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Cutting strip steel with a variable speed pump

Save energy, reduce noise, prolong maintenance intervals

A hydraulic pump of a strip steel cutting system controlled by a converter saves up to 90 percent energy, reduces noise emissions, prolongs the maintenance intervals – and, last but not least, achieves a higher throughput.

Sometimes, the simplest solutions are also the most efficient: By retrofitting the hydraulic pump of a strip steel cutting system to incorporate a variable-speed pump, hydraulic system energy costs can be slashed by up to 90%. This is because the motor operates only as long as the actual demand. In parallel, the average hydraulic oil temperature drops from 85 to 50 °C and the wear on the parts is reduced, which allows to prolong the maintenance intervals. Last but not least, this also significantly reduces the noise emission.

Norder Bandstahl (NB) – a successful service business active in the area of stainless steel strips, sheets and bars – focuses on the energy efficiency of all of the systems it uses itself and those that are to be marketed. The company is always searching for innovative solutions to reduce energy usage, for instance, at the interface between hydraulics and state-of-the-art drive technology.

Energy costs slashed by up to 90 percent

In a specific case, together with Siemens, Norder Lager-technik GmbH & Co. Maschinenbau KG developed a solution with which the hydraulic energy usage of its strip steel cutting system could be reduced by 90%. Previously, for hydraulic applications, NB used a pump in conjunction with a proportional and pressure-limiting valve (bypass configuration).

With this configuration, the motor constantly operates at its highest speed, and therefore permanently supplies the maximum flow rate – independent of the actual demand. “For some time now, we have seen it as a matter of urgency to reduce the energy usage of our systems”, explained Stefan Glave, CEO of NB.

Existing pump is transformed into a variable-speed pump

Together with Siemens, NLT engineers looked for ways of optimizing the hydraulic process. They came up with a solution based on a variable-speed pump, comprising a motor, converter and pump.

This combination allows us to precisely provide the flow rate and pressure that is actually required in each operating step. When retrofitting and optimizing the first strip steel cutting system, the induction motor and the hydraulic pump were initially supplemented by a SINAMICS G120 converter, which was connected to the existing SIMATIC S7-300 control system via PROFINET. A pressure sensor that measures the hydraulic pressure, which is then fed back as signal to the closed-loop control system, was also integrated.

Optimizing the system

“One of the first steps after the retrofit was to monitor the existing system”, explained Dr. Yiyang Cai, Project Manager of NLT: “The converter and the commissioning software helped us to understand the system and analyze it. Although we knew that the system requires a high hydraulic power, the trace of the pressure and flow rate profile provided us with a lot of useful information.” Horst Zimmermann, an NLT engineer, programmed the new automation solution. In the end, the power reduction was so high that even a smaller motor could have been selected.

Break-even point within shortest time

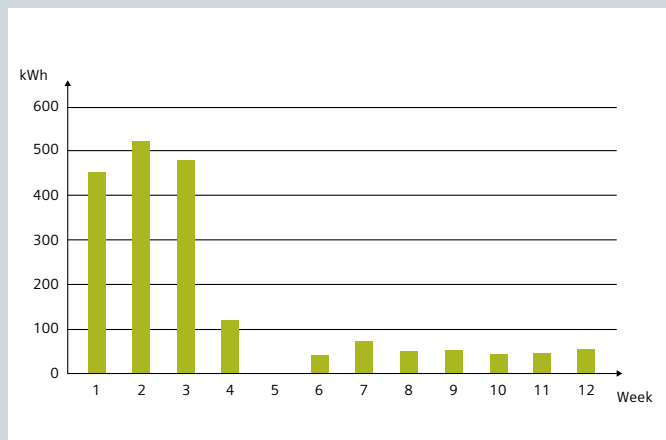
Before integrating the converter into the system and commissioning, there was a four-week monitoring phase in which the usage data of the previous system was determined and recorded using an energy measuring instrument. After completing and optimizing the controller, a new energy

measurement was performed over a period of two months: As a result of the converter operation, energy usage was able to be slashed by between 80 and 90%. “This meant that within just a few weeks we were able to reduce the energy usage of approx. 11.25 kWh per hour down to approx. 1.25 kWh.”, explained Zimmermann. “As a result of the energy savings alone, our investment in products, planning, retrofit and optimization will already have been paid back in two to three years”, added Stefan Glave. “The additional, positive impact regarding wear, noise and throughput will shorten the break-even point even more.”

Additional advantages are becoming apparent

In addition to the significant energy savings, the retrofit brought with it other positive changes. For instance, the hydraulic oil temperature significantly decreased from 85°C to just 50°C, which meant that the operating time of the oil cooling system was able to be reduced. As a whole, all of the system components are subject to less stress than before as a result of the new closed-loop control. This also meant that we have been able to lengthen the maintenance intervals. “The retrofit also improved the response times of our system, which naturally had a positive impact on our production rate,” explained Stefan Glave. In these cases, for short periods of time, the motor can be allowed to rotate faster than the previous rated speed.

After the success of the pilot project, NB has decided to use variable-speed pumps for additional systems.



Measurements carried out with the SENTRON PAC 4200 before, during and after the retrofit verify the enormous energy saving potential of hydraulic pumps.



A favorably priced SINAMICS G120 converter is the core of the new closed-loop control.

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