in operation of the gearbox, an action accomplished by the geometry of the gears.

Gearbox efficiencies or mechanical advantage in simplest form is the gearbox output torque divided by the

gearbox input torque (with torque in the same units). As an example, in a gearbox incorporating two gears, the first gear would be a small diameter. This would result in a high transmission force at the gear teeth as $\text{Force} = \text{Input Torque} / \text{gear pitch radius}$. A small radius results in larger force. The second gear would be a larger diameter than the first. Accepting the high transmission force from the first gear at the gear teeth results in force times the second gear pitch radius, which equals output torque. A large radius increases the force by multiplication, resulting in an overall increase of torque from input to output.

A desirable feature for gearboxes is a self-locking ability. This is the inability of the gear to be driven from the rotational output end of the gearbox.

The number of turns is the required amount of gearbox input revolutions to equal one output revolution. Because the function of a gearbox is to increase the amount of input torque as an output to impart rotational movement, the employed gears typically follow the gearbox efficiency configuration mentioned above. By this configuration, the first gear, accepting the input, would be a small diameter and the second, providing the output, would be a larger diameter. A smaller input gear mating with a larger output gear results in an increased number of turns required at the input to provide one complete

turn of the output. Typically, as the efficiency of a gearbox increases, so does the required number of input turns to equal one output turn. This results from further varying gear diameters or the addition of additional gears to provide an increase of the output torque while the input torque remains constant.

STANDARDS AND SPECS

Various standards exist for different industries governing the construction and testing of gearboxes. This ensures the purchaser of a gearbox that the manufacturer meets a certain level of quality and aids in alleviating possible uncertainties for the basic integrity of a unit.

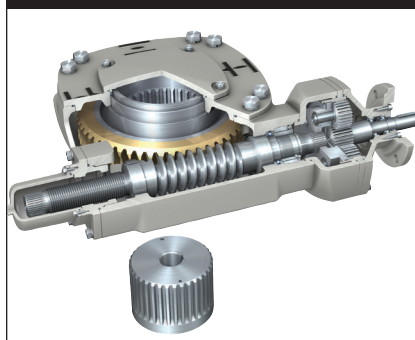
Still, there remains aspects of construction that satisfy the standards, but differ between specific manufacturers. For example, the worm wheel of a worm gearbox can be made from either ductile iron or alloy bronze material. It also can be either segmented geometry or a full circular gear. A ductile iron or alloy bronze segment of a worm gear (providing the minimum surface of the gear to give 90-degree operation) may appear cost effective at initial purchase, but could result in elevated maintenance costs and loss of operational time because of the minimal design.

A full alloy bronze worm gear (Figure 8) can provide optimal operation, corrosion resistance and four times the life span of a segmented gear by having the ability to use four quadrants of the gear before requisitioning a replacement expenditure for a worm gear or complete replacement unit. The adjustable 90-degree stops are integral mechanisms activated by the turning of the worm shaft to be able to incorporate a full 360-degree worm wheel (this is a manufacturer specific design).

CONCLUSION

It's up to the purchaser to define specifications and exact requirements. Careful consideration should be afforded to determine the best overall configuration for the application. **WM**

□ Figure 8. Full alloy bronze worm gear



MARK BUJALSKI is an application specialist for AUMA Actuators Inc. Reach him at Mark.Bujalski@auma-usa.com.



“Is my company eligible to join the Valve Manufacturers Association of America?”

VMA is the only association that exclusively supports and represents the interests of the U.S. and Canadian industrial valve, actuator and controls industry.

