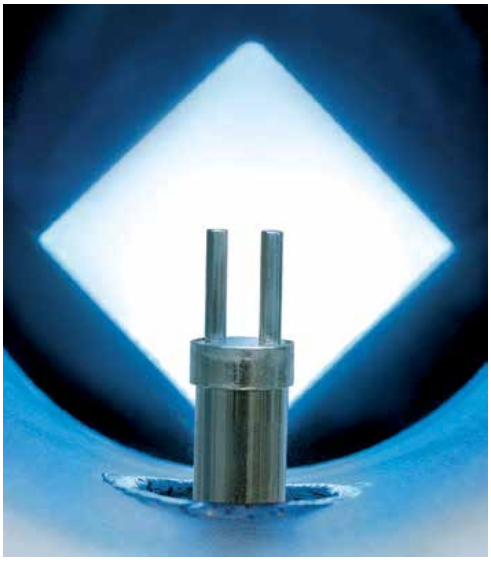
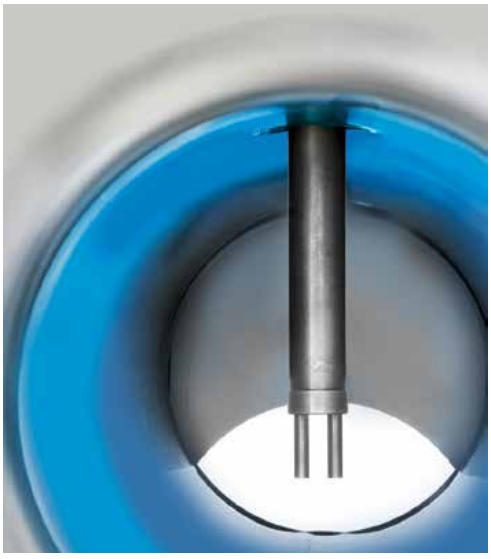
VACOMASS®

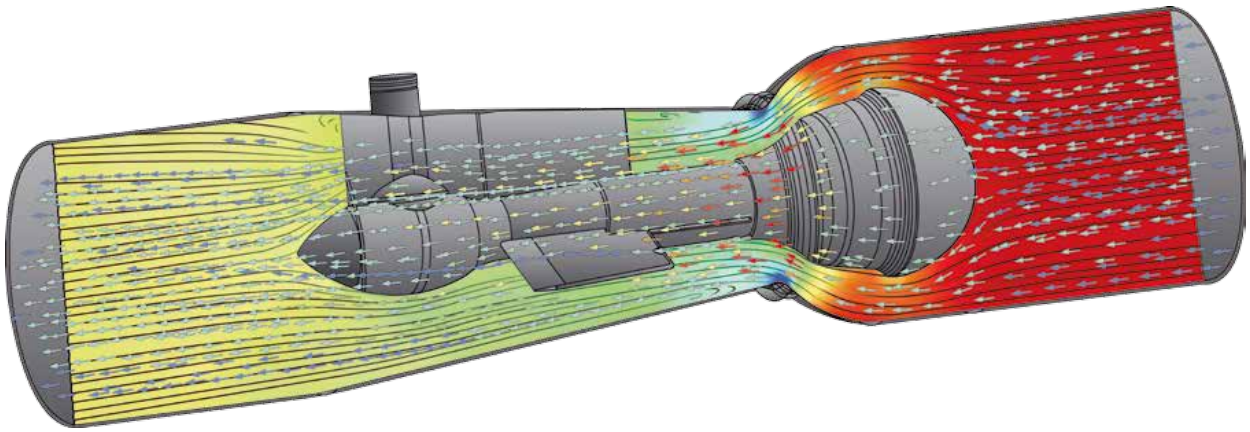
The modular air supply system in wastewater treatment plants

Economical plant operation made possible by precise and efficient aeration control in the biological treatment





BINDER
BINDERGROUP



BINDER
BINDERGROUP

VACOMASS®
Biology under control

When the biological stage of a wastewater treatment plant is underaerated it will lead to process disruptions, and effluent limits can be exceeded. However, an over-supply of air wastes blower energy and results in uneconomical operation of the plant. Additionally the denitrification process can be compromized by surplus dissolved oxygen in the RAS flow (Return Activated Sludge).

Only innovative aeration control based on actual demand can ensure both a controlled and economical plant operation. The modular **VACOMASS®** system consists of components that are optimized for this application and matched to each other for precise measurement, control and distribution of air in wastewater treatment plants. **VACOMASS®** ensures that air is supplied according to actual oxygen demand in the various basins and aeration zones of the plant.

VACOMASS® therefore guarantees

- optimized treatment
- avoidance of disruptions to plant operations
- compliance with effluent permits
- and economical operation of your wastewater treatment plant.

With **VACOMASS®** your biological treatment is under control and energy consumption is significantly reduced.

VACOMASS® System integration

Aeration air has to overcome static and dynamic back pressures, e.g. changes in water level, condition of the aerators and pressure drop of the piping, on the way to the treatment tank. These factors change over time and are hard to control. Therefore, even very small changes will have a significant influence on the air distribution. This is exactly where the **VACOMASS®** concept can be applied: Each **VACOMASS®** system continuously monitors the local air supply and can immediately detect the smallest deviation from the setpoint. The local control immediately intervenes and compensates for any external disturbances of the air distribution. The system integration guarantees optimal interaction of the components and ensures the transmission of important data for the operation of the whole control system, even for complex installations.

Simultaneous flow profile correction
In the case of a compact VACOMASS® system, the thermal mass flow sensor is positioned directly upstream of the control valve. If a diaphragm control valve with falling flow axis is used, the flow profile will fluctuate steadily during system operation. Without correction, this will lead to errors when measuring the airflow rate. The information about the current valve position must be constantly communicated in order to correct for these flow profile distortions. With this information, the flow signal, the decisive variable for precise control of the air supply, can be corrected automatically. However when **VACOMASS® jet control valve** is used in a compact system, simultaneous flow profile correction is not needed.

