Honeywell

krom schroder

Pressure regulators with solenoid valve VAD, VAG, VAV
Flow rate regulators VAH, VRH
Pressure regulators with double solenoid valve VCD, VCG, VCV, VCH

TECHNICAL INFORMATION

- All-purpose servo regulator for gaseous media with integrated safety valve
- Suitable for a max. inlet pressure of 500 mbar (7 psig)
- Minimum installation effort: no external impulse line required
- Can be adjusted from two sides
- Suitable for hydrogen



Safety manual for products complying with EN 61508-2

EN
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03250530

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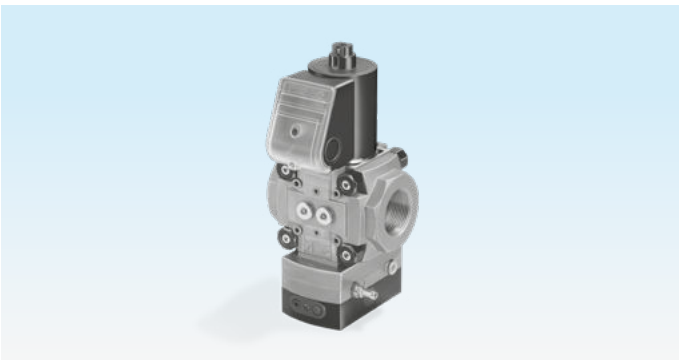
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1 Application

Regulators with solenoid valves are designed for shut-off, and thanks to the servo technology, for precise control of the gas supply to gas burners and gas appliances.

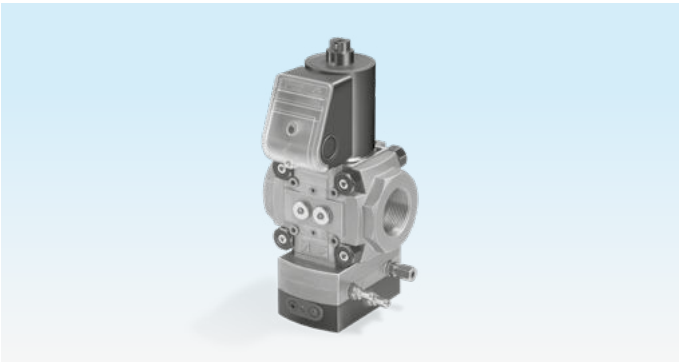
VAD



VAD

Constant pressure governor, Class A, with high control accuracy, for excess air burners, atmospheric burners or single-stage force draught burners. The pressure is preset via the setpoint spring. In the case of fluctuating furnace or kiln pressures, the furnace chamber pressure may also be connected for maintaining a constant burner capacity.

VAG



VAG

Air/gas ratio control, Class A, for maintaining a constant air/gas pressure ratio for modulating-controlled burners or with VAS 1 bypass valve for stage-controlled burners. The pressure is preset by the air control line. The VAG..N can also be used as a zero governor for gas engines.

VAH, VRH



VAH



VRH

Flow rate regulators VAH and VRH are used to maintain a constant gas/air ratio for modulating-controlled and stage-controlled burners. The gas flow rate is controlled proportionally to the air flow rate.

In addition, flow rate regulator VAH is designed as a gas solenoid valve and shuts off the gas or air supply safely.

VAV



VAV

Variable air/gas ratio control, Class A, for maintaining a constant gas/air pressure ratio for modulating-controlled burners. The pressure is preset by the air control line. The ratio of gas pressure to air pressure remains constant. It can be set from 0.6:1 to 3:1. Pressure fluctuations in the combustion chamber can be compensated via the combustion chamber control pressure.

VAD, VAG, VAV, VAH, VRH

Regulators with solenoid valves are used in gas control and safety systems in all sectors of the iron, steel, glass and ceramics industries, as well as in residential or commercial heat generation, such as the packaging, paper and foodstuffs industries.



Pressure regulator on excess air burners in the ceramics industry



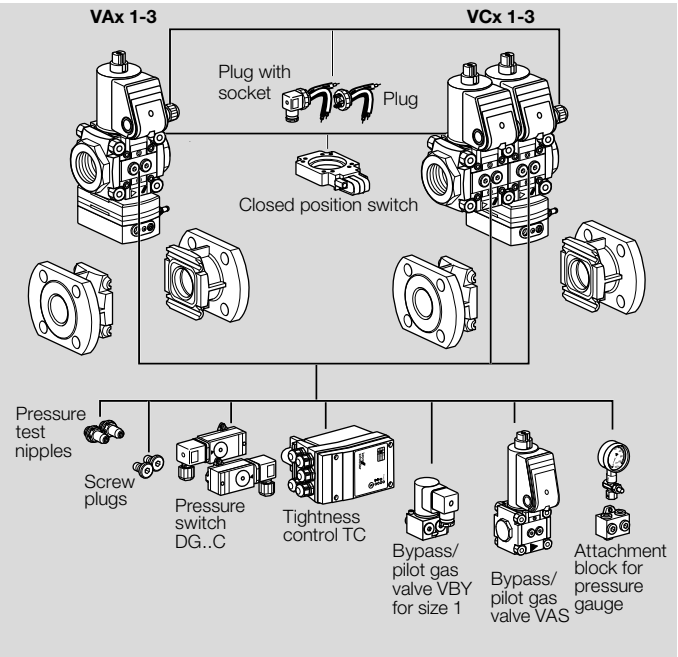
Air/gas ratio control on melting furnace for ensuring stoichiometric combustion over the entire capacity range



Aluminium age-hardening furnace with air/gas ratio controls for low air pressure protection

1.1 Configuring pressure regulators with solenoid valve VAx 1–3 or pressure regulators with double solenoid valve VCx 1–3

Threaded flange for pipe connections (Rp or NPT) from DN 15 to 65, flanged connection (ISO or ANSI) for sizes 2 and 3 for pipe connections DN 40 and 50.



