JIM WHITE OF CURTISS-WRIGHT ELECTED VMA CHAIRMAN; KIM BEISE OF DOWCO RECEIVES VMA'S HIGHEST AWARD

VALVE MAGAZINE

FALL 2016
VOL. 28, NO. 4

Market Outlook FOR 2017:

Seeing Past the Uncertainty

- THE SKILLS GAP
- ADVANTAGES OF TOV BUTTERFLY VALVES
- THE CAST VS. FORGED DECISION
- TODAY'S WELDING BASICS

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OUTLOOK FOR 2017

SLUGGISH GROWTH WITH A FOCUS ON NEW REALITIES

12 Most forecasters agree we won't see much growth in economic activity for end-user industries, and that the current situation is complicated by factors that make it hard to predict what lies ahead. Still, VMA's Market Outlook speakers shared what they see coming next year.

BY KATE KUNKEL

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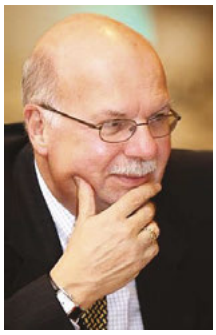
Very Few Bright Spots



VMA's 35th Annual Market Outlook Workshop in San Diego last August offered a fairly pessimistic view for 2017 after no real growth in 2016. The condition of the market also was reflected in attendance, which was down for both VMA and VRC members, as well as the Hydraulic Institute, our workshop partner the last 12 years and the trade association for pump manufacturers. Workshop attendees heard from a number of end-user industry experts, and what they had to say about the outlook for 2017 varied by industry. But the overall feeling for the near future was cautious pessimism.

For example, Simona Mocuta, senior economist for State Street Global Advisors, who addressed the group on global economics, referred to what's happening around the world with these descriptions:

- Low growth
- Low inflation
- Ineffective policies, and
- Destructive politics

The way she put it was: the economy "should be better, but could be worse." Mocuta pointed out that 2016 marks the fifth year and 2017 will mark the sixth year of sub-par growth.

Still, she said she felt that the Eurozone recovery has gained a little traction, though there are no signs of a sharp growth acceleration. Meanwhile, some factors that could help the situation are:

- A let up in the fighting in the Ukraine
- The (temporary) resolution of the Greek crisis
- The fall in oil prices
- The fall of the euro

To hear what else she had to say as well as what other speakers forecast, go to the indepth article beginning on page 12.

As far as the meeting itself, evaluations were very favorable for both the expertise of speakers and for the meeting facility and staff.

I also had my ear to the ground, taking in what the attendees were saying about their business experience over the past half-year. I'm sorry to report that here, too, I detected a glint of pessimism. But I've heard it all before over the years, and everyone's hope is that the economies of our industries will survive and thrive just as they have in past rough times.

VMA and VRC members: We hope you'll join us at the 36th Market Outlook Workshop scheduled for Aug. 3-4, 2017 in Boston and that what you hear turns the tide towards optimism. VM

Bill Sandler
President, Valve Manufacturers Association of America

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NEW CONTRACTS

GE Oil & Gas Making Subsea Equipment

GE signed an exclusive Memorandum of Understanding with L&T Hydrocarbon Engineering Limited, a wholly-owned subsidiary of Larsen & Toubro (L&T). Together, the firms will partner in manufacturing subsea manifolds destined for future deep-water projects in the Krishna-Godavari basin on the east coast of India.

Spread over an area of 600,000 square meters (.23 square miles) and with an annual capacity of 50,000 metric tons (55,116 tons), L&T's modular fabrication facility in Tamil Nadu was chosen as the production site after a rigorous qualification process. The plant is equipped with advanced welding and fabrication capabilities along with a large jetty, making it an ideal location to manufacture advanced hardware for the seabed.

L&T's Kattupalli facility, Tamil Nadu, India

Metso Signs Deal on Huge Copper Mine

Metso won a significant deal to support the conversion of the largest open-pit copper mine in the world to a large-scale underground mining operation. The Chuquicamata mine, located north of Santiago, Chile, is owned and operated by Chile's National Copper Corporation, Codelco.

Metso's scope in the contract includes engineering, supply of equipment and materials, and site assistance for 12 underground crusher stations combined with a conveyor package.

The project is scheduled to continue until 2020.

MARKET FOCUS: GOOD LONG-TERM NEWS FOR U.S.

Although much of what was said at the VMA Annual Meeting this year was tinged with pessimism, speakers who addressed the long-term had good news for attendees.

China currently has an edge in competitiveness; however, the U.S. will pull ahead by 2020 and "leave them in the dust," according to Alex Chausovsky, senior analyst, ITR Economics. Chausovsky's analysis was based on a competitiveness survey by Deloitte Touche and the U.S. Council on Competitiveness.

The most important driver of a country's ability to compete on the global stage is talent, while cost competitiveness is the second most influential driver, Chausovsky said. The U.S. is well-positioned in both those areas to be a manufacturing powerhouse in the future, he said.

Ben Dollar, principal of Deloitte, who spoke during this year's Market Outlook in San Diego, backed up that long-term look. Dollar also referred to the Deloitte survey and said the U.S., because of its high-quality talent, abundance of resources, industrial clusters and ability to innovate, will be the world's most formidable business competitor (see page 26).

2016 Global Manufacturing Competitiveness Index

2016 (Current)		
Rank	Country	Index Score
1	China	100.0
2	United States	99.5
3	Germany	93.9
4	Japan	80.4
5	South Korea	76.7
6	United Kingdom	75.8
7	Taiwan	72.9
8	Mexico	69.5
9	Canada	68.7
10	Singapore	68.4

2020 (Projected)		
Rank	Country	Index Score
1	United States	100.0
2	China	93.5
3	Germany	90.8
4	Japan	78.0
5	India	77.5
6	South Korea	77.0
7	Mexico	75.9
8	United Kingdom	73.8
9	Taiwan	72.1
10	Canada	68.1

Source: Deloitte Touche Tohmatsu Ltd. and U.S. Council on Competitiveness

Curtiss-Wright Gets Contracts for U.S. Naval Platforms

Curtiss-Wright announced it has been awarded contracts valued at more than $80 million to provide valves for the U.S. Navy's Virginia-class submarines and Ford-class aircraft carriers. The awards were received from Bechtel Plant Machinery, Inc. and General Dynamics Electric Boat Division to support ship construction and spare parts procurement.

Contracts include orders for two ship sets of submarine propulsion plant valves, an order for aircraft carrier propulsion plant valves, and the balance of the funding for the Virginia-class submarine Block IV Ship Service Ball valve contract awarded in 2014. Curtiss-Wright is performing the work at its facility in East Farmingdale, NY.

MERGERS & ACQUISITIONS

Emerson Buys Pentair Valves & Controls

Emerson has signed an agreement to purchase the Valves & Controls business of Pentair for $3.15 billion. Pentair Valves & Controls has nearly 7,500 employees around the world. The deal is expected to close in four to six months, subject to various regulatory approvals.

This transaction follows Emerson's recently announced divestitures of Network Power, Leroy-Somer and Control Techniques as part of the company's overall strategic portfolio repositioning initiated in June 2015.

FloWorks Sells Plate and Sheet Business

FloWorks International LLC sold its plate and sheet operations located in Garland, TX to CL Alloys-Dallas LLC. The transaction closed June 30, 2016.

The Garland plate and sheet operations were the remaining assets of the legacy Fabrication and Distribution Services business, which FloWorks divested in 2014. This sale completes FloWorks exit from locations dedicated to the distribution of flat products and metal services.

Spirax Sarco Purchases Brazilian Valve Manufacturer

Spirax Sarco acquired the assets of the process control valve manufacturer, Hiter Indústria e Comércio de Controles Termo-Hidráulicos Ltda (Hiter), based in Sorocaba, Brazil. Hiter was a subsidiary of Pentair. Following the acquisition, Spirax becomes the only significant manufacturer of both control and safety valves in Brazil.

Hiter has undergone significant change as part of Pentair's Valves & Controls segment, resulting in a December 2015 announcement to close the company effective March 2016. The assets have been acquired by a new Spirax subsidiary, Hiter Controls Engenharia Ltda.

NEW FACILITIES

Watson Valve Upgrades Oxygen Cleanroom

To ensure proper cleaning procedures are performed on valves intended for oxygen service, Watson Valve Services upgraded its clean room within its manufacturing plant in Houston. Watson Valve Services' clean room is operated by trained technicians and is constructed with positive pressure ventilation, which is used to limit airborne particles and environmental contamination. Both mechanical and solvent cleaning methods are used. Watson Valve maintains separate tools, benches and equipment to reduce the potential for cross contamination.

Chemours Selects Wilmington, DE for its Global Headquarters

The Chemours Company will locate its global headquarters in Wilmington, DE. The company began evaluating headquarters location options more than six months ago. Recent changes to Delaware's corporate tax

Chemours' new Wilmington, DE headquarters

NOVEMBER

14-15
VMA Human Resources Workshop
Houston
www.vma.org/HRworkshop

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Valve World Conference & Exhibition
Düsseldorf, Germany
www.valveworldexpo.com

DECEMBER

13-15
Power-Gen International
Orlando, FL
www.powergen.com

MARCH 2017

3-4
VMA Technical Seminar & Exhibits
Nashville, TN
www.vma.org

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

MAY

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

JUNE

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

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

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structure were key components in Chemours' decision.

The company followed a disciplined evaluation process against a range of criteria, including quality of life for employees, access to a strong talent pool and a positive, long-term financial case for the company.

DeZURIK Adds Dedicated Cleanroom to Sartell Plant

DeZURIK constructed a new dedicated clean room within its Sartell, MN manufacturing plant to ensure proper cleaning procedures for valves intended for oxygen, ozone, chlorine, hydrogen peroxide, isocyanate and other applications.

Operated by trained cleaning technicians, DeZURIK's clean room is constructed with positive pressure ventilation to limit environmental contamination and airborne particles. The facility maintains all separate tools, benches and equipment to reduce the potential for cross contamination. Cleaning procedures include mechanical, ultrasonic and solvent cleaning methods, with each part inspected under both white light and UV black light to identify contaminants.

Testing after clean assembly in Dezurik clean room

Emerson Expands Pasadena, TX Manufacturing Capabilities

Emerson recently moved its service center in Pasadena, TX into a larger facility to expand its local manufacturing and assembly capabilities. The service center houses service, design, manufacturing and assembly operations for measurement technologies, which allows for same- or next-day manufacturing.

Specific process measurement products that now can be manufactured or assembled at the Pasadena facility include thermocouples, thermowells and temperature sensors. Local capabilities also encompass pressure, temperature and level transmitters—along with the related components required to make these measurements.

AWARDS & MILESTONES

MRC Global Ranked #1 Industrial PVF Distributor

Modern Distribution Management (MDM) ranked MRC Global as #1 on the 2016 Top Industrial PVF Distributors list and #5 on the Top Industrial Distributors list. The MDM Market Leaders lists identify the top distributors by revenue across 15 distribution sectors.

Data to determine placement on the lists was collected from the companies, public filings and news releases. For companies that did not provide their data, MDM estimated rankings based on past reported revenues, average revenue increases within the sectors, data from economic reports and conversations with industry experts.

AUMA Actuators Celebrates 40th Anniversary

This year benchmarks the 40th anniversary of AUMA-USA's manufacturing and operations. In 1976, AUMA began manufacturing in Pittsburgh, PA. In 2004, due to company growth, AUMA-USA relocated to Canonsburg, PA. Today, AUMA employs 2,300 staff members worldwide, including U.S. locations in Canonsburg, Houston and Tustin, CA.

Emerson Wins Growth Excellence Leadership Award

Emerson Process Management earned Frost & Sullivan's 2016 Growth Excellence Leadership Award for its portfolio of best practice technologies and services through its Project Certainty initiative. Frost & Sullivan recognized Emerson's DeltaV distributed control system with CHARMs technology, a key element of Project Certainty.

Frost & Sullivan presents the Growth Excellence Leadership Award to a company that achieves growth through customer focus and delivering value creatively. Candidates are evaluated based on overall growth performance and customer impact.

NEW CERTIFICATIONS

ValvTechnologies Approved by NUPIC, Saudi Aramco

ValvTechnologies, Inc. recently achieved NUPIC-

approved supplier list status after completing the Nuclear Procurement Issues Committee (NUPIC) audit conducted at the Houston facility. NUPIC members include all domestic U.S. nuclear utilities as well as several international members.

ValvTechnologies also successfully completed Saudi Aramco's 9COM certification process. This allows the valve company to supply Saudi Aramco with both V Series metal-seated ball valves and IsoTech parallel slide gate valves. To become 9COM certified, ValvTechnologies underwent an evaluation process that included quality control, process management, document control and facility evaluation.

VanAire Achieves ISO 9001:2015

VanAire, Inc. achieved ISO 9001:2015 registration following a special "Upgrade Audit" reviewing the company's entire Quality Management System. VanAire has been ISO registered since 2012 and was previously certified to the ISO 9001:2008 Standard.

VanAire completed the upgrade audit with no major or minor non-conformances. Nearly every member of the VanAire team was involved in reviewing the quality system to ensure that it met or exceeded the requirements of the new standard.

PEOPLE IN THE NEWS

MUELLER COMPANY... has selected **Mike Lindgren** to succeed retiring vice president of sales **Mike Williams**.

A nearly 25-year veteran employee, Lindgren most recently held the Mueller Co. director of sales and sales processes role for the past few years. Prior roles include central district manager, district engineer, senior field sales representative, field sales representative and sales trainee.

WATSON GRINDING... has given a stake in the company's future to **Kelly L. Watson**, the second of two, third-generation family-member shareholders, preceded by her cousin, and future partner, **Jason White**.

Watson

Today, Watson Grinding & Manufacturing, Watson Valve Services Inc. is owned and operated by the founder's son, **John Watson**; son-in-law, **Bob White**; grandson, Jason White; and now, granddaughter, Kelly Watson.

ROTORK CONTROLS... has named **Lee Howard** president, overseeing both the U.S. and Canada. He replaces the recently retired **Bob Arnold**, a former VMA chairman, who served as president of Rotork Controls since 1988.

Howard

Howard was born in Wales and is a native of the UK. He previously served as managing director, Rotork Africa; general manager, Rotork Australia; and regional general manager, Australasia, Japan and Korea.

VAL-MATIC... has appointed **Mark T. Troyanowski** as vice president of sales and marketing. Troyanowski joined Val-Matic earlier this year and previously worked in various sales management roles at other manufacturing companies.

Troyanowski

Over his career, he participated in several municipal industry organizations including American Public Works Association, American Water Works Association and Water and Sewer Distributors of America.

VALVTECHNOLOGIES... has appointed **Joe Kelly** as regional director, Europe, Middle East and Africa (EMEA). Based in the UK, he will have senior management responsibility for leading sales growth in the EMEA region.

In addition, **Bryant Holt** is the new industry director for the company's fossil power division. Holt will succeed **George Stover**, who has served in this role since 2014.

POWELL VALVES... has added **Cory Foster** to the sales team as regional manager southwest. Foster will be based in Powell's Stafford, TX location and be responsible for sales and business development in Texas, Oklahoma, Kansas and parts of Louisiana.

VELAN... announced that **Tom Velan**, chairman of the board and CEO of Velan Inc., plans to retire from his CEO position effective March 1, 2017. On that date, **Yves Leduc**, who is currently the president of the company, will become president and CEO. Tom Velan will continue to be the chairman of the board.

CIRCOR ENERGY... recently added **Barry Abel** as its new North American midstream manager. Abel will be responsible for Trunnion Mounted Valve (KF Valves Welded Body & P3) and Engineered Valve (Pibiviesse) sales into North American transmission and midstream accounts.

Abel

METSO... announces that **Olli-Pekka Oksanen** has been appointed senior vice president, strategy and business development.

Eeva Sipilä came on as CFO on Aug. 1, 2016. **Harri Nikunen**, who held that position, was appointed senior vice president, mergers and acquisitions and special projects.

Simo Sääskilahti, currently senior vice president, strategy and business development, will start as the head of valve technologies in the flow control business area.

FORUM ENERGY TECHNOLOGIES... recently promoted **Prady Iyyanki** to the office of president and CEO. Iyyanki has served as the company's executive vice president and CEO since January 2014.

VMA Elects New Chairman, Honors VRC Member, Addresses Tough Issues

VMA chose new leaders, honored a member who has served the association and listened to several well-received speakers at the VMA/VRC 78th Annual Meeting Sept. 21-23 in Rancho Mirage, CA.

Jim White (left) takes over the chair from Bob Kemple.

At the conclusion of the event on Sept. 23, **Jim White**, Curtiss-Wright, took over as chair of VMA. He succeeds **Bob Kemple**, ASCO, who has served in that capacity since the last annual meeting.