Optimized operation of the control valve
Conventional controllers change the stroke of the control valve in a stepwise fashion. This inevitably leads to high switching frequencies and premature wear and tear of the actuator and the valve. However, the characteristic control curve of the valve and specific process data of the treatment plant are stored in each VACOMASS® electronic module. During setpoint deviations, the electronics precisely calculate the new opening position of the control valve, providing precise control in a single step.

Plausibility check
Each VACOMASS® system continuously monitors the airflow rate and checks this value for plausibility in relation to the valve position. In this way any disruptions, such as changes in the diffusers, can be detected immediately. The VACOMASS® system reacts to each disruption without delay and automatically initiates appropriate countermeasures. To reduce the pressure drop at the diffusers, a periodic and selective cleaning procedure can be implemented. This not only improves oxygen transfer efficiency but also reduces pressure drop and power consumption, and the life of the diffusers can be extended.

Redundant monitoring of process parameters
The aeration control is based on certain process parameters (e.g. O_2, ORP, NH_4-N, etc.). Faulty measurements of these parameters can indicate a low oxygen demand, resulting in an undersupply of activation air. To prevent this, VACOMASS® supports redundant monitoring of specific process parameters. Thus, any malfunction or failure of a probe can be detected immediately. To determine the oxygen demand, only signals of the properly functioning probes continue to be considered.

Alarm and safety functions
VACOMASS® provides comprehensive monitoring functions allowing each process disruption to be indicated immediately. Additionally, the SCADA system can always take over the aeration control. In the case of a fault, the control valve will automatically move into an operator specified safe position. This way, VACOMASS® ensures a surplus of oxygen at any time. Consequently, a VACOMASS® installation significantly improves the operational safety of a wastewater treatment plant. Process disruptions, as well as unnecessary costs due to late detection of failures, can be prevented.

Retrofitting and modernization

The modernization of the wastewater treatment plant at Ulm-Steinhäule in Germany demonstrates the possibilities for optimization that are now possible with a **VACOMASS® jet control valve**. The classic system was designed in the 1990s: a blower station with a generously-dimensioned common header to the basins and 20 electrically-operated DN 400 (16 inch) control valves in the drop pipes to the diffuser grids. The control valves typically operate in the range of 10 to 30 % open, generating a measurable pressure drop of up to 58 mbar (0.85 psi). With the installation of the **VACOMASS® jet control valve** DN 400 in the existing pipelines, the airflow

rates can be controlled precisely and according to the specific requirements at a fraction of the previous pressure loss. This reduces energy costs. A reduction and expansion of the pipeline was not necessary since the DN 400 **VACOMASS® jet control valve** guarantees accurate operation across the entire control range with as little as 1 mbar (0.4 inch WC) pressure drop, thanks to its design and precision. The design of the **VACOMASS® jet control valve**, which also functions as a flow conditioner, allows the installation of the air flow meter just 0.5 x D upstream of the control valve with a very short inlet pipe run from the header pipe.
Installation was therefore very easy, quick and cost-effective using pre-fabricated pipe sections.

VACOMASS®
System components

The modular design of the **VACOMASS®** measurement and control system operates on the building block principle. Depending on plant size, control concept and specific requirements, the system components of the **VACOMASS®** product family can be supplied individually or in combination with each other. The **VACOMASS®** system integration and precise calibration of the combined airflow measurement system in our **CAMASS®** Calibration Lab guarantees that all components fit together perfectly, ensuring highest precision for controlling the air supply.

VACOMASS® flow meter
Thermal dispersion mass flow meter for precise monitoring of the airflow at standard (DIN 1343)

VACOMASS® hot tapping unit
Hot tapping unit for the flow meter in various versions

VACOMASS® flow conditioner
Flow conditioner for swirl reduction, damping of pulsations and equalization of flow profile at difficult installation points

VACOMASS® jet control valve
Gas-tight shut-off, aerodynamically optimized stainless steel control valve with a linear operating characteristic over the full stroke for highly precise air supply at minimum pressure loss

Constant positioning precision and repeatability across a nearly unlimited control range. Pressure recovery of up to 80 % thanks to low-turbulence flow and venturi outlet.

Very short installation lengths thanks to 3D design with flow conditioning and airflow meter 0.5 x D upstream of the control valve.
Patent no. DE102013110581

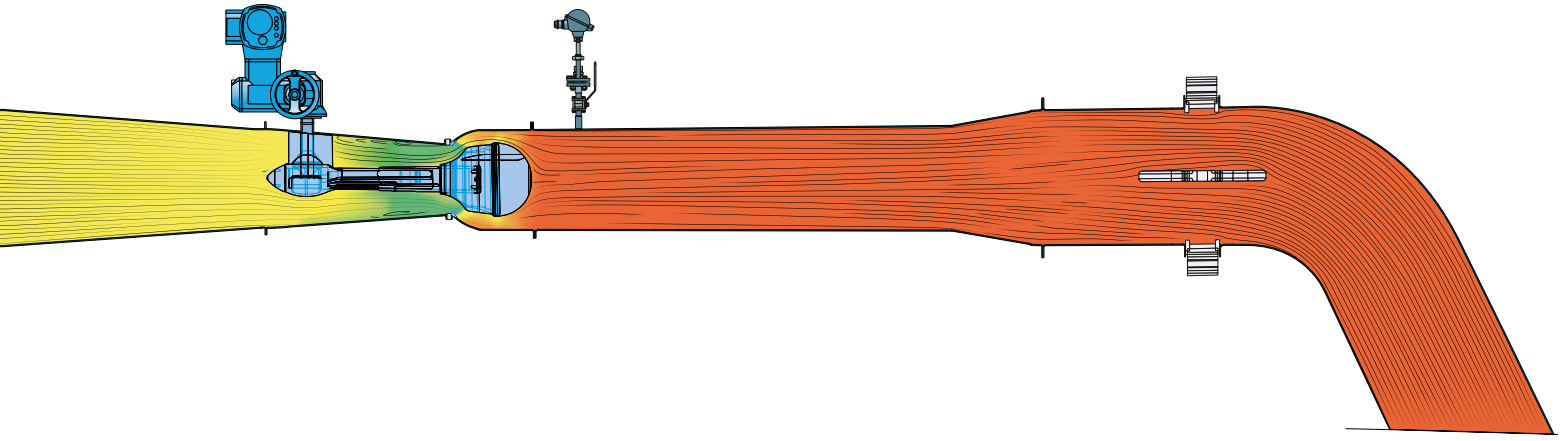
VACOMASS® actuator
Electrical or pneumatic actuator for precise control of air supply, mounted on the control valves