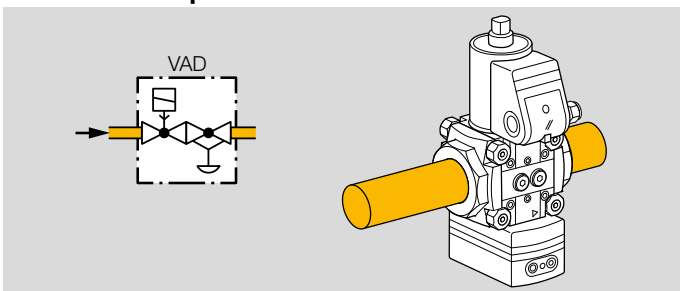
Modularly configurable with:

- Screw plugs
- Pressure test nipples
- Pressure switch DG..C for inlet and/or outlet pressure
- Tightness control TC
- Bypass/pilot gas valve VBY 8 for size 1
- Bypass/pilot gas valve VAS 1
- Attachment block for the connection of a pressure gauge, for example

For further information, see page 38 (7 Accessories).

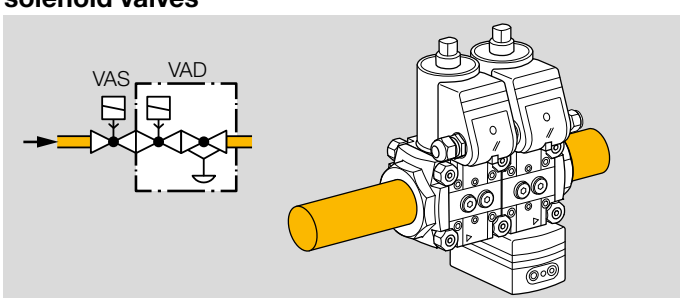
1.2 Application examples

1.2.1 Constant pressure control



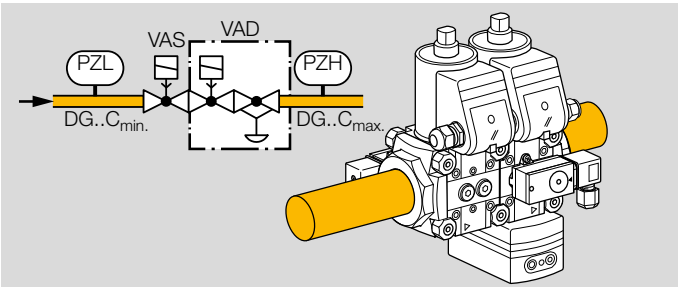
The pressure regulator with gas solenoid valve VAD maintains the set gas outlet pressure p_d constant when subject to differing flow rates. If a second gas solenoid valve is used upstream of the VAD, this complies with the requirements of EN 746-2 for two Class A gas solenoid valves connected in series.

1.2.2 Constant pressure control with two gas solenoid valves



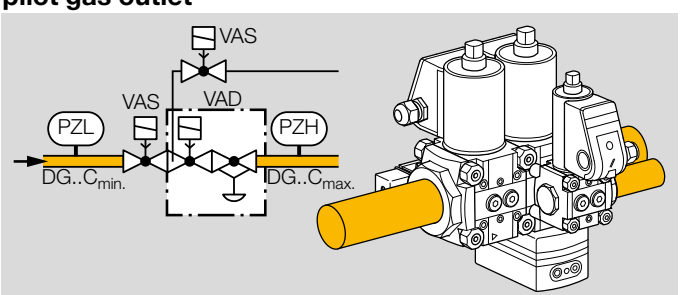
The pressure regulator with gas solenoid valve VAD maintains the set gas outlet pressure p_d constant when subject to differing flow rates.

1.2.3 Constant pressure control with max. pressure switch



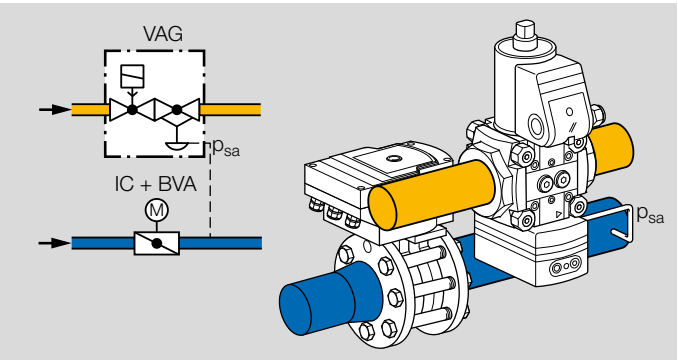
In this example, the minimum inlet pressure p_u and the maximum outlet pressure p_d are monitored with the pressure switches DG..C. The simple attachment of the pressure switch module makes installation easier.

1.2.4 Constant pressure control with non-controlled pilot gas outlet



In this application, the pilot burner is supplied with a high inlet pressure via the pilot gas outlet. The simple attachment of the bypass valve module makes installation easier. The minimum inlet pressure p_u and the maximum outlet pressure p_d are monitored with the pressure switches DG..C.

