By Ulrich Latz

Automatic Filter Cleaning Yields Positive Results

Sewage treatment plants require a lot of energy. However, there is potential to reduce the energy consumption. In the central sewage treatment plant of the city of Bocholt in North Rhine-Westphalia, Germany, two measures were taken: replacement of pumps and motors and the implementation of an innovative cleaning process. A new pre-filtration technology was also needed for the system to operate efficiently and safely in the new conditions. The solution was an automatic self-cleaning filter.

Ambitious Sustainability Goals in Münsterland, Germany

Reducing the energy consumption of sewage treatment plants is a major challenge to achieving climate goals. To contribute to this, the waste disposal and services company Bocholt (ESB) —the operator of the central sewage treatment plant in the Mussum district—decided to optimize the energy efficiency of the system, in which wastewater from more than 70,000 homes and several commercial operations are treated. The measures not only include the reduction of energy consumption through highly efficient pumps and low-consumption motors, but also an innovative process to improve the existing activated sludge process: Following the mechanical pre-cleaning with a rake and sand trap, the new process accelerates the sedimentation of the sludge through the use of hydrocyclones and reduces the load on secondary clarification.

Sensitive Components Make Operation Difficult

Hydrocyclones are centrifugal separators for liquid mixtures that separate solid particles from suspensions in a process based on centrifugal force. Thanks to this process, the wastewater treatment in Bocholt is more stable and efficient. However, the innovative process has a challenge: larger contaminants, such as plastic material or leaves that happen to pass through rakes in mechanical pretreatment, can clog the hydrocyclones. If several cyclones breakdown at the same time, a shutdown of the entire plant may occur.

To avoid unplanned downtime as much as possible from the start, the ESB previously used a manual basket strainer that was installed between mechanical pre-scrapping and hydro-cyclones. The filter reliably removed contaminants with sizes of more than 0.4 inch (9 millimeters). The disadvantage: the filter element had to be cleaned three times a day. Employees at the sewage treatment plant had to plan an hour or two a day for this process. This manual cleaning reinforced the need for a higher degree of automation in ESB. In addition, employees came into contact with the just pre-cleaned wastewater at all times. Therefore, for reasons of hygiene and employee protection, ESB was looking for alternatives.

A New Task for an Innovative Filtration System

In many applications, basket strainers are ideal for coarse filtration of process media However, operating in a sewage treatment plant with a very heterogeneous waste-laden medium required a different solution, especially since the filtration step should not be a bottleneck with the desired degree of automation of the entire system.

To meet the customer's needs, a cylindrical stainless steel housing with a filter element was suggested. The liquid to be filtered enters the housing, flows through the filter element from the inside to the outside and leaves the housing through the outlet. During this process, solids are deposited on the inner surface of the filter element. Slotted wedge wire elements are used as filters in typical application areas. This type of solution has been previously used in industrial processes such the treatment of

process water and cooling water, or in the production of paper and cellulose or food and beverages. For use in a municipal sewage treatment plant, a filter unit with a perforated filter element was needed to avoid sudden clogging of the filters. According to the size of the system in Bocholt and the specifications of the hydrocyclones, a unit enabling throughputs of up to 500 gallons per minute (114 cubic meters per hour), and a filter element with a perforation of 1/4 inch (6.35 millimeters) were needed.

Automatic Cleaning with a Sophisticated Actuation

"A unit capable of automatic mechanical cleaning was also desirable," said Ulrich Latz, a technical sales engineer at Eaton. The process is continuous: The differential pressure before and after the filter is measured continuously—once a certain pressure is reached, cleaning begins automatically. A cleaning disc sweeps the entire surface of the filter element and removes any accumulated dirt particles. In the same step, the accumulated dirt is directed to a collection area. When it reaches its maximum capacity, a dirt drain valve opens and dirt is discharged in a highly concentrated manner.

The total travel time of the cleaning disc is approximately five seconds per stroke. At the Bocholt sewage treatment plant, only one or two automated cleaning processes are needed per hour, which is equivalent to a few minutes a day. "Compared to previous technology, this is already a huge savings," noted Latz. "If you also take into account that you are replacing the previous manual cleaning with a fully automatic solution, the result is, of course, much better."