VACOMASS® square diaphragm control valve
Tried and tested in the market, gas-tight shut-off, square diaphragm control valve with falling flow axis and a stable and proportional operation characteristics in the normal operation range

VACOMASS® elliptic diaphragm control valve
Diaphragm valve with falling flow axis, elliptical control diaphragm and gas-tight shut-off. The control diaphragm opens the cross-section completely, allowing very high flow rates with minimum pressure drop and low noise emissions due to an integrated pressure wave breaker (patent pending)

VACOMASS® flexcontrol
PLC-based modular control system for precise air distribution in wastewater treatment systems. The control cabinet is suitable for indoor and outdoor installation. The following software packages are available as individual modules:

VACOMASS® master
Module for autonomous determination of the actual oxygen demand and control of the air supply



VACOMASS® slave
Module for local control of air supply according to external airflow setting via VACOMASS® master or the main PLC

VACOMASS® econtrol
Module for control of minimum required header pressure based on actual air requirement

VACOMASS® blower monitoring
Module for detection of critical operating states, such as tripping

VACOMASS® multipoint
Module for multipoint measuring systems

VACOMASS® basic
Module for simultaneous flow profile correction of diaphragm control valves based on the stroke (if not directly compensated in the AL100 flow meter)

VACOMASS® simulation
Computational fluid dynamic simulation of actual piping layout, to improve the design of the measurement and control section

VACOMASS® calibration
Component or system calibration, considering actual piping layout and operating conditions

VACOMASS® silencer
Reduces noise level, used in systems where tanks have different water levels

VACOMASS® blow-off valve
Safety blow-off valve to prevent blower trip-out

VACOMASS® tune valve
Hand operated diaphragm valve with measuring stub for fine adjustment of air distribution into the drop pipes of the diffuser grids

VACOMASS® biocontrol
Electronic module for the control of biological processes such as the load-dependent calculation of aeration time for intermittent nitrification/denitrification, load-dependent calculation of the required DO-setpoint, the nitrate recycle rate and required aerated volume

VACOMASS® start-up/fine tuning
Support during installation and start-up of the system, including adaptation of control parameters to the local situation and loads by Binder Service personnel on-site or via remote access


VACOMASS
VACOMASS
VACOMASS


VACOMASS


VACOMASS

VACOMASS®
Valves and actuators

The heart of any air distribution and control loop is the valve. It should have a linear operating characteristic, preferably over its full stroke coupled with a low pressure drop. Additionally the air should exit the valve with low turbulence, to achieve a low noise level and keeping the pipe section to the first drop pipe of the diffuser grid as short as possible.

Binder offers two essentially different types of diaphragm control valves: the proven **VACOMASS® square diaphragm control valve** with a square shaped control aperture and the **VACOMASS® elliptic diaphragm control valve** with an elliptically shaped control aperture. The **VACOMASS® jet control valve** is superior to both diaphragm control valves in terms of energy consumption and control accuracy.

VACOMASS® square diaphragm control valve – proven for many years

The **VACOMASS® square diaphragm control valve** has a gas-tight control aperture for precise control of air with low losses. It has a falling flow axis for sensitive control of normal and tangential air flows (e.g. after elbows) according to DIN EN 60534-2-3 and has a proportional opening from 0 to 100 %. The operating range in the field is typically from 15 to 85 % stroke.

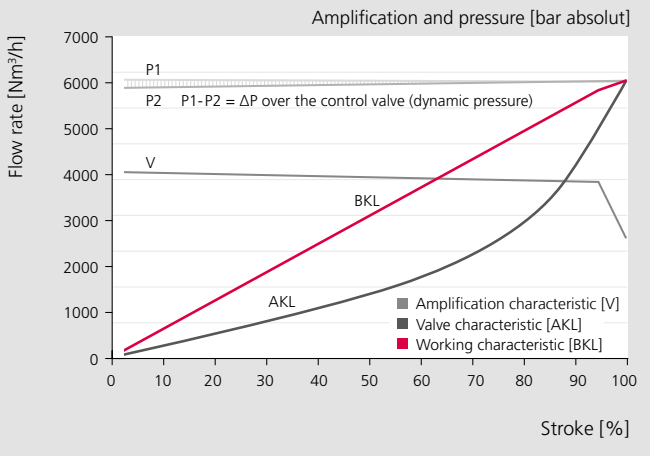
Depending on ambient conditions at the installation site, various materials for the gaskets, spindle and sliding gate plate cover are available. The spindle can be equipped with a fully automatic lubrication system.

