

## Case note

# Low voltage AC drives balance flow to wastewater treatment process



Sewage from the city of Jakobstad and neighboring areas is cleaned at the Alheda wastewater treatment plant, founded in 1979 and located on Finland's west coast. Some 17 pumping stations are used to move the sewage to a central incoming pumping station. From here the sewage passes into the nearby Alheda treatment plant for cleansing.

Within the incoming pumping station there are five pumps operating in parallel, three rated at 22 kW and two rated at 26 kW. Each pump is connected direct-on-line, with contactors switching the pumps on or off, according to the water level. Depending on the flow rate to the pumping station, two to three pumps can be used, with each running at its nominal speed.

### **Tackling the challenges of inconsistent flow rates**

The incoming pumping station plays a critical role in regulating sewage flow into the treatment process. But as the flow rates fluctuate so vigorously, the pumps are started and stopped inconsistently. This causes erratic flow rates to the treatment plant making it difficult to optimize the cleaning cycle. Furthermore, starting and stopping the pumps leads to water hammer or pressure shocks in the pipework. When a pump is stopped suddenly a shock wave ripples through the water damaging the pipework.

### **Intelligent pump control stabilizes flow rates**

To gain better control of the pumps, Jakobstad water utility chose ABB drive modules ACQ810, which are specially designed for water and wastewater applications. ABB authorized partner, Pietec, supplied and installed five drive modules, with three rated at 30 kW and two rated at 37 kW.

The drive modules feature several intelligent pump functions including soft-pipe filling, multi-pump control and flow calculation.

Soft-pipe filling sets smooth acceleration for pumps, allowing a gradual build-up of flow in the pipes. This avoids water hammer and limits pipework damage.

Multi-pump control provides redundancy so should one or more pumps fail or require maintenance, the remaining pumps continue operating. Overall maintenance time and cost are decreased. A pump auto change feature balances the operating time of all the pumps in the parallel pumping system over the long term. This helps to increase the mean time between repairs and reduce service costs.

Flow calculation function lets staff monitor the system performance and make adjustments accordingly.

A drive-to-drive link allows communication between drives thereby enabling reliable master-follower functionality within the pumps. The master pump is alternated every 20 minutes, ensuring a balanced operating time between all the pumps. The lifetime of the pumps and motors is increased while reducing overall maintenance time and costs.

“Since installing drive modules, the wastewater treatment plant now has a more consistent inflow of sewage. The smooth starting and stopping of the pumps has virtually eliminated water hammer and the resulting stress on the pipework. Along with the elimination of contactors, this has helped lower maintenance costs,” says Leif Snellman, Production manager. “Although we have not measured it directly, we believe that the energy consumption of the pumping station has also fallen.”



ABB drive module, ACQ810, is specifically designed for water and wastewater applications.

## Challenges

- Flow rates to pumping station and treatment plant fluctuate
- Inconsistent pump starting and stopping making it difficult to optimize cleaning cycle
- Irregular starting and stopping leads to water hammer and pipework damage
- Difficult to accurately measure flow rate and energy consumption

## Solution

- Five ABB drive modules installed featuring intelligent pump functions
- Soft-pipe filling sets smooth acceleration for pumps
- Multi-pump control provides:
  - Redundancy if pump fails or requires maintenance
  - Pump auto change balances operating time of all pumps in parallel pumping system
- Flow calculation function lets staff monitor system performance
- Drive-to-drive link allows communication between drives enabling reliable master-follower functionality within the pumps

## Benefits

- More consistent flow rates between pumping station and treatment plant
- Avoids water hammer and limits pipework damage, increasing system lifetime
- Decreases overall maintenance time and cost
- Increases the mean time between repairs and reduces service costs
- Balances operating time between all pumps
- Reliable operation through pump redundancy
- More system data available for analysis

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