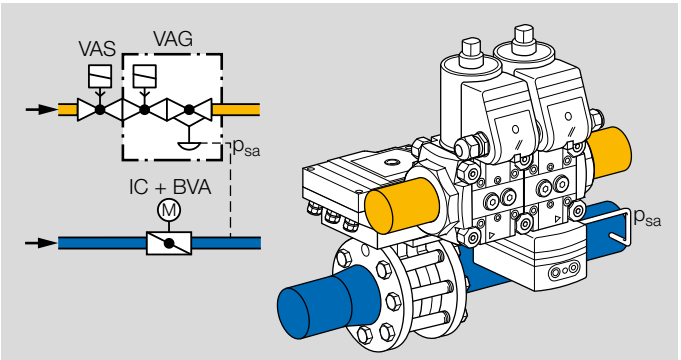
1.2.5 Modulating control



The gas outlet pressure p_d is controlled via the air/gas ratio control with gas solenoid valve VAG. The gas outlet pressure p_d follows the changing air control pressure p_{sa}. The ratio of gas pressure to air pressure remains constant. The VAG is suitable for a turndown up to 10:1.

If a second solenoid valve is used upstream of the VAG, this complies with the requirements of EN 746-2 for two Class A valves connected in series.

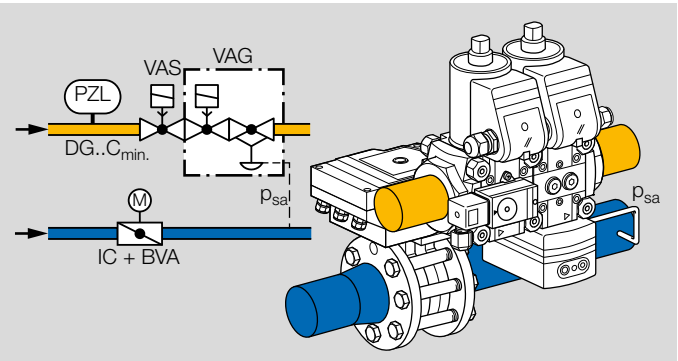
1.2.6 Modulating control with two gas solenoid valves



The gas outlet pressure p_d is controlled via the air/gas ratio control with gas solenoid valve VAG. The gas outlet pressure p_d follows the changing air control pressure p_{sa}. The ratio of gas pressure to air pressure remains constant. The VAG is suitable for a turndown up to 10:1.

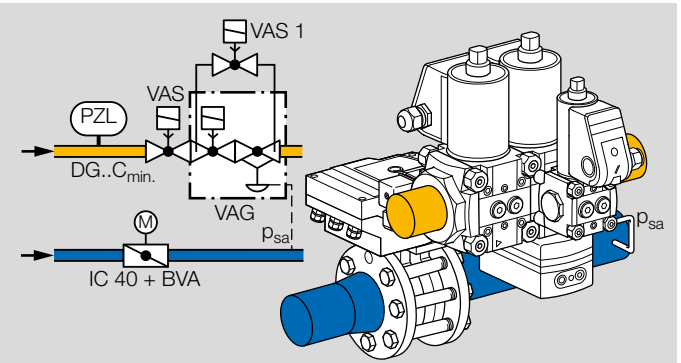
The gas line is shut off by two Class A valves connected in series, in accordance with the requirements of EN 746-2.

1.2.7 Modulating control with two gas solenoid valves and inlet pressure switch



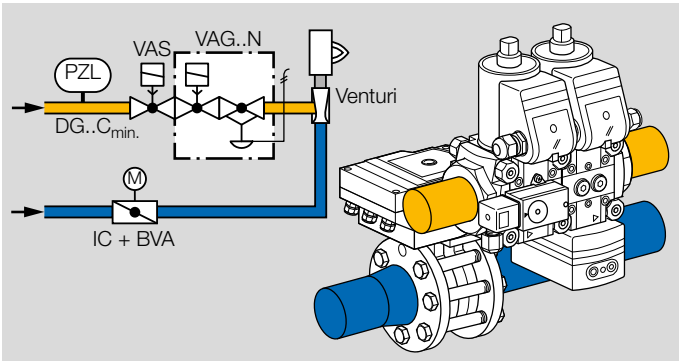
In this case, the minimum inlet pressure p_u is monitored by the pressure switch DG..C. The simple attachment of the pressure switch module makes installation easier.

1.2.8 High/Low control



At high fire, the gas outlet pressure p_d follows the air control pressure p_{sa}. The ratio of gas pressure to air pressure remains constant. The low-fire rate is determined by the bypass valve VAS 1. Here as well, the simple attachment of the bypass valve module makes installation easier.