VACOMASS® elliptic diaphragm control valve – for high air quantities in purge mode

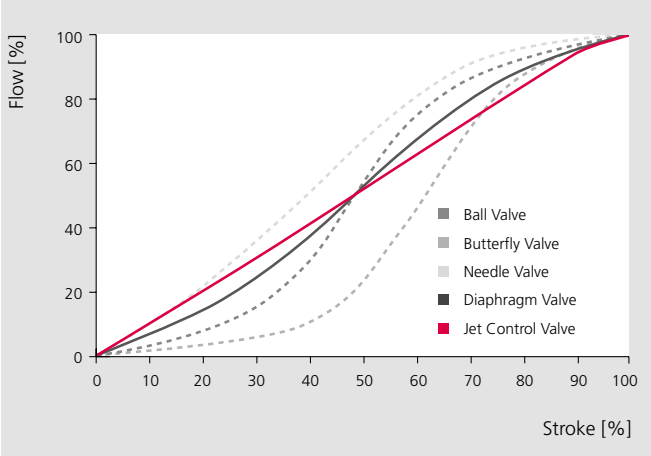
The **diaphragm control valve** with elliptical control aperture is an enhancement of the proven model with square aperture, however it is specially designed for high flow rates at low pressure drop and low noise level. Due to the geometric shape of the cross-section, a pressure wave breaker is integrated into the valve design to prevent noise in control operation. When it is 100 % open the pipe cross-section is completely available and maximum flow is possible. The installation length is identical to many sliding gate valves and butterfly valves, so a simple replacement on existing systems can be realized in order to achieve significantly higher air flow rates with lower pressure drop and better control. This optimization ensures sufficient oxygen supply to the aeration tanks and enables prescribed periodic high air rates to purge and clean the diffusers and increase their life span. The peak pressure of the blowers can be lowered and the risk of surge is reduced. If systems reach their limits due to higher effluent load or ageing diffusers generate an increased pressure drop due to ageing, the installation of a **VACOMASS® elliptic diaphragm control valve** can improve or prevent this stress situation. Expensive retrofitting measures can usually be delayed or omitted entirely.

VACOMASS® jet control valve – the special control valve

The **VACOMASS® jet control valve** is unique worldwide and combines aerodynamically optimized design with high precision manufacturing. It has a central control axis and an actuator for sensitive control of air flow. Stroke is adjusted along the flow axis, so the flow attaches to the wall, which allows a fast and high pressure recovery. The



Characteristics of VACOMASS® jet control valve

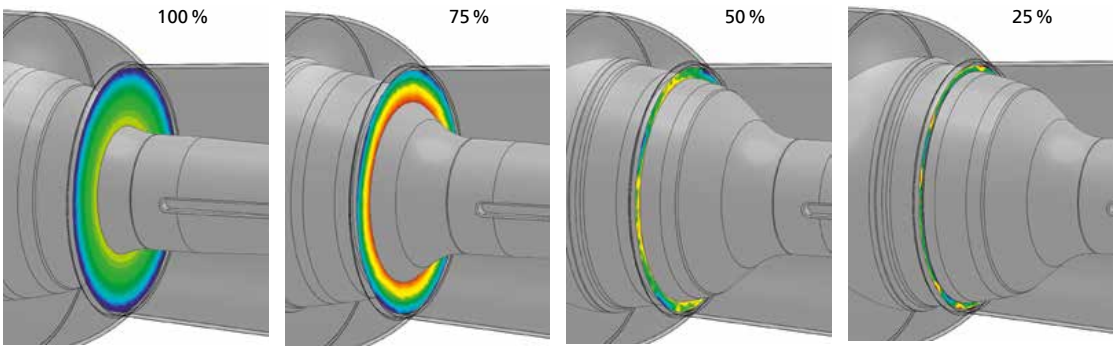


Comparison VACOMASS® jet control valve with conventional valves

control body has a very low drag coefficient and therefore requires only a low driving torque. It has low friction so a smaller size actuator can be used. Usually the valve can be connected directly to the pipe without additional reduction and expansion pieces. The control valve's operating characteristic is nearly linear over the valve's entire operating range thanks to the 3D design of the valve trim. The resulting high-precision control characteristics and precision manufacturing of the components allow the resolution of minute control steps (0.15 %). Due to the flow-optimized geometry and up to 80 % pressure recovery, the pressure drop is comparatively very low and results in a significant reduction in operating costs. The valve closes 100 % gas-tight. All parts in contact with media are completely made of 316 stainless steel/Teflon/ carbon/ PEEK/FKM (Viton), suitable for continuous operation at -40 °C to +150 °C (-40 °F to +300 °F) and virtually maintenance-free.

VACOMASS®
elliptic diaphragm control valve

VACOMASS®
square diaphragm control valve



3D-Design: Over-proportional increase of free flow area leads to the linear operational characteristics

VACOMASS®
jet control valve

Flow and pressure are equalized at the outlet of the valve hence the first drop pipe to a diffuser grid can be located directly behind the valve. This is a big advantage in upgrade projects and can significantly reduce the costs for pipe adaptation while improving the air distribution.

The air flow meter can be placed 0.5 x D upstream of the valve as this position has proven high repeatability of the flow profile, so an easy and cost-effective installation without the usual straight inlet and outlet pipe sections becomes possible.

The development of the jet control valve was supported by a CFD (Computational Fluid Dynamics) flow simulation software and parallel flow experiments in the **CAMASS® Calibration Lab** at a 1:1 scale, allowing real operational conditions of a plant to be simulated.

In addition to piping orientation, pipe size, pressure, temperature, air mass flow and noise level measurement, the dynamic pressure drop of a plant could be simulated.

VACOMASS® actuator

The control valves of the **VACOMASS®** series can be combined with various electrical as well as pneumatic actuators, taking into consideration that the drive of the actuator is optimized for minute steps to achieve a sensitive air adjustment. Depending on ambient conditions at the site, different requirements in corrosion protection, mode of operation, data transmission and actuator duty cycles can be accomodated.

VACOMASS®
Air flow meter

Knowledge of the air flow at various locations in the aeration system not only improves system understanding, it also provides additional control possibilities.