We offer four types of membership for companies based in the U.S. or Canada, and that meet other criteria.*

- **FULL MEMBERSHIP** U.S. and Canadian manufacturers of valves, actuators and controls
- **ASSOCIATE - SUPPLIERS** Companies that supply products and services to U.S. and Canadian manufacturers of valves, actuators and controls
- **ASSOCIATE - DISTRIBUTORS/CHANNEL PARTNERS** Companies that take title to and stock valves, actuators and controls manufactured by at least one VMA member
- **VALVE REPAIR COUNCIL** OEM-certified service, repair and maintenance firms for U.S. and Canadian manufactured valves, actuators and controls

If your company does qualify, here are some of the benefits you will enjoy:

- **Significant discount off of advertising in VALVE Magazine**, on VALVEMagazine.com, VALVE eNews and other VMA publications!
- **Free listing in VMA's Product Finders** (located on VMA.org).
- **Invitations to an array of VMA meetings and networking events** open only to members, including the VMA/VRC Annual Meeting, Valve Industry Leadership Forum, Market Outlook Workshop and Manufacturers Workshop. Plus, reduced rates for exhibits at the Valve Basics and Technical seminars, and the biennial Valve Repair Conference.
- **VMA's popular members-only newsletter, QuickRead**, delivered to your computer every Friday!
- **Participation in VMA's statistical and economic programs**, providing you with data not available anywhere else.



Join today and you'll find out why 95% of VMA members renew each year!

**To determine if you qualify to join VMA, go to: VMA.org > About VMA > Qualifications.
To determine eligibility for the Valve Repair Council, go to: VMA.org > Valve Repair Council.*

Admiral Valve (dba CPV Manufacturing)

Kennett Square, PA
www.cpvnmfg.com

Allagash International Group, LLC

Portland, ME
www.allagashinternational.com

- **Nor'East Controls**
www.noreastcontrols.com

American Valve, Inc.

Greensboro, NC
www.americanvalve.com

ARI Armaturen USA L.P.

Webster, TX
www.ari-armatureusa.com

ASCO Valve, Inc. - Emerson Industrial Automation

Florham Park, NJ
www.ascovalve.com

A-T Controls

Cincinnati, OH
www.a-tcontrols.com

AUMA Actuators, Inc.

Canonsburg, PA
www.auma-usa.com

Automation Technology, Inc.

Houston
www.atiactuators.com

Babbitt Chainwheel

New Bedford, MA
www.babbittsteam.com

Harold Beck & Sons, Inc.

Newtown, PA
www.haroldbeck.com

Bernard Controls, Inc.

Houston
www.bernardcontrols.com

Bray International Inc.

Houston
www.bray.com

Cameron, A Schlumberger Company

Houston
http://cameron.slb.com/

- **Flow Control**
Houston
- **Valves & Measurement**
Houston

Champion Valves, Inc.

Wilmington, NC
www.wafercheck.com

Check-All Valve Mfg. Co.

Des Moines, IA
www.checkall.com

Continental Disc Corporation

Liberty, MO
www.contdisc.com

- **Groth Corporation**
Stafford, TX
www.grothcorp.com
- **LaMOT Brand Products**
Liberty, MO
www.lamot.com

Conval, Inc.

Somers, CT
www.conval.com

Cowan Dynamics, Inc.

Montreal, Quebec, Canada
www.cowandynamics.com

Crane Co.

Stamford, CT
www.cranecpe.com

• **Crane Energy Flow Solutions**

The Woodlands, TX

• **Crane ChemPharma Flow Solutions**

Cincinnati

Curtiss-Wright Valve Group - Industrial Division

www.cw-industrial.com

- **Enertech**
Brea, CA
- **Exlar**
Chanhassen, MN
- **Farris Engineering**
Brecksville, OH
- **Target Rock**
East Farmingdale, NY

DeZURIK

Sartell, MN
www.dezurik.com

- **APCO Willamette**
Schaumburg, IL
www.apcovalves.com
- **Hilton Valve**
Redmond, MN
www.hiltonvalve.com

DFT Inc.