To use the filtration unit with automatic cleaning in this application, a considerable upgrade was necessary. In this instance, the use of a magnetically coupled linear actuator in fluids had not yet been attempted. An expert actuation supplier developed a solution that had passed extensive testing and was reliable in operation.

Image 1:
With a quick-cleaning actuation, the strainer basket filter model reduces costly maintenance work and downtime. © Eaton

Image 2:
At the sewage treatment plant, the fully automatic strainer basket filter replaces a manual solution that costs operations personnel several hours of work per day.
© ESB Bocholt

Ease of Use and Satisfied Employees

The system shows its strengths, especially when used in the Bocholt sewage treatment plant: without dynamic seals, the filter unit is completely leak-proof and enables continuous operation without interruptions. The maintenance-friendly design also saves operating costs and simplifies routine work. The filtration unit can be completely disassembled and reassembled in five minutes and easily serviced without the need for special tools. Ergonomics were also kept in mind: thanks to the 45-degree inclination, the filter can be disassembled without a crane. In-line filtration also enables the inlet and outlet to be at the same level, which means there is no need for additional, cumbersome pipe work during installation.

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ESB Bocholt, a waste disposal and services company in Bocholt, Germany, eliminated the manual cleaning of basket strainers with an innovative cleaning process. A new pre-filtration technology was also needed for the system to operate efficiently and safely in the new conditions. The solution was an automatic self-cleaning filter.

CHALLENGE:
Filter coarse particle larger than 1/4 inch (6.35 millimeters) from the wastewater flow in the mechanical cleaning phase to enable automated operation of the entire system and to ensure trouble-free operation of hydrocyclones (cyclonic separators that separate fluids in different phases and solids).

SOLUTION:
Pre-filtration of wastewater by means of mechanical self-cleaning filter with magnetically coupled pneumatic actuation.

RESULT:
The self-cleaning filter reduces maintenance, enables automatic pre-filtration of wastewater, ensures smooth operation of the hydrocyclonic unit, and thus increases the efficiency and operational safety of the entire sewage treatment plant.

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The filter system has been in use successfully in Bocholt since its installation and ensures stable process conditions, significantly lower maintenance costs and reduced contact between employees and wastewater. “After extensive testing and long periods of use in regular operation, our experience has been consistently positive," confirms Andreas Wehren, Operations Manager at the ESB sewage treatment plant. "With the installation of the filter, we no longer have any failure in the hydrocyclonic system.” This lack of failure was a decisive prerequisite for the trouble-free and efficient operation of the entire sewage treatment process. Since the filter unit can be fully operated automatically, it was integrated into the process control system of the sewage treatment plant to be able to recover all parameters centrally at any time.

The keys to achieving climate goals are everywhere—in industry, with consumers, and in municipalities. With the improvement of the energy savings of its sewage treatment plant, the city of Bocholt has taken a big step towards assuming responsibilities as a municipality and significantly reducing the ecological footprint of its service groups.

Wehren is especially pleased with the seamless collaboration with the supplier’s filtration experts. "We were very satisfied with the communication between the partners, especially during the testing phase," recalls Wehren. "During the transition from testing to purchasing the system, the whole process took place with the same ease."

The keys to achieving climate goals are everywhere—in industry, with consumers, and in municipalities. With the improvement of the energy savings of its sewage treatment plant, the city of Bocholt has taken a big step towards assuming responsibilities as a municipality and significantly reducing the ecological footprint of its service groups. This filter system provides an indispensable contribution to this, with its reliable and efficient filtration solution for pre-filtration of wastewater. WCP

About the author

Ulrich Latz *is a technical sales engineer at Eaton and located in Nettersheim, Germany. He specializes in self-cleaning filter systems and has more than 10 years of experience in diverse industrial filtration applications.*

About the company

Eaton *is a leader in liquid filtration which helps its customers make clean and pure products spanning a range of industries such as pharmaceuticals, food and beverage, industrial and municipal water, petrochemicals, marine, automotive, municipal water, agriculture and construction equipment, or power generation.*