Typical installation locations are:
- Downstream of the blowers for efficiency monitoring in ongoing operation and long-term tracking
- In header pipes to individual aeration basins in order to detect and reduce any uneven distribution of wastewater in multi-stream aeration basins
- In branch lines/drop pipes for direct determination of the oxygen supply to an aerated basin or an aerated zone, in order to monitor the ageing of diffusers or incorporate the air flow into the control of the oxygen supply and distribution

The left top photo shows the installation of the VACOMASS® flow meter SS in combination with the torsion-proof hot tapping unit OEIN-F. The right top photo shows the VACOMASS® flow meter AL 100 with the integrated simultaneous flow profile compensation of the flow signal.

Thermal air flow meter are well-suited for all of these measurement tasks. They measure the mass flow at standard conditions directly and require no pressure or temperature compensation, like all other measurement technologies. They also do not generate a pressure drop that would increase the power required by the blowers and raise the electricity costs.

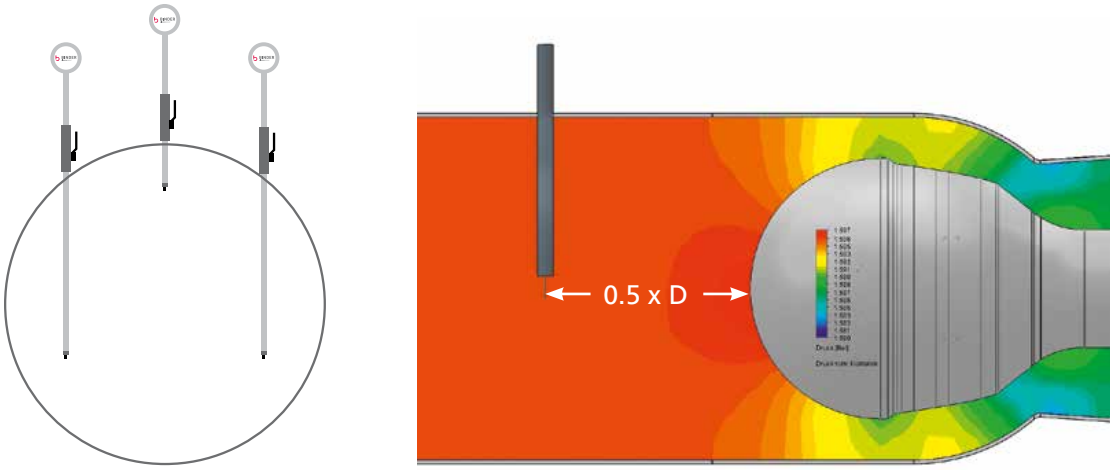
Requirements on the installation location
For precise measurement, they require an evenly-formed flow profile and sufficiently long straight inlet and outlet pipe sections.

For large nominal pipe sizes and/or especially high precision and insufficient straight inlet and outlet pipe sections, a patented and pressure drop-optimized upstream **VACOMASS® flow conditioner** a multiple sensor system **VACOMASS® flow meter multi** with appropriate electronic compensation can be installed.

Alternatively, installation specific calibration in the **CAMASS® Calibration Lab** can compensate for local flow disturbances so that the precision of the measured value improves significantly.

One device, several models
There are several different sensor models available for indoor and outdoor installation. The electronics can be installed in a compact, pressure-proof stainless steel housing (type SS) with a separate connector box or in an aluminium housing (types AL, AL DIN or AL100). Optionally, for some housing models, an integrated display is available; all models can have an external 10-digit graphic display with control panel for display of the actual flow value and the totalized value.

Combination with control valves
If the air flow meters are mounted directly upstream of diaphragm control valves, generally a minimum distance is required so that the opening/closing control aperture does not disturb the measurement signal due to the profile shift of the flow. Commonly, and especially in retrofits, this space is not available. In these cases, the flow meter is calibrated together with the valve and the flow-conditioned influence is compensated in the **VACOMASS®** control modules or directly in the **VACOMASS® flow meter AL100** (integrated simultaneous flow profile correction). This allows the installation of the flow meter directly upstream of the control valve, thus reducing the required length of the measurement and control pipe section significantly. The **VACOMASS® hot tapping unit** allows removal of the sensor in operation for maintenance purposes even at higher temperatures and pressures without losing air. Various versions are available, from the simple tap model with variable immersion depth (Version S) to the torsion-proof model with locked installation depth and orientation of the sensor (Version F).



The left top graphic shows the arrangement of a multiple sensor system mounted in a large collector pipe DN800. This way, even with relatively short inlet sections and large diameters, acceptable precision can be achieved.
The CFD-picture explains the advantages and the efficiency of the integrated flow conditioner even after extremely short straight inlet piping: the airflow meter can be installed only 0.5 x D in front of the control valve.

VACOMASS® Calibration

Only the exact calibration of an air supply system can provide precise control of the air flow to the aeration basins of a wastewater treatment plant. To achieve this we simulate, in detail, the operating conditions at which our **VACOMASS®** air supply and distribution systems will be operated, in our **CAMASS® calibration center**. For this purpose, the pressure and temperature conditions as well as the various flow rates that will occur later in the treatment plant are precisely reproduced during calibration.

Generally, the existing straight pipe sections at the top of the basin are not long enough to provide an even flow profile and to position the air flow meter far enough upstream of the control valve.

Factory approval testing (FAT) of the VACOMASS® air supply systems for the municipal sewage treatment plant of Vienna in our CAMASS® calibration centre. Due to the precise simulation of the field operating conditions and its piping layout during the calibration of the VACOMASS® systems, an accuracy of 1.5 % of the airflow reading could be guaranteed despite the difficult piping.

In these cases, special calibration allows compact installation: the air flow meter is placed directly upstream of the control valve. The total length of the measurement and control pipe section is thus reduced significantly, and retrofitting is possible even in tight spaces.