Exton, PA
www.dft-valves.com

Emerson

Corporate Headquarters
St. Louis, MO
www.emerson.com/FinalControl

Actuation Technologies

- **Bettis, EIM actuators**
Houston, TX
- **Morin actuators**
Pelham, AL

Flow Controls

- **Fisher control valves**
Marshalltown, IA

Fluid and Motion Control

- **ASCO solenoid and pneumatic valves, cylinders & air preparation equipment**
Florham Park, NJ
www.asco.com
- **TESCOM pressure regulators, valves & systems**
Elk River, MN
- **Anderson Greenwood instrumentation valves and manifolds**
Elk River, MN
- **TopWorx valve position indicators, switches & sensors**
Louisville, KY

Isolation Valves

- **Keystone, KTM, Vanessa valves**
Houston, TX

Pressure Management

- **Anderson Greenwood and Crosby pressure relief valves**
Stafford, TX
- **Fisher regulators**
McKinney, TX

Everlasting Valve Company, Inc.

South Plainfield, NJ
www.everlastingvalveusa.com

Flowserve Corporation HQ.

Irving, TX
www.flowserve.com

• **Flowserve Durco, Automax, Worcester**

Cookeville, TN
www.flowserve.com

• **Flowserve Valtek Control Valves**

Springville, UT
www.flowserve.com

• **Flowserve Edward and Anchor/Darting**

Raleigh, NC
www.flowserve.com

• **Flowserve Limitorque**

Lynchburg, VA
www.limitorque.com

• **Flowserve Gestra Steam Traps & Systems**

Louisville, KY
www.gestra.com

• **Flowserve Nordstrom and Vogt**

Sulphur Springs, TX
www.flowserve.com

• **Flowserve Valbart**

Houston
www.flowserve.com

Forum Energy Technologies - Valve Solutions

Stafford, TX
www.f-e-t.com

GE Oil & Gas

Houston
www.ge.com

• **Consolidated Safety and Safety Relief Valves**

Alexandria, LA

• **Masoneilan Control Valves**

Avon, MA

• **Regulation and Control**

Houston

Hunt Valve

Salem, OH
www.huntvalve.com

Indelac Controls, Inc.

Florence, KY
www.indelac.com

ITT Engineered Valves

Lancaster, PA
www.engvalves.com

Kingston Valves

Torrance, CA
www.kingstonvalves.com

Kitz Corporation of America

Stafford, TX
www.kitz.com

Koso America, Inc.

West Bridgewater, MA
www.kosohd.com

Metso Flow Control USA Inc.

Shrewsbury, MA
www.metso.com

Moog Flo-Tork, Inc.

Orrville, OH
www.moog.com

Mueller Water Products

Atlanta
www.muellerwaterproducts.com

• **Henry Pratt Company**

Aurora, IL
www.henrypratt.com

• **Henry Pratt, Hydro Gate**

Denver
www.hydrogate.com

• **Henry Pratt, Lined Valve**

Woodland, WA
www.knifegatevalves.com

• **Milliken Valve Company**

Bethlehem, PA

www.millikenvalve.com

• **Mueller Co.**

Chattanooga, TN

www.muellercompany.com

PBM, Inc.

Irwin, PA
www.pbmvalve.com

The Wm. Powell Company

Cincinnati
www.powellvalves.com

Process Development & Control, Inc.

Corapolis, PA
www.pdcvalve.com

QTRCO, Inc.

Tomball, TX
www.qtrco.com

REXA

West Bridgewater, MA
www.rexa.com

Richards Industries-Valve Group, Inc.

Cincinnati
www.jordanvalve.com

Rotork Controls, Inc.

Dallas, TX
Houston, TX

Milwaukee, WI
Petaluma, CA

Rochester, NY
Tulsa, OK

www.rotork.com

• **Rotork Controls Canada Ltd.**

Calgary, Alberta, Canada
Mississauga, Ontario, Canada

www.rotork.com

• **Rotork Instruments**

Winston-Salem, NC
www.rotork.com

• **Remote Control**

N. Kingstown, RI
www.rciactuators.com

R.S.V.P. Actuators & Controls

Hempstead, TX
www.rsvpactuators.com

Score Valves

Edmonton, Alberta, Canada
www.scorevalves.com

Spirax Sarco, Inc.

