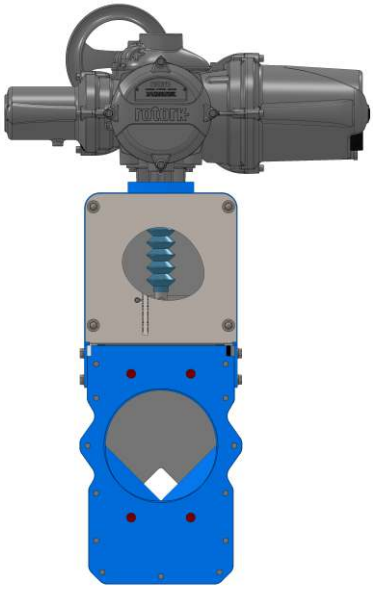
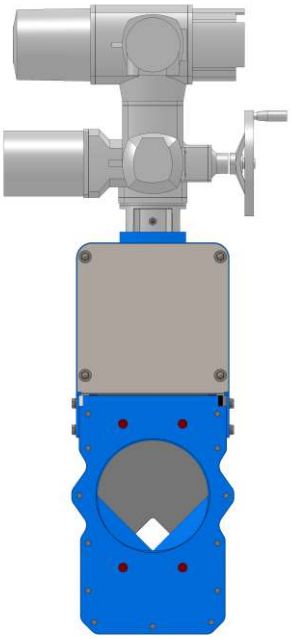
VACOMASS®

Technical information

VACOMASS® square diaphragm control valve

Diaphragm control valve with a square shaped control aperture and falling flow axis





BINDER
BINDERGROUP

VACOMASS® SQUARE DIAPHRAGM CONTROL VALVE

The **VACOMASS® square diaphragm control valve** is a technically optimized sliding gate control valve with gas-tight shut-off and a square control aperture. It is used for precise and low-loss control of airflow 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 control curve that is proportional to the open area, 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 control valve body consists of two identical 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.

The main features of the valve are:

- Design with a falling flow axis: the flow remains partially attached to the wall, which leads to pressure recovery and reduced total pressure drop of the valve during operation – reduction in power consumption
- 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 airflow rates and is designed for optimal control performance at average airflows (check that pressure drop at max. air flow is acceptable)
- 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
- The valve can be supplied with an air flow meter, **VACOMASS® flow meter** for measurement and control purposes
- 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

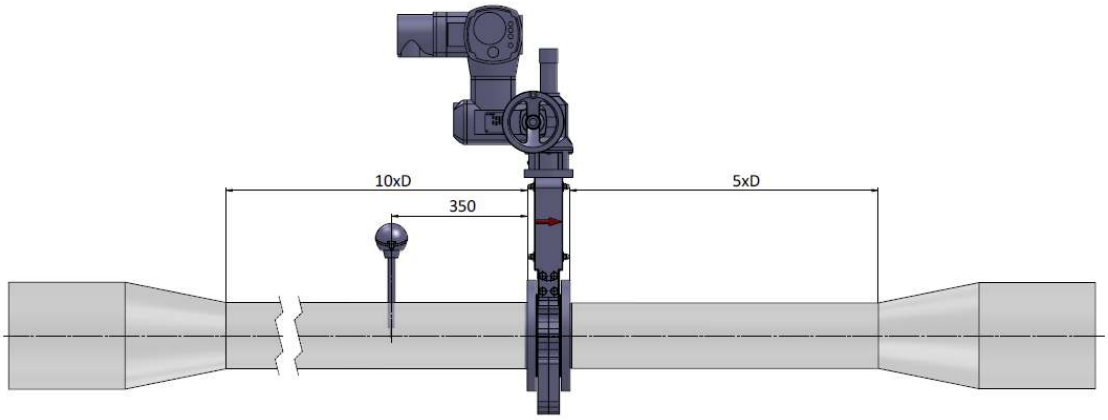
The **VACOMASS® square diaphragm control valve** has to solve following tasks: 1. the control of air into an aeration zone based on actual demand and 2. the correct distribution of air into various tanks or zones from one main air header.