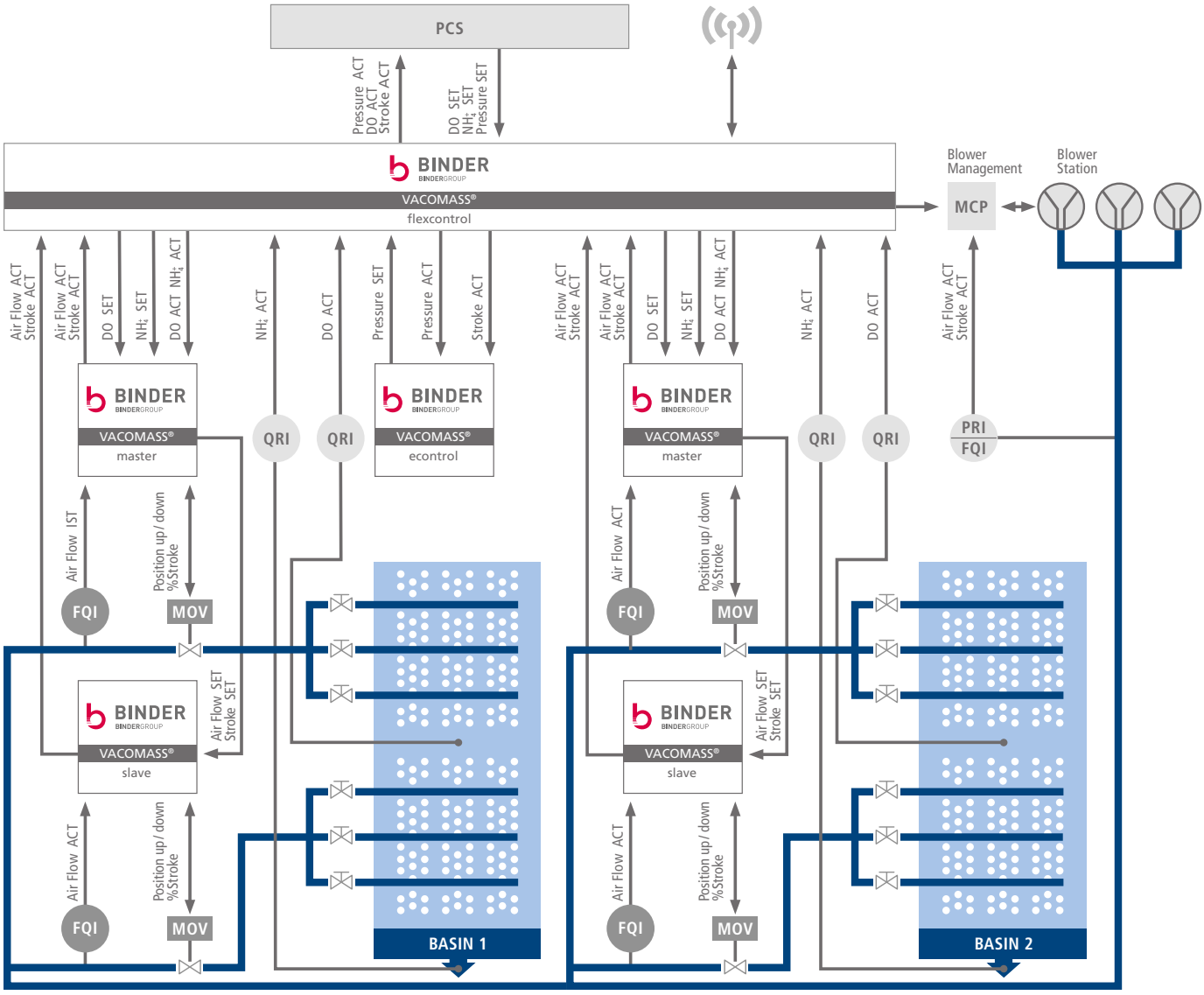
When the air flow meter is mounted directly upstream of a **VACOMASS® diaphragm control valve**, the influence of control aperature movements on the flow profile and on the thermal sensor's raw signal can be accurately recorded during calibration.

This data enables the calculation of correction factors and allows precise airflow measurement even under changing operating pressures and loads. Due to the flow-conditioning shape of the **VACOMASS® jet control valve**, the valve position does not influence the airflow signal and the airflow meter can be positioned just 0.5 x D upstream of the control valve.

The influence of the piping layout on the airflow measurement can be recorded and compensated by simulating the installation during calibration.

VACOMASS® Control concepts

Depending on loading and other plant conditions, customized concepts are needed for good aeration control. The control objective has traditionally been increased process stability and improved effluent quality; more recently in addition to the level of capital investment, the focus has moved to the potential for reducing energy costs. Approximately two-thirds of a wastewater treatment system's total energy consumption is solely for the supply of aeration air. **VACOMASS®** always guarantees an air supply tailored precisely to the specific needs.



Example of a complex VACOMASS® installation

The combination of **VACOMASS®** system components allows you to implement individual concepts for aeration control, as well as intermittent aeration. It begins with simple installations to ensure equal air distribution, continues to the implementation of conventional dissolved oxygen control, through to complex installations with cascading control loops for individual, local airflow control that adjust the dissolved oxygen setpoint based on NH_4-N concentration. By monitoring the positions of the control valves ("most open valve control"), the header pressure and airflow rates during nitrification can be adjusted according to the specific needs, and variable pressure control can be realized. A module for implementing cleaning cycles for the diffusers or pulse aeration can be activated. Based on additional process parameters such as ORP and pH, the time phases for nitrification and denitrification can be determined based on the load or aerated basins (swing zones) can be switched on or off. Special control concepts for systems with intermittent aeration as well as for systems with upstream denitrification are available. Plausibility checks increase process safety in case of signal failure. Standardized control modules allow easy and cost-effective configuration.

