VACOMASS®

The modular air supply system in wastewater treatment plants

Efficient and economical plant operation made possible by precise control of air supply
VACOMASS®
Biology securely under control

When the biological stage of a sewage plant is undersupplied with oxygen, this will lead to process disruptions and consequently, the legally required limits for the discharge will be exceeded. However, if too much activation air is supplied, a significant increase in energy is consumed, resulting in uneconomical operation of the wastewater treatment plant.

Therefore, only a well-designed regulation of the air supply according to actual demand can ensure both a controlled and economical plant operation.

The modular VACOMASS® air supply system comprises several system components which are optimised for this application and matched to each other for precise measurement, control and distribution of activation air in wastewater treatment plants.

VACOMASS® ensures – depending on the pollution level and oxygen requirement – that controlled air supply according to actual demand occurs in the various basins, zones and cascades of your plant.

VACOMASS® therefore guarantees

- optimized degradation performance
- avoidance of disruptions to plant operation
- compliance with legally required limits in the discharge and
- economical operation of your wastewater treatment plant.

With VACOMASS® your biological stage is under control and energy consumption is significantly reduced.
**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 employed either individually or in combination with each other.

The VACOMASS® system integration and precise calibration of the combined air supply systems in our CAMASS® flow calibration lab guarantees that all components fit to each other in a perfect manner ensuring highest precision for controlling the air supply.

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**VACOMASS® flow meter**

Flow meter based on thermal dispersion principle for precise monitoring of the air supply

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**VACOMASS® control valve**

Diaphragm control valve with multi-turn actuator for precise control of air flows

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**VACOMASS® tune valve**

Manually operated diaphragm valve with measuring stub for fine adjustment of air distribution

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**VACOMASS® master**

Electronic module featuring autonomous determination of the actual oxygen demand and local control of the air supply

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**VACOMASS® slave**

Electronic module featuring local control of the air supply according to external air flow setting via VACOMASS master or the PCS

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**VACOMASS® econtrol**

Electronic module for floating pressure control of the blowers according to actual air requirement

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The microprocessor based electronics of the various VACOMASS® modules is located in DIN rail housings for easy installation in switch cabinets.
VACOMASS®
Control concepts for the air distribution

Depending on capacity and the relevant situation of each plant, individual design concepts are required for controlling the air supply. In addition, the investment cost as well as the available potential for energy savings play a decisive role.

By combining the VACOMASS® system components you will be able to implement individual control concepts for regulation of the air supply. This starts with simple installations to secure homogenous distribution, extending further to the implementation of a conventional oxygen control system, up to complex installations with local control of the air supply and suitably controlled pressure level of the blowers.

Moving towards the biological basin, the air must overcome several counterpressures dynamically to reach a state of equilibrium. These counterpressures vary with the flow velocity or fluctuate as a result of external disruptive factors that can only be controlled with much difficulty. Examples of these are the changes in the water level of the basins or in the condition of the aerators.

Therefore, even very small changes in this equilibrium of pressures will have a significant influence on the air distribution in a sewage plant. This is precisely where the VACOMASS® concept of the locally controlled air supply can be applied. Each VACOMASS® system continuously monitors the air supply and, therefore, can immediately detect even the smallest change in the pressure conditions. The local control immediately intervenes and consequently eliminates the influence of external disruptions on the air distribution.

In this way, VACOMASS® always ensures a regulated air supply according to the actual demand.
Ensuring a well-distributed air supply in small sewage plants

In order to manually adjust the air supply, a VACOMASS® tune valve is installed in each down-pipe to the aerators.

Each of these diaphragm valves is equipped with a measuring nozzle for a mobile VACOMASS® tune meter to be installed. By this means, the flow rate can then be measured and checked during manual adjustment of the air supply or at certain intervals.

Implementation of a conventional oxygen control system

VACOMASS® control valves are used to regulate the air supply. These diaphragm control valves are characterised by an ideal control characteristic curve and are developed specifically for the sensitive regulation of airflows.

The setting of the VACOMASS® control valve is simply controlled via the process control system or the PLC according to the oxygen concentration in the aeration basin.

VACOMASS® installation for locally controlled air supply according to external airflow setting

Each air entrainment system consists of VACOMASS® slave, VACOMASS® control valve and VACOMASS® flow meter.

The process control system merely specifies the required air quantity as setpoint. The VACOMASS® air entrainment system automatically controls the air supply to the individual basins or zones.

The influence of external disruptive factors on the air distribution (e.g. different basin content level, clogging of the aerators etc.) is eliminated, thereby ensuring an appropriate supply of air.

VACOMASS® installation for locally controlled air supply according to specific process parameters

The VACOMASS® master module continually monitors the process parameters in order to determine the respective air requirement. This value serves as internal setpoint setting for the local control of the air supply.