Blythwood, SC
www.spiraxsarco-usa.com

• **Spirax Sarco Canada Ltd.**

Concord, Ontario, Canada

Total Valve Systems

Broken Arrow, OK
www.totalvalve.com

Townley Engineering & Manufacturing Company, Inc.

Candler, FL
www.townley.net

Union Tech Co., LLC

Houston
www.uniontechmfg.com

UniTorq Actuators & Controls

Duluth, GA
www.unitorq.com

Val-Matic Valve and Mfg. Corp.

Elmhurst, IL
www.valmatic.com

ValvTechnologies, Inc.

Houston
www.valv.com

Velan Valve Corporation
Montreal, Quebec, Canada
www.velan.com

Victaulic
Easton, PA
www.victaulic.com

Weir Valves & Controls-USA
Ipswich, MA
www.weirvalveusa.com

Western Valve, Inc.
Bakersfield, CA
www.westernvalve.com

WEY Valve
Nettleton, MS
www.weyvalve.com

ASSOCIATE MEMBERS

DISTRIBUTOR/CHANNEL PARTNERS

AIV, LP
Houston
www.aivinc.com

Andrews Industrial Controls
Carnegie, PA
www.andrewsic.com

Ci Valves & Actuators
Houston
www.ciactuation.com

Classic Controls, Inc.
Lakeland, FL
www.classiccontrols.com

DistributionNOW
Houston
www.distributionnow.com

FloWorks
Pasadena, TX
www.flowworkspvf.com

MRC Global, Inc.
Houston
www.mrcglobal.com

QRC Valve Distributors
Stafford, TX
www.qrcvalves.com

Setpoint Integrated Systems
Baton Rouge, LA
www.setpointis.com

TRIFLOW Corp.
West Berlin, NJ
www.triflowcorp.com

Wolseley Industrial Group
Newport News, VA
www.wolseleyindustrialgroup.com

SUPPLIERS

A.W. Chesterton
Groveland, MA
www.chesterton.com

All-Pro Fasteners, Inc.
Arlington, TX
www.all-profasteners.com

American Foundry Group
Bixby, OK
www.americanfoundry.com

Auge Industrial Fasteners
Houston
www.augeusa.com

AVK Carbo-Bond/Bi-Torq Inc.
LaFox, IL
www.bitorq.com

Badger Alloys, Inc.
Milwaukee, WI
www.badgeralloys.com

Bradken-Engineered Products
Chehalis, WA
www.bradkenamericas.com

Delta Centrifugal
Temple, TX
www.deltacentrifugal.com

EGC Enterprises, Inc.
Chardon, OH
www.egcflexiblegraphitesolutions.com

The Flexitallic Group, Inc.
Houston
www.flexitallic.com

Garlock Sealing Technologies
Palmyra, NY
www.garlock.com

Highland Foundry Limited
Surrey, British Columbia, Canada
www.highlandfoundry.com

Jet-Lube Inc.
Houston
www.jetlube.com

Key Bellevilles, Inc.
Leechburg, PA
www.keybellevilles.com

Krytox® Performance Lubricants
Wilmington, DE
www.krytox.com

Matrix Metals LLC
Richmond, TX
www.matrixmetalsllc.com

Omaha Steel Casting Co.
Wahoo, NE
www.omahasteel.com

Precision Polymer Engineering, Inc. (PPE LLC)
Houston
www.prepol.com

Scientific Linings & Coatings
San Antonio
www.weathercap.com

Siemens Industry, Inc.
Spring House, PA
www.usa.siemens.com

Sigma Corporation
Cream Ridge, NJ
www.sigmaco.com

Solon Manufacturing Co.
Chardon, OH
www.solonmfg.com

Teadit North America
Pasadena, TX
www.teadit-na.com

Technetics Group
Columbia, SC
www.technetics.com

Thermodyn Corporation
Sylvania, OH
www.thermodyn.com

VanAire, Inc.
Gladstone, MI
www.vanaireinc.com

Watson Grinding & Mfg.
Houston
www.watsongrinding.com

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

MEMBERS OF THE VALVE REPAIR COUNCIL *An affiliate of the Valve Manufacturers Association of America*

