

ALLWEILER® PROGRESSIVE CAVITY PUMPS: A RELIABLE, ENERGY EFFICIENT, LOW MAINTENANCE ALTERNATIVE TO INCLINED CONVEYERS FOR THE DUISBURG-KASSLERFELD SEWAGE PLANT

CHALLENGE

Determine the most reliable, low-maintenance and efficient solution for discharging digested residual sludge at the Duisburg-Kasslerfeld sewage plant.

SOLUTION

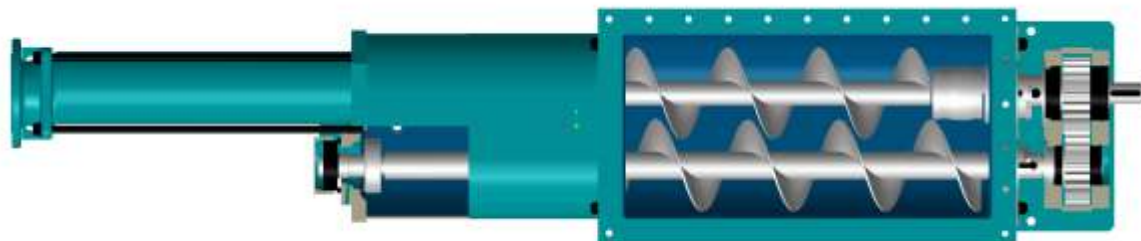
Four-stage Allweiler® progressive cavity pump from the RG series.

RESULTS

The Allweiler® PC pump saves significant amounts of energy and lowers maintenance costs while simultaneously reducing downtime compared to an inclined conveyor.



The sewage plant is designed for 450,000 resident equivalent units; its dry-weather inflow is approximately 1.3 m³/s, rainy-weather inflow is up to 4.1 m³/s. At the right-center, the two feed tubes into the residual sludge silos can be seen. In the front silo, an inclined conveyor moves sludge from the top; in the rear silo a pump moves it from the bottom.



The AE-RG series pumps move drained sludge with dry substance proportion of up to 45%. The two edge-to-edge feed or mixing screws in the feed funnel and the extra-long stuffing housing ensure reliable filling of the pumping elements without bridging or formation of deposits.

CHALLENGE

The Duisburg-Kasslerfeld sewage plant is the largest in the Ruhrverband, a non-profit water management company serving the Ruhr and Lenne catchment areas in western Germany. Approximately 50% of the wastewater volume comes from households, with the remainder from a variety of industrial operations, including tank cleaning, beverage production and the Duisburg Zoo. In recent years, plant operators decided to replace the chambered filter presses with two centrifuges. During the course of the conversion, the plant set up two systems for discharging drained sludge to compare reliability and efficiency: a centrifuge with an inclined conveyor and a centrifuge with a progressive cavity pump from German manufacturer Allweiler®, which is part of the American firm CIRCOR International, Inc. (NYSE: CIR), since late 2017. According to Dipl.-Ing. Ralf Wilms, Operational Group Leader in the West regional zone of the Ruhrverband, "We wanted to know whether a discharge pump would be a more economical and reliable solution than a conventional inclined conveyor."



Dipl.-Ing. Ralf Wilms: "The progressive cavity pump has really proven itself."



Four-stage solid-substance progressive cavity pump, type AE4N1450-RG from Allweiler®, used as residual sludge discharge pump, below the centrifuge.



Approximately 80% of all pumps in the plant are from Allweiler®, including the thin sludge pumps in this photo.



Allweiler® progressive cavity pump used as metering pump.

SOLUTION

Since starting operations in November of 2013, wear and associated maintenance costs at the Duisburg-Kasslerfeld sewage plant are significantly lower with Allweiler®'s four-stage progressive cavity pump from the RG series than with the conveyor. Additionally, the pump requires about 4 to 5 kW/h less energy than the conveyor. The pump moves a daily volume of approximately 55 m³ of sludge with a dry substance proportion of approximately 25%. Pressure ranges from 4 to 6 bar. Maximum discharge pressure is about 20 bar, so the plant's silo could be completely filled with no difficulty.

Optimized balance of materials

Materials selection and optimized dimensioning of the pump unit are important requirements for disturbance-free operation. Technical design characteristics that match the pumped liquid are also important considerations. In addition to energy consumption, low costs for spare parts and maintenance are decisive for maintaining economical operation: Allweiler® is one of just a few manufacturers that makes its own stators and rotors. As a result, Allweiler® specialists can select from 20 different stator elastomers and find the right combination that matches the chemical and physical characteristics of the pumped liquid and ensures the longest possible service life. This results in long maintenance intervals, minimal downtime, and very reliable, continuous operations. The discharge pump has already been in operation for 7000 hours without detectable wear. The manufacturer currently anticipates that the pump will complete 15,000 to 20,000 operating hours before needing overhaul.



In nearly 7000 operating hours, there has been no recorded loss of performance and no failures. Allweiler® anticipates another 15,000 operating hours before the first maintenance.