If several zones of a basin are aerated separately, the calculated amount of air required serves as control input for further VACOMASS® air supply systems.
The VACOMASS® system integration

Within a well-organised team, each member can safely rely on the others and everything interlocks together. This is exactly what happens in the case of a VACOMASS® installation. Each system component executes a precisely defined task. The overall system integration guarantees an optimum inter-relationship between the individual components. Even in the case of complex installations, it ensures a reliable exchange of important data in order to provide perfect operation of the whole control system.

Simultaneous flow profile correction
In the case of a compact VACOMASS® system, the thermal sensor is positioned directly upstream of the control valve. Thus the flow profile will fluctuate steadily during system operation. Without correction, this will lead to errors when measuring the air supply.

In order to correct for these flow profile distortions, the setting of the control valve is indicated at any time. With this information, the flow signal – the command variable for precise control of the air supply – can be corrected automatically.

Optimised operation of the control valve
Conventional controllers alter the stroke of the control valve in a stepwise fashion. This inevitably leads to high switching frequencies as well as premature wear and tear of the drive and the valve.

Contrast to this, the control characteristic curve of the valve and specific process data of the sewage plant are stored in each VACOMASS® module. In case of control deviations, the microprocessor based electronics calculates exactly the new setting of the control valve, thus allowing for precise adjustment in only one single control step.

Plausibility check
Each VACOMASS® system continuously monitors the air supply and checks this value for plausibility in relation to the valve setting.

In this way, any disruptions, such as at the aerators, can be detected immediately. The VACOMASS® system reacts to each disruption without delay and automatically initiates appropriate countermeasures.

Redundant monitoring of the process parameters
The control of the air supply is carried out based on certain process parameters (e.g. DOC, Redox, NH₄⁺, etc.). False measurements of these process data, however, can indicate an oxygen demand, which is too low thus resulting in an undersupply of activation air.

In order to prevent this, VACOMASS® allows for redundant monitoring of specific process parameters. Thus, any malfunction or failure of a measuring probe can be detected immediately. For determination of the oxygen demand, only signals of the properly functioning probes continue to be considered.

Comprehensive alarm and safety functions
VACOMASS® provides comprehensive monitoring functions allowing each process disruption to be indicated immediately. Additionally, the control of the air supply can always be taken over via the process control system.

Upon the occurrence of a fault, the control valve will automatically move into a safe position. In such way, VACOMASS® ensures a surplus of oxygen at any time.

Consequently, a VACOMASS® installation improves significantly the operational safety of a sewage plant. Process disruptions, as well as unnecessary cost due to late detection of failures can be prevented. This results in an efficient and economical plant operation.
VACOMASS®
Cutting down the energy costs!

Approximately two thirds of the power consumption of a wastewater treatment plant is expended on the provision of aeration only. VACOMASS® precisely ensures air supply according to actual demand. Depending on the degree of utilization of the sewage plant, the control system allows as well for floating adjustment of the blower pressure. Thus a VACOMASS® installation often results in power savings of up to 20%.

Lowering the oxygen concentration
Conventional control systems for the air supply intervene only after a certain time delay. For this reason, the oxygen concentration steadily fluctuates around the specified setpoint.

In contrast, VACOMASS® reacts immediately to each disruption and ensures a regulated air supply at any time. In most cases, this allows for increased oxygen concentrations in the activation basins.

Even with the same pollutant level, in such case less air is required due to the smaller saturation deficit. This results in lower power consumption.

Floating pressure control

Without VACOMASS® econtrol

In case of operating a plant under partial load conditions, the flow dependent counterpressures will decrease. At constant blower pressure, this is compensated by closing the control valve which results in an increased differential pressure.

Instead of throttling the air supply via the valve, however, it makes more sense to provide a variable adjustment of the blower pressure according to the actual air demand. For this, VACOMASS® econtrol monitors the operating state of all VACOMASS® systems in order to determine the pressure necessary just to maintain sufficient air supply for the whole installation.

A lower pressure level, however, results in less energy consumption for the air supply thus ensuring an economical plant operation.
Official acceptance of the VACOMASS® air supply systems for the municipal wastewater 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 reading could be guaranteed for the measurement of the air supply.

**VACOMASS® Calibration**

Only the exact calibration of an air supply system can provide for precise control of the airflow to the aeration basins of a wastewater treatment plant. In order to ensure this, in our CAMASS® Calibration Centre we precisely simulate the operating conditions at which our VACOMASS® air supply systems will finally be operated. For this, the pressure and temperature conditions as well as the various flow rates that will also occur later in the sewage plant, are reproduced exactly during calibration.

In order to allow for simultaneous flow profile correction, mostly the VACOMASS® air supply systems are calibrated as a compact unit. On the flow stands of our CAMASS® Calibration Centre, the impact of varying valve positions on the raw signal of the thermal flow sensor will be determined precisely during that calibration. These data will be used to calculate the correction factors, which allow for precise air supply measurements even at fluctuating operating conditions and varying utilization of the sewage plant.

In simulating exactly the field installation situation during the calibration process, also the influence of the piping layout on the flow rate measurement due to flow profile distortions may be compensated.