Allagash International Group, LLC
Portland, ME
www.allagashinternational.com

Allied Valve
Chicago
www.alliedvalveinc.com

AVP Valve, Inc.
Lakeland, FL
www.avpvalve.com

Bay Valve Service, Inc.
Seattle
www.bay-valve.com

Cameron, A Schlumberger Company
Houston
www.cameron.slb.com

CFM/VR-TESCO LLC
Elgin, IL
www.globalfield.net

Classic Controls, Inc.
Lakeland, FL
www.classiccontrols.com

Cleveland Valve & Gauge/ Renew Valve & Machine Co.
Cleveland/Carleton, MI
www.clevelandvalve.com
www.renewvalve.com

Dayton Precision Services
Dayton, OH
www.daytonprecisionservices.com

Dowco Valve Company
Hastings, MN
www.dowcovalve.com

Eastern Controls, Inc.
Philadelphia
www.easterncontrols.com

Emerson
Corporate Headquarters
St. Louis, MO
www.emerson.com/FinalControl
Emerson Lifecycle Services

Actuators
Control valves
Isolation valves
Pressure relief
Regulators
Marshalltown, IA

Flotech, Inc.
Jacksonville, FL
www.flotechinc.com

Flowserve Corporation
Baton Rouge, LA
www.flowserve.com

Formosa Plastics USA
Point Comfort, TX
www.fpcusa.com

Furmanite
Houston
www.furmanite.com

GE Oil & Gas
Houston
www.ge.com

• Consolidated and Masoneilan
Aftermarket and Field Service
Deer Park, TX

• Consolidated Safety and Safety
Relief Valves
Alexandria, LA

• Masoneilan Control Valves
Avon, MA

Gulf Coast Modification, LP
Houston
www.gulfcoastmod.com

Gulf Coast Valve, Inc.
Corpus Christi, TX
www.gulfcoastvalve.net

J&S Machine and Valve, Inc.
Nowata, OK
www.jsmachineandvalve.com

Kirksey Machine
Houston
www.kirkseymachine.com

Metso Automation
Shrewsbury, MA
www.metso.com

Midwest Valve Services, Inc.
Minooka, IL
www.mwvalve.com

Pioneer Industrial Corporation
St. Louis, MO
www.pioneerindustrial.com

Precision Fitting and Gauge
Tulsa, OK
www.pfandg.com

Precision Pump & Valve Service
Charleston, WV
www.ppps.com

Precision Valve Group
Monroe, NC
www.precisionvalvegroup.com

Setpoint Integrated Solutions
Baton Rouge, LA
www.SetpointIS.com

Southeast Valve Inc.
Charlotte, NC
www.sevalve.com

Southern Valve Service, Inc.
Baton Rouge, LA
www.southernvalve.com

Thorco
Tulsa, OK
www.thorcousa.com

United Valve
South Houston, TX
www.unitedvalve.com

Universe Machine Corporation
Edmonton, AB Canada
www.umcorp.com

Valve Reconditioning Service Co.
Melvindale, MI
www.vrsinc.net

ValvTechnologies
Houston
www.valv.com

Wal-Tech Inc.
Mobile, AL
www.wal-tech.com

Watson Valve Services
Houston
www.watsonvalve.com

VRC ASSOCIATE MEMBER

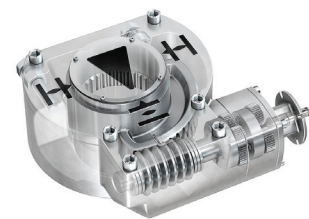
Quality Valve
Mobile, AL
www.qualityvalves.com