White will be aided in his role by **Mark Nahorski**, PBM, who is the new vice chairman; **David Hughes**, Pentair Valves & Controls, who is program chairman; and Kemple, who remains on the board as the immediate past chairman.

Joining the board this year is **Douglas Meikle**, Cameron. Serving board terms until 2017/2018 are **Arie Bregman**, DFT Inc.; **James Gray**, GE Oil & Gas; **Bruce Johnson**, Emerson Process Management; **Brad Ellis**, Crane Co.; **Jim Walther**, Kitz Corp. of America; **Ron Warren,** Bray International; and **Brian Wright,** A-T Controls. Serving terms until 2019 are **Bryan Burns**, DeZURIK; **Patrick Dunn**, Metso Automation; and **John Lenander**, Flowserve. **Greg Rogowski**, Mueller Co., retired from the board this year.

VRC MEMBER GETS TOP AWARD

A surprised and appreciative **Kim Beise**, Dowco Valve Company, Hastings, MN, was called to the podium during the meeting to receive the prestigious Person of the Year award, which is given to someone who has gone above and beyond in giving time and talent to the causes of the association. Beise has been active in the Valve Repair Council (VRC) for almost 15 years; 12 of those years he served on the board. He became VRC chair in 2015 and is only the second council member to receive this award.

Top VMA award winner Kim Beise

Beise also has been involved in VMA activities, contributing to the success of the association's Valve Basics Seminar by volunteering as one of the instructors. In addition, he was selected in 2015 to join the VMA Education & Training Committee and serves as the committee's expert on pressure relief valves.

OUTSTANDING SPEAKERS

Several business speakers spoke to the nearly 100 association leaders in attendance, and addressed some of today's challenges including the realities of today's digital world, the changing role of distribution in the valve industry, and the general economic and political outlooks for this country.

Jill Rowley outlined for attendees a world in which many a deal has been sealed on the golf course or over a steak dinner. Today those deals often begin on the internet where 90% of business-to-business buyers start the search for business solutions, she said.

Speaker Jill Rowley

We live in a digital-mobile-social world that is largely affected by the millennial generation, which is accustomed to operating in that environment, Rowley said. As a result, companies need to learn how to reach what is now about a quarter of the U.S. population and will constitute half the workforce by 2020. One of the realities is that this generation is much less likely to follow a brand and more likely to follow people and companies that have a message, she said. Social selling using sites such as LinkedIn, Twitter and Facebook are increasingly important in the everyday lives of the current generations.

The more you have a presence in social networks—particularly LinkedIn because it's the site used most often to conduct business—the more likely people will intercept your message, she said.

As far as the world of distribution, **Joe Nettemeyer**, CEO/Chairman, Valin, said wholesale distribution has transitioned from a transactional business to value added.

The reality today is the role of the distributor has changed to become a seamless provider of information: Distributors must have the ability to respond quickly with quotations and to offer expertise as well as products.

Those businesses who get the fact that today's attention span is in seconds as well as those that know how to provide the right data will be the leaders of tomorrow, he said. "Competition is about having the best information and data and actually using it, across the organization in each and every customer interaction," he said.

Alex Chausovsky, senior analyst, ITR Economics, had a bit of good news to report on the economic front. He said there are better days ahead of us and that while some people say the economy is shrinking, core factors point in another direction. While the expected growth is not robust (about 1.9% for 2016), we will see rising economic activity over 2017 (3.5% growth) and into 2018 before heading into a downturn. Most of the sectors where valves play a role will be in a better position in 2017 so Chausovsky said many businesses will see improved performance. "The leading indicators for the valve industry are good," he concluded. VM

HR Workshop in Houston, Nov. 14-15, to Address Retention, Training and Mentoring

VMA has invited all industry human resources professionals working in manufacturing and industrial settings to attend the 2016 HR Workshop: Building a Better Workforce through Employee Engagement. The workshop is Nov. 14-15 at the Houston Marriott West Loop – Galleria.

The event will focus on retention, training and mentoring and features four outstanding speakers from several different areas of expertise: Ian Baynes, a global strategy and marketing expert who directed an award-winning mentoring program at a VMA member company; Tiffany Gearhart, a mentoring and training specialist; Jack Wisdom, an employment law authority; and Joe Bontke, deputy director of the Houston Equal Employment Opportunity Commission office. Attendees will have several opportunities to network with their industry HR peers, discuss shared challenges and solutions, as well as hear from a panel of VMA's "YVPs" (young valve professionals). In addition, attendees will receive a VMA Certificate of Completion awarding 8 credit hours upon completion of the workshop. The registration fee is $495 for non-members and $425 for members.

For more information and to register for this event, please visit www.vma.org/HRWorkshop.

The Place for Information on Power: Power-Gen

Over 20,000 people are expected to attend this year's Power-Gen International, Dec. 13-15 at the Orange County Convention Center, Orlando, FL. The world's largest power generation event offers the expertise of 200 speakers in more than 36 conference sessions as well as access to 1,400 exhibitors.

Power-Gen is the place where a wide range of professionals in the power industry gather to network, shop and learn about the latest innovations and issues surrounding the world's energy needs.

The conference sessions are divided into tracks of specific areas such as energy storage, digital power plants, emissions control, gas turbine technology, general power generation trends, financing and more.

Keynote speakers include Alex Glenn, president of Duke Energy Florida, which serves 1.7 million electric retail customers in central Florida, and Rich Halil, senior vice president and general manager, Energy, for Burns & McDonall, an engineering and construction consulting company for many industries, including energy and oil & gas. Those two will address "The Power to Change."

Power-Gen is also held in conjunction with four other events that cover the areas of renewable energy, nuclear power, coal generation and the business side of power generation.

Many of the exhibitors are VMA members or makers of valves. Stop by and see VMA at booth 726. VM

For information on the conference, go to www.power-gen.com.

Valve World Biennial Global Conference Coming Soon

Valve World Expo 2016 returns to Düsseldorf, Germany for the fourth time on Nov. 29 to Dec. 1 as valve specialists such as manufacturers and representatives from a number of end-user industries wander the giant exhibit halls to hear about and see the latest products and trends in the valve industry.

The international conference is held every two years. In 2014, more than 12,500 mid- to upper-management professionals attended the event and just as many are expected this time around as they gather at the Messe Düsseldorf fairgrounds. They come from a number of industries including oil and gas, petrochemical, food processing, water and wastewater, power generation and others.

The more than 600 companies that exhibit at the expo include those who manufacture and provide services to valves and the equipment used in conjunction with valves. Those who come for knowledge have a wide range of plenary lectures, presentations and workshops from which to choose over the three days, planned by a steering committee with a large number of end users as members.

VMA will be exhibiting at Stand #4A21 along with the British Valve & Actuator Association. Bill Sandler, president, will be on hand to greet visitors from all over the world. VM

For information, go to www.valveworldexpo.com.


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Market Outlook FOR 2017:

Sluggish Growth with a Focus on New Realities

BY KATE KUNKEL

While the current uptick in the economy is good news to all industries, continued low oil prices and political unpredictability are making it difficult to get financing for projects, according to speakers at the 2016 VMA Market Outlook workshop in San Diego last August. This is especially true in the water and wastewater infrastructure and chemical processing markets.

In addition to those shorter-term issues, a new concern is making its way to the forefront of people's minds—and it promises to have long-term effects. Nearly every workshop presenter expressed serious concerns about the ability of manufacturers and end users to get the skilled workers they need.

SOME OF TODAY'S UNCERTAINTIES

- **The recovery of the U.S. economy** (as well as many other countries) has been much slower than after past recessions. While companies have assets and access to affordable credit, many are not investing in capital improvements, which contributes to the slow growth.
- **The U.S. elections, the Brexit situation, and political upheavals** and bad policies in other areas of the world have created hard-to-predict situations and nervous investors.
- **Oil and gas prices remain low**, while coal and nuclear in the U.S. are dying and renewable energy sources are picking up speed throughout the world.
- **Demand for consumer goods, power, water and infrastructure** in undeveloped and developing countries is increasing, spreading economic considerations around the globe.

OIL AND GAS
Give it Two Years

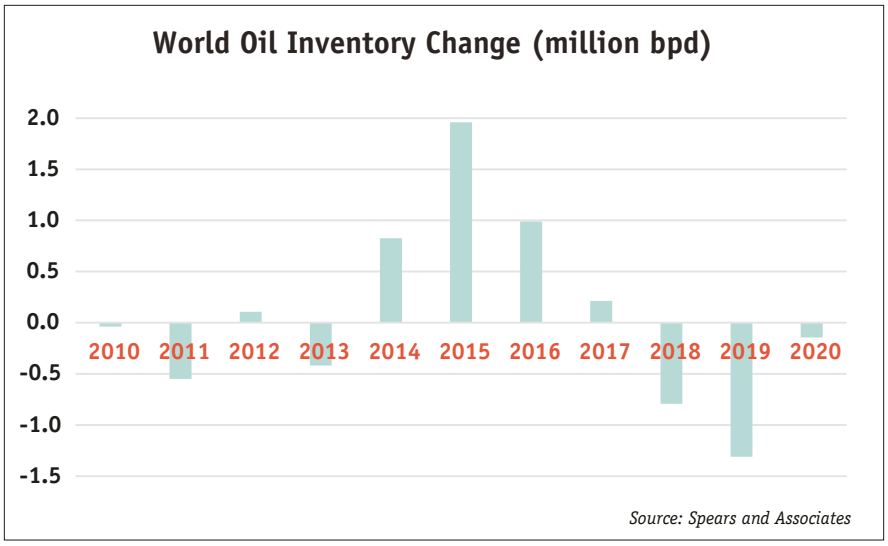
Despite a 75-80% fall-off in drilling activity recently, John Spears, president of Spears and Associates, was optimistic about the future of oil and gas over the next two years.

"World oil demand is estimated to increase 1.5% in 2016 and another 1.6% in 2017," he said.

That demand is coming from emerging markets, which now account for over half of worldwide oil demand. India and China also will see demand growth—Spears said those countries will need 300,000 barrels per day (bpd) this year.

As a result, even though 500,000 bpd was added to the market by post-sanction Iran in 2016, global oil supply is expected to grow only half a percentage point this year as reduced output from the U.S. offsets gains elsewhere.

Spears said it will take only about 18 months to deplete the "extra" 800 million barrels of oil that have been placed in inventory over the last two years. "With this trend, we will likely have negative inventory by 2018," Spears said.



As far as drilling activity, Spears said that when the need grows sufficiently, U.S. producers will be able to finish about 1,800 oil wells now awaiting oil price recovery (which he said is above $50 a barrel). He predicted that producers would need to start increasing production by the second half of 2018 to fill the emerging gap between demand and supply, and that may mean well completions beginning next year in anticipation. That will be good news for valve and associated equipment demand, he said. He also reported that:

Natural Gas

U.S. spot gas prices fell to around $1.60 per million British thermal units (mmbtu) last spring. Drillers are responding by making their operations more efficient. For example, "Operators have found that an ever-longer horizontal section doesn't get

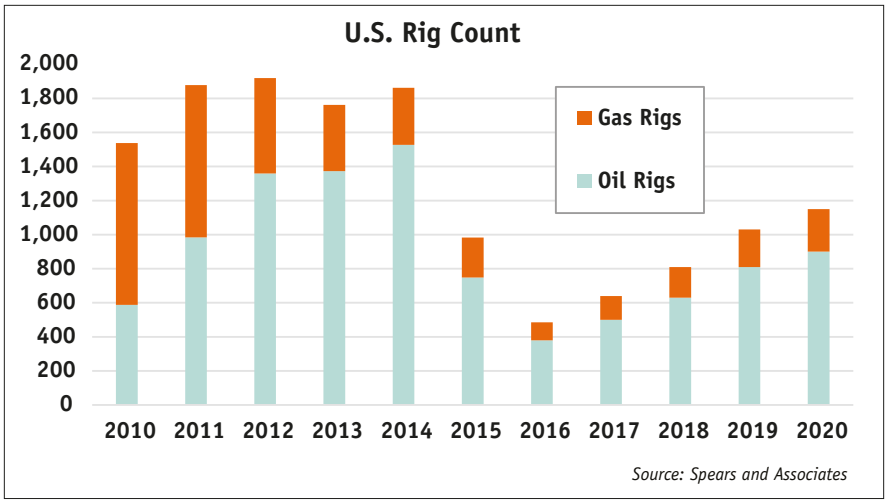
as much bang for the buck," he said. Instead of continuing horizontally, drillers are drilling shorter lengths then going to a different place and reversing direction to drill back towards the original spot. "This way they utilize as much as possible of the resource," he said.

These changing drilling methods and price fluctuations from weather and supply issues make it difficult to forecast drilling activity.

Meanwhile, gas consumption has grown at a 2.4% compound annual growth rate (CAGR) since 2012, with 45% of the growth coming from power sector needs, where gas has taken over coal's share. U.S. gas output is projected to reach 74.8 billion cubic feet per day (bcfd) in 2016 (up 0.8%), but has not grown since the third quarter of 2015.

Spears projected that by Thanksgiving 2016, gas inventories should allow prices to get back to around $3.20. "We do not project gas prices going back to the $4 or $5 level," he said. Still, new techniques have put the incentive to drill a well at about $3.

Meanwhile, "Where are you going to find the people to run the equipment when you do gear up?" he said.



Source: Spears and Associates

Rig Activity

U.S. rig activity is projected to fall about 45% in 2016, but then will rise about 30% in 2017. "It's a tough environment for the producers," Spears noted, because "they don't have the access to Wall Street to get funds to support activity."

Canadian rig activity is projected to fall about 39% in 2016 before rising about 30% in 2017. A challenge there "comes from Alberta's plans to double its carbon tax to C$30 per tonne by 2018," Spears said, along with a 100-megatonne per annum cap on oil sands emissions (up from 70 million megatonnes).

FORECAST

- *U.S. oil prices will recover to about $50/barrel by the end of this year and about $60 by the end of 2017. That means oil traders will begin to anticipate the potential for inventory draws beyond 2017.*

- *U.S. gas prices will average about $2.30/mmbtu this year. Gas prices are forecast to average over $3/mmbtu in 2017.*
- *The global market for surface and subsea equipment including wellheads and Christmas trees will total $19.5 billion in 2016 and rise to $21 billion in 2017. Global spending on rig equipment is forecast to total $11 billion in 2016, down from 2015, then fall about 10% in 2017. Most of what's needed will be replacement for worn-out equipment; it will be about 2018 before new equipment is needed.*

LNG/GAS EXPORTS
Activity Shifts

Four years ago, Liquified Natural Gas (LNG) was a very heated market and, "We (the U.S.) were discussing export capacity and ways to capture the market," said Ken Medlock, senior director, Baker Institute for Public Policy, the Center for Energy Studies. While the U.S. will remain a major player, today, "There is new capacity going online in other areas of the world closer to where the need exists."

Meanwhile, "The role of natural gas in meeting the demands of the developing world is largely dependent on the availability of networks and grids," said Medlock. He shared with the audience a global picture at night to illustrate where power is needed.

Eastern China has brightened considerably recently, he pointed out. Since the current per-capital income within China's interior is 1/20th of what it is on the coast, "It's just a matter of time before the lights get brighter there," he said.

Medlock also explained that, as more than 500 million people move into the middle class around the globe in the next 20 years, the first requirements they have are roofs over their heads, food and clothes. After that, they start using energy. Meeting those energy demands will require unprecedented levels of investment.

"So where does natural gas fit?" he asked. In the developed world, demand is relatively flat, which means opportunities arise as older infrastructures need to be replaced.

The last major build-out of coal-fired infrastructure in the U.S. was in the late 1970s to early 1980s, Medlock said. When that infrastructure meets its life end, the decision to replace must be made.