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 the 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 new German Wastewater Association standard 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 behind 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 (also see M264). Additionally, 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 that 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® square 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® square 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

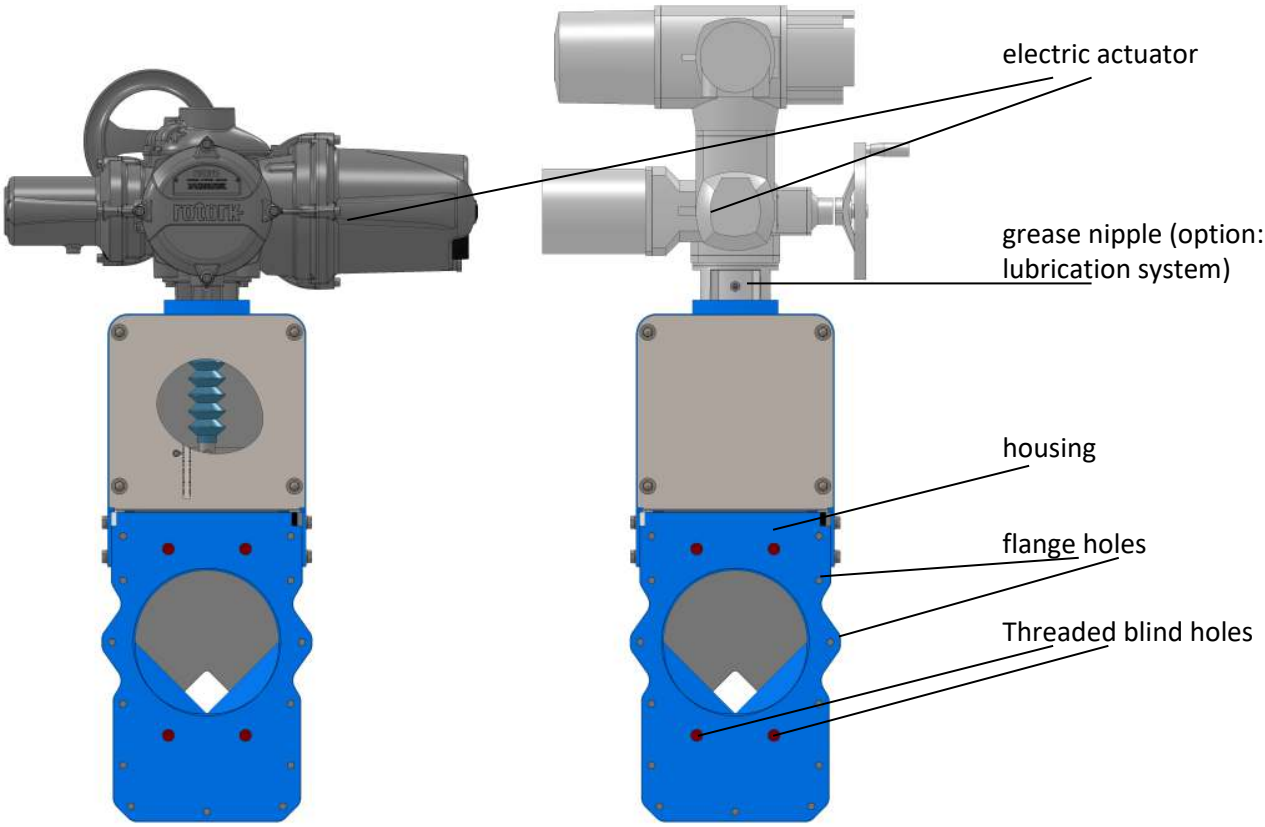
Option 2: housing plates completely is stainless steel A2 or A4

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.

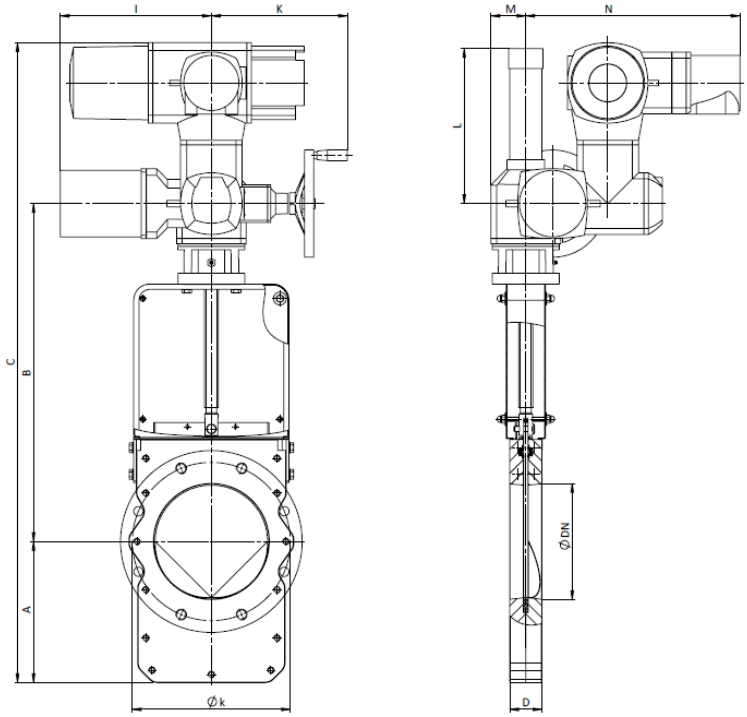
Design of valve size: The design is done on a project basis, for which the information is required:

- 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® square diaphragm control valve with Rotork and AUMA actuator

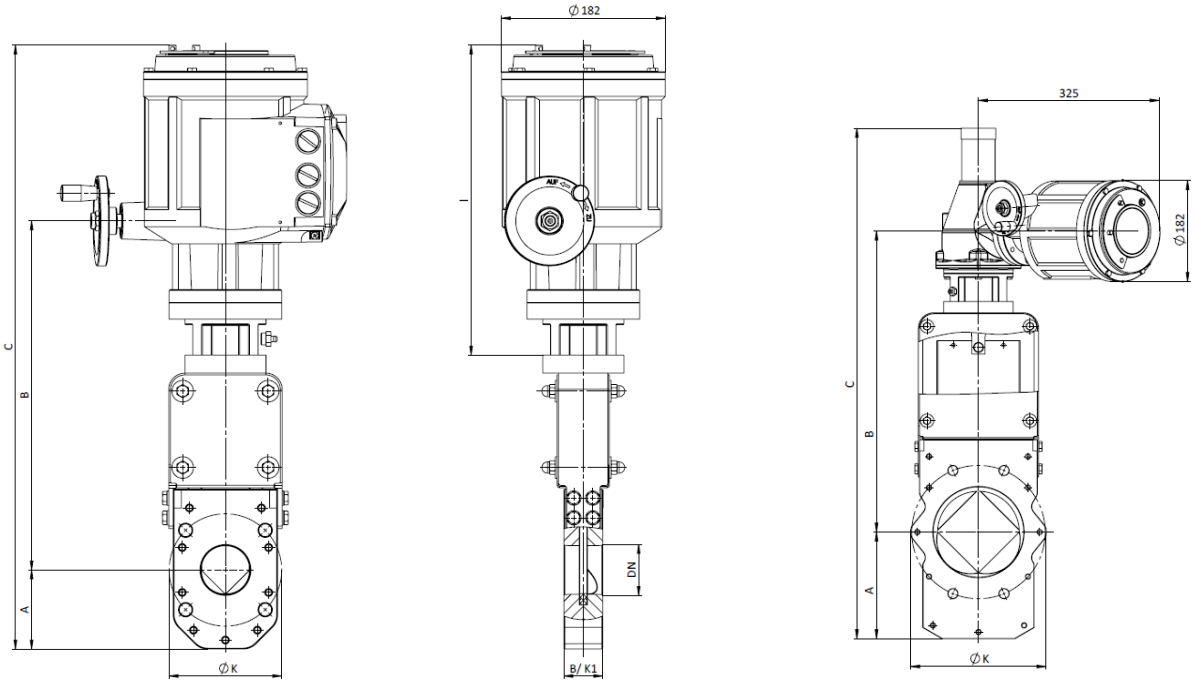
DIMENSIONS



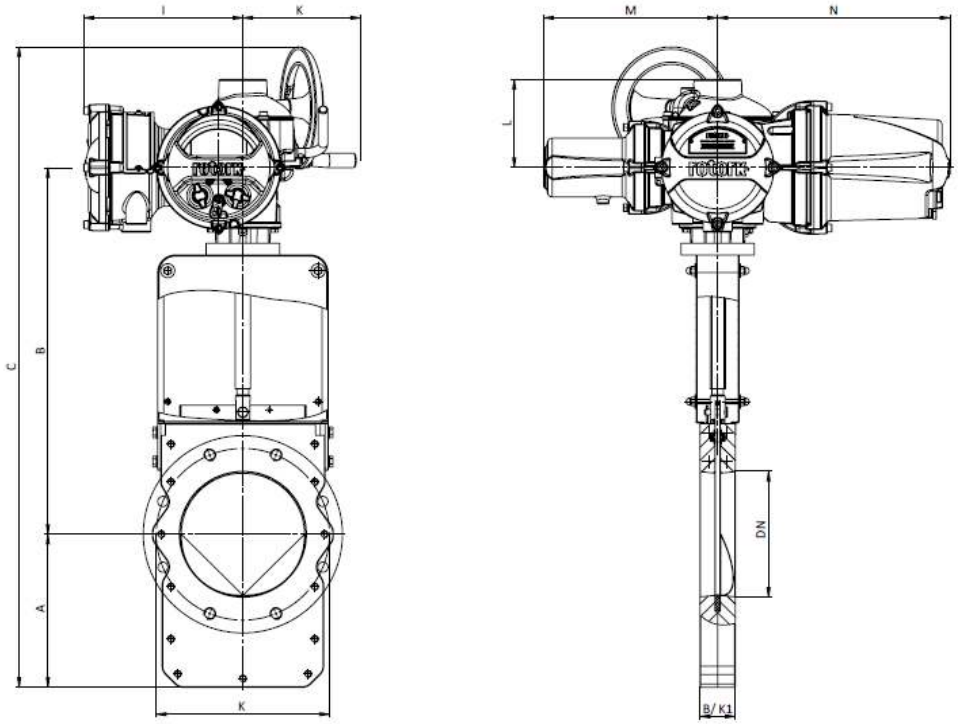
VACOMASS® square diaphragm control valve with an electric actuator type AUMA-SAR (for DN50-400)