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

Mueller Water Products introduced the Singer 106/206 PGM-2PR-630-SM Pressure Management Valve with Integral Backup. Designed for applications where failure is not an option, the valve hydraulically manages pressure around the clock to reduce water loss, save money and prevent unwanted pressure spikes that contribute to premature pipe failure. The valve switches between high- and low-pressure pilots based on flow rate. It requires no electrical power or independent flow signal, as it takes its flow signal from an orifice plate installed on the valve inlet.



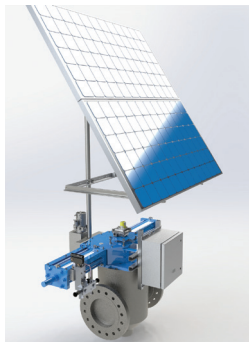
A.W. Chesterton Company introduced 1726 Low Emissions Packing, a new sealing solution for isolation valves. The innovative packing is designed to help companies in the petrochemical, chemical, and oil and gas industries meet and exceed current emissions requirements and improve safety. It is offered in a single spool and fits a wide range of isolation valve applications, allowing companies to simplify inventory and installation.



AUMA has a new range of part-turn gearboxes, the GQB series. They have been specifically designed to meet the requirements for basic 90-degree applications with standard industrial valves such as

butterfly and ball valves. The housing incorporates a coaxial primary reduction gear as well as integral mounting flanges for the actuator, handwheel and valve. This reduces the number of parts and the amount of material required, without compromising performance.

Automation Technology (ATI) introduced an electro-hydraulic control system. The product can be directly mounted to a linear or quarter-turn spring-return or double-acting actuator to perform critical shutdowns even when a power source is unavailable. It can be provided for either non-hazardous or hazardous area rated service and consists of a power module and a control module. The power module includes an electrical motor, a single-direction hydraulic pump with reservoir, a valve manifold, and a power supply for control components.



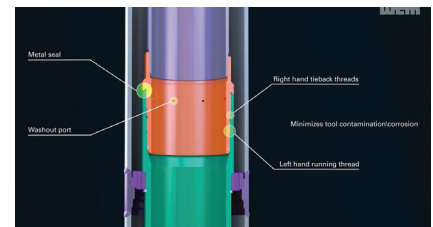
Emerson launched automation technology for utilities and independent power producers that rely on diverse renewable energy sources and serve the fast-growing microgrid market. The company's new, modular Ovation OCC100 controller extends Emerson's proven Ovation control technology by managing the flow of energy from various sources to ensure continuous, reliable generation. The small footprint, scalable technology is also well-suited to critical water and wastewater applications.



Schlumberger released the GROVE IST integrated seat technology ball valve. New ball valve technology features a patented seat-on-ball design that significantly improves performance over conventional metal-seated ball valves in addition to offering considerable size and weight benefits.

The new product has a seat design that provides advanced sealing performance and increased valve life span while minimizing size and weight, enabling customers to reduce total cost of ownership. The valve qualifies to API 6A PR2 for performance, API 6AV1 for slurry testing and API 607/6FA for fire testing.

Weir Oil & Gas introduced its WMSS10 Mudline Suspension System for exploratory and developmental wells. This stack-down system eliminates debris traps, improves reliability and enhances efficiency of tieback operations in offshore operations.



The system transfers the weight of the well to the seabed. It offers a method of disconnect for all casing strings, allowing the temporary abandonment of a well in a minimum amount of time and without having to cut casings. It is designed for high-capacity casing hang-off loads and high pressure STD and H₂S wells to allow operators to run casings to deeper depths.



4 of the Top 5 Industrial PVF distributors* in 2016 are members of the Valve Manufacturers Association!

Since 2015 VMA has welcomed valve, actuator and control distributors and channel partners as members of the association.