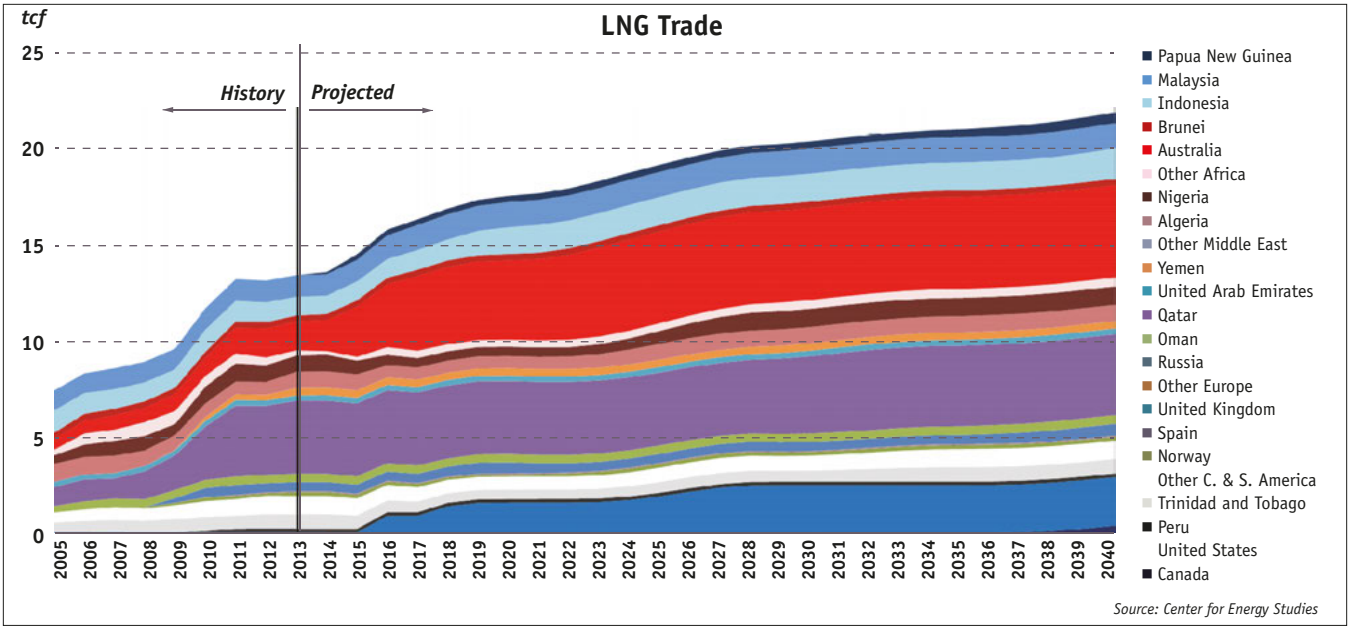
While a percentage of the replacement will be in renewables such as wind, solar and geothermal, Medlock said natural gas will remain a significant portion for at least the next few decades.

Shale has been a driver behind the growth of natural gas and crude oil, but that driver is U.S.-centric, he said.

The growth of energy use "is an international conversation," he reminded the group. India is beginning to grow and economic reforms have been launched to develop road infrastructure across the country, which will connect the country and promote internal development.

In China, "More than 60% of the infrastructure built to create or transmit power was built in the last decade," he said. "They are not going to retire that any time soon."

However, the Chinese government is



Source: Center for Energy Studies

thinking of moving toward renewables and natural gas "so there will be opportunity for new builds. That means an opportunity for LNG," Medlock said.

Including all gas resources, there is about 2,500 trillion cubic feet (tcf) of natural gas available at wellhead prices below $6 in North America, so this continent is likely to be a driver of supply-side global gas market development for years to come. However, the LNG market is saturated because demand didn't materialize the way it was anticipated and production has begun in many other areas of the world, he concluded.

For example, Australia's LNG is exporting to Malaysia and other markets close to them, such as China and India. The U.S. is expected to emerge as the third largest LNG exporter in the world.

Medlock stressed that Asian demand is going to drive the market, but there will also be LNG import growth in Latin America. Because the U.S. is connected to Canada and Mexico, existing infrastructure to get the gas from Canada to the gulf and out can be used.

"Politics have an impact when you talk about pipelines, but once you put natural gas on the water as LNG, you can transport it anywhere in the world as long as there is receipt capacity," he pointed out.

Medlock believes gas prices overall will moderate. "The U.S. price remains among the lowest in the world, but the bottom line is: it is affected by demand, which is often seasonal, and by global trade."

FORECAST

- *Elasticity of supply in North America will push the large, long-term price impacts onto international markets.*
- *North America is positioned to take an increasing role in the global gas market balance, carrying geopolitical and environmental impact.*
- *Renewables will capture greater market share, but they face challenges that even cost abatement policies cannot sustainably address.*
- *Energy efficiency will play an important role in balancing demand in an increasingly environmentally sensitive world.*

THE PETROCHEMICAL MARKET

North America is Champ

Mark Eramo, vice president, IHS Chemical, said opportunity for growth in the chemical industry exists.

"But the story in this industry is the same basically as it was last year. As long as predictions hold true that crude will return to nearly $80 a barrel and gas will stay low, North America is still the most attractive place to invest in petrochemicals and plastics," he said.

ExxonMobil and Sabec have announced a major project on the U.S. gulf coast, an indication they believe North America is the place where they can count on the availability and good prices of natural gas.

Still, because demand growth is questionable, many companies are holding off on making build decisions, he said. Russia and Brazil have not recovered from 2009's economic woes and are currently facing recessions. While India remains a bright spot with steady growth, the full impact from China's economic reform has yet to be seen.

The result, according to Eramo, is a slowdown in approving new investments for 2020 and beyond. Lower costs added to the pause in demand result in price declines. While lower prices can stimulate chemical demand, those prices also lower margins, which could force re-assessment of capital spending. The combination can create tight markets in the near term and will influence future investment decisions.

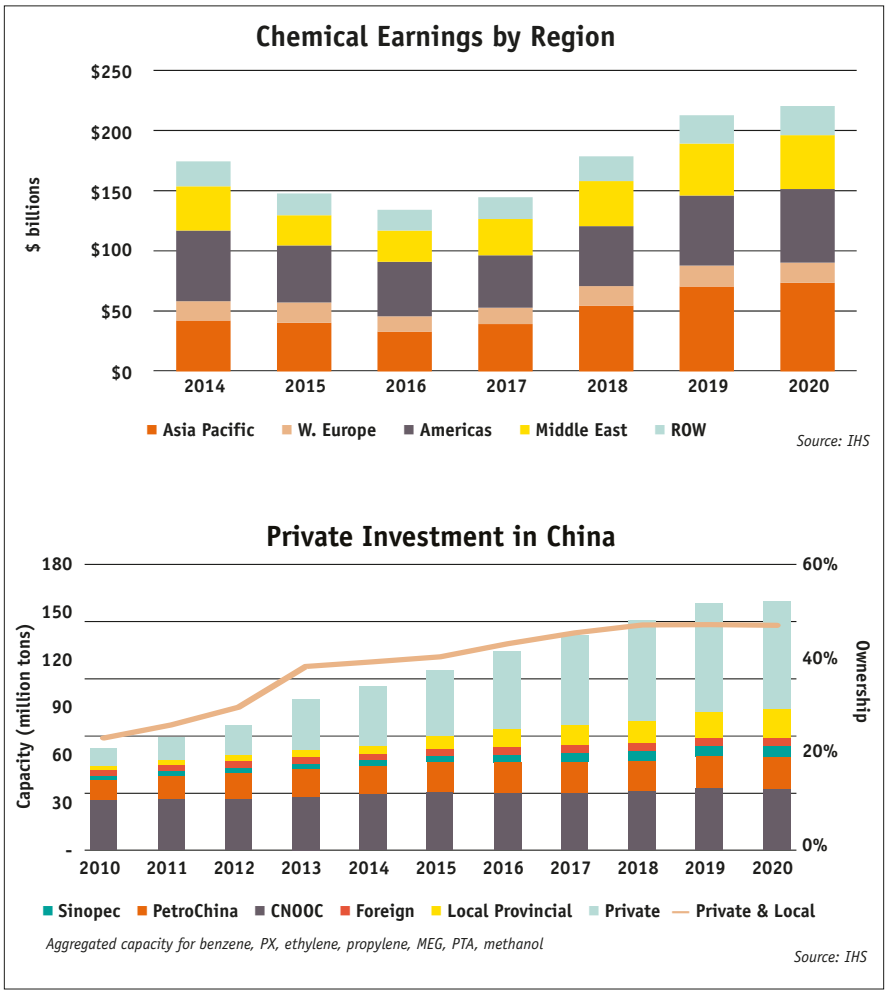
Compared to its rate of advancement and to other countries in the world, China is seeing a much lower level of spending. "There is a capacity overbuild that has created a supply surplus in certain product chains," Eramo said. As a result, "there will be a change in the kinds of products," he said. Also, private company investment continues to gain market share in that country.

Meanwhile, "they [Chinese companies] are getting more active in overseas investment, and the government's policy is moving toward market-driven dynamics to drive investments," Eramo said.

China represents about 50% of the 4% growth in plastics consumption and will add nearly 250 million metric tons of capacity in the next three decades, he said. Almost half of that capacity is owned and operated by private companies, which are also building infrastructure in preparation for new plants.

"The question arises—Does private investment change behavior?" Eramo asked. "Can you expect companies in China to react and act in response to market conditions? And what does all of this mean for the valve industry?"

The Chinese government also is promoting industry consolidation to combat pollution and improve industry efficiency and safety. "We're seeing all the right things happening in China. The economy there is still growing and more people in China are consuming more of their own things," he said.



In North America

Low-cost energy and natural gas liquids provide a sustainable advantage for a new investment wave in North America, Eramo said. Advantaged feedstock will enable an additional wave of building beyond 2020, assuming crude oil prices recover (to near $80/barrel) and low natural gas pricing (near $3/mmbtu). However, logistics and port infrastructure investments are desperately needed to support a higher level of exports.

Shale oil and gas have brought back competitive economics to the U.S. Domestic and international companies are seeking to invest to leverage the low-cost opportunities, and new entrants in the market will create increased competition in domestic markets.

"North American ethylene capacity will increase to more than 45 million metric tons by 2020, driven by low-cost ethane feedstock," said Eramo. All of the current growth lies in turning the feedstock into base chemicals, but there will be more growth in derivative units.

However, delays will come from issues regarding the quality and availability of labor. "In terms of executing this size and complexity of plants, there are problems getting the right kind of people to plan, build and operate them," Eramo noted. "There have not been projects like this built in the recent past, so finding people who can make them happen is a challenge."

FORECAST

- *2016 will see a 10% earnings decline; 2017-2018 should see earnings improve as demand grows into supply base.*
- *Decisions to put investments on hold in 2016 could lead to supply limitations in 2020 and beyond as demand growth accelerates.*
- *By 2019-2020, earnings should peak as oil recovers and demand grows into installed capacity base.*

THE WATER MARKET

A Leaking Situation

While the 2015 water and wastewater market exceeded predictions by growing about 5%, water construction was down in 2016 compared to the previous year, though wastewater was up.

"The flat numbers are certainly not because there isn't a huge need for work in the market," according to Tom Decker, water marketing and business strategy consultant. "The American Society of Civil Engineers has projected a $113 billion shortfall in water projects over the next few years, and the Environmental Protection Agency (EPA) says that over the next 20 years, water needs a $384 billion and wastewater needs a $271 billion investment," he added.

Meanwhile, the American Water Works Association says the U.S. needs $1 trillion over the next 25 years just to stay at the current level of service.

The condition of the water system in the U.S. has been called a national security threat, while the World Economic Forum says water shortage is the number one global crisis of the next decade.

This is despite public support for investment in water infrastructure.

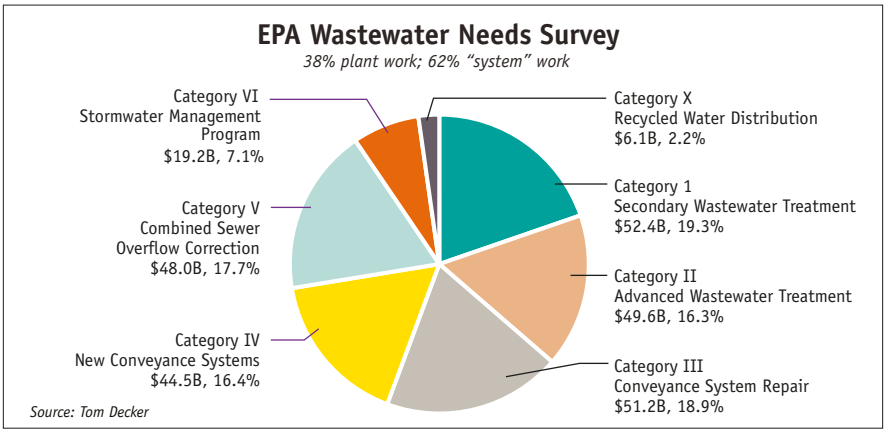
"The episode in Flint had a big impact on public perception," Decker said. But so far, the funds have not flowed as freely as the leaks in the system, "and much of the need is not necessarily in plants—it's out in the system, for pipes, pumps and valves."

Supply Shortage

A huge factor affecting water needs is shortage—the west, for example is in its fifth year of drought. "Lake Mead is now at only 49% of its capacity, and many cities are looking for alternative supply sources," he said.

For example, San Diego has wisely created a multi-year program to maximize water re-use, while Houston is set to spend $2 billion to reduce groundwater pumping. Many others are looking for alternative sources of water, including desalination, Decker said.

Currently 17,000 desalination plants operate in 150 countries, with the most active areas of the world the U.S., India, the Middle East and China. While reverse osmosis is still the leader in this market (about 80% of the plants), development in the U.S. has slowed because of the economics of the process as well as concerns about brine disposal and the



impact of intake structures on aquatic life. Still, Decker pointed out that a Frost and Sullivan study found that growth in desalination worldwide will be in double digits for the next four years—about a 13% CAGR worldwide.

Water re-use is also seeing growth, although only about 3.8% of wastewater in the U.S. is recycled back into the system. Other factors affecting the current market include:

Crumbling infrastructure: "We are still averaging about 240,000 pipe breaks per year in the U.S., and we lose in excess of 6 billion gallons of treated water per day" due to leaks, Decker pointed out. Utility companies do well if they can replace 1% of their systems per year, he said. "That means it takes 100 years to replace a system. And today's pipe materials don't have a 100-year lifespan."

Overflows: Last year about 800 billion gallons of untreated water was released in the U.S. Cities such as Baltimore, Winnipeg and Nashville are developing multi-billion dollar programs to clean up overflows. "There is plenty of work out there in the overflow arena, and there is more enforcement from the EPA, forcing utilities to reduce overflows," said Decker. The Obama administration's EPA made this a priority issue, but "the question is, once Obama is gone, will the enforcement get pared back?" he asked.

Financial forces: While the need for funding is significant, utilities are not earning sufficient revenue despite the fact that rates are up about 6% in 2015 and have been up 41% since 2010. People are using less water, either because of conservation or restrictions, and rate increases are not keeping up with reduced volume. Decker pointed to a Black and Veatch study that showed only one-third of water utilities can cover their current and future needs with current rates; one-third will need to raise between 5-10% to cover costs, and the final third "simply don't know where that money will come from," Decker said.

Once funds are obtained, the other problem is finding construction companies able to bid, he added. Staffing shortages have made some firms reluctant because they are not confident they will find the skilled labor needed for big projects.

While about $120 trillion is available for infrastructure from banks and institutional investors, the price of oil is currently depressing infrastructure spending in some markets. Meanwhile big drivers for the global market include a growing middle class and urbanization in developing countries.

Canada has just proposed a $90 billion infrastructure spend over the next decade and 12% of that will go to water and wastewater.

FORECAST

- *A 2% overall growth will occur in the market for 2016 with the second half doing better than the first. For 2017, a continued slow growth pattern will occur but contraction will be part of the picture going into 2018.*

POWER

Flatlining for Some

Kevin Geraghty, vice president, generation, NV Energy, began his presentation with this somber announcement: "I hate to say it, but coal and nuclear are basically dead in the U.S."

The markets are no longer economically feasible, and the U.S. power market is flat, with less than 1% annual growth expected this year, he said.

"Everybody talks about environmental laws, the administration, new gas discoveries and lower cost renewables as a driver, but you know what is really driving this is energy efficiency," he proclaimed.

The recession had a huge impact on the degree of efficiency and the way products are made, he added, and power consumption has not bounced back thanks in part to smart technology and other conservation efforts.

"There is a glut of energy in the U.S., and this is the most stable period for energy prices in 30 years," he said.

The U.S. nuclear fleet will get very old in the next 25 years and much of it will be shut down for economic reasons (not because of problems). Operators just can't pay the money to stay around. The exception is Palo Verde in Arizona and some plants in the Southeast, where there are regulated utilities and the costs to run the reactors are built into the rates, he said.

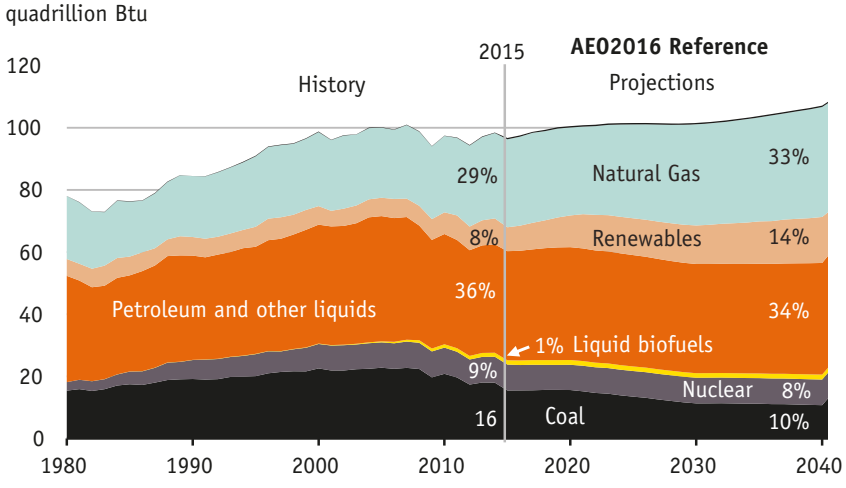
Geraghty expects half of nuclear power to go away while new coal plants will exist only if one scenario enters the picture: high oil prices. "I believe that daytime power requirements will be almost 100% solar and wind," he said.