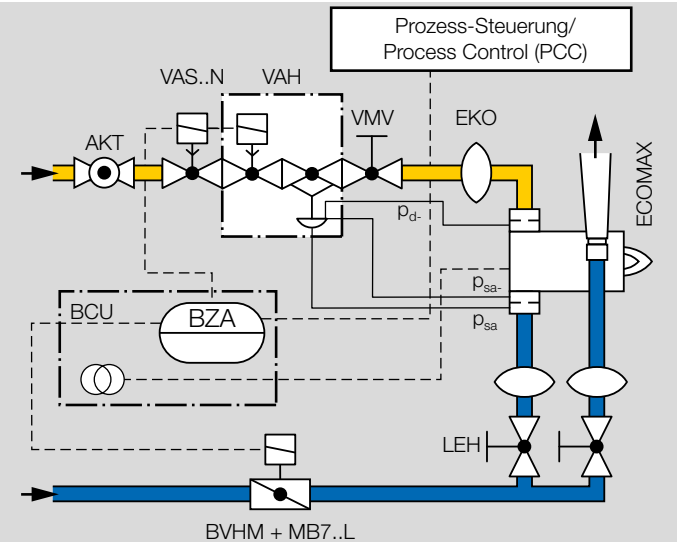
1.2.9 Zero pressure control



In this application, the control air pressure is the atmospheric air pressure. The air flow rate generates a negative pressure in the gas pipe via the Venturi. This negative pressure is compensated by the air/gas ratio control with gas solenoid valve VAG..N.

The greater the negative pressure, the greater the gas flow rate.

1.2.10 Staged flow rate control

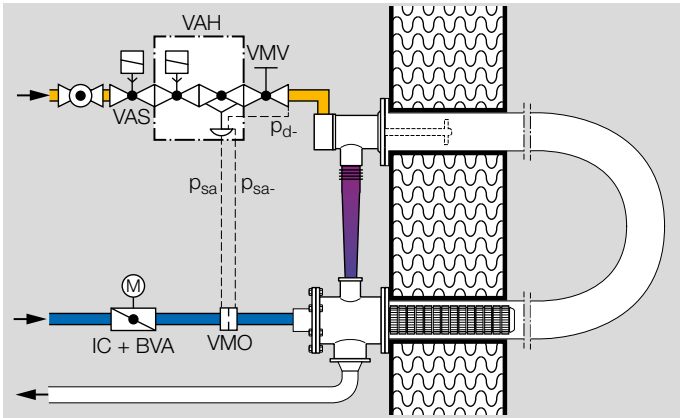


This application shows the VAH on a self-recuperative burner.

The pressure loss in the recuperator depends on the furnace or kiln temperature. When the furnace or kiln temperature is increased (at a constant air supply pressure), the flow rate drops. This change in the air flow rate is measured by the orifice and the VAH changes the gas volume accordingly.

The air index (lambda) can be set using the fine-adjusting valve VMV.

1.2.11 Continuous or staged flow rate control

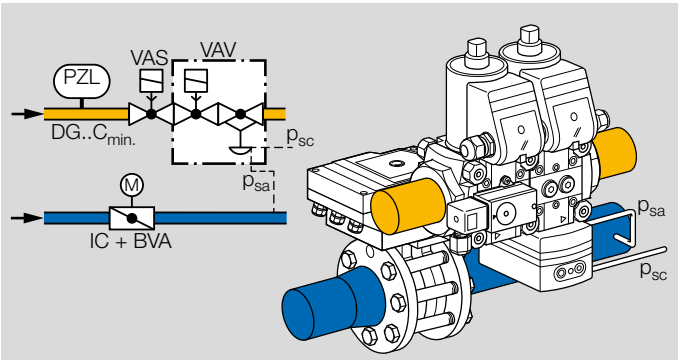


This application shows flow rate control for a tube firing burner system with plug-in recuperator for air preheating.

There are temperature-dependent air pressure losses in the recuperator. The ratio of gas pressure to air pressure does not remain constant. The fluctuating air flow rate is measured at the measuring orifice VMO and the VAH controls the gas flow rate proportionally.

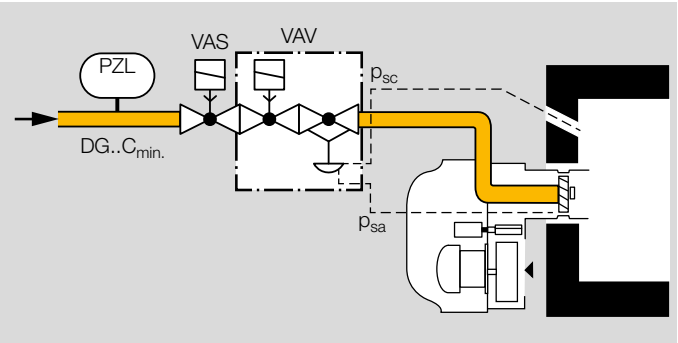
The air index (lambda) can be set using the fine-adjusting valve VMV.

1.2.12 Modulating control with variable air/gas ratio control with gas solenoid valve



The ratio of gas pressure to air pressure can be adjusted infinitely between 0.6:1 and 3:1. Pressure fluctuations in the combustion chamber can be compensated via the combustion chamber control pressure p_{sc}, see page 16 (3 Function).

1.2.13 Modulating control in residential heat generation



This application shows the variable air/gas ratio control with solenoid valve VAV fitted to a modulating-controlled forced draught burner.

The combustion air volume is set via a butterfly valve for air or by adjusting the fan speed.

2 Certification

2.1 Certificate download

Certificates – see www.docuthek.com

2.2 Declaration of conformity

CE

We, the manufacturer, hereby declare that the products VAD/VAG/VAV/VAH/VRH 1–3 with product ID No. CE-0063BO1580 comply with the requirements of the listed Directives and Standards.

Directives:

- 2014/35/EU – LVD
- 2014/30/EU – EMC
- 2011/65/EU – RoHS II
- 2015/863/EU – RoHS III

Regulation:

- (EU) 2016/426 – GAR

Standards:

- EN 161:2011+A3:2013
- EN 88-1:2011+A1:2016
- EN 126:2012
- EN 1854:2010

The relevant product corresponds to the tested type sample.