Use of air flow information – cuts energy costs

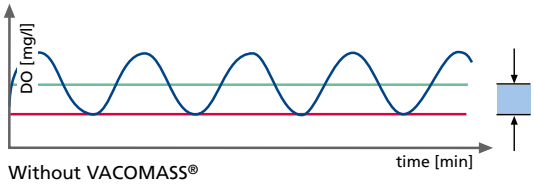
The inclusion of airflow rates in the control concept improves the aeration control especially for very large basins, very deep basins or basins with diffusers that do not cover the whole bottom area (see DWA-M 264 Gasdurchflussmessungen auf Abwasserbehandlungsanlagen, Mai 2015 [*DWA-M 264 gas flow measurements for sewage treatment systems, May 2015*]). Typically, the dissolved oxygen concentration in the aeration basin is measured and the air supply set via the blowers or control valves. The oxygen concentration fluctuates constantly around the setpoint. If the air flow in the interconnected control loop is used as the setpoint variable for the oxygen concentration and controlled by a cascading control loop via the valve setting, the control system will become much faster.

VACOMASS® reacts immediately to any disruption, so that even in wet weather conditions the dissolved oxygen concentration generally does not fluctuate much and cleaning performance remains more even. This frequently allows the dissolved oxygen setpoint to be lowered without compromizing the process outcome. Even with the same contamination load, the saturation deficit decreases, as does the airflow rate, and therefore the energy consumption.

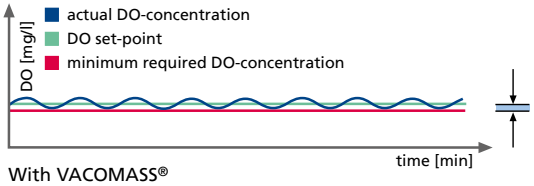
Since the aeration air is by far the wastewater treatment system's largest energy consumer, in addition to the use of low-differential-pressure control valves, special attention should be given to load-dependent aeration control. Monitoring of the pressure alone is not sufficient for this since the pressure provides no information about the required specific air distribution. The incorporation of direct airflow measurement into the automation process improves the efficiency and quality of the effluent.

Constant pressure control – variable pressure control – air distribution control

With constant pressure control, the individual valves provide the required aeration air from the constant pressure header to the diffuser grid independently of one another. The blowers are controlled by pressure. In partial load operation, the required air volume and thus the system pressure drop (pipeline and diffuser resistances) are low, and the excess pressure must be dissipated by throttling the control valves.

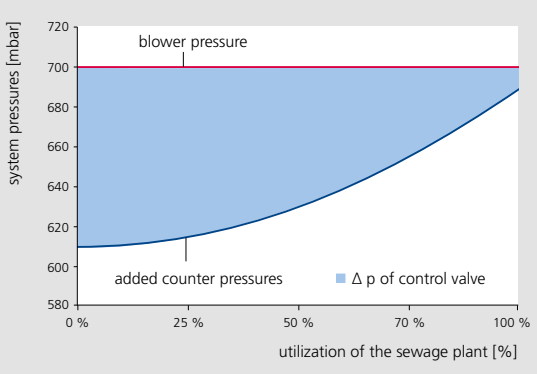


Without VACOMASS®

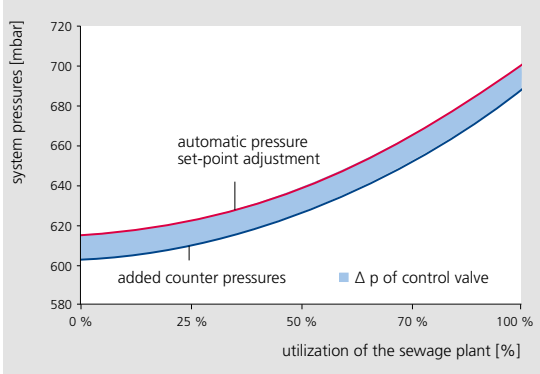


With VACOMASS®

More economic than throttling the air supply via the valves, however, is the variable adjustment of the blower pressure to the specific air requirement. For this, the **VACOMASS® econtrol** monitors the actual operating conditions of the control valves and determines the required pressure level to ensure that just enough air is supplied for the entire system. By reducing the pressure, the power consumption is also reduced.
With **VACOMASS® econtrol**, efficient system operation is ensured. Alternatively, air distribution control can be used. In contrast to pressure-based control, where the required pressure in the header must be kept constant and the air quantity to the diffusers is controlled by opening the control valve, with air distribution control a demand-based air



Constant pressure control system



Variable pressure control system (e.g. with VACOMASS® econtrol)

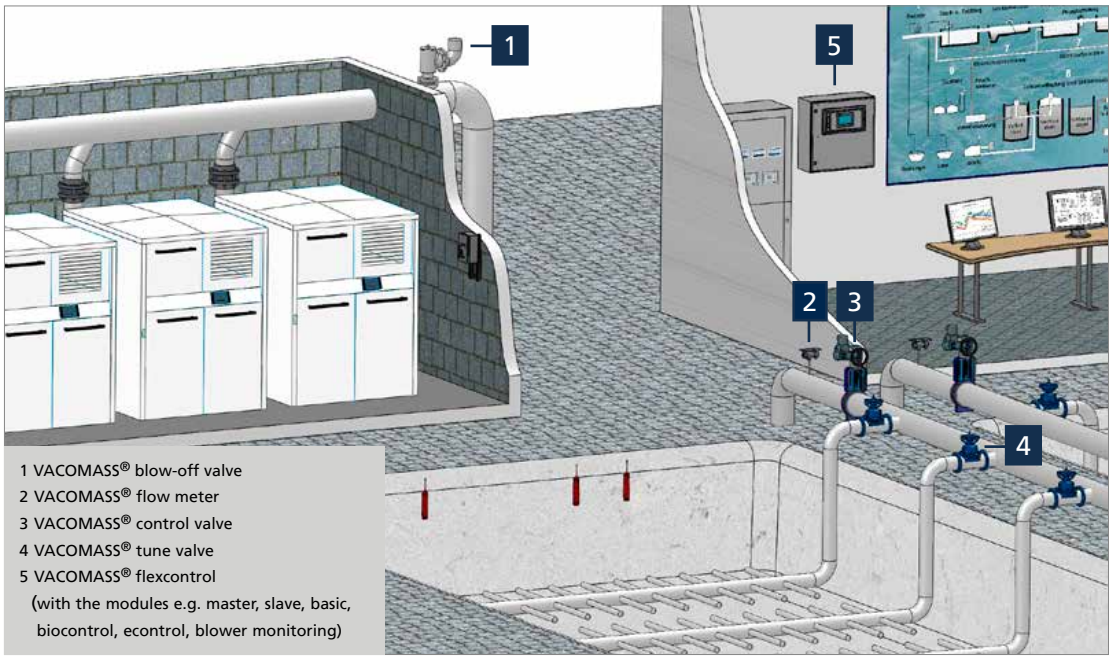
quantity is requested by the blower management. Detailed timing information about the switching of blowers can be incorporated into the control algorithms so that the air supply is kept as constant as possible during the blower switch and the danger of surging of single and multi-stage blowers can be largely avoided.