At the same time, storage of that power remains a problem, and natural gas-fired generation will cover the shortages.

"But in a decade or so, natural gas will be attacked as well. Most of the energy added in the U.S. will not use pumps or valves except for the southeast and the southwest where there are huge load needs," he added.

For valves and pumps, "the most important thing to remember in North America is that baseload energy does not exist in natural gas and coal anymore, so they are starting and stopping," Geraghty said. "That puts stress on the valves and that is where the valve and pump business can grow. Cycling is hard on the technology."

U.S. Primary Energy Consumption



Source: EIA, Annual Energy Outlook 2016

FORECAST

- *Coal plants that survive will run less and need to be flexible—most of these plants are base-loaded today and will need help with heavy cycling requirements.*
- *Flat to negative growth in power generation and use will occur in the U.S. in the coming years.*
- *Explosive growth will occur in developing nations.*
- *The need for technological advances to enable efficiency and demand-side management, distributed energy systems and storage is increasing.*
- *Sometime in the next decade, more energy will come from renewable resources than coal resources.*

WALL STREET

Why Are Stocks So High?

The overall economic improvement people had hoped for after the recession is not happening, and fundamentals are stable-to-worsening in the economy, according to Michael Halloran, senior research analyst and managing director of Robert W. Baird and Company. However, the stock market continues to hit all-time highs, which is counter-intuitive given several negative variables affecting the marketplace, he added. Those variables include a strong U.S. dollar, which hurts U.S. exporters; impacts from low oil prices; slower growth in China; struggling U.S. debt-dependent emerging markets; and political instability in many markets. All of these are a drag on global growth, he said.

While Halloran remained optimistic about the distant future for capital expenditure (capex) investments, he wasn't so cheerful about the short term.

"When political instability rises, you defer investment decisions. This is especially true with oil and gas projects," he said. "Global demand outlooks remain sluggish, and persistent headwinds are reflected in recent orders and sales. Overcapacity, peak debt levels and the ongoing race to cut costs enough to preserve margins are negative factors."

While the automotive, municipal water and wastewater, and U.S. residential and commercial construction markets are exhibiting some improvement, agriculture, general industrial, mining and oil and gas are trending downward while aerospace, defense, chemical and power remain stable.

The biggest negative for the process industry is cuts in oil and gas-related spending. Upstream capital spending in 2016 is projected to fall as much as 30-50% in North America and 10-20% internationally. Additionally, the effects of commodity deflation have spilled over into midstream and downstream projects, which means project deferrals and cancellations are likely to continue through 2016 into 2017. Oil and gas industry experts have speculated that oil prices of $60 to $70 per barrel must be sustained to justify a material rebound in capex, he said.

Service companies in oil and gas are making no money today, he said. As oil goes up, the service providers will raise prices, which means the capex pool stays the same, and there won't be as much money for suppliers. While Halloran believes a recovery is coming, he sees no growth in 2017. There will be limited large scale capex projects and a heavy focus on after-market replacement of worn products.

The question is, why is the stock market so high? Many factors, including interest rates and a broader scale of economics are currently trumping the market, he said.

"Low interest rates worldwide mean that people are chasing yield. They want to make their money work so they push into riskier assets—stocks," he said.

But that does not mean that companies whose stocks are going up are more valuable. In fact, many are restructuring, an accelerated theme over the last 18 months.

Restructuring brings with it "layoffs and facility consolidation, which means less power, less physical footprint. Facilities are being reduced 5-10% but when you ask managers if they will increase space again, the answer isn't necessarily yes because capacity stays basically the same," he said.

Though many companies have suggested that industrial trends are stabilizing in the short term, Halloran sees pressure remaining for 2016/2017. But the realities that industrial capital spending remains bleak, key input costs are rising and year-over-year (YOY) declines are occurring do not support the idea of stabilization. Halloran sees limited catalysts emerging to support expectations for the second half of 2016, and he expects 2017 revenue to be down YOY for many core industrial companies. Margin levels are largely expected to remain resilient.

Expansion from 2009 to the present is unique in that low growth has been the norm, and the gross domestic product and industrial production have lagged in comparison to past cycles.

"There is stagnant population growth, falling productivity, capital growth is nearing exhaustion due to low interest rates and peak debt, and there haven't been big technology catalysts to spur growth," he said.

FORECAST

- *In oil and gas upstream markets where the focus is shifting from decline to rebound, a "lower for longer" dynamic will persist because of producers' resilience and ability to ramp production quickly as prices rise. In midstream and downstream, many industry participants expect MRO spend will recover somewhat through 2016.*
- *In chemical processing, capex spend growth will increase by more than 2% in 2016 and more than 3% in 2017.*
- *In power generation, a material recovery is unlikely in the near term, but activity remains fairly stable and is increasingly targeted at natural gas, nuclear and renewable fuel sources. Energy efficiency remains a key focus area for projects.*
- *In municipal water/wastewater, large capex infrastructure work has recently shown improvement and bears watching as infrastructure issues go before policymakers.*

THE GLOBAL PICTURE

Murky at Best

Simona Mocuta, senior economist for State Street Global Advisors, said her desire to be optimistic about the world outlook this year has been tempered by BREXIT (Britain's Exit from the euro market).

The status of the economy of the world today "should be better, but it could be worse," she said, reminding attendees that what goes down will eventually come back up. Part of the problem today is the huge challenge of political uncertainty.

The year 2016 is the fifth year of sub-par growth and 2017 will be the sixth year, she pointed out.

"There is a lot of discussion that the next recession is right around the corner," she said. As a result, "Many have lost the ability to think that things are going well, so that is a problem in and of itself," she said.

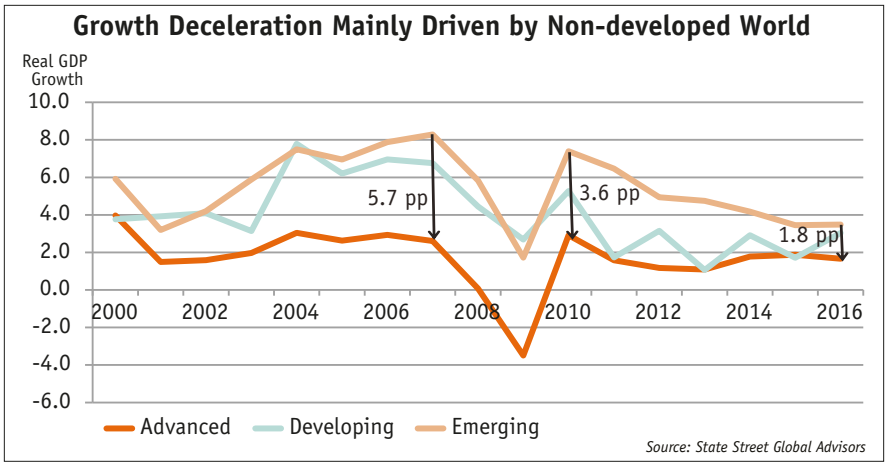
Also, in many parts of the world, policies are generally ineffective, and can be harmful or destructive.

"Politics is a big negative to economic performance in an indirect way; politics direct policies that effect how growth and inflation work," she said.

Still, despite BREXIT, Japan's huge workforce problems and China's relative slowdown, there are many positive signs, she said. The Eurozone recovery has gained traction; a let-up in the fighting in Ukraine has occurred; the Greek crisis has been temporarily resolved; oil prices are low; and the value of the euro has fallen.

"For many years we spoke of outperformance of developing markets compared to advanced economies," Mocuta said. At the time, there was a huge differential between the two. The financial crisis of 2008 changed that scenario.

"Today, there is only a 1.8% difference. The deceleration in growth worldwide is driven mainly by the non-developed world," she said.



Workers and Productivity

The biggest change affecting the world globally is illustrated by what's happening in China. Before 2015, the country had "a growing working age population," she said. That is no longer true and its effects have the potential for global implications.

"If there is not a 2% point gain per year, China's costs rise, making it less productive and competitive," she said.

Productivity is also affecting other countries, including the U.S. where the participation rate of working age people is at a record low.

"Since the recession, it keeps going down and we don't know why," Mocuta said. "Even when you account for those who gave up on jobs and the retirement of the baby boomers, there is still a gap."

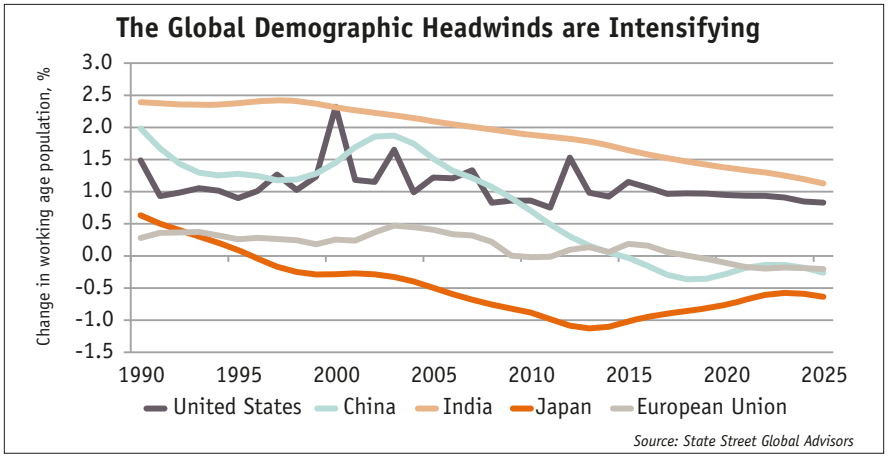
The biggest debate in economics right now is: why is productivity so low? she said.

Many companies are hoarding money and not deploying the capital they have, which hurts overall productivity. "Companies that are at the forefront globally are just as productive as they used to be; but others are not instituting innovations. A new way of doing business comes up, but the adoption rate does not trickle down," she said.

Another challenge comes from retail space issues. "If you have to maintain a physical space, your cost of operating the business is already much higher than internet-based retailers," said Mocuta.

Meanwhile, negative interest rates are detrimental, she said. [Negative interest rate does not mean negative *real* interest rates. It means a rate above zero but lower than inflation so that the money borrowed could be worth less after repayment is made]. These negative rates "are destroying the business models of insurance companies and pension plans," Mocuta said. Central banks are trying to help; however, "sustainable growth is not the gift of monetary or fiscal policy," she said.

Problems in the Eurozone arise from the disparity in the economies of the stronger vs. the weaker countries. "You cannot survive on austerity forever," noted Mocuta. "The Eurozone does not have the current framework to balance productivity



and currency values. This means richer countries have to pay out to the poorer countries because there is no way for the poorer countries to devaluate their currency to help counteract for less productivity."

As far as BREXIT, Mocuta said many economic consequences could occur. The EU will lose its second largest economy and budget contributor, and it will lose influence in global affairs because of the loss of UK military capability. This will also increase the influence of Germany and France and may prompt calls for referendums elsewhere in the EU.

In regards to China, Mocuta said she doesn't see a return to the 10% growth of previous years. Right now, "there is a big power struggle between reform vs. traditional and there is policy paralysis. It won't be until 2018 or 2019 that we will see serious action."

FORECAST

- *Much of what will happen depends on the outcome of elections in the U.S., in Germany and in China.*
- *For the UK, BREXIT could mean a slowdown in growth and a possible recession.*
- *The window for any meaningful structural reforms resulting from the current political situation is late 2017, so financially, things will remain the same for the next year.*

THE U.S. ECONOMY

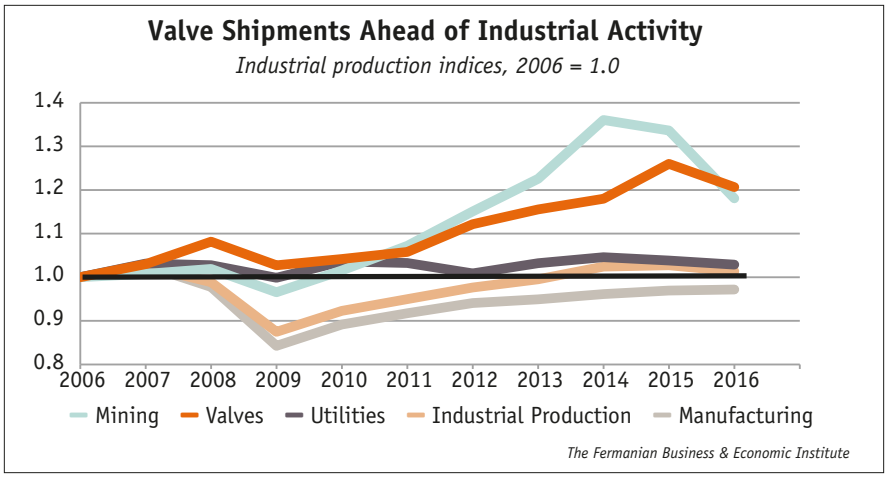
Surviving the Tsunami

While the U.S. is the lead dog right now, outperforming the global economy, "It is still subject to the same pressures as those being exerted against the rest of the world. The major tsunami that is covering the world is low interest rates," said Lynn Reaser, chief economist, the Fermanian Business & Economic Institute, Point Loma Nazarene University.

"Investors are chasing yield," and the U.S. is the least unattractive alternative right now, Reaser said.

The money that investors are bringing to the U.S. has put downward pressure on treasury bond rates. "That is also distorting the stock market and forcing the dollar up, which is positive for imported goods, but negative for the export market," she said.

Despite these negative challenges, Reaser was cautiously optimistic about the U.S. economy while warning that expansion will remain sluggish. She did not predict a recession in the near term, but noted that the slow growth worldwide is causing problems in the U.S. More pressure comes from neighboring Canada, which is suffering the impact of depressed energy prices, keeping its growth under 1.4%.



Positives/Negatives

Currently, housing demand is rising, government finances are in somewhat better shape, the Fed is in accommodative mode, and the job market "is doing fine," Reaser said.

"We're still hiring, job growth is moderate; we are nearly at full employment and wages are picking up and rising faster than prices," she said. Meanwhile, consumers, who make up 7% of the economy in this country, are basically holding it up right now, she said.

The most significant negative is that the U.S. economy is not getting much help from the rest of the world, she continued. But another problem stems from lagging productivity. "Companies seem to be substituting workers for capital spending," Reaser warned. That reality combined with the fact that businesses are buying back stock, paying out dividends and hoarding cash, seems to be getting in the way of capital equipment spending.

The Valve Industry

Reaser pointed out that valve manufacturing numbers are actually higher than manufacturing as a whole. However, "There is a big disconnect between energy and non-energy," she said. The non-energy sector was stable when the energy markets were on fire. The sector then dove, and is now stabilizing.

"But while there is a lot of variation, manufacturing is clearly not in recession," she said.

The bottom line for the valve manufacturing industry is that while low and stabilizing energy prices, increasing commercial construction and water system upgrades will drive spending, firms are limiting capital spending so they are not buying as many valves. Higher steel prices and a need for higher levels of wages are also negatives in the industry.

"A huge problem is the lack of skilled workers," said Reaser. "Don't let anybody retire in your company. You may not be able to replace them," she joked.

FORECAST

- *While the global economy will continue to be soft, the U.S. economy is plodding along. The Fed will remain cautious but will raise rates slightly. There is no recession in valve manufacturing; she sees modest firming in the market.*
- *In the valve market, valves will show some improvement in 2017.* VM

Kate Kunkel is senior editor for VALVE Magazine. Reach her at kkunkel@vma.org.

Market Outlook for 2017

Competition and the Human Factor

Because of the criticality of what's happening with today's labor force, Ben Dollar, principal of Deloitte, spoke to Market Outlook attendees about the effect the lack of skilled workers is having around the world and how it affects current competitiveness. Deloitte recently completed a survey of senior executives to arrive at a global manufacturing competitiveness index. Dollar said it showed "the current view is that China ends up a tiny bit ahead of the U.S."

Despite China's slight edge, "Over the last few years, the powerhouses of the 1980s have returned to their spots at the top due to technological innovation and talent," he said. "Our research predicts that the U.S. will take back its place as the number one manufacturing nation by 2020" (See also Market Focus, page 6).

In North America, the U.S. emerges at the top with the highest levels of manufacturing investments, along with a strong energy profile, high quality talent, infrastructure and dedicated industrial clusters.