The production is subject to the surveillance procedure pursuant to Regulation (EU) 2016/426 Annex III paragraph 3.

Elster GmbH

2.3 SIL and PL

SIL PL

See page 52 (11 Safety-specific characteristic values for SIL and PL).

2.4 UKCA certified

UK CA

Gas Appliances (Product Safety and Metrology etc. (Amendment etc.) (EU Exit) Regulations 2019)

BS EN 88-1:2011
BBS EN 126:2012
BBS EN 161:2011+A3:2013

2.5 VAD, VAG, VAV, VAV: FM listed

Approval does not apply for 100 V AC and 200 V AC.

FM APPROVED

Factory Mutual (FM) Research Class: 7400 and 7411 Safety overpressure slam shut valves. Designed for applications pursuant to NFPA 85 and NFPA 86.

2.6 VAD, VAG: ANSI/CSA approved

Approval does not apply for 100 V AC and 200 V AC.

Canadian Standards Association – ANSI Z21.21 and CSA 6.5

2.7 VAD, VAG, VAV (120 V AC): UL listed

Underwriters Laboratories – UL 429 “Electrically operated valves”.

2.8 VAD, VAG, VAV: AGA listed

Approval does not apply for 100 V AC and 200 V AC.

Australian Gas Association, Approval No.: 5319.

2.9 Eurasian Customs Union

The products VAD, VAG, VAH, VAV, VCD, VCG, VCV, VCH meet the technical specifications of the Eurasian Customs Union.

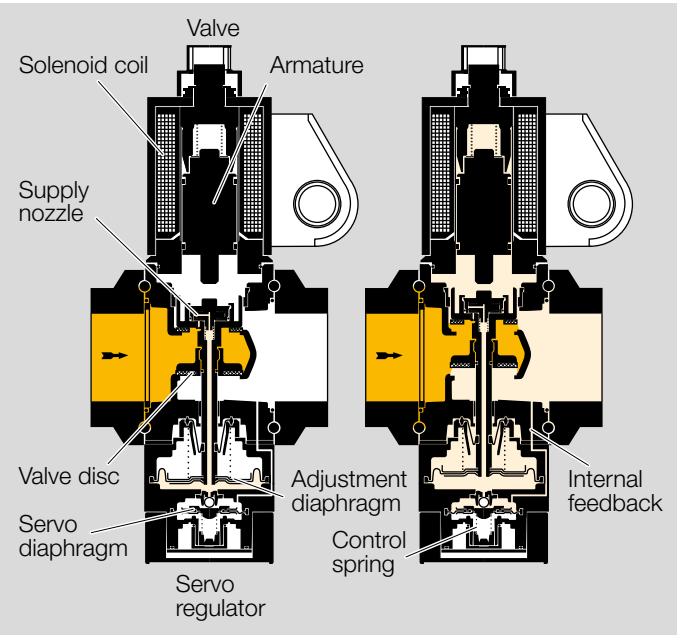
2.10 REACH Regulation

The device contains substances of very high concern which are listed in the Candidate List of the European REACH Regulation No. 1907/2006. See Reach list HTS at www.docuthek.com.

2.11 China RoHS

Directive on the restriction of the use of hazardous substances (RoHS) in China. Scan of the Disclosure Table China RoHS2, see certificates at www.docuthek.com.

3 Function

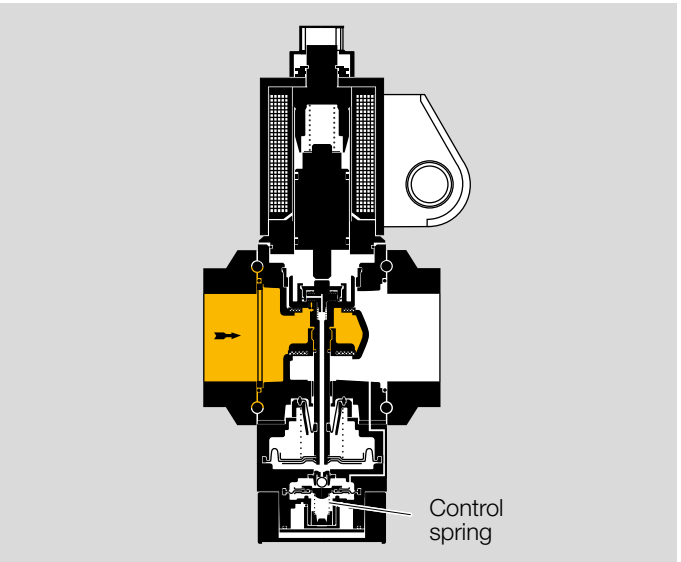


VAD, VAG, VAH, VRH, VAV

The regulator is closed when it is disconnected from the power supply.

Opening: connect the system to the electrical power supply (alternating voltage will be rectified). The blue LED lights up. The coil's magnetic field pulls the armature upwards and clears the supply nozzle for the gas inlet pressure p_u. The gas passes through the internal impulse tube to the adjustment diaphragm and then pushes the valve plate open. The outlet pressure is applied to the servo-diaphragm via the internal feedback. The servo regulator then maintains a set constant outlet pressure p_d.

