Centrifugal Pumps in Power Plant

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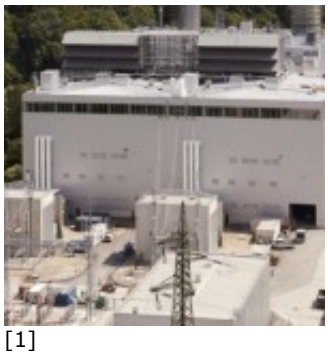
The Siemens Energy Sector Austria shows exactly how a contemporary power supply should now be with the new gas and steam power plant in the Styrian town of Mellach. With the gas-fired combined cycle power plant a total of five decommissioned power plants are being replaced. In use on site: the self-regulating centrifugal pumps from the V-AN range – genuine problem solvers.



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Gas-fired combined cycle power plant

According to the information provided, the most modern thermal power plant in Austria reduces CO_2 emissions by more than half compared to a conventional thermal power plant. Up to two million tons of CO_2 are saved in total. The highly efficient combined heat and power in the gas-fired combined cycle power plant generates electricity and heat simultaneously. This saves large amounts of energy. The power plant is operated with natural gas, so that the new gas-fired combined cycle power plant also sets new standards in terms of environmental protection. At the heart of the plant are two machine sets with a total capacity of 832 megawatts, both of which consisting of a gas turbine and a downstream steam boiler with steam turbine. The resulting level of efficiency is around 59 percent in the case of pure power generation and approximately 80 percent for combined heat and power: the highest value that is feasible with state-of-the-art technology. "One of the main arguments in favor of gas and steam power plants, namely their high level of efficiency, results from the combination of two steps in power generation," explains Overall Project Manager Graduate Engineer Martin Hochfellner (Verbund, GSPP (gas-steam power plant) Mellach).

How does the system work?

The process begins with the intake of combustion air. This is compressed in the gas turbine compressor and then passed to the combustor of the gas turbine. Here, the compressed air is then mixed with natural gas and subsequently ignited. The hot gas (approximately 1,400°C) produced during combustion flows through the power turbine of the gas turbine, thereby driving it. In turn, this turbine drives the compressor and the generator and thereby generates the electric current. After this first electricity generation step, the residual energy contained in the combustion gas is used to convert liquid water into steam at a temperature of about 560 degrees Celsius and a pressure of around 125 bar. This is where the second step begins: the generated steam is passed to a steam turbine, which drives the generator. At the GSPP in Mellach, the gas and steam turbine drive the same generator, which is why we speak of a single-shaft plant. With the help of the block transformer, the power produced by the generator is brought up to the required grid voltage. For the production of district heating, steam can be extracted from the steam turbine, which is then passed to a heat exchanger. This is then used to heat up the district heating water, which then transfers the heat through pipes to the end consumer.

Reliable and trouble-free pumping.

Condensates are derived from the water-steam cycle. The medium remains hot; while boiling hot it is first fed into the vapor separation vessel and, after cooling, pumped into the neutralization tank. "This is where the Bungartz pumps fulfill their important task," explains Graduate Engineer Frank Bungartz, Chief Executive Officer of the manufacturing company. "The condensate is reliably pumped without any problems by the self-regulating VKS-AN pump in a manner which is unmatched by virtually any other pump in the world," as confirmed on site. Standardized chemical pumps with a closed impeller often have problems which lead to interruptions to the pumping process. In contrast, the self-regulating AN pumps work with an open impeller. Pressure equalization with the impeller inlet prevents cavitation. The special features of the impeller geometry and the pressure equalization on the impeller contribute to the stability. Steam which reaches the pump does not cause any damage; it is simply led away by means of pressure equalization. The pumps operate without cavitation and without any interruption to the delivery rate. The delivery height and incoming volume flow determine the height of the liquid in the

pump reservoir. The operating point on the plant characteristic line is always between zero flow and the Q limit (the Q limit is the intersection of the plant characteristic line and the characteristic curve of the "self-priming" centrifugal pump). Its NPSH value is 0, meaning it works without cavitation. If no further liquid flows in, the pump maintains the static height of the plant at zero delivery. The V-AN can be operated for any amount of time at Q = 0 m³/h.