The benefits of membership

As the only organization representing the U.S. and Canadian valve manufacturing industry, membership in VMA offers a unique opportunity for distributors and channel partners:

- Attend top VMA members-only events such as the Annual Meeting, Leadership Forum and Market Outlook Workshop
- Get preferential pricing on meetings, advertising and exhibits
- Enjoy exclusive networking opportunities

- Receive enhanced editorial coverage in VALVE Magazine—both print and online—and via social media
- Access VMA's popular members-only weekly newsletter, QuickRead
- And much more!

Does your firm qualify?

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

For additional criteria, visit VMA.org > About VMA > Qualifications

VMA is proud to recognize as members the following distributor/channel partners:

- AIV, LP
- Andrews Industrial Controls
- Ci Valves & Actuators
- Classic Controls, Inc.
- DistributionNOW, Inc.*
- FloWorks*
- MRC Global, Inc.*
- QRC Valve Distributors
- Setpoint Integrated Systems
- TRIFLOW Corp.
- Wolseley Industrial Group*

*Modern Distribution Management Top 5**

Questions? Contact VMA President Bill Sandler at wsandler@vma.org or call 202.331.8105 ext. 306.



To apply for membership, go to VMA.org > About VMA

“YellowJacket” WeatherCaps
Extend The Life Of Your Relief Valves

Protecting Your Relief Valves Against Environmental Degradation
(Rain, insects, bird’s nests, sand, dust & salt spray)

NO Tools Needed to Install

Meets or Exceeds Environmental Requirements

Proudly Made and Assembled In the USA

SCIENTIFIC LININGS & COATINGS, INC.
FIND A DISTRIBUTOR ON THE WEBSITE www.WeatherCap.com

- 29 **ASCO**
www.asco.com/spoolvalves
- 24 **Assured Automation**
www.assuredautomation.com
- 19 **AT Controls**
www.at-controls.com
- 5 **AUMA**
www.auma-usa.com
- 17 **Babbitt Chainwheels**
www.babbitt.com
- 21 **Champion Valves**
www.wafercheck.com
- C4 **Crane**
www.cranecpe.com
- 13 **Highland Foundry**
www.highlandfoundry.com
- 16 **Manufacturers Standardization Society**
www.mss-hq.org
- 32 **Polymet Corporation**
www.polymet.us
- C2 **Powell Valves**
www.powellvalves.com
- 1 **Rotork Controls**
www.rotork.com
- 44 **Scientific Linings & Coatings, Inc.**
www.weathercap.com
- 33 **Score Valves**
www.scorevalves.com
- 35 **Solon Manufacturing**
www.solonmfg.com
- C3 **United Valve**
www.unitedvalve.com
- 2 **Velan**
www.velan.com
- 43 **VMA Distributor Membership**
www.VMA.org/About VMA
- 39 **VMA Membership**
www.VMA.org/AboutVMA
- 22 **Valve Industry Knowledge Forum**
www.VMA.org/KnowledgeForum
- 25 **Wolseley Industrial Group**
www.wolseleyindustrialgroup.com

When your company advertises in VALVE Magazine, you'll reach close to 70,000 industry professionals, from end users and AEC/EPC firms to distributors and valve manufacturers.

Contact Sue Partyke, advertising director, at 540.374.9100 or email spartyke@vma.org to learn more.

**STATEMENT OF OWNERSHIP, MANAGEMENT,
AND QUARTERLY CIRCULATION OF VALVE MAGAZINE**

OWNER: Valve Manufacturers Association of America; William S. Sandler, President and Publisher; Judith P. Tibbs, Associate Publisher and Editor-in-Chief

HEADQUARTERS OF PUBLISHER, EDITOR AND PUBLICATION:
1625 K Street, NW, Suite 325, Washington, DC 20006

