SUCCESS STORY

Bürkert < > Everswinkel Waterworks

Oxidator box: Efficient oxidation process for removal of iron and manganese due to intelligent automated air control.

Oxidator box from Bürkert: Two-channel system in Everswinkel Municipal Utilities Waterworks

Efficient oxidation process for removal of iron and manganese due to intelligent automated air control.

Correct metering of the oxidation air in the treatment of drinking water depends in many waterworks to this day on one factor: Many years of experience on the part of the waterworks supervisor, who manually supplies the air to the untreated water by means of a simple needle valve. With the Bürkert oxidation air unit this experience is readily available in a controlled and documented process.

Drinking water pumped from the ground is rich in valuable minerals. These include iron and manganese, high concentrations of which however can cause problematic precipitations in pipes and valves and discoloring of the water. The Drinking Water Ordinance therefore specifies limits for both elements. The limits are depending on the countries and are defined locally by drinking water regulations. E.g. in Europe the limits are set by the European parliament and in the US are set by the EPA. To comply with these limits, the untreated water is injected with air or oxygen in the waterworks, based on the quality of the raw water. The oxides precipitated out of the water can then be removed from the drinking water by using conventional filters. But other techniques exist as well. Oxidation can be carried out with various chemicals like chlorine or ozone but it is mostly done with compressed air.

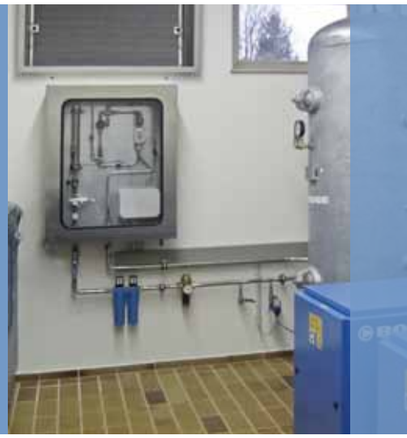
In many waterworks the addition of oxidation air is performed manually by means of simple mechanical valves. With this procedure, an experienced waterworks supervisor can guarantee the quality of the drinking water beyond doubt – however, the procedure can neither be traced nor documented. If the composition or quantity of the drinking water fluctuates, for example due to the changing interconnection of several wells with different water qualities, manual readjustment is necessary, which is costly and time-consuming.

The fluid technology specialist Bürkert recognised this problem some time back and worked together with planning specialists and drinking water experts to develop a ready-to-connect solution for automated metering of oxidation air. The oxidator box operates on the basis of a high-performance, flexibly configurable mass flow controller. The compact system solution can automatically regulate the gas quantity needed for oxidation based on different process parameters, to achieve optimal results with minimal gas consumption. In addition to constant water quality and documented, traceable processes, the automated oxidation air metering system also offers substantial economic benefits due to reduced oxygen consumption and optimised operation of the compressors during metering of the air.

Bürkert pneumatic cabinet for filter control

Mass Flow Controller

Oxidation air control in Tarmstedt waterworks: before (left) and after (right).



Solid basis through professional planning and project support

As a result of intensive contact to planning specialists and engineering firms specialising in waterworks, the idea for the first prototypes of the oxidator box were born at Bürkert about ten years ago. The goal was a compact, flexible and reliable system solution that could simplify the manual process of supplying oxidation air based solely on the experience of the waterworks supervisor; the system also needed to be connected to a higher-level controller to allow an automated and reproducible process. In addition to constant water quality, economic factors were also a reason for automation. “To ensure compliance with the requirements of the Drinking Water Ordinance, which specifies a maximum of 0.2 mg/l iron and 0.05 mg/l manganese, an overdose of oxidation air is generally the result in manual supply of the oxidation air”, explains Hartmut Schmalz, sales engineer for technical systems at Bürkert’s Sales Center Hanover. The uncontrolled supply of air to the untreated water can cause unnecessary additional costs due to sub-optimal utilisation or potential over-dimensioning of the compressors. If pure oxygen is used for oxidation, only one-fifth of the required quantity is needed; however, the oxygen has to be purchased and also causes avoidable additional costs in case of uncontrolled metering.

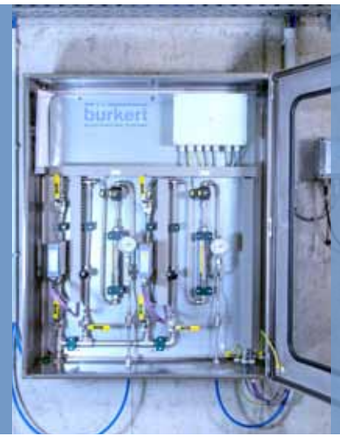
An absolute prerequisite for on-demand oxidation air metering is the precise determination of the relevant process parameters such as inlet pressure, back pressure and flow rate. At Bürkert, this is accomplished with a standardised process based on a specially developed specification sheet. For the design of the oxidation air control, it is also necessary to consider the oxygen requirements for the different oxidation processes. These values are dependent on the iron and manganese content of the untreated water: the oxidation of 1 mg iron(II) ions requires 0.14 mg oxygen; for the oxidation of 1 mg manganese(II) ions the oxygen requirement is significantly higher, at 0.28 mg. Clarification of the process parameters sometimes necessitates close coordination with the planning specialist and the end customer.