Ecologically valuable, economically expedient.

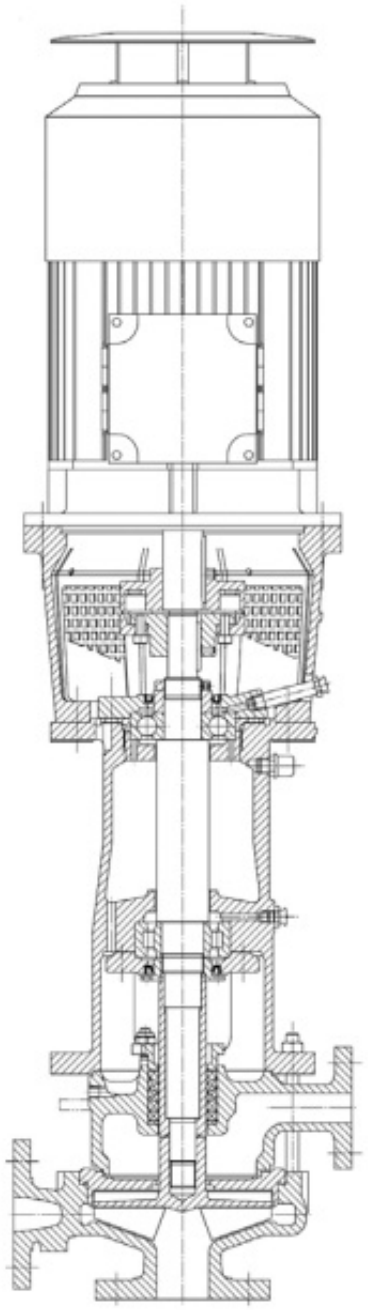
In order to satisfy the highest demands of environmental and energy supply security in the Styrian town of Mellach, the strictest standards were asked of all manufacturers and suppliers. When a pump is selected, the classical technical selection criteria for the specific application are important from the point of view of the plant engineers and operators: in this case the boiling medium, the delivery volume, the conveying pressure and the optimum suction head. Savings can be made with respect to the installation height, as no separate story is necessary. Typical power plant conditions are the very high level of plant availability and the high safety performance. In order to deal with the problem of pumping boiling condensates, the Bungartz company makes use of the special self-regulating VKSAN centrifugal pumps.

An overview of the advantages:

- easy-to-implement sealing technology
- very highly suited to boiling and pumping liquids containing solids, NPSH pump = 0
- a large number of volume flow controls are possible
- pulsation-free pumping
- the pumps are self-regulating, but also accept other forms of regulation.

Reliable working.

An important aspect for large projects is also the step-by-step and punctual call-up of the pumps in order to guarantee trouble-free commissioning. The high demands placed on reliability are guaranteed by the manufacturer by means of individual tests: each pump is tested on the test bed before delivery. Its function, delivery rate and performance are tested. The sturdy technology of the pumps – casting wall thickness of 10 mm is not uncommon – also undergoes the in-house test procedure. The result is very long service lives. "Pumps for life" is what the special centrifugal pumps made by the long-standing and innovative manufacturer are sometimes called. In many regions of the world the pumps from the V-AN range have been running for years without any malfunctions whatsoever. Depending on the location, "problem-solving pumps" with 50-60 Hz and 1,500-3,600 revolutions in the pumping area, a delivery height of 30-120 meters and volume flows from 2 to 80 m³ per hour are in use. In Austria they are installed in the latest-generation power plants in Simmering and Timelkam and are reported to have been running without any malfunctions whatsoever since being put into operation. For the economic evaluation, the high operational reliability, the generous maintenance intervals and very long service lives of the pumps were significant. With a bearing life of up to 32,000 operating hours, very low maintenance costs and many years of trouble-free operation, the pumps pay for themselves very quickly.



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Self-regulating V-AN-type centrifugal pump.

www.bungartz.de [3]

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Bungartz test bed at the German works in Euskirchen.