

Case story | VLT® AQUA Drive

Affinity Water **saves £0.3 million** by using Danfoss drives vs the next best alternative

Danfoss VLT® AQUA Drives recently installed at the Chertsey Water Treatment Works of Affinity Water are forecast to deliver savings of more than a third of a million pounds in running costs over their 20-year lives compared with the 'next best' solution offered for the project. The exceptional efficiency of the Danfoss drives results from the use of active filters for harmonic mitigation and a unique back-channel cooling concept.

For many years, four high lift pumps at Chertsey Water Treatment works have each been controlled by a 500 kW 12-pulse variable speed drive operating at 675 V. Recently, however, these aging drives had become increasingly unreliable and difficult to maintain. In addition, Affinity Water knew that they were much less energy efficient than their modern counterparts. The

company therefore decided that the time had come to replace the drives.

Key requirements for the replacements were that they should deliver the best possible energy efficiency, that they should meet G5/4 harmonic requirements and that they should be suitable for use with pump motors with insulation that was non-compliant with

IEC 60034-25 curve B for 690 V inverter use. Having surveyed the market for suitable drive solutions, Affinity Water was ultimately able to narrow the choice to two alternatives. One of these was based on Danfoss VLT® AQUA Drives with active harmonic filters while the other used drives incorporating active front-end (AFE) technology.



Additional
saving of up to
20%
of original
investment

Lower losses, higher savings

An important benefit of the Danfoss active filters is that they are connected in parallel with the supply to the drive, which means that the motor current does not pass through them. Losses are, therefore, much lower than with conventional filters where the motor current must pass through one or more inductors. Further benefits are that the motor voltage is unaffected by the use of the filters, whereas with AFE drives it is typically boosted by around 10%. Further, in the unlikely event of an active filter failing, the drive can continue to operate as the filter is not directly in the current path to the motor.

In addition, Danfoss VLT® AQUA Drives with ratings above 90 kW feature back-channel cooling, which reduces the amount of fan cooling power required by as much as 90% compared to conventionally designed drives. This means fewer fans are needed, allowing savings to be made on the energy needed to power the fans and the cost of replacement air filters over the life of the system.

To assist Affinity Water in making a decision between the two alternative solutions on offer, engineers from Danfoss carried out a very detailed comparison of the running costs associated with each. This revealed that the losses with Danfoss 400 kW VLT® AQUA Drives would be 9.6 kW lower per drive than with the AFE alternatives.

On the basis that two of the four pumps would normally be running, the Danfoss drives would, therefore, save $2 \times 9.6 \times 8760 = 168,192$ kWh per year. Assuming an energy cost of £0.10 per kWh, this represents a saving on energy costs of £16,820 per year which is equivalent to up to 20% of the original investment. Over the 20-year life of the system, the energy savings would be £336,380.

Fulfilling the demands of the water supply industry

This analysis proved decisive for Affinity Water, and the company elected to go ahead with the Danfoss solution. The system builder chosen for the project was Safronics Controls Limited, a Danfoss Business Partner with extensive experience in meeting the demanding requirements of the water supply industry. Safronics selected IP20 versions of the drives, rated at 400 kW when used on the Affinity 675 V supply system. The drives were installed in two new motor control centres designed and manufactured by Safronics Controls Limited, along with du/dt filters to safeguard the pump motors as these have insulation that was not originally designed for use with variable speed drives.

Each of the new motor control centres houses two drives and two du/dt filters. The drives are arranged for efficient back channel cooling. Because of this, only eight cooling fans were needed, compared with the 24 – the number estimated for conventional drives. To make best possible use of the limited space available on the site, the active harmonic filters were installed in existing control panels.

After building and fully testing the control panels at its works in Leeds, Safronics Controls Limited delivered the new equipment to site, installed and commissioned it. At every stage, Safronics worked in close cooperation with Affinity Water to minimize the impact of the work on the operations of the water treatment works.

“The Danfoss VLT® AQUA Drives have now been in operation for 24 months and have performed fully to specification. They are providing accurate and dependable control of the pumps, the harmonic levels easily meet G5/4 requirements, and initial measurements confirm that the predicted energy savings will be achieved,” states Affinity Water.



Motor control panels at Affinity Water

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