STOCKHOLDERS; BONDHOLDERS; MORTGAGE; OTHER SECURITY HOLDERS: None

	Avg. No. Copies Each Issue Preceding 12 Months	No. Copies of Single Issue Published Nearest to Filing Date
Summer 2017		
A. TOTAL COPIES PRINTED (Net Press Run)	20,932	20,790
B. Paid/Circulation		
(1) Outside County	10,384	10,072
(2) In County	0	0
(3) Outside the Mail	611	658
(4) Other Classes Mailed through USPS	0	0
C. Total Paid and/or Requested Circulation	10,995	10,730
D. Nonrequested Distribution by Mail		
(1) Outside County	9,794	9,916
(2) In County	0	0
(3) Other Classes Mailed through USPS	0	0
(4) Outside the Mail	288	300
E. Total Nonrequested Distribution	10,082	10,216
F. Total Distribution	21,077	20,946
G. Copies Not Distributed	267	228
H. Total	21,344	21,174
I. Percent Paid and/or Requested Circulation	52.2%	51.2%

Date of Filing: Oct. 1, 2017

Technology + Expertise

Valve Modification and Repair is a business of technology and expertise. At United Valve we always maintain a healthy blend of both. A combination of

56 years of business experience combined with the latest technology ensures the highest quality products and services for our customers.



1. To work on extra-large valves it takes an extra-large materials handling system. Our 40-ton crane with 37 feet of hook height makes easy work out of servicing and testing the biggest valves the industry can produce.

2. Spare parts or valve components of nearly any size can be created in our CNC machine department. The combination of software, experience and large-part machine capacity makes even complex component production quick and highly accurate.

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

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

5. Our fugitive emissions testing capabilities include multiple test set-ups equipped to perform any API, ISO, or customer testing protocol. Custom software-driven, programmable-logic-controllers make easy work of all control and monitoring operations during FE tests.



United Valve

The Valve Service Specialists

9916 Gulf Freeway, Houston, Texas 77034-1045
Phone 713/944-9852 888/715-5093 Fax 713/944-5964

Visit us online at: www.unitedvalve.com

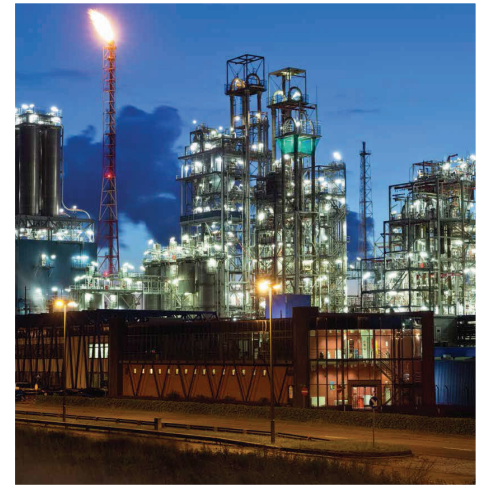
DIGITAL EPIC-2 INTELLIGENT VALVE POSITION TRANSMITTER FOR SAFETY VALVES

ADVANCED SAFETY FUNCTIONS: Emergency Shutdown Monitoring (ESM), simple Partial Stroke Testing (PST) implementation, and Solenoid Operated Valve Testing (SOVT) are reliably carried out to preserve the integrity of critical safety systems.

PREDICTIVE DIAGNOSTICS: Diagnostic functions and intelligent alarms pinpoint the root cause of problems to predict necessary valve maintenance before it fails, thereby lowering the total cost of ownership and ensuring effective valve maintenance and operational integrity.

HART 7 COMMUNICATION AND DTM TECHNOLOGY: Allows seamless integration into any control system, enabling remote configuration, calibration and diagnostics.

HART® is a registered trademark of FieldComm Group



Westlock is a global leader in innovative and emerging technologies in the Valve Position Monitor, Digital Control Monitor, Network Control Monitor, Position Transmitter and Smart Positioner segments of the Flow Control Industry



CRANE

www.westlockcontrols.com

A BUSINESS OF CRANE CO.