82% of executives believe the skills gap will impact their ability to meet customer demand

Executives also agree it will impact their ability to:

- **78%** implement new technologies and increase productivity
- **69%** provide effective customer service
- **62%** innovate and develop new products
- **48%** expand internationally

Deloitte Development LLC and The Manufacturing Institute

These all provide strong support for innovation, he said. Meanwhile, Canada is considered the freest economy in the region and is the G7's first tariff-free zone. Mexico also has more than 40 free trade agreements, and enjoys the advantage of relatively lower labor costs and close proximity to the U.S.

The top three drivers of manufacturing competitiveness anywhere are talent, cost competitiveness and workforce productivity, Dollar pointed out. He referred to another recent study confirming that 84% of executives agree U.S. manufacturing is carrying a significant shortage of talent that will grow over the next decade. Even though 80% of manufacturing companies said they are willing to pay more than the market rates for that labor, nearly 2 million of the 3.5 million manufacturing jobs that need to be filled in the next decade will go unfilled according to The Manufacturing Institute.

Selected Country Manufacturing Competitiveness Drivers

	U.S.	Germany	Japan	South Korea	China	India
Talent	89.5	97.4	88.7	64.9	55.5	51.5
Innovation policy and infrastructure	98.7	93.9	87.8	65.4	47.1	32.8
Cost competitiveness	39.3	37.2	38.1	59.5	96.3	83.5
Energy policy	68.9	66.0	62.3	50.1	40.3	25.7
Physical infrastructure	90.8	100.0	89.9	69.2	55.7	10.0
Legal and regulatory environment	88.3	89.3	78.9	57.2	24.7	18.8

Most Competitive — Least Competitive

Source: Deloitte Touche Tohmatsu Limited and U.S. Council on Competitiveness, 2016 Global Manufacturing Competitiveness Index

The implications are significant and widespread. Every job in manufacturing creates another 2.5 new jobs in local goods and services and for every $1 invested in manufacturing, another $1.37 in additional value is created in other sectors. The talent gap influences operations, company growth and the bottom line in a variety of ways, he said.

The U.S. has high-quality engineers, but very few of them, and the numbers are declining. The other serious shortage centers around skilled trades—computer numeric code machinists, welders, plumbers and electricians. "Those skilled tradespeople are the lynch pin in effective manufacturing, and we are not producing nearly enough of them in North America," Dollar said.

Add to that fact the changing skill sets needed for advanced manufacturing and the fact many people with those skills are retiring "and you have the perfect storm. We also have to get potential recruits past the idea that manufacturing is dirty, dumb and dangerous," he said.

It's not just about numbers, Dollar said. "It's about getting the right skills in the door. And you can't solve it by shining the brightest light on your factory or paying the most money. The only way to solve the problem is to become a participant in a broader ecosystem which gives them access to talent they might not have otherwise."

SOLUTIONS FOR FILLING THE GAP

Beyond nurturing current employees, innovative methods must be deployed to attract and develop the right people. "You should manage talent more like a supply chain," Dollar said. His advice was:

Find

Employ advanced analytics to enhance candidate screening practices.

Dollar also suggested reaching out to the long-term unemployed and to women. The workforce in the U.S. is 49% women, but manufacturing is made up of only 26% women. One way to appeal to them is to keep in mind that mothers, especially single moms, want a flexible schedule; there are many scenarios where someone could be plugged into positions such as a welder for shorter or more flexible hours.

Dollar also pointed out that if companies need many engineers quickly, they won't get them. However, there are companies that do have access, and he suggested working with those companies and developing a network of suppliers in countries like India, where such talent is abundant.

Develop

Invest in internal training programs and external partnerships that build critical skills.

Dollar recommended that companies make their own training programs available to the public. There is more crowd sourcing of learning today through Massive Online Open Courses. If, for example, a manufacturer needs a certain type of technician, it could develop a course and offer it online. The more people that have access to it, the more likely a steady stream of possible recruits will be formed.

American companies should also use apprenticeship programs more, and mentoring programs are a good way to get the aging workforce to continue in a meaningful way, without working full time.

Target

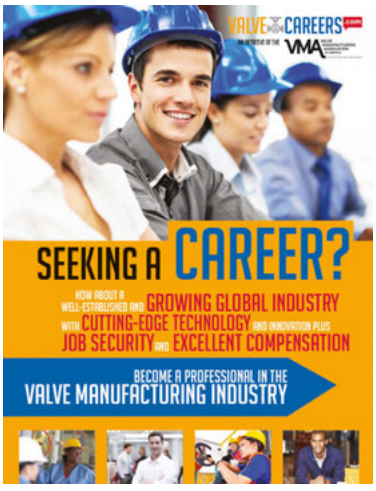
Develop an integrated recruiting and communications approach with a target in mind.

Companies that are branding themselves as high tech have more recruiting success. An example from another industry comes from the business of making cars. Currently, there are companies that have developed the perception that they are not just car manufacturers, but rather companies that make "technology that enables driverless cars."

Grow

Change the public's perception to grow the overall pool of interest. He suggested starting by developing programs to get kids into high tech factories to pique an interest in manufacturing. Build relationships with high schools, trade schools or universities. New veteran hiring programs are also springing up and should be nurtured. VM

VMA's Careers Initiative Aims to Fill the Talent Void



With the issue of the skills gap in mind, VMA launched its Valve Careers initiative in early 2015—a program that aims to inform and educate the next generation of talent about the lucrative and challenging field of industrial valve manufacturing. This program strives to enlighten young people and show them careers in this field are exciting and rewarding and that many different career paths and opportunities for growth exist.

Through social media marketing, awareness videos, outreach to secondary and post-secondary schools and by providing resources and educational materials to VMA members, the Valve Careers program is spreading the message that careers in valve manufacturing are worth exploring. It also helps VMA member companies connect with potential talent in their communities.

Read more about this important initiative, follow Valve Careers on social media, and view the awareness videos at www.valvecareers.com.

Although casting defects can be repaired, making the component fit for service again, the casting repair welding and associated non-destructive evaluation can be expensive.

Cast vs. Forged

The Ongoing Debate Takes a New Direction

BY ARVO EILAU

In the valve industry, the cast versus forged debate has been around for many years. Cast production still dominates. However, changing operating environments in the power industry, such as the shift towards higher pressure and temperature needs, have reignited talks on which technique is most suitable for the evolving application requirements. While both cast and forged production deliver high-quality valves, it isn't always immediately obvious which solution has the best cost-performance ratio for different power applications.

APPLICATION CHALLENGES

As the world demands more and more energy, operational temperatures in supercritical and ultrasupercritical power plants as well as in combined cycle power plants (CCPP) have climbed significantly. Testing in Europe is currently at 1292°F (700°C) for boiler systems, and plants in the U.S. will soon be operating above 1112°F (600°C).

While multiple thermal cycles and higher temperatures allow operators to increase plant efficiency, they also put an immense amount of stress on system components. Degradation of material

Executive Summary

SUBJECT: New operational requirements in the power industry have created a new level of discussion on when cast or forged processes are better.

KEY ISSUES:

- New application challenges
- Advantages/disadvantages of cast
- What forged offers for new requirements

TAKE AWAY: While casting will remain an important part of the making of valves, forging offers some benefits power plants now need.

caused by creep and corrosion fatigue are detected more often in modern CCPPs and heat recovery steam generators, leading to higher maintenance levels and plant downtime.

As a result, many valve manufacturers have started to rethink material specifications and production techniques, in particular when dealing with components for critical and severe service applications.

Valve material behavior and choices are affected by changes in the operating parameters of these modern power plants. In particular, the move from static to dynamic loads through combined cycle operations plays a role. So do increases in plant cycling impact temperature and pressure differentials, which affect the load placed on valves and pipeline components within the steam circuit.

Fluctuations in temperature create stress and elongation as valves expand and contract under different loads up to a designed yield strength. Once stresses placed on the valve exceed this yield strength, valve deformation occurs, and over time, the dimensions of components are affected. Mechanical stress eventually can cause component fatigue and failure.

KEY MATERIAL CONSIDERATIONS

In general, all valve materials, whether forged or cast, have to fulfill the demands for tensile strength and corrosion resistance found in critical process environments. The stronger the material of the valve, the better that valve can resist failure when put under pressure. This strength means higher ductility and ultimately longer product life. However, in the power generation industry, the potential for valve failure from increased plant cycling exists. The impact of high-cycling duty on steam temperature and pressure places greater stresses on valve components. This means materials must endure fluctuations and differentials throughout the lifetime of the valve.

Cast materials tend to require less mass than forged products. More mass can lead to larger thermal gradients, which can result in more stress. Because of this, casting and its relationship to voids needs to be taken into account, with consideration given to determing safety factors and allowable stress levels.

☐ Bars or blanks used for forging valve components are heated to a high temperature and then pressed to shape in special dies. This machine is die-forging small forged steel valve bodies.

Another important aspect to consider is the metal's ability to withstand the effects of corrosion. Corrosion is still a major problem in the power industry, often resulting in costly repairs and excessive downtime. The degradation of valve material that occurs from the combined actions of oxygen, metals and salt is exacerbated by high operating temperatures. The higher the temperature, the softer the material will become, increasing the risk of thermal fatigue.

Design codes and standards from the American Society of Mechanical Engineers (ASME) allow both forged and cast materials to be used within the primary circuit, depending on the boiler design and operational parameters. The chemical composition of these components, in particular the level of chrome, and the manufacturing method are key factors in determining creep strength and metallurgical stability. For example, WC9 grade alloys, which contain 2.25% of chrome, can retain their strength in temperatures of up to 1020°F (550°C), while higher grades, such as C12-A with 9% chrome, can withstand temperatures of up to 1130°F (610°C).

Changes in power plant operations mean the situation for forging grades is evolving. While lower grades, such as F22, containing 2.25% of chrome, can be suitable for up to 1100°F (590°C), F91 materials with 9% chrome can withstand temperatures of up to 1200°F (650°C). This is significant because increased efficiency targets of modern power plants mean operating temperatures are pushed above 1112°F (600°C). As a result, plant engineers and valve manufacturers are moving to F92 grade alloys, for which no cast equivalent within the ASME standard exists.

The differences in performance for alloys over F91 grade is also clear. For example, an F92 Class 2500 valve at 1112°F (600°C) delivers a special class rating of 223.4 bar compared with 203.1 bar for F91. At 1067°F (575°C), the ratings are the same for both materials (F91 and F92). However, at 1157°F (625°C), the difference is 190.6 bar for F92 compared with 152.1 for F91.

Although chemical composition is an important consideration because it impacts the mechanical properties of the material, the heat treatment of the material is also an essential parameter. Heat treatment determines the overall strength of the valve when operated in high temperature environments and under intense mechanical stress. Whether forging or casting, each valve needs to be heated to a normalized temperature—usually about 1832°F (1000°C) and cooled down in less than 4000 seconds to achieve a highly durable end product.

While smaller valves can be cooled down relatively quickly, valves with higher mass (and typically a larger diameter) have a much more complex cooling process. This will affect the mechanical properties of the valve—

in particular its performance at high temperatures, which could lead to a reduced product lifecycle.

STRINGENT QUALITY STANDARDS

While most international standards provide guidance on the expected guaranteed life of a material in ambient temperatures, no official data is available for tests in high temperatures. Still, the power industry's changing operating environment, particularly the stresses of higher cycling and regular shutdowns, call for changes in testing. As a result, tests that take into consideration additional parameters, such as operating hours, number of shutdowns and temperature range, are increasingly important to accurately evaluate the lifespan of products.

With changes to material guidelines and regulations imminent, many engineers already are specifying materials beyond the current requirements so they can secure future compliance. In fact, some governing bodies, such as the American Society of Testing and Materials (ASTM) and ASME, have started to include detailed manufacturing process requirements into their specifications. Besides fulfilling stringent criteria in terms of the chemical composition, testing procedures and physical properties of the material, many valves now also have to be either cast or forged, depending on the industry and application.

Ultrasupercritical coal-fired plants, for example, can operate above 1112°F (600°C), making these applications ideally suited to F92 forged grade materials. In the coming years, the combined cycle market will move towards these temperature ranges and the use of F92 will become more prevalent in these applications.

VALVE CASTING SUITABILITY

Casting still represents a large share of the valve manufacturing industry. In fact, most steel components start as castings, a process in which molten metal is poured into a customized mold and then solidified. The advantages to this procedure include:

- *Flexibility in design*. Valves can be cast-to-shape, which gives greater variety and complexity of shape (from processing in liquid form).
- *Greater metal choice* (custom alloys) because foundries have full control over the chemical metal composition to meet unique requirements at an affordable cost. This can ensure valves are modified to meet exact specifications (i.e., the level of ferrite can be controlled to enhance corrosion resistance, etc.).
- *Reduced machining costs* because cast requires less machining than forging when more complex shapes are needed.
- *Wider availability*, which means replacements are easier.
- *Different shapes*. Cast valves can have a contoured shape (rounded edges).

Although castings remain an integral part of the valve manufacturing industry, the shift towards higher pressure operation in the last few years has exposed shortcomings that include:

- The solidification process can produce small impurities, such as voids and cracks. This can mean lower mechanical properties and costly and time-intensive weld repair.
- Welding and post-weld heat treatment alters the microstructure of castings, resulting in higher creep and much lower hardness. This requires rigorous inspection of a valve to ensure it has maintained the proper strength and creep resistance.
- Higher specifications in 9-chrome material can only be achieved after extensive heat-treatment, resulting in longer delivery times. This can be caused by many factors including non-destructive evaluation and other testing requirements.

Still, significant improvements in mold- and core-making processes have reduced defects on casted valves. For example, an increasing number of foundries have adopted low-pressure die-casting techniques to improve the overall mechanical integrity of the final product.

RISE OF FORGED VALVES

For valves used in critical and severe service applications, the last few years have seen a shift towards the use of forged steel. This is reflected by the use of higher performance alloys in temperature applications above 1112°F (600°C). Forging processes start with a solid piece of metal or ingot that is forged into shape with hammers or presses. Although labor-intensive, the process provides benefits that include:

- Less material waste because less reworking is necessary. (The valve is forged into shape out of one solid piece/ingot).
- Because of the immense pressures involved in the manufacturing process, the forging process reduces surface porosity and closes up internal cavities and voids. This allows forged valves to retain structural integrity, resulting in a mechanically stronger and more durable product (with higher ductility and tensile strength).
- The flexibility of being able to manufacture the forged material to the intermediate rating means less wall thickness for enhanced performance from thermal cycle fatigue with 9Cr-1Mo material. Less wall thickness has a smaller temperature gradient, which requires less time for material thickness to reach equilibrium. Therefore, there is less potential for thermal fatigue, which offers a robust solution for power plants that cycle through start-up and phase-down on a daily basis.
- Forged material can be machined to meet specific design conditions using intermediate ratings. This gives end users and asset owners another alternative. With the use of an intermediate rating, a lighter weight valve more suitable to cycle

☐ These high-strength metal dies are used to make 2-inch forged valve bodies.

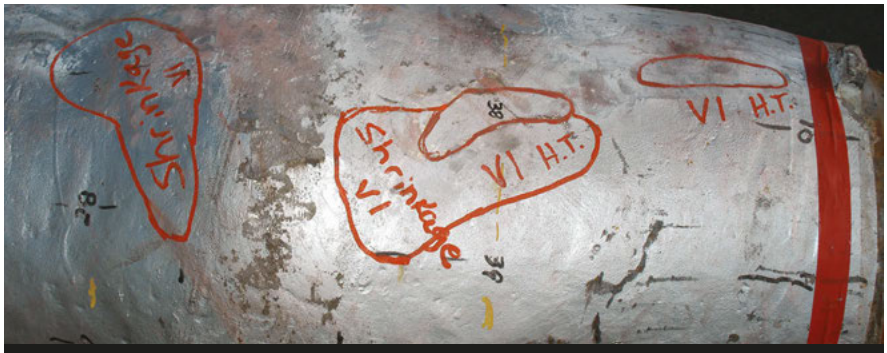
duties can be produced. The lighter weight valve can reduce the heating/cooling stresses as the units cycle on and off, particularly because thinner wall components can heat and cool more quickly, resulting in fewer thermal stresses.

While forging produces a very strong piece of equipment, some consequences and limitations to be aware of include:

- Forging is cost and energy-intensive. It requires extensive work to refine the product and achieve the required shape and finish.
- Limitations exist on size, shape and thickness because processing occurs in a solid state.
- Larger forgings need to be produced from two or more pieces and welded together.

IT DEPENDS ON APPLICATION

High manufacturing standards and attention to detail are paramount to ensure that each valve, whether cast or forged, meets the required design and performance criteria. While forged materials will start to dominate high-pressure and temperature applications in some industries, casting will continue to provide a cost-effective and reliable alternative.