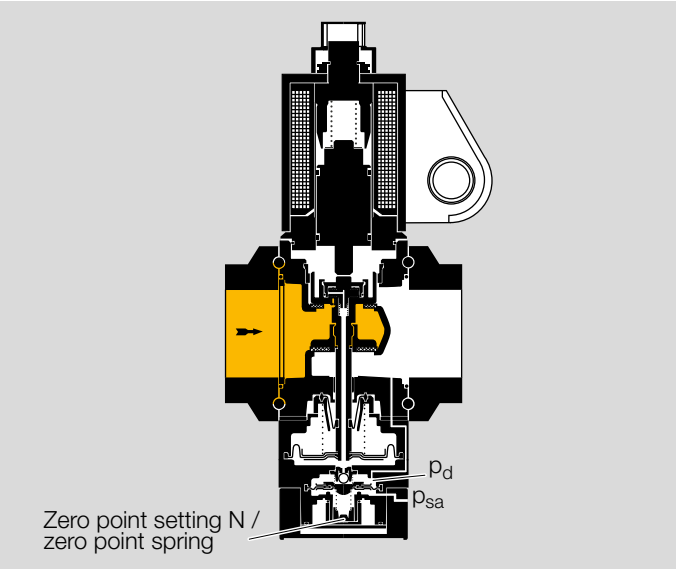
3.1 Pressure regulator for gas VAD



VAD

The nominal outlet pressure p_d is defined by the control spring.

3.2 Air/gas ratio control VAG



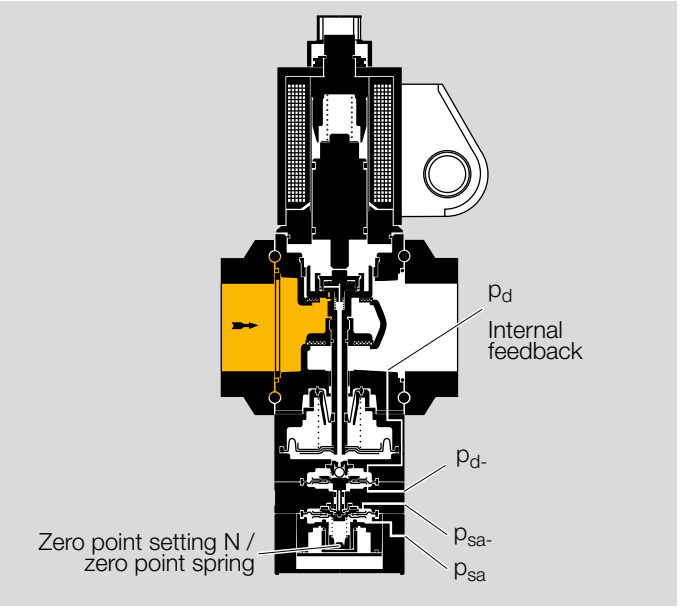
VAG

The air/gas ratio control VAG controls the outlet pressure p_d depending on the variable air control pressure p_{sa}.

The ratio of gas pressure to air pressure remains constant: 1:1. The VAG is suitable for a turndown up to 10:1.

If the burner operates at low-fire rate, the gas/air mixture can be changed by adjusting the zero point spring “N”.

3.3 Flow rate regulators VAH, VRH

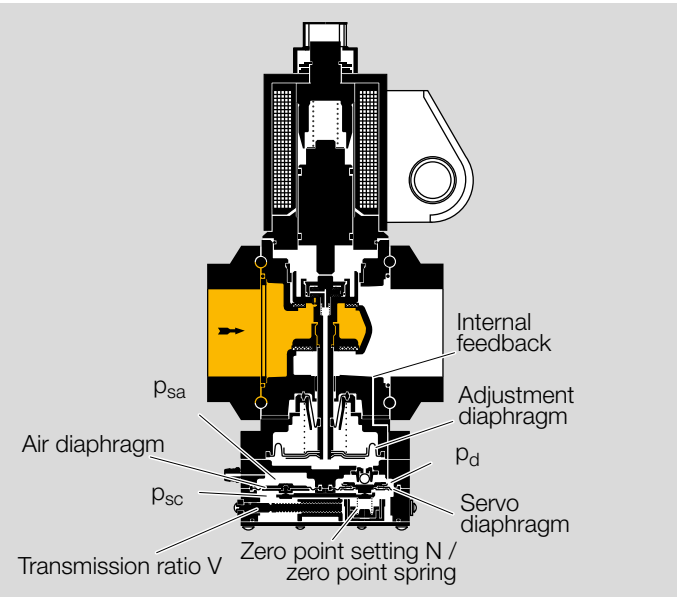


VAH (VRH: no valve)

The flow rate regulators VAH, VRH control the gas flow rate depending on the variable air flow rate. The ratio of gas flow rate to air flow rate remains constant. If the burner operates at low-fire rate, the gas/air mixture can be changed by adjusting the zero point spring “N”.

In addition, flow rate regulator VAH is designed as a gas solenoid valve and shuts off the gas or air supply safely.

3.4 Variable air/gas ratio control VAV



VAV

The servo regulator maintains a set constant outlet pressure p_d. The variable air/gas ratio control VAV controls the outlet pressure p_d depending on the variable air control pressure p_{sa}. The ratio of gas pressure to air pressure remains constant.

The settings N and V can be changed and read off from both sides of the unit using the adjusting screws.

