Laying steam distribution systems with on-the-spot precision for individual needs

SCHUBERT SALZER

Sliding gate valves open up enhanced flexibility for power plant planners and operators

An application report by Klaus Heigl and Helmut Ambros

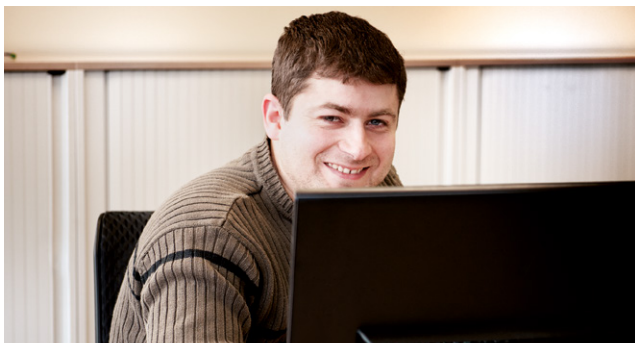
The biomass combined heat and power plant (BMCHPP) by Naturenergie Cham GmbH generates 2.8 MWh of power from woodchips. The remaining medium steam pressure of 9 bar is supplied to different energy consumers with different requirements. In order to be able to serve this wide range, the steam flows have to be individually planned, controlled and if necessary finely adjusted. At the Cham plant, as well, the sliding gate valves by Schubert & Salzer Control Systems have proven to be perfectly suitable for this purpose. In addition to the low weight, compact dimensions, good insulation capabilities, low flow noises, high control precision, quickness, minimal leakage and minimal intrinsic energy consumption, for this project the sliding gate valves were outstanding due to the fact that K_{vs} values can be easily adapted to new circumstances with no problem by simply changing the functional unit.

Biomass combined heat and power plants (BMCHPP) contribute to energy conversion. This technology is also used by the city of Cham. For years, the wood chip power plant of Naturenergie Cham GmbH has reliably supplied process steam, power and remote heat. Up to 70 % of the process steam goes to three adjacent cheese plants of Goldsteig Käsereien Bayerwald GmbH. Then power is created for the municipal works and remote heating for local institutions such as schools, outdoor pools, indoor pools etc.

The design of this plant was in the hands of the planning team Schmid GmbH, a 50 % subsidiary of Gammel Engineering GmbH in Abensberg. The automation from the field level to the control system was developed and implemented by Kappenberger + Braun GmbH & Co. KG. Klaus Heigl was responsible for this project. After commissioning of the power plant, he became the power plant operator and now manages the plant which he himself programmed.

Sliding gate valves are the core for need-based steam distribution

Given the different requirements for steam supply, the planning company was looking for valve solutions which meet the needs of planners and operators both in terms of flexibility, control precision but also in terms of specific plant aspects. The planning team of Schmid GmbH found this in the sliding gate valves of Schubert & Salzer Control Systems.



Klaus Heigl: “I do not know any other valve solution which reacts so quickly and thereby can achieve the highest possible energy yield in both of our heat condensers.”

With its special construction of two disks which slide onto each other and seal each other, sliding gate valves are one of the few industrial valves which combine high control precision with a very low leakage rate. The central throttle organ - the two disks - is also hardly subjected to wear so that long service lives can also be achieved under extreme conditions in power plants depending on the system.

Sliding gate valves are therefore very cost-effective solutions to control steam flows. However, with different materials and in combination with all conventional positioners they can be used in virtually all other industrial areas and applications. For this purpose, they are made

- in the dimensions DN 15 to DN 250
- for pressures to PN 160
- for medium temperatures from - 200 °C to + 530 °C

All versions are parameterised via a PC interface using a graphic configuration software “DeviceConfig” and can therefore be easily adapted to the respective application.

Particularly in steam distribution systems, very short reaction times of actuators are crucial. This requires short strokes, low moving masses and low driving forces. The sliding gate valve

combines all of these properties in an ideal manner. The typical stroke between open and closed is only 6 mm to 9 mm.