In addition to design and production, Bürkert also offers a broad spectrum of services for commissioning of the oxidation control system, such as connection to the PLC or the respective bus system.

Modular system for tailor-made solutions

The initial prototypes and customised solutions led to the development of a flexible and cost-effective modular system with time-tested standard components that can easily be adapted to the requirements of individual users. The Bürkert mass flow controllers (MFC) Types 8626 and 8712 provide a high-performance basis for the oxidator box. Other safety-related functions such as pressure monitoring, emergency valves, check valves, optional manual operation or field displays are offered on an individual basis and delivered as a ready-for-connection solution in a stainless steel control cabinet or on a mounting base.

The mass flow controllers 8626 and 8712 are compact systems consisting of flow meters with control electronics and actuators. Using the principle of thermal mass measurement the MFC determines the flow rate independently of the inlet pressure. In many waterworks, this pressure can fluctuate substantially due to connecting and disconnecting of different well pumps. The MFC nevertheless reliably determines the gas flow rate and provides the measurement data in real time for control of the oxidation air metering. The system generally obtains the set point for the air metering from the higher-level PLC via a 4…20 mA standard signal or an optional bus interface, e.g. Profibus DP.



Bürkert oxidator box – inside view of the Everswinkel Municipal Utilities Waterworks

"The intelligent design of the Bürkert oxidator box ensures precise control of the oxygen input based on the current quantity of untreated water. This oxygen quantity is always reproducible and no longer depends on the expertise of the waterworks supervisor. Every year we replace about 10 pumps at the wells, which in the past required one week for adjustment of the oxygen quantity. This adjustment work has now been eliminated and the metering rate is always precise.
Due to the precisely controlled oxidation we now have less iron in the treated water tank, which saves us the costly and time-consuming task of cleaning the tank. This also eliminates the subsequent use of disinfectants, which is good for us and the environment."

B. Rengers (Everswinkel Municipal Utilities Waterworks Supervisor)

Especially for applications in small waterworks without a separate PLC or in the case of modernisation of the air metering system, where intervention in the existing PLC has to be avoided, the oxidator box can also be designed as a standalone system with all control processes performed by a water flow sensor and proportional controller. The flow rate is then measured in the untreated water line by means of a suitable Q-sensor and sent to the integrated konti-Dos® 8025 control unit. This unit allows the user to enter the required quantity directly as a percentage value in digital form via a simple control software. The MFC is controlled by a standard signal from the control unit and continuously meters the oxidation air supplied to the untreated water line based on the specified rate proportional to the water quantity. The process values and parameters are shown on a display for control purposes. The water quantity and the calculated air consumption can be output via a scaled pulse signal, for registration in a higher-level control room, for example.

For servicing of the mass flow controller, which is easily connected and disconnected by means of detachable double nipples, the air flow can also be adjusted via a bypass with a needle valve for temporary uncontrolled supply to the drinking water. Two 3/2-way ball valves allow switching between the MFC and bypass. For additional visual control of the air quantity, a float-type flow meter with a glass cone is integrated in the main air flow. The MFC is equipped with a pre-programmed start-up ramp to protect the glass cone flow meter.

Competence in control cabinet construction and stainless steel production

The control cabinets for the oxidator box are manufactured and assembled at the Bürkert Systemhaus in Menden, near Dortmund, which specialises in electro-pneumatic control units. The Systemhaus bundles Bürkert competence in the systematic combination of fluid technology with electronics and stainless steel manufacturing. Oxidator boxes used for oxygen are equipped only with oil- and grease-free components that are suitable for the application. All pipework is also oil- and grease-free. Pipe couplings are used for the air inlet and outlet and cable glands are used for the sealed electric lines to the MFC. This construction ensures easy installation and trouble-free process connections. An integrated terminal box with a power supply unit and transfer terminal strip is optionally available.

On-demand and cost-effective

In the design and planning of the oxidator box Bürkert pays close attention to optimal cost effectiveness in accordance with the motto "fit for purpose". This means avoidance of over-dimensioning and non-relevant functions for the specific application.
In addition to the treatment of municipal drinking water, the oxidator box is also suitable for use in other applications where gaseous media have to be controllably metered into a liquid flow. Here some exambles:

- Fish farming: Precise control of the oxygen content supplied to the breeding basin.
- Nanofiltration or Reverse Osmosis: pH Setting by CO2 injection for Pretreatment of feedwater for RO or NF.
- Beverage: Aeration of the Gyle in breweries by injection of steril air or oxygene.

Version 06/13 Bürkert Corporate Communications

Bürkert Fluid Control Systems
Christian-Bürkert-Straße 13-17
74653 Ingelfingen
Germany

Tel.: +49 (0) 7940/10-0
Fax: +49 (0) 7940/10-91 204

info@buerkert.de
www.buerkert.de