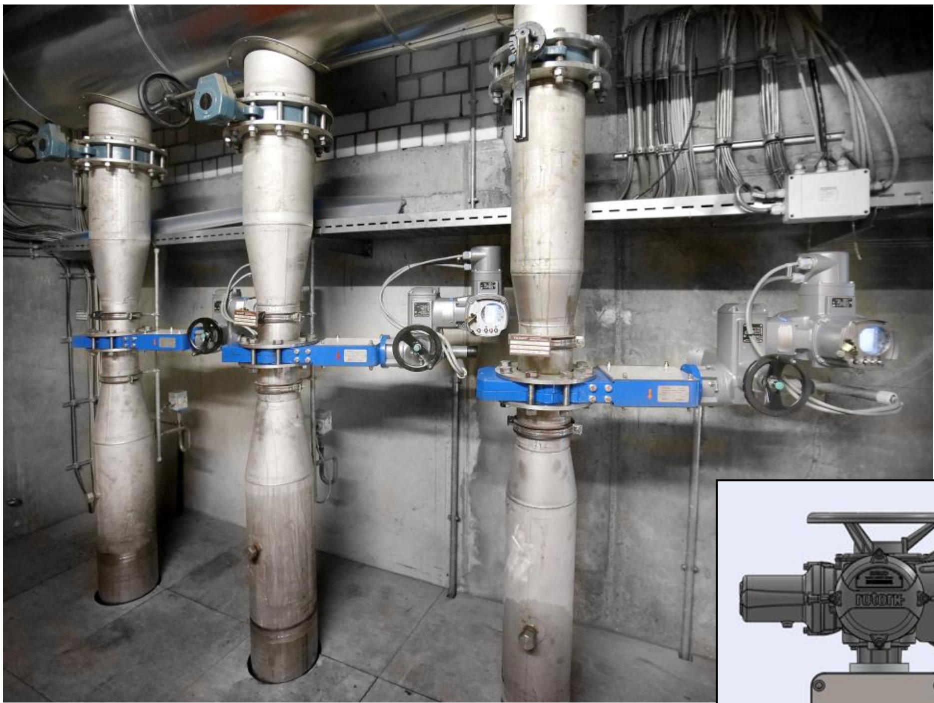
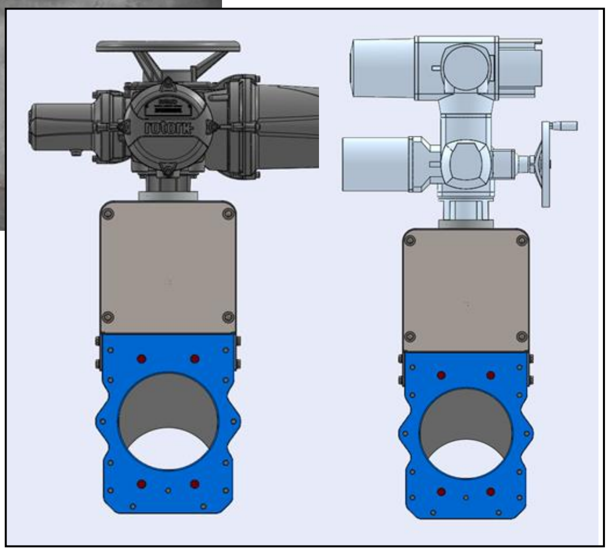
VACOMASS®

Technical information

VACOMASS® elliptic diaphragm control valve

Diaphragm control valve with an elliptical control aperture and falling flow axis





BINDER

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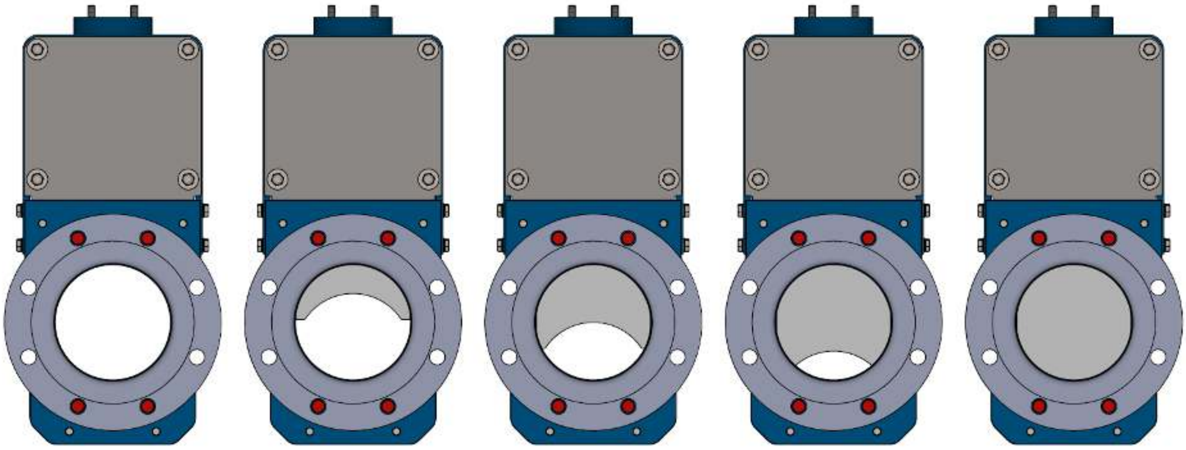
VACOMASS® ELLIPTIC DIAPHRAGM CONTROL VALVE

