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Power Generation

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It's never too late to learn something new

Dear readers,

I'm pleased to present you with the brand-new October issue of Valve World. As with each and every issue of the magazine, our dedicated editorial team has worked hard to bring you the latest and most relevant valve related news and information with the hope that you will come across a topic that piques your interest.

Even more importantly, we want you to learn something new about the valve industry that you can apply to your career either in the office or out in the field. It's never too late to learn something new, whether it's about a valve manufacturer you were previously unfamiliar with, how an end-user goes about procuring valves or perhaps an innovative new type of automation technology. Regardless of the specifics, we want to continually encourage and inspire your quest for knowledge.

Here are just some of the many highlights that we have prepared for you in this latest edition: Our cover story features A-T Controls, a global leader in the design, manufacturing and sale of manual and automated, highly-engineered valve solutions. We had the pleasure of speaking with Mr. Brian Wright, President and CEO, at A-T Controls' 122,000-square-foot headquarters in Cincinnati, Ohio, USA. We discussed the company's solutions-orientated sales structure, its plans for future growth, as well as the many industries its products are used in including the power sector.

Speaking of the power generation industry that is our issue's Special Topic this time around. This subject is examined in the article *Electric actuators in biomass power plants* written by Gerda Nölp who explains how biomass power plants are an important source of renewable energy. She analyzes the potentials and challenges for electric actuators in these biomass-fired power plants. Andreas Pischke, Metso writes about the power and gas turbine market, *On saving costs and improving turbine efficiency*.

We also have two end-user/EPC interviews for you to enjoy. Our first interview is with Mr. Joel Katzman who is a Manager of Piping Engineering for CH2M, one of the largest Engineering and Construction (E&C) firms in the United States. He shared with us some of his experiences from working on countless projects with thousands of colleagues and clients over his 40-year career in the engineering industry. Our second interview is with Mr. Zulkarnain, who is the director of Indonesia's PT. Bemi Energi. He provides some insight into what foreign companies should know if they want to benefit from the extensive business opportunities currently available in Indonesia.

In addition to our Cover Story, Special Topic and End-user/EPC Features we have many other interesting articles including the EPC Feature, *Through conduit double expanding gate valves* written by Fluor Daniel India Limited's Yogesh Jangra, as well as a market report about valve selection for coal-fired boilers, among many other informative articles. So you have a lot of great valve-related content to read and learn about in this issue.

But we want to know more about your thoughts, so we can learn from you. What article(s) did you find the most helpful? Is there a particular subject you would like to learn more about? Do you have the perfect valve user in mind for us to interview for an upcoming issue? Or perhaps you have an idea for future content and would like to submit an article? Please feel free to contact me with your thoughts, comments, technical articles, press releases and news updates.

I look forward to hearing from you!

Happy reading,

Sarah Bradley

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COVER STORY

Since its establishment in 1994, A-T Controls has become a global leader in the design, manufacturing and sale of manual and automated, highly-engineered valve solutions for process industries. Products such as actuation systems for valves and dampers including pneumatic actuators, electric actuators and electro-hydraulic actuators, as well as manual ball vlaves and automated valve packages to control industrial valves. Supplying products to virutally every industrial sector, A-T Controls is active in the oil & gas, refining, petrochemical, chemical processing, pulp & paper, mining, water & wastewater, transportation, food & beverage, pharmaceuticals, ship building, HVAC and power industries.
A-T Controls currently operates from its 122,000-square-foot headquarters in Cincinnati, Ohio and newly-expanded 68,000-square-foot facility in Stafford, Texas, supported by several sales offices throughout North America. Valve World had the opportunity to meet with President and CEO, Brian Wright at A-T Controls' headquarters to discuss the company's solutions-oriented sales structure and plans for future growth.

SPECIAL TOPIC

Global warming and climate change are on everyone's lips. The Paris Agreement to reduce global greenhouse emissions, signed by 174 countries, is one reason for the growing importance of renewable energy, including biomass. This article looks at the potentials and challenges for electric actuators in biomass plants.