Wear minimised

The locking and throttling of steam results in considerable vulnerabilities to scratches in traditional valves with a metallic seating. Leaks with expensive and also dangerous losses of steam are the unavoidable result. The pressure of the medium against the moving disc supports the sealing function of the valve. This functional principle ensures a self-cleaning and adaption effect of the moving disc. This surface seal is thereby more robust and a leak rating of < 0.0001 % of the K_{vs} value is being achieved. In addition, the disks which slide onto each other are hardly subjected to wear so that these valves combine long service lives with a high permanent seal - also with demanding requirements such as steam systems.

Sliding gate valves are extremely compact, fit easily between two flanges and are easy to handle - a DN 150 is just 15 kg including its actuator. This means that it can be installed and disassembled by one single person. The compact structure of the valves also allows cost-effective insulation.

Overall, sliding gate valves provide a lot of flexibility for planners and operators, particularly in power plants. These control valves have proven to be secure, precise, flexibly adjustable and very cost-effective solutions both technically planned and also during commission and during continuous operation.

Modern valve solutions for biomass combined heat and power plant

Approximately 70 % of the process steam which occurs at the Cham biomass combined heat and power plant at 9 bar is provided to the Goldsteig cheese dairies. In order to serve this important process steam consumer safely and to be able to simultaneously prevent a pressure decrease in the medium pressure part of the power plant, the planning company has used a large sliding gate valve DN 200 at the transfer point.

During the commissioning of the power plant, it was decided due to fluctuations in the compressed air network to design the sliding gate valve with its electro-pneumatic positioner to be fail open and to secure it with stop valves. At this time, the permit from TÜV was not yet available for this version so that a special feature of the sliding gate valve becomes particularly beneficial here: a conversion from fail open to fail closed only requires a 180° rotation of the moving disc and thus very short time and no cost. This prominent characteristic has proven to be a major advantage after the TÜV required fail closed for this sliding gate valve after the fact.

The remaining third of the process steam is also used for re-supply and energy recovery in the medium pressure portion as well as for remote heating for public institutions. The resupply of the steam with 9 bar overpressure and the reduction to 0.2 bar over-pressure in the second turbine portion provides approximately one third of the total, generated electrical energy. The low pressure steam is also conducted into two downstream heat condensers for hot water preparations so that 95 °C hot water can be used for a remote heating supply. Here the control of the condensate filling level is taken over by two simultaneously activated sliding gate valves type 8044 in DN 40 and DN 32. With this plant configuration, a precise condensate control is ensured because only fast acting valves facilitate the optimum efficiency of the heat condensers.

Klaus Heigl has been very satisfied with this solution: “The sliding gate valves work precisely and extremely quickly. I do not know any other valve solution which reacts that quickly and thereby ensures the highest possible energy yield in the two heat condensers.”

At the power plant, two redundant steam boilers ensure the seamless supply to all consumers. For this reason, these steam boilers are constantly preheated to 180 °C so they are ready for operation in order to guarantee a reliable supply in the event of a turbine failure or during service work. A sliding gate control valve type 8044 DN 50 each is used to heat the two redundant boilers with process steam.

Variable K_{vs} values make plan changes possible with no problem

Plan changes often mean that the calculated and required steam quantities are no longer being achieved. However, with sliding gate valves providing a simple opportunity to change the valve characteristics as well as flow coefficients (K_{vs} valve) in almost any way, this problem was obsolete.

The K_{vs} value of 16, originally planned for DN 40 valves, was recalculated by the Schubert & Salzer valve specialists and then quick changed by switching the function units to a K_{vs} of 26. The K_{vs} value adjustment within one nominal size is a change in the free slot areas. This means that the sliding gate valve can be adapted easily and only with minimal costs to new steam consumptions. This capability enables planners and plant operators to react to changes of the required steam quantities - even after the changes occur.

Two sliding gate valves, operated in parallel lines, secure precise condensate control for an optimum efficiency of the heat condensers.

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