Defects (such as those shown here) are more prevalent in higher chrome content valve castings such as those used in ultrasupercritical and supercritical steam applications.

The ultimate choice will come down to evaluating the operational needs of a specific plant to identify the best valve solution. While forged valves offer enhanced performance for high-temperature and severe service applications, the cost and difficulty of repeatability for standardized products may restrict some use. The key consideration for plant engineers assessing cast components is identifying the long-term effect of an acceptable void within the valve's construction once it is installed.

One way to mitigate risk is to work with an experienced manufacturer that offers engineering expertise in both cast and forged valves and can advise on the most appropriate ASME-compliant product to meet specific plant and application needs. VM

Arvo Eilau is marketing manager, Power, Pentair Valves & Controls (www.pentair.com). Reach him at http://valves.pentair.com/valves.

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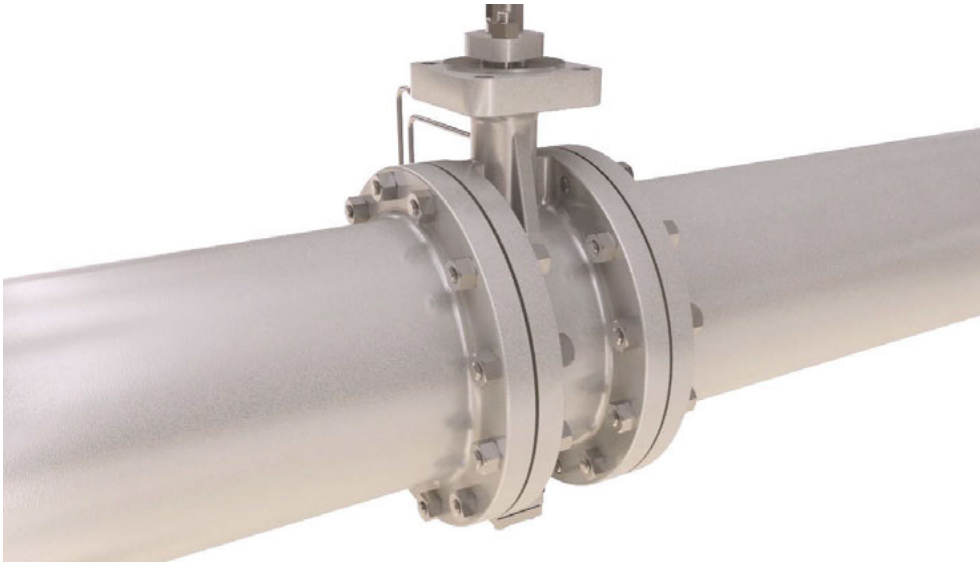
BACK TO BASICS

Triple Offset Butterfly Valves



BY PHILIP TAYLOR

Since their introduction to the market more than 50 years ago, triple offset valves (TOVs), which are also known as triple eccentric valves, have continued to evolve, while uses for this type of valve have expanded across multiple industries. Originally designed for water shut-off applications, design enhancements through the years placed this versatile valve among other industry staples for performance in the harshest conditions of critical process environments. At the same time, these valves have always had certain parameters within which they can operate effectively.

Today, TOVs offer countless benefits to the industry, and most recently they've received attention because of the role they can play in controlling fugitive emissions. The industry has started to look for more unique and innovative ways of combating this global emissions challenge, and TOVs are an area where valve manufacturers have recently focused. By incorporating new and improved features, TOVs are used in ways never before seen while they are also being used more cost effectively. To understand how far these valves have come, we first must inspect the standard features and benefits that made the TOV valuable in the first place.

Executive Summary

SUBJECT: Because of the attention on fugitive emissions and new features that give superior sealing, triple offset high-performance butterfly valves are gaining in popularity.

KEY ISSUES:

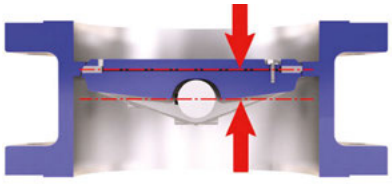
- How they work
- New features available
- What those features mean

TAKE AWAY: The next generation means enhanced valve safety and performance. When added to cost savings, that should lead to even more use.

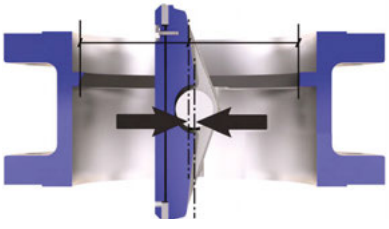
DECONSTRUCTING THE TOV

A TOV can be the right solution when a tight seal is required. As the name implies, three separate offsets are designed into the valve (Figure 1). They are: 1) the center line of the disc/seat sealing surfaces, 2) the location of the shaft with respect to the center line of the bore, and 3) the axis of the seat cone angle that is offset from the center line of the valve bore.

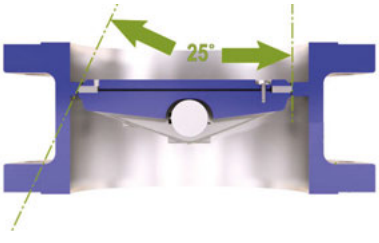
The combination of these three offsets provides an uninterrupted sealing surface, minimizes wear between the seat and seal, and preserves sealing integrity over the lifecycle of the valve.



First Offset: This offset applies to the center line of the disc/seat sealing surfaces, which provides an uninterrupted sealing surface.



Second Offset: This offset refers to the location of the shaft with respect to the center line of the bore, which enables a camming action of the disc to minimize rubbing and wear between the seat and seal.



Third Offset: This offset is the axis of the seat cone angle that is offset from the center line of the valve bore to eliminate rubbing of the seat/seal contact surfaces during operation and to preserve sealing integrity over the cycle life of the valve.

Figure 1. The three offsets of a TOV

Additionally, the optimized seat angle minimizes sticking or binding of the disc and lowers valve operating torque.

Generally, TOVs are selected for specific applications because of their sealing features as well as cost savings over other metal-seated valve types. Because of the compact, quarter-turn design and lightweight structure, TOVs can be installed and operated easily, and they require less pipe bracing. A replaceable seal ring that allows quick and easy repair and the low torque of TOVs (which permits smaller actuators) mean even more cost savings.

In addition to the financial benefits, TOVs offer a bi-directional zero leakage closure with a metal seat once only available with soft-seated valves. This expands application possibilities tremendously. Innovative self-centering, flexible seal rings and optimal torque transmissions mean these valves can offer fire-safe design and sealing performance that can be greater than the largest temperature range of general butterfly valve designs (Figure 2).

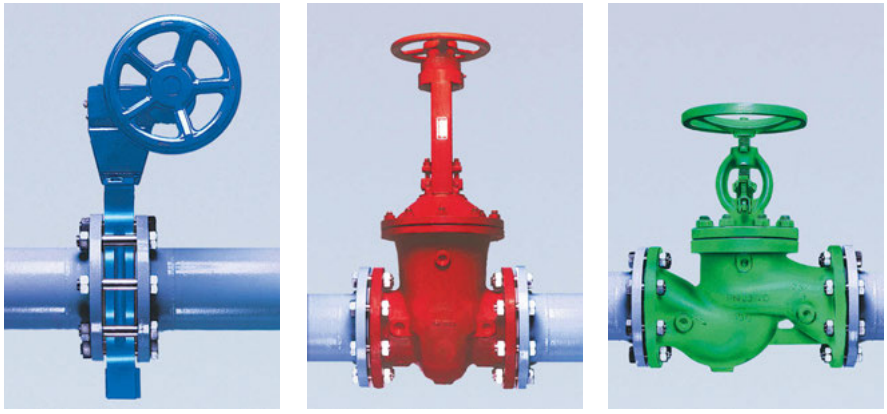


Figure 2. TOV (left) compared to gate (middle) and globe (right) valves

TRADITIONAL TOV AND UPDATED TRENDS

Traditionally, TOVs could be found in numerous industries spanning oil and gas processing, refining, chemical and petrochemical plants, power generation, offshore platforms, district heating, pulp and paper, steel mills, sugar mills, desalination, and water treatment and distribution.

Their use in all industries has increased as strict governmental regulations and greater production demands have compelled users to seek solutions that are as efficient as they are effective. Usage is also climbing because the features of the TOV that have been around for decades offer many benefits to all applications, including those with greater challenges. Some of those benefits include operational efficiency, resistance to abrasive media and chemicals up to a certain temperature or pressure, and versatility within numerous operating conditions.

Capitalizing on previous TOV design features, the next generation offers features that further enhance valve safety and performance, including:

Figure 3. One of the benefits of using a wide gasket TOV is that it assures an even compression over the entire sealing surface of the laminated seal, resulting in a long seal life and tight shutoff.

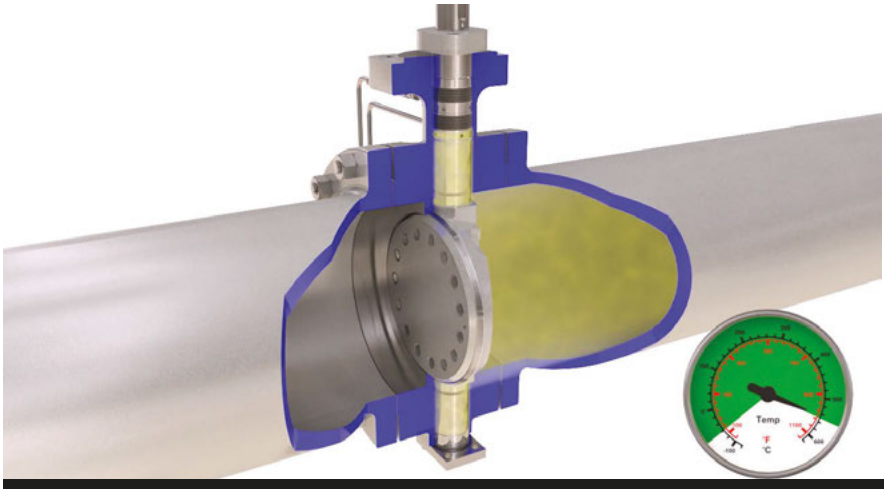


Figure 4. TOV high-temperature operation

WHY USE A TRIPLE OFFSET VALVE?

Triple-offset butterfly valves offer the best sealing and longest life of all butterfly valve designs. Here are some of the reasons they are chosen:

- For the harsh conditions of critical process applications, steam isolation and temperature extremes, TOVs provide performance reliability and quality.
- The bi-directional zero leakage closure with a metal seat, even after extensive cycling, provides sealing integrity formerly associated only with soft-seated valves.
- Low torque from quarter-turn action permits smaller actuators and lower cost.
- Fire-tested designs per API 607, 5th Edition/ISO 10497-5 are available.
- Compact design means easier installation since valves are lighter and require less pipe bracing.

1. ***Metal-to-Metal Sealing.*** By offering a precision-machined metal seat and seal ring, the TOV can deliver reliable and bi-directional shutoff approaching zero in high-temperature, high-pressure and severe service applications as well as others. Additionally, a metal-to-metal seat can better handle thermal fluctuations, and the standard right-angle conical design of the TOV facilitates low-friction, in-line sealing, an important feature in high-temperature/high-pressure applications. In hydrocarbon service, the metal-to-metal seat allows a valve to meet the requirement for fire-safe applications, which is further supported by the TOV's quarter-turn characteristic.

2. ***Optimized Seat Angle.*** The seat angle design combined with using Stellite in the valve body seat, results in a longer seal life, as well as improved abrasion resistance, even after extensive cycling. This optimized seat angle can minimize wedging or binding of the disc, and lower the operating torque.

3. ***Torque seating.*** Torque-seating in TOVs allows the valve to self-adjust to evenly distribute seal compression. A "floating" seal ring and a wide seal ring-supporting gasket yield a superior seal and a tight shutoff (Figure 3). A slight increase in torque yields a better seal because of more evenly distributed compression of the seal ring along the entire sealing area. The applied torque also ensures a bi-directional seal.

4. ***Shaft Design.*** Positioning the pin connector in the lower portion of the disk allows good performance in thermal expansion and minimizes shaft deflection, thus permitting a longer valve life.

Today, manufacturers are tweaking the classic design and are blending standard features with new ones that are enhancing TOV capabilities, allowing these valves to cater to more challenging applications and environments. TOVs are also offered in expanded size and pressure ranges. A key differentiator from previous designs is a tighter ISO Class A emissions level that typically was associated with bellow-sealed valves. By incorporating new stem seals, TOVs can also provide fugitive emissions control under thermal cycling. This tighter seal is possible because of updated stem seal designs and packing assembly methods, which allow the valve to face higher temperatures (Figure 4).

By offering different packing solutions, including standard process industry (ISO 15848, Class BH), a Low-E option (ISO 15848, Class AH), and TA-Luft (VDI 2440), TOVs can be customized by application.

With the incorporation of these new types of features, TOVs can accommodate high-temperature steam applications, emergency shutdown service and fire-safe applications.

CONCLUSION

Although many valve types are effective in controlling fugitive emissions, the compact design of TOVs makes them a viable alternative to higher-cost valve selections. VM

Philip Taylor is a business line manager for Crane ChemPharma & Energy (www.cranecpe.com). Reach him at ptaylor@cranecpe.com.

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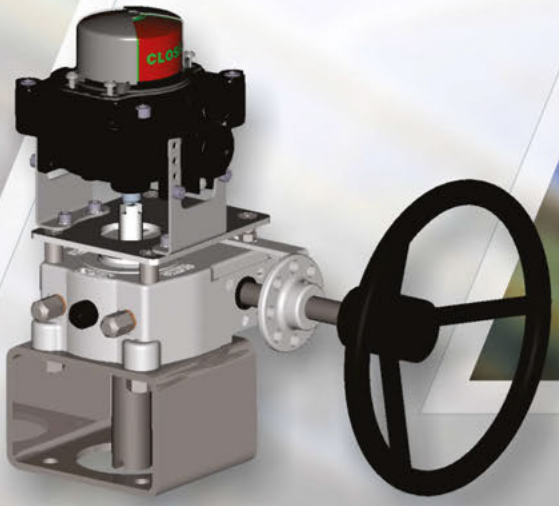

AB *worm gear quarter-turn manual gearbox*

IB *bevel gear multi-turn manual gearbox*

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Keeping the World Flowing

Tying our World Together with Digital Threads

BY GARY OSTROWSKI

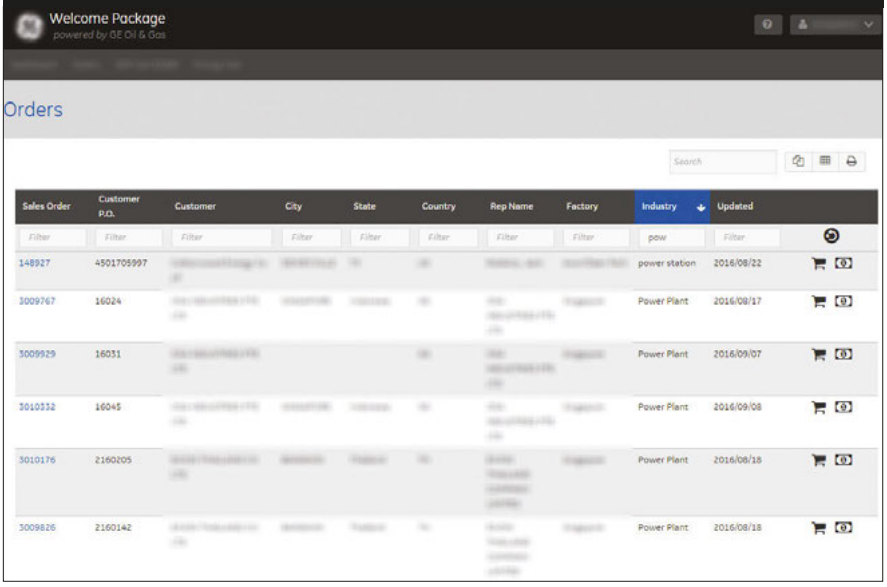
The words, "maintenance" and "repair" are so common in everyone's vocabulary that we use them almost daily, and sometimes we're not exactly happy about it. Whether it's our cars and the oil change or tires they need or the washing machine that's been making strange noises, most of us aren't happy with the necessity of maintenance or repair in our personal lives. So why is it so different in our business lives? It isn't. We hear phrases all the time such as: "run to failure," "budget cuts," "extended outage periods" that make us shudder. But are there better ways to deal with what's happening?

The answer is unequivocally yes. Today's world has migrated to the digital age or as my company sometimes calls it: the industrial internet. We have machines that talk to each other, exchanging information that can help us make better decisions. From smart digital controllers on valves to plant distributed control systems to diagnostic test tools to life-cycle asset management tools, tools and devices talking to each other produce a "digital thread." This digital thread can then be used to prompt action for maintenance and repair in a simplistic and orderly manner.