In the power and gas turbine market, competition among turbine and compressor manufacturers has become more challenging. Decisions are driven mainly by price and efficiency. Saving costs by selecting the correct application-based control and safety valves has become more important.

CASE HISTORY

Square port knife gate valves with double acting pneumatic actuators have been selected for a rejects bulk handling system in a coal mill.

COLUMNS

Electric actuators in biomass power plants

Four parallel conveying lanes and feeders supply straw to the boiler at Lisbjerg power plant.

Global warming and climate change are on everyone's lips. The Paris Agreement to reduce global greenhouse emissions, signed by 174 countries, is one reason for the growing importance of renewable energy, including biomass. This article looks at the potentials and challenges for electric actuators in biomass-fired power plants.

By Gerda Nölp, AUMA

Biomass-fired power plants are becoming increasingly popular, especially in Scandinavian countries, but also in other regions of the world that are striving to reduce their carbon dioxide emissions.
A wide range of recent projects shows that the technology to run these plants economically is available today, making them a viable alternative to fossil-fueled plants.
Biomass-fired power plants can use various kinds of organic matter as fuel: usually waste or by-products that are available locally in large quantities. Combinations of different types of biomass, natural gas and biomass, or coal and biomass are also possible.
European biomass power plants frequently burn straw – a by-product of agriculture – or wood in various forms such as wood chips, pellets or other wood waste. In other regions, other materials such as corn waste, sugar cane bagasse, or oil palm residues are often used.
The basic design and operation of a biomass power plant are almost identical to those of a coal-fired plant. Converting an existing coal-fired power station to biomass is possible with reasonable effort, as numerous examples demonstrate.
Apart from the fuel itself, the main differences between biomass and fossil-fuel plants lie in the way the fuel is transported, the grates and ash handling systems, and the boiler design. Because biomass is generally coarser than pulverized coal, for example, biomass boilers have to be comparatively tall to allow a longer time for complete combustion.
Most biomass-fired power plants are cogeneration (combined heat and power, CHP) facilities that produce heat for district heating as well as electricity. Their total efficiency is typically much higher than that of plants producing only electricity.
Valves and valve actuators are key components in the classic processes of feedwater treatment, steam generation, turbine injection, flue gas cleaning, and district heating networks, just as they are in conventional power and cogeneration plants. And, as with conventional plants, high temperatures, high pressures, and vibration all test the durability of valves and actuators. However, the complex

and variable nature of biofuels introduces some challenges, as the following examples show.

Special SIL requirements at Lisbjerg power plant

The straw-fired Lisbjerg power plant, commissioned in 2016, is one of the largest of its kind in Denmark.With its output of 38 MW of electricity and 78 MW of heat, the plant supplies 20 percent of the district heating demand of Aarhus, the second largest city in Denmark. Aarhus plans to source all its district heating from CO_2-neutral energy sources by 2030.
Lisbjerg power plant burns up to 240,000 t/y of straw from nearby farms. To increase its flexibility, the plant can also burn up to 50% woodchips. Four parallel conveying lanes and feeders supply straw to the boiler. Combustion takes place on a water-cooled vibrating grate. Approximately 50 of AUMA's latest-generation SA and SAR electric actuators automate valves in the Lisbjerg plant. Equipped with AC intelligent controls, all the actuators are centrally controlled via a Profibus DP-V1 interface. Notable is the actuator on the condenser bypass damper, which has special safety requirements.
To make full use of its residual heat, the flue gas passes through a condenser. In case this needs to be taken offline for maintenance, the plant has a large bypass damper that allows the flue gas to be routed directly to the chimney. Failure of the damper to open when required could lead to a plant shutdown.

An AUMA SA 14.6 actuator with AC 01.2 SIL actuator controls and GS 250.3 gearbox meets SIL 2 requirements for the condenser bypass damper at Lisbjerg power plant.

AUMA's modular SA and SQ electric actuators control the flow of water and steam at Lisbjerg power plant.