VACOMASS® flexcontrol – the PLC-based hardware platform for control software

The control cabinet is suitable for indoor and outdoor installation. Operator input is done with a 7" touch screen with system-specific screens and menus. The complete flexibility and intuitive operation of this open system is its outstanding feature. It enables easy adaptation to system requirements, no "black box" that creates uncertainty, but rather standardized modules based on control algorithms that are easy and clear for any circuit and that have been used successfully worldwide for many years. All modules are mounted on top hat rails and can be changed easily by the operator. Up to 10 control loops can be implemented in a control cabinet. As many control cabinets as desired can be combined so that smaller systems and larger wastewater treatment systems can use the same standardized and thus cost-efficient modules. Each control loop has its own processor with software that is configured for the required tasks and works completely independently. This provides maximum operating reliability and flexibility. Therefore, cost-effective fine-tuning of control parameters for each individual control loop via remote access is also possible. The operator can change the control parameters on-site or remotely at any time. There are up to 40 parameters available for the fine-tuning of a system. All common interfaces are available. The freely-expandable number of inputs and outputs and data transmission via bus systems open up possibilities for data recording and evaluation for more sophisticated process monitoring and optimization. Security updates can be installed remotely. The software modules also offer an automatic mode for the calculation of correction factors for operation, plausibility queries, and thereby greater protection against manipulation. The modular structure allows after-the-fact programming and remote download of customer changes. All parameters can be set via remote access and alarms can be tracked (service). Transmission of standardized reports can be activated in order to rapidly detect trends in the wastewater treatment system.

System integration

Only the interaction of all components enables secure and energy-optimised aeration of the biological cleaning stage: from the precise measurement of the air supply to low-differential-pressure control valves with linear performance curves and the use of standardized control modules for precise air distribution on through to process control of intermittent denitrification. The installation of low resistance control valves and VACOMASS® control systems frequently reduces energy consumption for aeration by up to 20%. VACOMASS® components or a complete system ensure this for your wastewater treatment system.



1 VACOMASS® blow-off valve
2 VACOMASS® flow meter
3 VACOMASS® control valve
4 VACOMASS® tune valve
5 VACOMASS® flexcontrol
(with the modules e.g. master, slave, basic, biocontrol, econtrol, blower monitoring)


VACOMASS®
jet control valve

BINDER
BINDERGROUP

LOCAL DISTRIBUTOR

PRODUCTION

BINDER GmbH
Buchbrunnenweg 18
89081 Ulm, Germany
Tel +49 731 18998-0
Fax +49 731 18998-88
info@bindergroup.info
www.bindergroup.info

INSTRUM GmbH
Buchbrunnenweg 18
89081 Ulm, Germany
Tel +49 731 96826-0
Fax +49 731 96826-99
instrum@bindergroup.info
www.instrum.de

BETA BV
Verrijn Stuartlaan 22
2288 EL Rijswijk, The Netherlands
Tel +31 70 3199700
Fax +31 70 3199790
info@beta-b.nl
www.beta-b.nl

DISTRIBUTION

Binder Engineering GmbH
Buchbrunnenweg 18
89081 Ulm, Germany
Tel +49 731 96826-0
Fax +49 731 96826-99
info@bindergroup.info
www.bindergroup.info

Binder Engineering AG
Aeschenvorstadt 71
4051 Basel, Switzerland
Tel +41 61 2254444
info@bindergroup.info
www.bindergroup.info

Binder Engineering BV
Cort van der Lindenstraat 25
2288 EV Rijswijk, The Netherlands
Tel +31 70 3074300
Fax +31 70 3074399
sales@binder-engineering.nl
www.bindergroup.info

Binder Engineering NV
Bergensesteenweg 709 A
1600 Sint-Pieters-Leeuw, Belgium
Tel +32 2 3000795
Fax +32 2 3000797
info@binder-engineering.be
www.bindergroup.info

Binder Engineering SAS
37, rue Hélène Muller (Bâtim. D1)
94320 Thiais, France
Tél +33 1 77 018480
Fax +33 1 77 018432
binder@mesa.fr
www.bindergroup.info

Binder Instrumentation Pte Ltd
4 Battery Road
Bank of China Building #25-01
Singapore 049908
Tel +65 6562 7631
Tel +65 6562 7637
Fax +65 6562 7638
info@bindergroup.info
www.bindergroup.info

Binder Instrumentation Trading (Shanghai) Co., Ltd
Room 106A
Xingyuan Tech Building
Guiping Road 418
Shanghai, P.R. China, 200233
Tel +86 21 64959889
Fax +86 21 64959887
info@binder-instrumentation.cn
www.bindergroup.info

Please visit our website for more information and distribution in other countries:
www.bindergroup.info

Please contact the company with the address shown in red or the local distributor.