The **VACOMASS® elliptic diaphragm control valve** is a technically optimized sliding gate control valve with gas-tight shut-off and an elliptical control aperture. It is used for precise and low-loss control of air flow and distribution in the aeration tanks of a wastewater treatment plant. The valve has a falling flow axis to achieve sensitive control of normal and tangential flows (e.g. after elbows), and is designed according to DIN EN 60534-2-3.

Within the usual control range the valve has a stable control curve, and it can be used from 0-100% stroke. It is designed to have a pressure loss of less than 10 mbar at full load and 100% stroke. The design stroke in control mode typically ranges between 30 – 70%, pressure drop will range between 8-15 mbar (technically required for a stable control and distribution of aeration air at stable and optimum boundary conditions – same pressure conditions related to water depth, aerators etc.).

Air flow rate can be increased significantly and easily for cleaning of aerators (air bumping, flexing) and/or pulse aeration in nitrification zones without mixer during non-aerated process phases by increasing the stroke up to 100% without increase of header pressure. This control valve complies with the requirements of the new standard paper of German Water and Wastewater Association M 229-1, published in September 2017 regarding pressure drop and related energy efficiency.



100% 75% 50% 25% 0% stroke

The control valve body consists of two halves that are designed to be of wafer or end-of-line type. The inner surface has a groove for a PTFE/ carbon gasket that makes the valve gas-tight and serves as an external guide for the valve´s knife-edge sliding gate. The combination of stainless steel on Teflon/carbon allows precision movement of the plate without vibrations or jamming. A wave breaker in the outlet area of the valve body (patent pending) prevents high-pitched noise generation.

The main features of the valve are:

- Gas-tight shut-off allows use in swing zones or intermittently aerated tanks without any further measures (no additional actuated isolation valves with are required) – reduction of capital expenditures
- Valve sizing is based on given air flow rates and is designed for optimal control performance in the typical average air flow range
- At 100% stroke the entire pipe cross section is open, eliminating any pressure losses

- The geometry of the control aperture provides a significantly larger range of control than comparable triangular, square, pentagonal or hexagonal diaphragm valves
- Design with a falling flow axis: the flow remains partially attached to the wall, which leads to pressure recovery and noise reduced total pressure drop of the valve during operation – reduction in power consumption
- Usually a pipe reduction upstream and expansion downstream are required to achieve best control performance (concentric versions are preferred to avoid stall and reduce pressure drop in the expansion piece – Binder can support the design of the fitting pieces using a tool)
- Design and construction of the valve with corrosion-proof sliding gate in stainless steel; Teflon/ Carbon/ Viton seals for ambient and media temperatures up to + 150°C
- Valves are supplied with a **VACOMASS® actuator** for precise aeration control; besides AUMA or ROTORK, other manufacturers can be provided as long as they meet the technical specifications
- Valves can be supplied with a **VACOMASS® air flow meter** for measurement and control of air
- The optional calibration of the valve and flow meter in a compact system (stroke compensation of the airflow measurement) reduces the required straight pipe length for measurement and control – ideal for retrofitting into existing pipe installations