Design benefits

The residual sludge contains approximately 25% dry substance and is stored in two silos before being transported for incineration. The selected four-stage progressive cavity pump of type AE-RG has several design characteristics that ensure reliable continuous operation with such high proportions of dry substances. Two force-feed screws arranged in parallel next to each other ensure continuous operation. A wide feed funnel that prevents bridging of the material is another important element to ensure movement of the sludge and disturbance-free operation of the plant. This



The inclined conveyor moves sludge from the top into the silo.

special pump design does not require a bridge breaker, and the pump's design height is significantly smaller than similar pumps from other manufacturers. Even when starting, there are no disturbances because the break-out torque (starting torque) is very low. The pump is regulated by a frequency converter and runs at 30 to 60 Hz. The low rotational speed makes a major contribution to achieving the anticipated long service life.

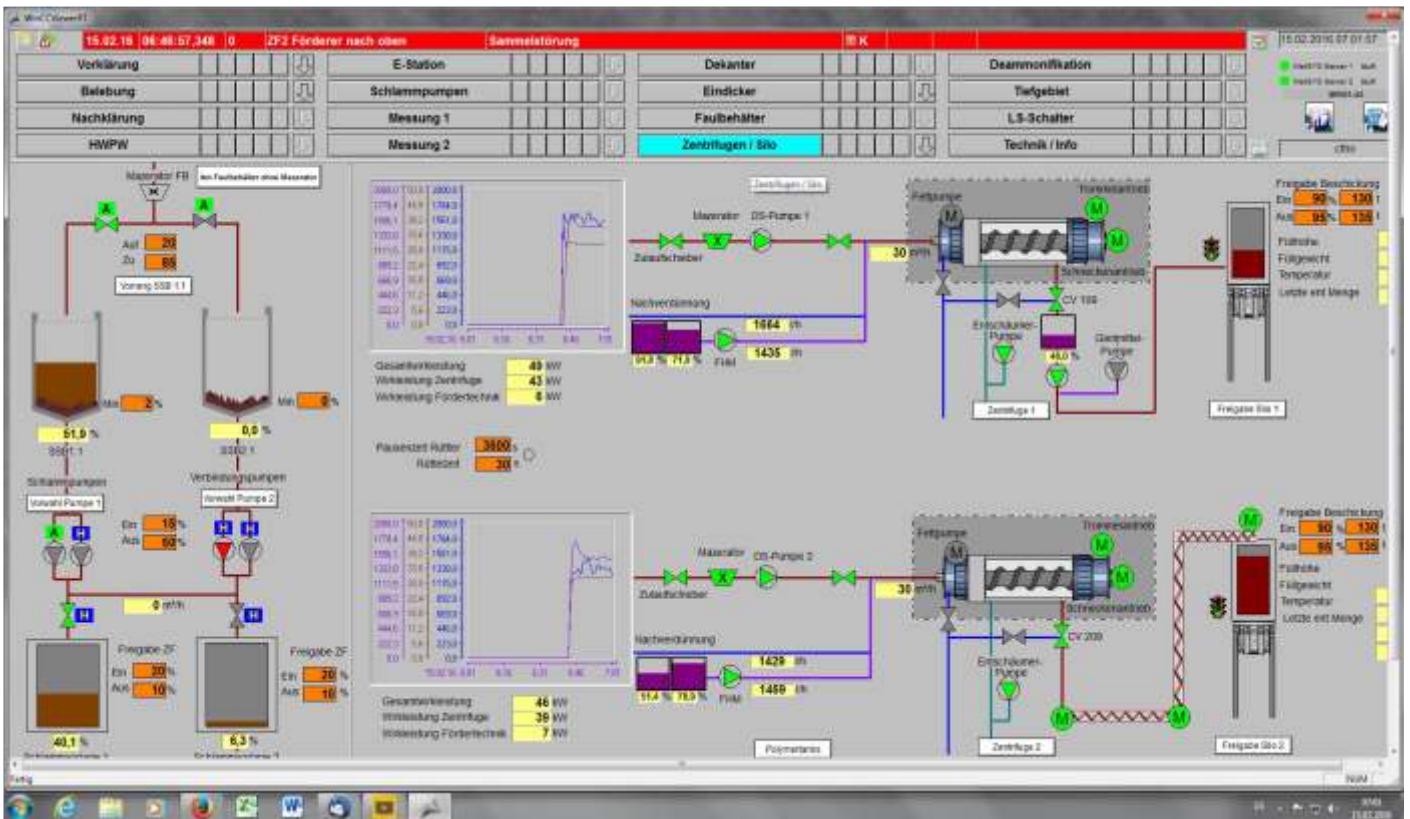
RESULTS

In addition to the reductions in pump wear, maintenance costs and energy consumption delivered by Allweiler®s four stage progressive cavity discharge pump, the Duisburg-Kasselerfeld relies on Allweiler® for approximately 80% of all other pumps at the sewage plant.

The benefits of original spare parts and consultation

After several attempts to use spare parts from other suppliers and comparison of the service lives, Ruhrverband decided to switch back to original Allweiler® spare parts due to their significantly greater durability. Consultation services have

also proved valuable. In particular, if conditions in the plant change or if pumps will be used in other processes, Allweiler® can readily recommend the materials that will have the longest service life and the configuration with the greatest efficiency. This benefit becomes clear, for example, when a new flocculant is used. Allweiler® conducts a durability test with several different elastomers and then delivers the mixture that is precisely adapted to the conditions. According to Heinz-Peter Sildatke, the plant's manufacturer's representative: "Getting the right combination of elastomers for the chemical and physical properties of the liquid is one of the consultation services that pays real dividends."



The diagram shows parallel operation of the inclined conveyor (bottom, red zig-zag line) and the progressive cavity discharge pump (top, straight line).



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