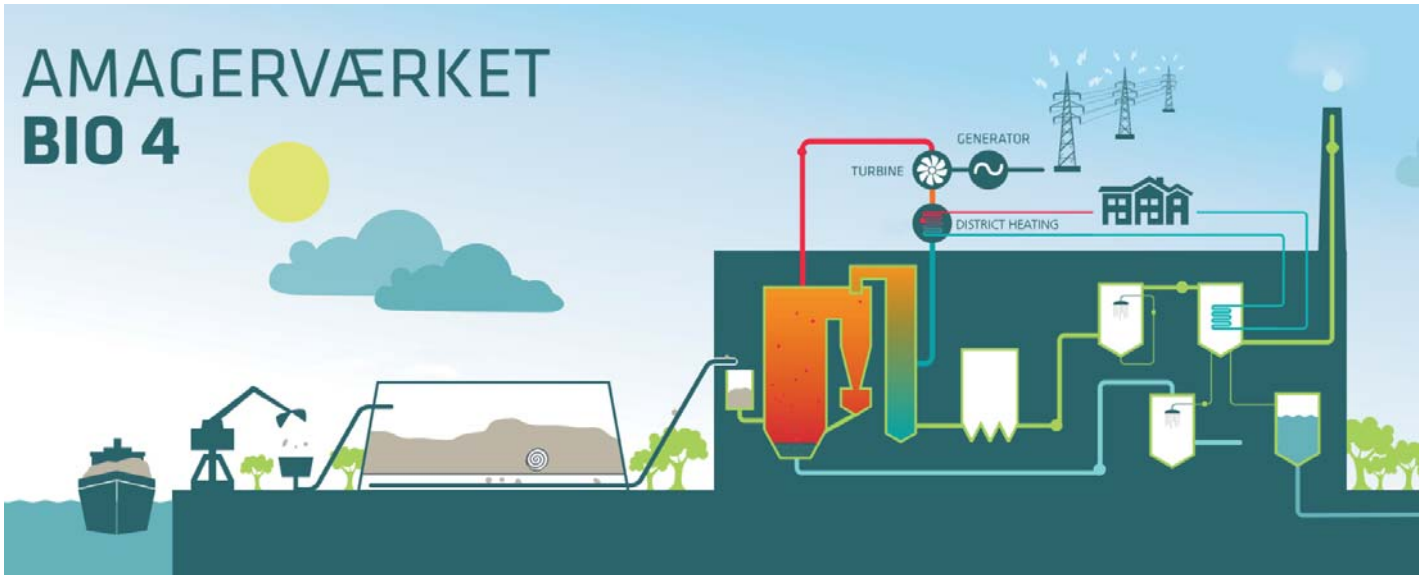
The contractor of the plant contacted Kolster, a Danish damper manufacturer that is part of engineering company K.S.M. Kragelund. Kolster has a long history of working with Grønbech & Sønner, AUMA's representative in Denmark. Together, Kolster and Grønbech & Sønner decided on the most suitable combination of actuator, control unit and gearbox for this critical application.
The designers specified that the actuator must meet the requirements of at least Safety Integrity Level (SIL) 1, as specified by IEC 61508 edition 2. They chose a Kolster KLS 1500 × 2750 mm damper with an AUMA SA 14.6 actuator, AC 01.2 SIL actuator controls, and GS 250.3 gearbox. This actuator combination is designed for applications requiring a high degree of safety, and meets SIL 2 requirements. At Lisbjerg it is used for both normal and safety-critical functions.

First straw-fired plant in Germany

The BEKW power plant in Emlichheim is the first in Germany to rely on straw as a fuel. This cogeneration plant (10.2 MWe / 49.8 MWt) started up in 2013 and burns approximately 70,000 t/y of straw from surrounding farms. It achieves a record primary energy efficiency of approximately 90 percent. Technical availability is 98 percent, which is excellent for this type of plant. AUMA electric actuators contribute to both the efficiency and the reliability of the Emlichheim plant. In use are around 30 SA actuators for open-close duty and SAR actuators for modulating duty, all equipped with AC intelligent actuator controls.
An example application is the control of water flow to the spray attemperators located after the superheaters. Variations in the quality of the straw fuel, and the continuously changing demand for district heat, make this a challenging task that the AUMA actuators are well placed to handle.