DESIGN OF THE CONTROL PIPE SECTION

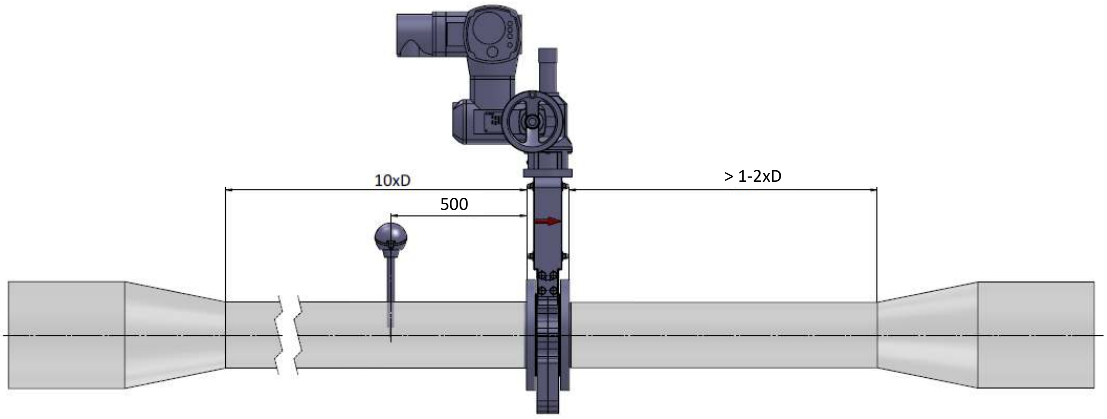
The **VACOMASS® elliptic diaphragm control valve** has to solve following tasks: 1. the control of air into an aeration zone based on actual demand and 2. the correct distribution of air into various tanks or zones from one main air header.

In the past, oxygen control loops were typically used. The valve was closed/ opened based on the difference between actual DO-concentration and set point DO-concentration. This led to a considerable delay in control loop. If air flow is measured and used as the correcting variable, then the control becomes much faster and smoother. In the control loop, the air flow becomes the calculated manipulated variable for the oxygen concentration and is adjusted by the use of a cascade control loop (blower speed control, valve stroke). This kind of control loop is able to react to disturbances (e.g. wet weather conditions or peak loads) much faster, so that cleaning capacity and effluent quality become more stable (see also the German Wastewater Association standard paper DWA-M 264: Gas flow measurements in sewage treatment plants, May 2015).

Depending on the local situation and pipe layout, different types of the measurement and control concepts can be implemented. For diaphragm control valves or gate valves, the pipe diameter must usually be reduced in front of and expanded downstream of the valve to achieve good control performance. Especially gate and butterfly valves are of limited utility because of non-linear control performance at the upper and lower end of their stroke. This leads to unsatisfactory operation of the valve at both ends of its range – low control accuracy and repeatability – as well as high pressure drop in normal operation.

Air flow meters have specific requirements on straight inlet and outlet piping for precise flow measurement. In addition, the opening/closing action of the control valve shifts the flow profile in front of and behind the valve. Therefore a minimum distance between the flow meter and the valve is required or the signal must be continuously corrected based on actual stroke (simultaneous flow profile correction). If the required minimum straight pipe runs are not available in existing installations (e.g. for upgrade projects), in most cases a high measurement accuracy can be achieved with a special calibration takes the actual pipe run into consideration.

CFD-simulations can be used to assess the installation situation and to optimize the measurement and control pipe section.



Compact System: The **VACOMASS® air flow meter** can be installed 500 mm in front of the **VACOMASS® elliptic diaphragm control valve** when using flow profile correction for very precise flow measurement. If necessary, piping related disturbances of the flow profile can be examined and compensated during calibration in Binder´s **CAMASS® Calibration Lab**.

Separated system: If there is sufficient straight pipe run (depending on the type of pipe fittings and the geometry of the pipe run, a minimum distance of 10*D upstream of the **VACOMASS® flow meter**), the flow meter can be installed at least 5*D in front of the **VACOMASS® elliptic diaphragm control valve.** The level of calibration can be reduced and flow profile correction is not necessary. The total length of the measurement and control section is very long and in most cases not available.

CONSTRUCTION DETAILS

Material selection: Version with standard seals and high-temperature seals for deep tanks and/or special geographical regions as well as further customized options

The valve is made of the following materials: the seals are made of PTFE25C (Teflon/ Carbon and HNBR up to 120°C - high temperature version up to 150 °C with Viton seals). The spindle and screws are made of stainless steel 304 type, the diaphragm plate is of 316 type. The surface finish is Ra <= 0.3µ.

The housing is made of steel S235JR, surface is galvanized first. Two-layer epoxy- and PU-coating is the ideal triple UV- and corrosion protection. Standard colour is RAL 5010, but customized colours can be supplied too.