DN	A	B	C	K1	I	K	L	M	N	weight without actuator in kg
50	90	357	745	43	270	250		65	390	9,5
65	95			46	270	250				12
80	120	416	836	46	270	250		65	390	14
100	140	446	902	52	270	250	190	65	390	20
125	160	492	942	56	270	250	190	65	390	21
150	182	537	1.026	56	270	250	190	65	390	22
200	245	630	1.175	60	280	254	290	65	400	51
250	295	735	1.240	68	280	254	290	65	400	80
300	360	858	1.520	78	280	254	290	65	400	155
400	465	1.050	1.915	102	390	340	400	90	433	285

Nominal pipe size ANSI		K	N	M	T	threated blind holes	guided past the housing
50	2“	5“	4	5/8“ UNC	11/32“	4	0
65	2 ½“	5 ½“	4	5/8“ UNC	11/32“	4	0
80	3“	6“	4	5/8“ UNC	11/32“	4	4
100	4“	7 ½“	8	5/8“ UNC	11/32“	4	4
125	5“	8 ½“	8	3/4“ UNC	3/8“	4	4
150	6“	9 ½“	8	3/4“ UNC	3/8“	4	4
200	8“	11 ¾“	8	3/4“ UNC	3/8“	4	4
250	10“	14 ¼“	12	7/8“ UNC	18/32“	8	4
300	12“	17“	12	7/8“ UNC	18/32“	8	4
400	16“	21 ¼“	16	1“ UNC	1,1“	12	4



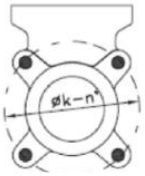
VACOMASS® square diaphragm control valve with an electric actuator type AUMA-SD (up to DN150 only)



VACOMASS® square diaphragm control valve with an electric actuator ROTORK-IQM (for DN50-400)

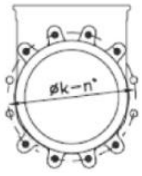
EN 1092-2 PN10

DN	K	n°	M	T	● ⊕
50	125	4	M-16	11	4 - —
65	145	4	M-16	11	4 - —
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

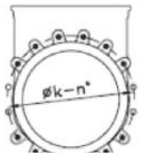


DN50-65

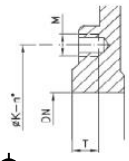
DN80-200



DN250-300



DN350-400



● threaded blind holes

⊕ holes guided around the housing

Legend
K = bolt circle
M = size of the screws metrical at PN10 and UNC-thread if ANSI
T = blind hole depth in mm
n° = No. of required bolts

Nominal pipe size DN	inches	Recommended air flow range [1] (depending on temperature and pressure) Nm³/h	scfm	kv-value[2]
50	2	10 – 275	6 – 162	93
65	2 ½	20 – 460	12 – 271	156
80	3	25 – 598	15 – 352	202
100	4	50 – 1,074	29 – 633	363
125	5	75 – 1,590	44 – 936	537
150	6	120 – 2,025	71 – 1193	684
200	8	170 – 3,582	100 – 2110	1,210
250	10	250 – 5,624	147 – 3312	1,900
300	12	430 – 8,125	253 – 4785	2,745
350	14	580 – 11,050	342 – 6508	3,733
400	16	750 – 14,356	442 – 8455	4,850

[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

[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-R05 Data Sheet
VACOMASS square diaphragm control valve

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