☐ The valve tester can integrate back to update the digital thread of the valve.

So let's dream a bit and consider the following scenario: You approach an Engineering, Procurement, Construction agreement to engage in an expansion of your plant. In the expansion, a multitude of valves and related equipment are needed and an order is placed. The valves/equipment are sized, configured, built and shipped to the site. Upon shipment, an electronic thread, "welcome package" is sent to the service team about the shipment. The thread is opened and all the information related to this equipment is at the fingertips of that team in a digital format. A click of a button and the information is downloaded to an asset management system to track and maintain all service, test and repair events. That is the start of the digital thread for this equipment. As the equipment goes into service, information is collected via the digital devices, which send alerts on a variety of events (i.e., friction, cycles, response, etc.). The alerts push their way through the asset management tool prompting on- or off-site support to take action. Over the course of time, all the information for this equipment is in a single location and retrievable with any smart device, 24/7 across the globe. In other words, a "medical record" for the equipment has been created and will be maintained as events occur. Data of all sorts is collected and monitored, all in an effort to make maintenance and repair easier and simpler.

☐ A welcome package can start the digital thread for each new piece of equipment. This information can be distributed around the world to the service team.



So why is this so important? Not so long ago America's greatest pastime sport—baseball—used scouts to find top prospects. Then along came the Oakland A's (as noted by Michael Lewis' 2003 book Moneyball), who learned to use data in the selection process. A data revolution was started in that sport just as it has been started in many other businesses. Today, it's difficult to find a sports team, a police department or a hospital that does not use data to manage their businesses. Data is analyzed in many directions and ways leading to new metrics that most of us sports fans do not understand. However, look at most successful teams and you'll see that data and analytics were involved in the success.

In the valve world, data use should reduce barriers in the past to maintenance and repair efforts. The keys to

this process are available today. They include:

- The foundation of this journey is a strong asset management tool. This tool needs the ability to seamlessly interface to the cloud for data, which means availability 24/7 across the globe. It should also be agnostic to the equipment and have powerful analytics to manage outages, notifications and upgrades, but be smart enough to run what-if scenarios or calculate a metric such as mean time between failure or some other measurement. (See VALVE Magazine article "Asset Management: Plant Managers Best Friend," Fall 2011 for helpful tips on this.)
- Second, the company must have the strength and capability to put this digital thread together and manage it—from the application engineering process to product design to the factory build to the service support. Information collected at the key stages of an asset's life will need to be used in the data analytics stage later. This is an enormous task of integration across devices, tools and software.
- Third, the next generation of tools, devices and technical support must be used to collect and communicate in the digital thread. For example, to test a safety valve or a control valve, we need an off-line diagnostic test device. After running the test, the tool should upload the information via the cloud to communicate back to the asset management platform and show the valve tested in a real-time video. This off-line diagnostic tool integrated back to the asset management tool adds more data on the asset and its digital thread. This is an example of machines talking to machines to produce data and results.
- Finally, one of the critical aspects for making this all happen is highly trained and certified service and support technicians who can navigate the tools, interrogate the data and have the skills to analyze that data in light of how best to repair it.

In summary, what once seemed like something out of a science fiction movie is becoming reality. "Maintenance" and "repair" have been joined with "data," "analytics," "tools," and "the cloud" as everyday parts of our world. But when all these words are integrated together, we have a digital thread that is so powerful to the end user that it will predict the next maintenance or repair point/period so that plant uptime can be optimized to increasingly higher levels. VM

OEM-certified technicians can use diagnostic and asset management tools to turn data into meaningful decision making events

Gary Ostrowski is senior aftermarket product manager for GE Oil & Gas (www.geoilandgas.com) Reach him at Gary.Ostrowski@ge.com.

Welding and Valves Go Hand in Hand

BY GREG JOHNSON

Welding and valves officially became joined at the hip with the perfection of the arc-welding process in the late 1920s. Up until then, every component in a valve was made of solid, homogeneous material, and all the end connections were either threaded or flanged.

Successful arc welding fostered the development of butt-weld end and socket-weld end connections for pipes, valves and fittings. The arc-welding process also allowed valve parts that were difficult to cast or forge to be joined together, and one of the biggest innovations was the development of weld-applied hardfacings.

The most prevalent and effective joint in piping systems today is the welded connection. It is used to join sections of pipe together, join flanges and fittings to pipe, as well as join butt-weld-end and socket-weld-end valves to other piping components.

Several welding processes are used in welded piping systems, and many of those processes are used in the manufacture of valves.

Just what is welding anyway? Welding is the process of joining where two components are attached by melting the area where they join, while also adding a filler metal to the molten mix. Since the welding joint area needs to become molten, the temperatures reached in the welding process equal or exceed the melting point of the base metal.

In the early 1950s, a cobalt-based overlay was applied to plug valve discs via the oxy-acetylene process.

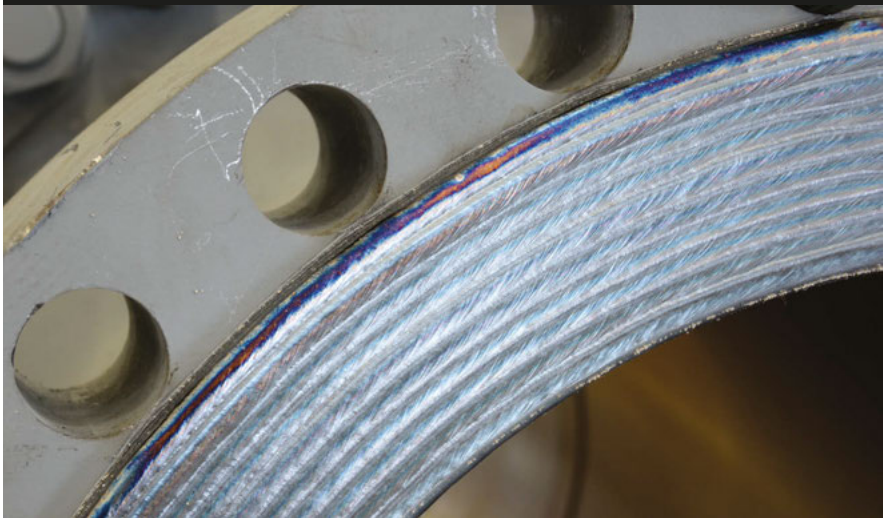
WELDING PROCESSES

Decades ago the only welding method available was the oxyacetylene process, which used an open-flame fueled by acetylene gas and supported by 100% oxygen. This was not an efficient method, and it was soon replaced by the arc-welding process. Still, applications where oxy/acetylene hardfacings were applied to valve components existed through the 1950s.

In arc welding, low-voltage and high-amperage electricity is directed through an electrode on one side of a circuit and through the piece to be welded on the other side. When the electrode gets close enough to the work piece, a very high-energy arc jumps from the electrode to the piece. This high-energy arc is powerful enough to melt both the electrode and the affected area of the work piece.

The most common "arc welding" process is the stick welding process, also called shielded metal arc welding (SMAW). However, others are more efficient, faster or produce a better weld. (See Table 1, page 39.)

This operation, performed with submerged arc welding, shows the high quality weld deposit of the process.



HARDFACING

One of the primary uses for welding in valve manufacturing is for applying hardfacing to seating surfaces. Decades ago, this laborious process was done with an acetylene gas torch and a long rod of filler material.

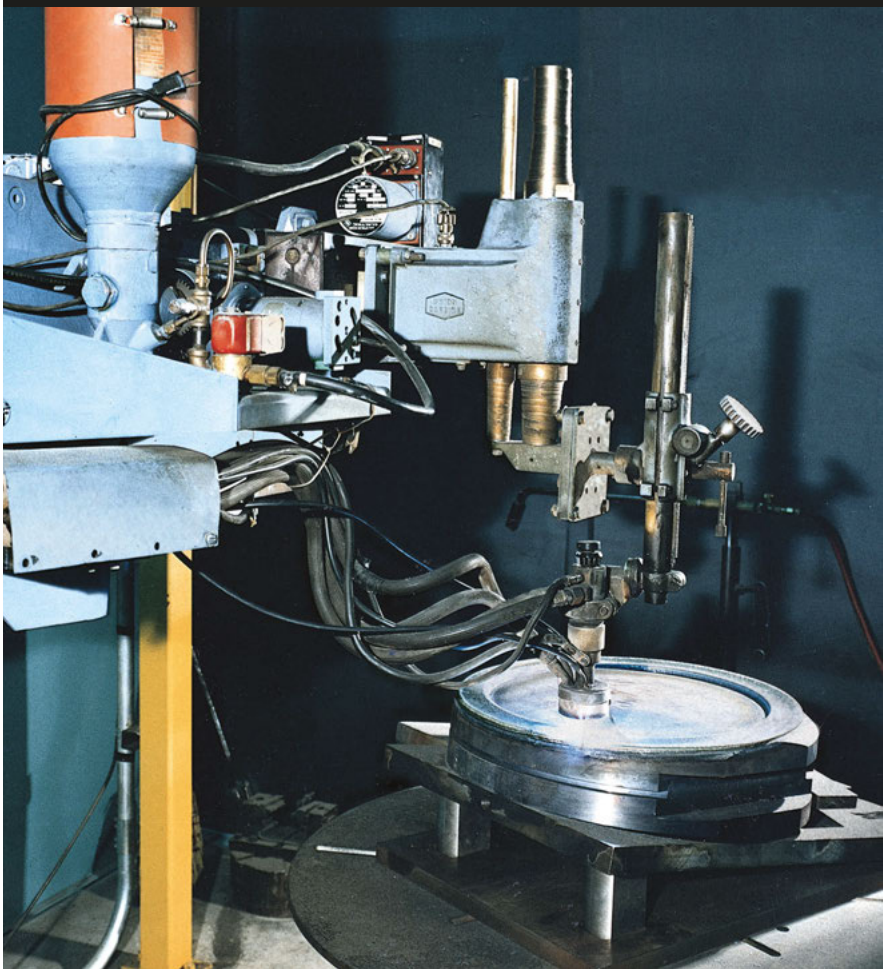
Table 1. Common Welding Processes Used in Valve Manufacturing

SMAW	Shielded Metal Arc Welding	Also called "stick" welding. Most widely used.
GMAW	Gas Metal Arc Welding	Also called "MIG" welding. Faster deposition rate.
GTAW	Gas Tungsten Arc Welding	Also called "TIG" welding. Produces very high quality welds but is slow unless automated processes are used.
SAW	Submerged Arc Welding	Very high deposition rates. Produces no visible arc during welding.
PAW	Plasma Arc Welding	Low dilution process. Great for hardfacing overlays

Today, automated and semi-automated PAW and GTAW are popular because of their high deposition rates and excellent, repeatable weld quality.

An important consideration in hardfacing operations is preventing loss of desired properties of the applied "hard" metal (e.g., hardness, abrasion-resistance and corrosion-resistance) through a process called dilution. Dilution in hardfacing is the mixing of elements of the base metal with that of the filler metal, resulting in the hardfacing material's chemical analysis being compromised enough to affect the desired properties of the hardfacing. To reduce dilution, welding procedures sometimes call for applying multiple layers of filler material, or in some cases, first applying an intermediate layer of a material metallurgically friendly to both the overlay and base material. These applications are oftentimes referred to as butter passes.

An automated plasma arc welding system is applying cobalt-based hard-facing material to a valve disc.



STRESS RELIEF

Because of the tremendous amount of heat applied during welding, great stress and strain can be put on both the weldment itself and the area adjacent to the weldment. That adjacent area is called the heat-affected-zone (HAZ). Many materials are stressed so greatly during the welding process that the mechanical properties of the weldment or HAZ are compromised. To restore the original desired properties to the components, a process called stress relief or post-weld heat-treatment (PWHT) is often required after welding. In the valve industry, this applies primarily to air-hardenable materials such as chrome/moly alloys and some martensitic stainless steels (400 series ss). Carbon steel components for use in hydrogen sulfide service also often require PWHT after welding.

The PWHT process consists of raising the temperature of the welded area to a specific amount that is much lower than the welding temperature and then holding that temperature for a prescribed amount of time to let the heat "soak" into the material. After the stress relief process, the desired properties have been restored to the components, and the stresses are relieved.

WELDING PROCEDURES

Like any other technical process, welding requires specific instructions to perform the process correctly. In the case of welding, these instructions are called the welding procedure. The correct term is "welding procedure specification" (WPS). A WPS is created by a welding engineer or other trained welding professional, and it is designed to meet specific piping construction codes or other standards. In the refining and power industries, for example, the primary code to be met is Section IX of the Boiler and Pressure Vessel Code.

The gas metal arc welding process is used to overlay a globe valve disc with Inconel.

For the WPS to become meaningful and valid, it must be qualified. This is done through a process called the "procedure qualification record" (PQR), which verifies that the WPS actually works as it should. All the directions and requirements in the WPS are closely followed so that the welder performs the weld exactly as stated in the WPS. In addition, all data and settings of the welding equipment are recorded on the PQR document. Following the actual PQR welding step, a "coupon" (sample weldment) is subjected to various mechanical and chemical tests to verify that the WPS creates a good, sound weld.

After the procedure is written and qualified, the individual welder that will perform a weld needs to prove that he or she can actually make a quality weld in accordance with that particular procedure. This third part of the welding procedure documentation trail is called the "welder performance qualification" (WPQ). After the weld is made, specific mechanical and or chemical tests are performed on the test sample to verify that the welder performed the procedure correctly, and the weld was sound.

To sum, the welding process consists of:

1. A welding procedure (WPS) is written.
2. The procedure is qualified via a PQR.
3. An individual qualifies to weld that particular procedure via a WPQ.

WELDING VALVES INTO PIPING

The popularity of welded connections in piping systems means that valves must have the proper end connections for weld attachment. The two welded connection types are the butt-weld and the socket-weld. The socket-weld is used for piping that is 2-inch nominal pipe size (2" NPS) and smaller. The butt-weld is sometimes used for small-diameter pipe; but it is normally applied to sizes above 2" NPS.

The socket-weld is the easier weld to perform since the pipe is slipped into the close-fitting socket of the valve or fitting, and there is a ready-made pocket in which to lay down the welding material. It can be performed using the stick, MIG or TIG welding process. This weld is usually made with one or two passes, depending on the pipe size.

The butt-weld on the other hand, is more complex because there is no socket alignment, and the ends of both the pipe and the valve must have matching bevels as well as be in perfect alignment during the welding process. The initial welding pass in butt-weld joints is called the root pass. It requires skill and practice to perform correctly. The root pass is followed by subsequent passes until the weld is completed.

Any requirement for PWHT also must be followed. With small valves, extreme care must be taken to cause no damage to the critical valve components, which may be close to the weld area, thereby receiving unwanted high heat input. Extreme care must be taken when welding soft-seated ball valves into piping systems, for example.

WELDING IS VITAL

Welding will always have a place in valve manufacturing because of the impracticality of casting or forging some alloys or material combinations. Over the last 80 years or so, the welding industry and the valve industry have worked together to meet the challenge of creating quality valves and effective welded piping systems. They will continue to march side by side as operating pressures increase and the need for higher integrity, environmentally-friendly, joint-free piping continues to grow. VM

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

Q: What are the differences between the results you get from a portable alloy verification device and the results you see on a supplier's certified materials test report (CMTR)?

A: Customers commonly request positive material identification (PMI), or alloy verification, and CMTRs to assure the valves and other chemical process equipment they are purchasing have the proper materials. It is important to understand the differences in these two requests and the capabilities of the equipment used to provide the information they require.

The chemical or heat analysis results provided on a CMTR are determined by analyzing a test sample obtained during the pouring of the raw material. These reports are meant to show that the raw material meets the requirements of the applicable material standard (such as those for the American Society of Mechanical Engineers or American Society for Testing and Materials (ASTM)). One common technique used for heat analysis is optical (or spark) emission spectroscopy (OES). With OES, atoms in a sample are excited by energy that comes from a spark formed between the sample and an electrode. This causes electrons to emit light, which is then detected by an analyzer; each element has its own emission pattern.

In contrast, portable alloy verification devices are typically used on semi-finished or finished products. This is considered product analysis as opposed to heat analysis. The range of the acceptable composition for this verification is normally greater than that for heat analysis to account for differences in the homogeneity of the finished product.

Portable alloy verification devices can provide quick and easy alloy identification for almost any size part. However, it is important to understand that several types of portable alloy verification devices are available and each type uses a different method to analyze a part's chemical makeup.

X-ray fluorescence is a common non-destructive technique for alloy identification and is often referred to as PMI. This works much the same way as OES, but samples are bombarded with x-rays and each element gives off its own characteristic x-rays, which are in turn detected by an analyzer.