From natural gas to co-firing biomass

Skærbæk power plant near Fredericia, Denmark, is one of three power plants operated by energy giant DONG that have recently been converted to biomass. Originally built for natural gas, the plant was converted to dual-fuel cogeneration in 2017. Two new highly efficient 140 MW wood chip boilers were installed during the refurbishment. Wood chips are the primary fuel, with natural gas as a backup.
The main purpose of the plant is to provide district heating for roughly 200,000 people. However, the new wood chip boilers can also supply steam to the existing turbine, to the extent that the plant can be dedicated entirely to electricity generation. This ensures maximum flexibility in the summer, and during periods when wind or solar electricity production drops. The plant also has a 5500 GJ heat storage system that covers approximately 8 hours of heat consumption on a winter's day.



Block flowsheet of the new HOFOR BIO4 unit at Amagerværket power plant. (Source: HOFOR)

Installing the wood chip boilers required new pipelines for water and steam to be installed and linked to the original gas-fired plant. Approximately 100 SIPOS SEVEN actuators were added.

The SIPOS SEVEN actuators, which are engineered and manufactured by AUMA Group company SIPOS Aktorik, incorporate frequency converters that allow their operating speeds to be adjusted during the valve travel. Variable speed offers significant advantages in a wide variety of closed-loop and open-loop control applications, since each change of valve position can be matched to its optimum operating speed.

Variable-speed operation also makes SIPOS SEVEN actuators very versatile, since a single size of actuator typically covers 8 different torque settings and 7 operating speeds. This reduces the number of actuator variants required across the plant, and so simplifies inventory management. Torques and speeds can be adjusted at any time to optimize the process or accommodate process changes.

Heavy-duty continuous modulation

The new HOFOR BIO4 cogeneration unit at Amagerværket power plant in Copenhagen, Denmark, is another example of challenging requirements for valve automation. The plant is currently under construction and is planned to start up in 2019. The new unit will burn approximately 1.2 million t/y of wood chips in a circulating fluidized bed (CFB) boiler to yield up to 150 MW of electricity and 415 MW of heat. The project is a milestone on Copenhagen's ambitious journey to becoming the world's first CO_2-neutral capital by 2025. The operator is HOFOR Energiproduktion A/S, Denmark's largest utility company.

The plant includes a turbine bypass to control the relative amounts of steam used for electricity generation and district

SIPOS SEVEN actuators with Profibus DP interface (V2 services as standard) in Skærbæk power plant.

heating. This requires high-precision electric actuators on the control valves in the district heating system to achieve precise temperature control and keep the plant in operation even when the turbine trips. These actuators have to meet the highest requirements for accurate positioning, short response times, and frequent operation.

The HOFOR BIO4 unit will use SIPOS SEVEN HiMod variable-speed actuators. The SEVEN HiMod range meets the requirements of class D for continuous modulating duty according to EN 15714–2, and is suitable for up to 3600 starts per hour, while also providing high positioning accuracy.

SEVEN HiMod actuators with frequency converters are able to reduce their operating speed as they approach the setpoint. By preventing any danger of overshoot, this ensures maximum accuracy and eliminates unnecessary switching cycles.

SEVEN HiMod actuators will also be used for the steam injection valves in the boiler. These face equally demanding requirements, since they must control the steam temperature to an accuracy of just a few degrees. Poor temperature control can damage the turbine blades and the superheater.