The ratio of gas pressure to air pressure at low-fire rate can be changed by adjusting the zero point setting N. By turning the adjusting screw “N”, the force of the zero point spring and thus the zero point is changed by ± 1.5 mbar (0.6 "WC), see page 33 (6 Project planning information).

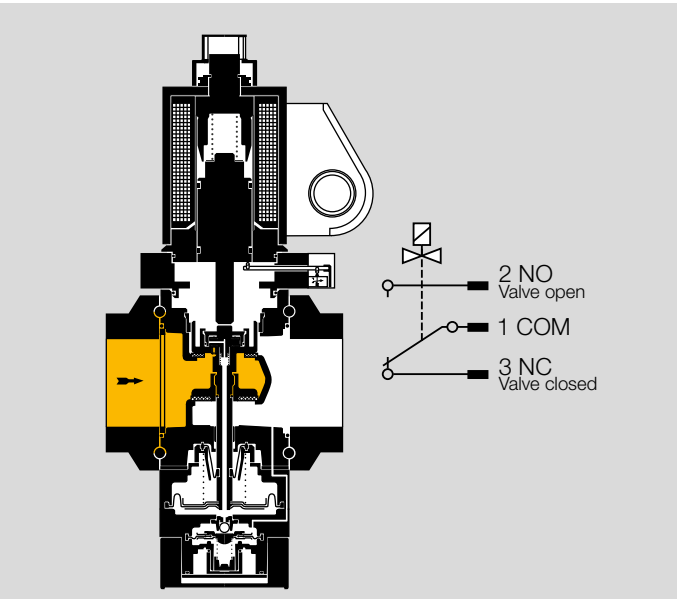
The high-fire rate is set by turning the adjusting screw “V” until the required flue gas values are achieved, see page 33 (6 Project planning information). The ratio of gas pressure to air pressure can be set from 0.6:1 to 3:1.

The settings N and V can influence each other and must be repeated if necessary.

The outlet pressure p_d is applied to the servo diaphragm via the internal feedback. The combustion chamber control pressure p_{sc} is transmitted to the space under the air and servo diaphragms via an impulse line.

The pressure differential p_{sa} - p_{sc} is achieved on the air diaphragm and the pressure differential p_d - p_{sc} on the servo diaphragm. This ensures that pressure fluctuations in the combustion chamber can be compensated. The flue gas values remain constant in the case of fluctuations in the combustion chamber pressure (p_d - p_{sc}) = (p_{sa} - p_{sc}) × V + N.

3.5 Pressure regulator with gas solenoid valve VAx..S and closed position indicator



VAx..S

Opening: when the pressure regulator is opened, the closed position indicator switches. The visual position indicator is activated. The “open” signal is marked in red. The double valve seat opens to release the volume of gas.

Closing: the pressure regulator VAx is disconnected from the voltage supply and the closing spring presses the double valve plate on to the valve seat. The closed position indicator switches. The visual position indicator is white for “closed”.

The actuator cannot be rotated on a pressure regulator with a closed position indicator.

NOTE: NFPA 86 – The safety shut-off valve VAS..S must be fitted with an overtravel switch with a visual position indicator, and the burner-side pressure regulator with gas solenoid valve VAx..S must be fitted with a closed position indicator. One gas solenoid valve must be verifiably closed. The closed position can be verified using the proof of closure switch of the gas solenoid valve VAS..S.

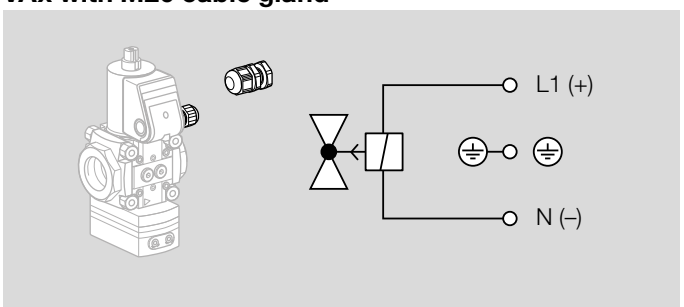
3.6 Connection diagram

Wiring to EN 60204-1.

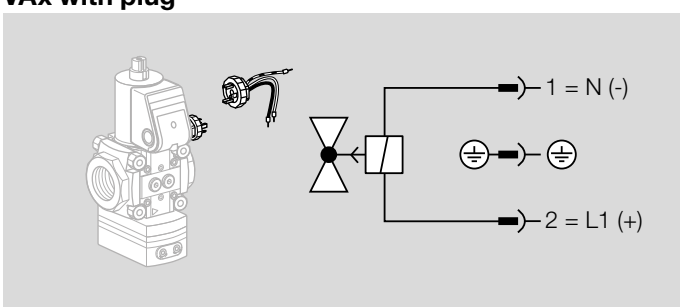
Connection diagram for VAx..S with closed position indicator, see page 19 (3.5 Pressure regulator with gas solenoid valve VAx..S and closed position indicator).

Further connection options, see Operating instructions VAD, VAG, VAV, VAH... at www.docuthek.com.