PMI analyzers are not capable of analyzing all elements of consequence in the alloys used in the process industries. For example, they do not provide information on light elements such as carbon, nitrogen, phosphorus, sulfur or silicon. This means they cannot verify the carbon content in carbon and alloy steels, nor can they distinguish between standard and low-carbon grades of stainless steel. They also cannot verify the nitrogen content in grades of stainless steels that are nitrogen-alloyed for increased strength and resistance to chloride pitting. They cannot verify that silicon, sulfur and phosphorus contents have been met.

Portable OES machines that can provide alloy identification using non-destructive methods are also available. These machines tend to be less accurate than the non-portable OES machines that foundries and mills use, especially when trying to detect trace elements. For example, one portable OES machine manufacturer reported that, to detect niobium (Nb) in carbon steel, an extra calibration step needed to be performed. Once all of the key elements were determined, the machine needed to be recalibrated to the Nb test standard so the carbon steel sample could be tested specifically for that element.

If a customer wants all components in a valve certified to an ASTM-grade chemistry, only heat analysis provided by the raw material supplier on a CMTR is sufficient. Despite what manufacturers of portable analyzers may claim and what customers may believe, these instruments can only provide alloy verification and cannot be used to check compliance to a CMTR or an ASTM specification. VM

Cherra Meloy is senior materials engineer, Advanced Technology Group, Emerson Process Management, Fisher (www.emersonprocess.com/fisher). Reach her at Cherra.Meloy@emerson.com.

Force and Direction Controls for Valve Actuators

BY CHRIS WARNETT

Valve actuators deliver either linear or rotary force. It's important that the force they provide to the valve is sufficient to operate it effectively, but not so great the seats or stems of the valve might get damaged.

For that reason, almost all actuators have some form of force-limiting mechanism.

TYPES OF MECHANISMS

On most applications, the force output of the fluid power actuator is limited by the system pressure. In almost all cases, this system pressure is controlled by a pressure regulator.

The typical electric actuator has an internal torque-limiting mechanism. This is to ensure sufficient force for seating the valve with prevention of excessive force that could gall the seats or cause the valve to jam.

For actuators with worm and wheel gears, the axial force reaction of the worm shaft against the worm wheel is directly proportional to the output torque of the actuator. The worm shaft moves in proportion to the force against a spring. Alternatively, some devices use an electronic pressure sensor to measure the force reaction on the worm shaft.

Electric motor current measurement or motor speed is also an indication of the level of torque generated.

Once the predetermined force or torque limit is reached, a torque sensor is tripped, and power is shut off to the motor. The predetermined force can be adjusted so that one size of actuator can be used on different valves or applications.

POSITION SENSING

Position sensing is important for two reasons:

1. To give feedback on the position of the valve. This could be transmitted to the remote control room or displayed locally on the actuator.
2. To allow the valve to be seated correctly.

Some valve designs require a specific amount of force to seat the closure element sufficiently so that the pipeline medium cannot pass. Typically, these valves are wedge gate, globe or triple offset butterfly valves.

Other valves, such as most quarter-turn valves (ball, plug and resilient-seated butterfly valves), along with some slab or knife gate valves, are designed to seal at a certain position.

To ensure proper seating on these "position-seating" valves, the actuator must move to the correct position and stop. One way to achieve this is to have a mechanical stop in the actuator. This often is provided on electric or fluid power actuators for quarter-turn valves, but position sensing is still needed as an indicator. That sensing is usually achieved by a direct drive from the part-turn actuator output shaft to switch trip mechanisms such as cams or levers. In addition, a potentiometer or a 4-20 milliamp transmitter can be driven from the same shaft to give continuous remote position indication.

For operational purposes, the actuator must always know where it is relative to the valve position. Because of this, a position-measuring system is mandatory in multi-turn actuators for position-seating valves. A mechanism driven from the output of the actuator is frequently used.

The multi-turn actuator needs a versatile counting mechanism to accommodate the variety of output turns that different valves require.

Some mechanisms count the output turns of the actuator using a geared rotating counter mechanism similar to an odometer but bi-directional. Another method uses a rotating threaded shaft on which a nut travels in proportion to the actuator output turns. Both types of mechanical drive mechanisms have a finite number of output turns they can accommodate.

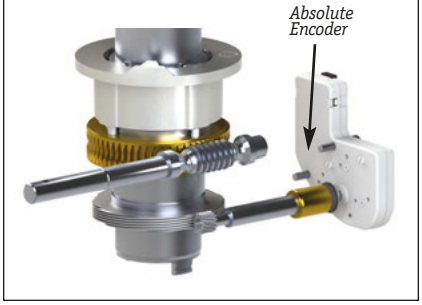
The more common method is to use an electronic encoder that can measure a much greater span of output turns.

The two types of encoders in general use for valve actuators are the absolute and the incremental. The incremental encoder will count the number of turns from a set position established in its memory during set up. It can only count when powered; if an incremental encoder is powered down and the actuator moves, it loses position reference. As a result, a backup battery is usually incorporated into the design to power the encoder and the processor in case the actuator loses main power.

The absolute encoder works differently. It doesn't need to be powered when moved because each position has a unique signature that can be read at any time. It does not rely on an incremental count to maintain position reference.

The position-sensing mechanism is used to trip the motor power at the ends of valve travel on position-seating valves.

Absolute encoder and drive mechanism



DIRECTION CONTROL

All types of actuators need some kind of direction control to move the valve in the opening or closing direction. For electric actuators this usually takes the form of a motor starter. For fluid-powered actuators, a direction control valve is used.

In both cases, an external control signal is used to energize the coils of

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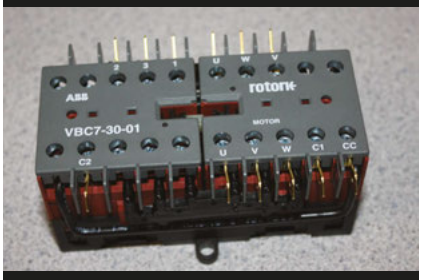
Fluid power direction control valve (gold color) with solenoid



Electric motor reversing starters for a three-phase motor

the motor starter or the solenoid coils of the direction control valve.

Control wires connect the control room to these directional controls and are often 110VAC or 24VDC.

For electric actuators, an important decision is how the motor is controlled. Two types of motor control layout are:

- *A separate motor control center (MCC)* that contains the motor starters for the actuators in one central location separate from the valves. This configuration is often used when actuators are located in hostile environments.
- *Motor starters integral to the actuator* located at the valve. This configuration provides a simpler and often less expensive installation.

The separate MCC most likely originated in the power industry where motor starters are typically grouped together. The control wiring runs from the control room to the MCC with feedback wires from the valve actuator position-indicating and torque-sensing switches. The power cables run from the MCC to the individual actuators.

Advantages of the MCC layout for actuator control include:

- Motor starters are all located in a single area for easy maintenance.
- The motor controls are removed from vibration, steam, dirt, water and other contaminants.
- The actuator requires a smaller space envelope and has less weight.

Advantages to the integral control method include:

- Torque and limit switches can be wired in the actuator allowing the unit to be self-contained and factory tested.
- Less site wiring is required.
- Automatic phase correction can be incorporated in the controls.
- A digital field bus link can be employed to reduce the multiple control and indication wires and also bring back diagnostic information.

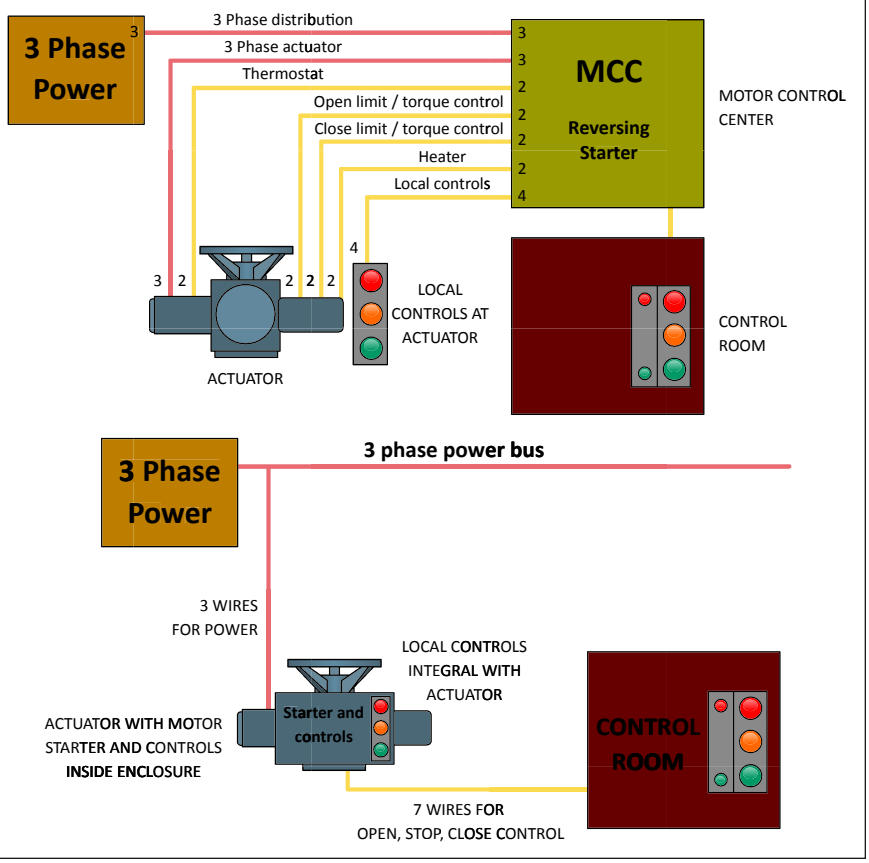
The MCC layout was the global standard in 20th century power plant design and is still seen in water treatment facilities and power plants of German design. In contrast, integral controls and starters are the preference in the oil, gas, petrochemical and most other industries.

Most manufacturers of electric actuators have product designs to accommodate either configuration.

The sensors and controls described in this column are the fundamental requirements needed in a modern valve actuator, whether fluid or electric powered. There are many refinements and additional controls available to enhance performance and protect the automated valve assembly. However, without this fundamental control of force and position, the valve actuator cannot perform effectively. VM

Chris Warnett is principal for CPLloyd Consulting (www.cplloyconsulting.com). Reach him at chris@cplloydconsulting.com. This column is an excerpt from his book, Valve Actuators: A Comprehensive Introduction to the Design, Selection, Sizing and Application of Valve and Damper Actuators, available on amazon.com or by visiting https://www.createspace.com/5327931, where readers of VALVE Magazine have a discount using the code "TXTMBQCY."

Power and control connections for separate MCC (top). Power and control connections for integral starters (bottom).



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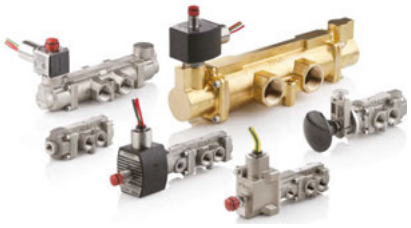

ASCO added to its 362 and 562 series of brass and stainless-steel spool valves by introducing 3/8-inch and 1/2-inch pipe sizes that feature the highest flow rates and low-power consumption. These new sizes provide design engineers with additional solutions for control valve automation, especially in the upstream, midstream and downstream oil and gas markets.

The high flow rates will enable OEMs to use smaller piping and purchase lower-cost valves while achieving the same flow specifications.

The 362 series is a three-way valve for single-acting process valve applications. The 562 series is a four-way spool valve for double-acting process valves.

Pentair Valves & Controls introduced the Anderson Greenwood 4000 series of pressure and vacuum relief valves, compliant with the latest API 2000 standard. That standard covers normal and emergency vapor venting requirements for bulk liquid storage tanks.

The new series pressure and vacuum relief valves are engineered to provide increased flow capacities and will fully open at 10% overpressure, protecting tanks from physical damage caused by internal pressure fluctuations. As a result, the valves can be set more closely to a storage tank's maximum allowable working pressure or maximum allowable working vacuum.

Garlock now offers a line of strainer gaskets that provide an affordable way to remove particulates and debris from process fluids. The new gaskets are suitable for standard flanged connections and can be inserted upstream from sensitive and costly processing equipment. They may be deployed as a single filter or as a graduated system of several strainers that consume less space and at a lower cost than other methods such as filtration cartridges.

Stainless-steel plain mesh weave is standard for 20, 40, 50, 60 or 100 mesh or available with dual layers for some meshes.

Rotork supplied IQ3 intelligent valve actuators for the automation of the world's first seven-way control valve. The innovative valve operates under high pressure to control and regulate the flow of chemicals such as polymers, reducing the load on instrumentation in the downstream manufacturing processes.

The radial design of the valve eliminates any dead space (no flow) areas that could erode the quality of the media. The design demands a compact actuation solution that is capable of delivering swift and precise valve movements with high operating torques.

High Pressure Equipment Company developed a line of standard and custom valves and fittings specifically designed for cryogenic and extreme heat environments. The company uses an extended stuffing box design with fins provided around the packing area to move packing away from cold or hot zones and dissipate the heat or cold for safe and reliable operation.

Standard and custom extreme temperature valves are available in manual and air-operated configurations for pressures from 10,000 to 30,000 psi. These valves use coned-and-threaded connections to provide dependability and are available in special materials such as Monel and Hastelloy.

Siemens SIPART PS2 valve positioner is designed for linear and part-turn actuators as well as for single-acting and double-acting actuators. The intelligent positioner masters any task without problems, whether used for "mini valves" with very small strokes or steam valves with large stroke. In addition to linear actuators, SIPART PS2 also controls part-turn actuators with a rotary angle range from 30-100 degrees. For easier mounting of the SIPART PS2 to standardized or manufacturer-specific actuators, 400 mounting kits are available. Initialization is started by using three push buttons and the display, and commissioning is complete within a few minutes.

Hunt Valve announced a new proportional poppet valve for descaling applications that lasts three to five times longer than traditional poppet valves. By eliminating the effects of water hammer and system shock, this valve technology promotes safety in plants and cuts operating costs in half.

Typically, the speed is only reduced for the last 10-20% of the stroke, just before completely shutting off the

CONTINUED ON P. 48

"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.

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- **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

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- **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.
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CONTINUED FROM P. 46

flow to the descale header. This slow rate of closure can be fine-turned via the integrated local control interface or programmable logic controller.

Spirax Sarco has rebranded the VLM10 Inline Vortex Flowmeter to the VLM20. It uses a common electronics platform now available in all the new 20 series meters to improve reliability and ease of use across the product line.

This flowmeter has a SMART multivariable transmitter with integral temperature and pressure sensor, giving users an all-in-one solution for measurement needs. A precision 1000 Ohm RTD and absolute pressure sensor are used to calculate density for mass flow and thermal energy flow from chilled, hot water and condensate return system.

Saint-Gobain Seals introduced a new polymer material solution for critical applications in jet engine lubrication systems called Fluoroloy A90. To contend with stricter pressure and temperature working conditions, the company developed this new material, which enables spring-energized seals to work with continuous temperatures above 608F° (320°C). The material formulation withstands static hot air sealing in temperatures up to 662°F (350°C) while retaining the mechanical properties with same or less leakage, surface indentation and material degradation.

Additionally, the polymer shows a low linear coefficient of thermal expansion favorable for high-temperature sealing applications. The material offers stability through time and minimum loss of properties due to thermal aging compared to perfluoroelastomer compounds.

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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.

Celebrating 55 Years of Service

For 55 years United Valve has been providing valve services for customers along the Gulf Coast and around the world. After five and one half decades, the buildings and equipment are different, but our goal of providing quality valve services with honesty and integrity has not changed. Based on our computer system's data and other historical information, we estimate that over 750,000 valves have passed through our doors for valve repair, testing or modification since John Kennedy was president. The range of customers from those early years of the 1960's through today, includes virtually every major manufacturer of gate, globe, check and ball valves, virtually every major refining and chemical company on the Gulf Coast, as well as nearly every major US valve distributor. Our customer list for 2015 alone has nearly 400 different companies on it.

Left to right: Matt Lovell, Kelly Lovell, Paula Johnson, Greg Johnson

The strength of our company has been and continues to be our quality employees. As we near our 56th year in business, we have employees with nearly 40 years of tenure with the company. The supervisory personnel average 20 years of service with United Valve as well. Our engineering staff is broad with a variety of technical and engineering degrees represented.

We continue to reinvest in our company and strive to keep our facilities and equipment state-of-the-art. Forty ton cranes, an extra-high-bay building, automated welding equipment, CNC machine tools, X-ray facilities, and fugitive emissions testing equipment are just some of the areas where we have put our profits back in the company to provide a broadening range of valve services of the highest quality.

L. D. Johnson, Founder

As the third generation of family leadership assumes its leadership role in the company, we look forward to more decades of successful valve service.

We would like to thank all of our customers who have made these 55 years of service possible. ***Without your confidence and support, we would not be here.***

UNITED VALVE

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