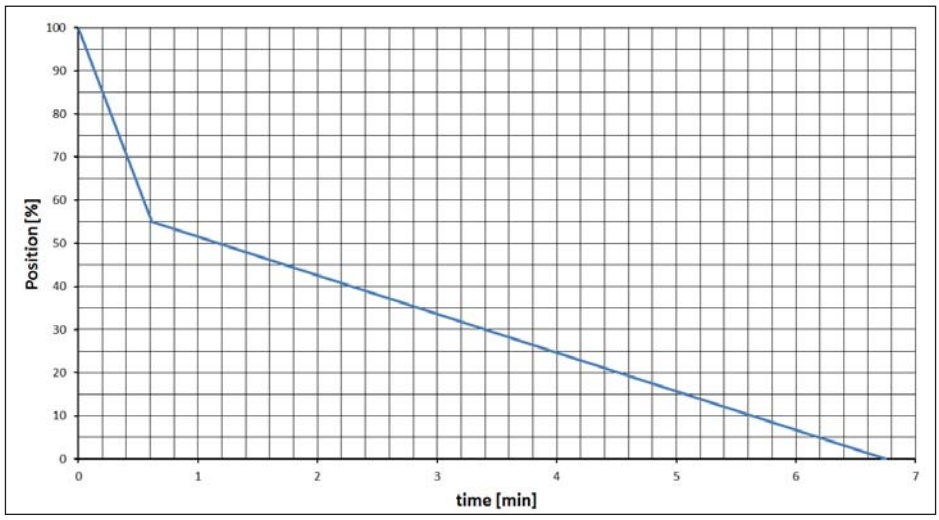
The plant will be equipped with the latest version of the Siemens SPPA-T3000 DCS system, which has the functionality to integrate the actuators automatically via a redundant Profibus DP-V2 network.

Green district heating for Stockholm

Recent biomass projects in Sweden include the new Fortum Värtaverket KVV8 CHP plant in Stockholm, which started up in February 2016.

This large plant generates 130 MW of electricity and 280 MW of heat, including 80 MW recovered from a flue gas condenser. Fuel flexibility was a prime concern at the design stage: in normal operation, the plant consumes around 12,000 m³/d of wood chips and forestry residues, but it can also burn coal when biomass is in short supply.

Värtaverket KVV8 is a big boost to Stockholm's ambition to make its district heating resource-neutral and carbon-neutral by 2030. It produces enough heat to supply 190,000 households, and has increased the fraction of renewable fuels used for district heating in Stockholm from 45 percent to 70 percent.



Example parametrization of actuator speed as a function of valve travel for a SIPOS SEVEN actuator. Up to 10 speed changes can be programmed.

Approximately 100 AUMA SA multi-turn and SQ part-turn actuators with AC intelligent actuator controls are used to automate a wide variety of valves within the plant. Profibus DP-V1 is the preferred communications standard to carry actuator commands, feedback signals, messages and diagnostic information. A standardized Electronic Device Description (EDD) for the AUMA devices facilitated integration with the Siemens SPAA-T3000 control system supplied by Austrian engineering company Andritz.

An additional 20 SIPOS SEVEN actuators are installed on important valves in the district heating system, where their variable motor speeds help prevent pressure surges in the pipelines. Combining the two AUMA and SIPOS product ranges within a single plant has proven successful in many recent projects, allowing the ideal actuation solution to be selected for each individual valve.

To avoid pressure surges, the SIPOS SEVEN actuators are programmed to close these critical valves in two steps. During the first part of the valve travel, the motor runs at high speed for maximum responsiveness. Then, after the valve has moved through 30–50 percent of its travel (depending on the valve type), the speed is reduced. The speed profile can also incorporate higher speeds for emergency operation.

The traditional way to avoid pressure peaks is to add a bypass line with a second, smaller, valve and actuator. The SIPOS variable-speed solution saves space and reduces costs for both installation and maintenance.

One face of future power generation

The examples above illustrate the important role of valves and electric actuators in biomass-fired power plants, which are supplying an increasing fraction of Europe's electricity and district heat. Alongside other renewable energy sources such as wind and solar, they will be a key component of the future energy mix.

AUMA has worked closely with stakeholders in the valve and power industries for more than 50 years, and continuously invests in research and product development. Thanks to its wide portfolio of proven and robust electric actuators, AUMA can offer advanced actuation solutions for the most challenging requirements in terms of positioning accuracy, repeatability, availability, functional safety, and harsh process environments.

About the author

Gerda Nölp is Area Sales Manager Europe at AUMA Riester GmbH & Co. KG, Müllheim, Germany, with more than 25 years of experience in electric actuators. She started in international sales of electric actuators 15 years ago at SIPOS Aktorik, a member of the AUMA Group. She began her career as a mechanical engineer designing electric actuators at Siemens AG in Nürnberg, Germany.

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