

Automated valves on trial to optimise dissolved air flotation (DAF) systems

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Water treatment plants and construction sites use dissolved air flotation to remove suspended solids, oil fat and grease from wastewater in an efficient and environmentally friendly way. One of the leading service providers to the UK and international industries is Siltbuster, which uses its expertise to improve water treatment, wastewater processing, and the prevention of waterborne pollution. To optimise the effectiveness of its dissolved air flotation (DAF) units, Siltbuster is trialling an automated valve system with flow control specialist, Bürkert.

A crucial aspect of wastewater treatment is the removal of solid matter. To achieve this, municipal water company treatment plants use a series of techniques. Screens are used to remove larger debris as well as a grit, before the wastewater moves into a sedimentation process to settle suspended solids. The effluent might then pass through a biological trickling filter before going on to a final UV polishing process. However, even at this stage, fine solids might still be present. To make the effluent safe and acceptable for UV treatment/discharge, these solids have to be removed.

Siltbuster, based in Monmouth, provides a portfolio of UK and international water treatment and process control services for the construction industry, as well as municipal, industrial, and mining sectors. As part of this offering, the company operates the largest fleet of dissolved air flotation (DAF) units in the UK.

Designed to remove suspended solids from wastewater, DAF systems use dissolved air (whitewater).

Distinct in colour due to its high concentration of micron sized air bubbles, the role of whitewater is to bring suspended solids to the water surface for removal by a mechanical scraper system. The floating particles can then be separated from the underlying water, leaving the treated water ready for further treatment or discharge.

DAF system

The floating particle product of a DAF system can be easier to control and dispose of due to having less bound water than a settlement process.

As a result, DAF systems have become increasingly popular in the wastewater industry, Siltbuster has a large fleet for rental, as well as units for sale.

The DAF systems comprise a retention unit, fed by screened wastewater, which is mixed with dissolved air, produced by a partial flow recirculation system.

The dissolved air is depressurised by a control valve and whitewater passes into the flotation tank, air microbubbles rise towards to the surface, attaching to and taking suspended particles with them.

Before the whitewater can pass into the flotation basin, it is crucial to ensure recirculated water is saturated with dissolved air.

If the air and water have not had sufficient contact time or pressure, allowing the air to dissolve before release, a lower concentration of microbubbles will occur. As a result, the whitewater will not be able to lift as great a quantity of solids to the surface, reducing the effectiveness of the system.

Valve operation

The air dissolving pressure is controlled by a valve that regulates the back pressure within a saturation vessel (air dissolving tube).

If the operator wants to change system throughput by altering the speed of the wastewater inflow pump, the valve needs to be modulated to maintain optimal back pressure, to enable effective flotation.

The operator also needs to adjust the back pressure valve if they intend to regulate the inflow of atmospheric air (gas to water ratio) if, for example, a different effluent composition is introduced.

Solids can settle behind the backpressure valve, reducing the recirculation flow rate and increasing the back pressure over time (this might lead to the recirculation pump triggering a high-pressure switch and turning the pump off, ceasing white water production).

If back pressure is not automatically regulated, a build-up of sediment can cause the valve to be impeded and need regular opening, to clear obstructions and maintain the desired setpoint.

Experienced operators can adjust the back-pressure valve and settle the system, aided by a pressure sensor reading. However, this level of control isn't achievable

for less experienced operators using DAF units on a rental basis, or for unmanned facilities. Automated pressure control gives the backpressure valve a self-cleaning function, for sites with infrequent maintenance.

As a result, Siltbuster set out to investigate automated backpressure control and startup saturation vessel purging. In a competitive marketplace however, this prohibited the integration of expensive control systems.

Automated valve control

For DAF system management, the advantage of integrating a valve with automated control would mean constant pressure feedback, without the expense of a PLC. To achieve this, Siltbuster turned to flow control specialist Bürkert, which specified its Type 3361 electromotive globe control valve. With an integrated process controller, the Bürkert valve could enable a direct pressure sensor input, to ensure effective whitewater control under all process conditions.

Combined with this regulated flow, on-site engineers could also set the valve to a fully open position from start-up for a specified time period, before control input would return to the pressure sensor. This partial unregulated full flow period would prevent any buildup of fine sediment behind the valve and inside the saturation vessel, ensuring a consistently reliable performance. As the Bürkert valve also included a super capacitor, this meant that operatives could select a desired valve position in the event of power failure to fully open, fully closed or indeed anywhere in-between, without the cost of integrating an additional backup power source.

Another advantage of Bürkert's Type 3361 valve was linear stepper motor actuation, which allowed the valve to retain its position even in the presence of excess or fluctuating pressure. The valve was also protected by IP67 sealing, ensuring

automated control even against high pressure water jets. With these robust features, Siltbuster's engineers were confident of progressing to trials.

Successful trials

In the latest external environment test, the valve performed as intended, maintaining a set point of 5 bar, even when the recirculation pump speed and airflow were adjusted.

After achieving the ideal whitewater production settings, Siltbuster is now taking the upgraded system to municipal water customers for live site trials.

Siltbuster's DAF units are not only crucial for municipal water treatment companies. Any type of facility that needs to treat water run-off before it enters a water course, from oil spills on construction projects to industrial plants, might require a dissolved air flotation system.

DAF units are also used in food/beverage production to reduce trade effluent charges and optimise effluent quality. Although the treatment requirements are wide ranging, automated back-pressure control could become an important consideration across wider DAF system applications, especially where maintenance visits could be reduced by the self-cleaning function.

Image captions:



Image 1: DAF systems have become increasingly popular in the wastewater industry.



Image 2: With an integrated process controller, the Type 3361 valve by Bürkert could enable a direct pressure sensor input, to ensure effective whitewater control under all process conditions.

Siltbuster[®]

The logo for Siltbuster features the brand name in a bold, italicized, orange sans-serif font. Below the text are two parallel, wavy orange lines that resemble water ripples.

Image 3: Siltbuster is one of the leading service providers to the UK and international industries.

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About Bürkert

Bürkert Fluid Control Systems is one of the leading manufacturers of control and measuring systems for fluids and gases. The products have a wide variety of applications and are used by breweries and laboratories as well as in medical engineering and space technology. The company employs over 2,200 people and has a comprehensive network of branches in 35 countries world-wide.

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