Option 1: mechanical stroke indicator

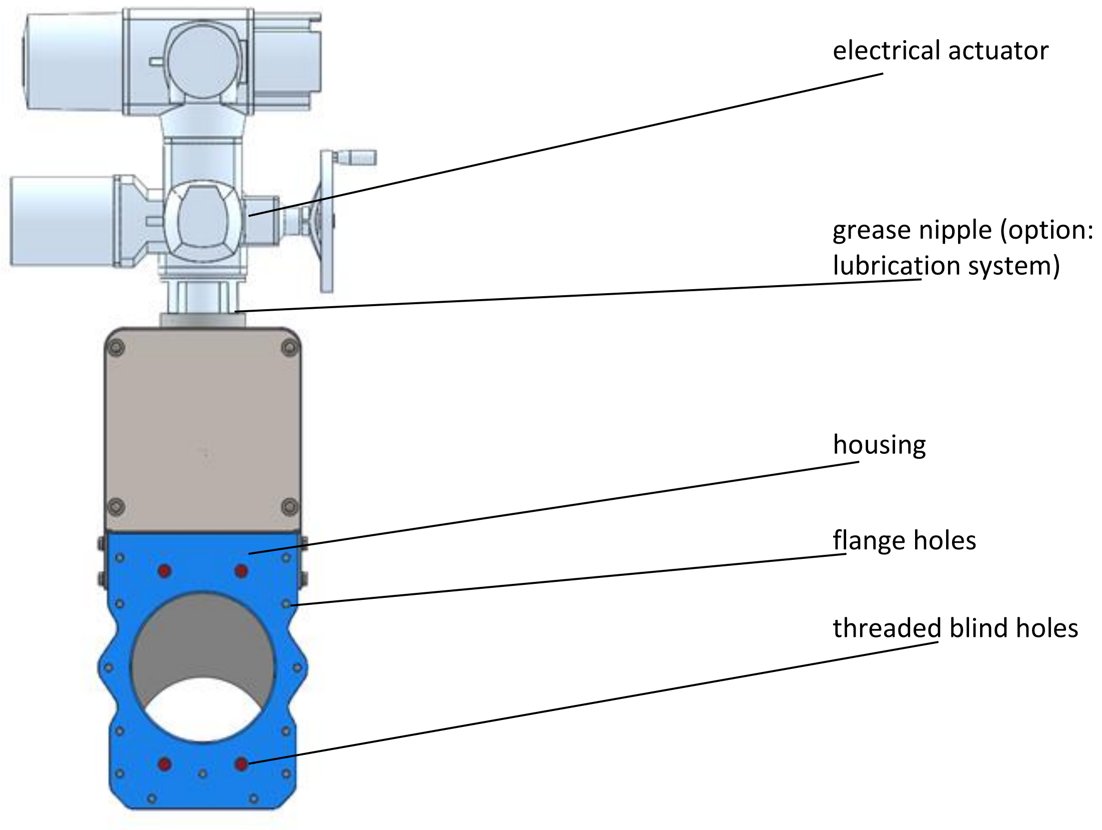
Option 2: housing plates completely is stainless steel A2 or A4

Maintenance: The valve spindle must be lubricated and the actuator has to be maintained according to manufacturer´s recommendation. The lubrication of the spindle can be done either manually, using a lubrication cartridge or a cartridge with an additional battery powered electromechanical lubricator for constant lubrication independent from ambient temperature etc..

Connections and Assembly: The elliptic diaphragm control valve can be mounted between two flanges. The length is generally according to DIN 3202/K1. The threaded flange holes with are consistent with EN 1092-2 PN10 or as an option ASME 16.5 Class 150 lbs. All fittings for pipe reduction/ expansion are to be provided by the contractor.

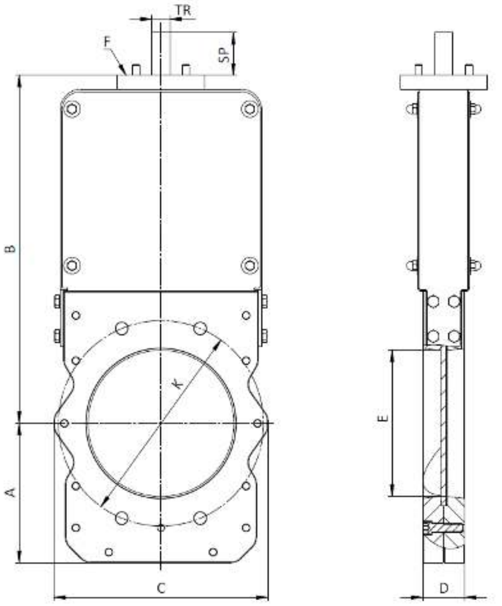
Design of valve size: The design is done on a project basis, for which the information is required:

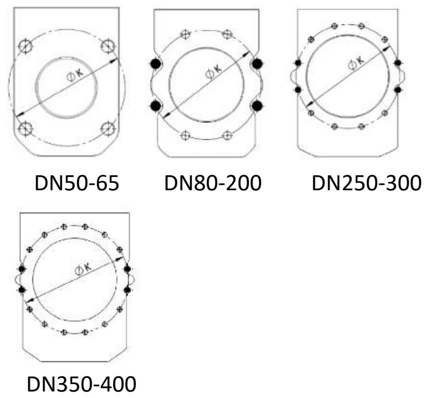
- Air flow range (min/average/max in normal control mode, maxmax for cases in which one tank is out of operation, maxclean for diffuser purging, maxpulse for pulse aeration, if required from process)
- Nominal size/nominal pressure of the connecting flange
- Operating pressure (min/average/max)
- Operating temperature of the medium (min/average/max)
- Ambient temperature and conditions at site
- Actuator: local supply voltage, data communication (analog/ digital, Profibus, Profinet, …), required positioning accuracy, type of control (via time or via stroke)



VACOMASS® elliptic diaphragm control valve

DIMENSIONS





EN 1092-2 PN10

DN	K	n°	M	T	● ⌖
50	125	4	M-16	11	4 - 0
65	145	4	M-16	11	4 - 0
80	160	8	M-16	11	4 - 4
100	180	8	M-16	11	4 - 4
125	210	8	M-16	11	4 - 4
150	240	8	M-20	14	4 - 4
200	295	8	M-20	14	4 - 4
250	350	12	M-20	18	8 - 4
300	400	12	M-20	18	8 - 4
350	460	16	M-20	22	12 - 4
400	515	16	M-24	24	12 - 4

Application as a wafer valve, flange hole pattern: DN – PN10
(note: all dimensions in following table are in mm)

DN	NPS	A	B	C	D	E	F	SP_close	SP_opn	K*	TR
50	2“	76	239	140*	43	54	F07	42	96	125	TR 20x4 LH
65	2 ½“	85	244	155*	46	71		47	118	145	
80	3“	107	299	166	46	82		68	150	160	
100	4“	120	328	187	52	108		50	158	180	
125	5“	141	352	219	56	133		63	196	210	
150	6“	159	427	246	56	160	F10	111	271	240	TR 26x5 LH
200	8“	200	500	308	60	210		61	271	295	
250	10“	245	615	355	68	264		56	320	350	TR 30x6 LH
300	12“	310	700	438	78	312		91	403	400	
350	14“	360	820	514	78	340	F14	78	423	460	TR 36x6 LH
400	16“	393	898	565	102	340		75	470	515	

*max. width

Nominal pipe size DN	inches	Recommended air flow range Min. – max. control mode (maxmax at 10 mbar) [1)] Nm³/h	scfm	kvs-value[2)]
50	2	20 - 300 (970)	11.7 - 176 (570)	315
65	2 ½	30 - 480 (1,600)	17.7 - 282 (942)	520
80	3	50 - 680 (2,200)	29.4 - 400 (1,295)	720
100	4	80 - 1,100 (3,700)	47.1 - 648 (2,179)	1,230
125	5	120 - 1,700 (5,700)	72.4 - 1,001 (3,356)	1,870
150	6	170 - 2,500 (8,300)	100 – 1,472 (4,888)	2,715
200	8	300 - 4,300 (14,400)	176 – 2,530 (8,480)	4,680
250	10	490 - 6,800 (22,600)	288 – 4,004 (13,309)	7,340
300	12	700 - 9,650 (32,100)	412 – 5,683 (18,904)	11,126
350	14	850 – 11,700 (38,800)	500 – 6,890 (22,850)	12,590
400	16	1,000 – 15,300 (50,900)	588 – 9,010 (29,976)	16,520

[1)] max. air flow depends on permissible pressure loss during operation (e.g. 10 mbar) at a specific stroke (e.g. 100%), header pressure and air temperature, the value in the brackets shows the available flow rate capacity for diffuser flexing without increase of header pressure

[2)] the kvs-value defines the water flow rate in m³/hr, which is flowing through the valve at 1 bar pressure drop and 100% stroke – this is a characteristic value of valves for water applications, this value

- cannot be used for any comparison or valuation for aeration air application
- doesn´t confirm suitability / non-suitability of the valve
- doesn´t confirm good/ poor control performance

IMPRESSUM

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BIDE-M-D-VACOMASS-EN-R02 Data Sheet
VACOMASS elliptic diaphragm control valve