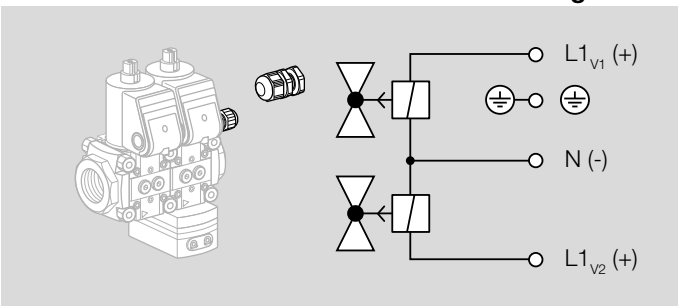
VAx with M20 cable gland



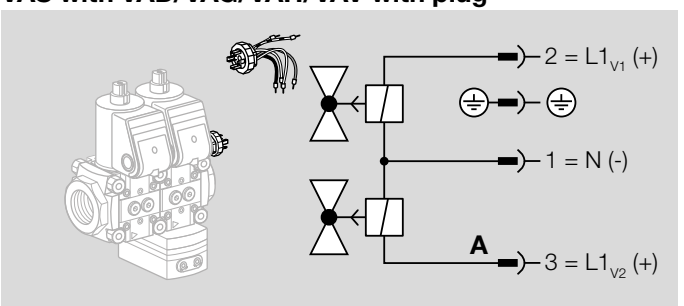
VAx with plug



VAS with VAD/VAG/VAH/VAV with M20 cable gland



VAS with VAD/VAG/VAH/VAV with plug

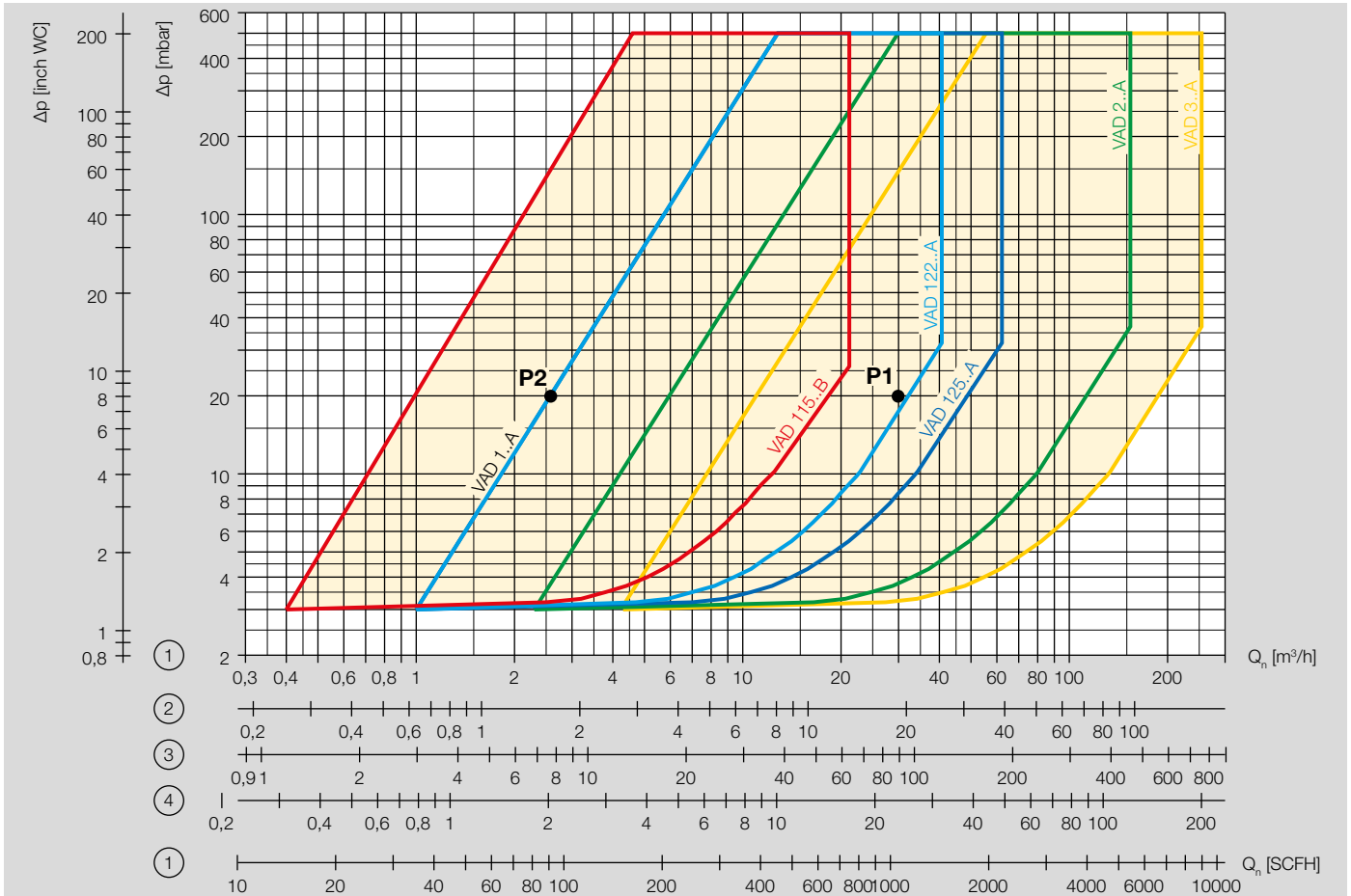


4 Flow rate

4.1 Calculating the nominal size

A web app for calculating the nominal size is available at www.adlatus.org.

4.2 VAD



1 = natural gas (ρ = 0.80 kg/m³)
2 = propane (ρ = 2.01 kg/m³)
3 = hydrogen (ρ = 0.09 kg/m³)
4 = air (ρ = 1.29 kg/m³)

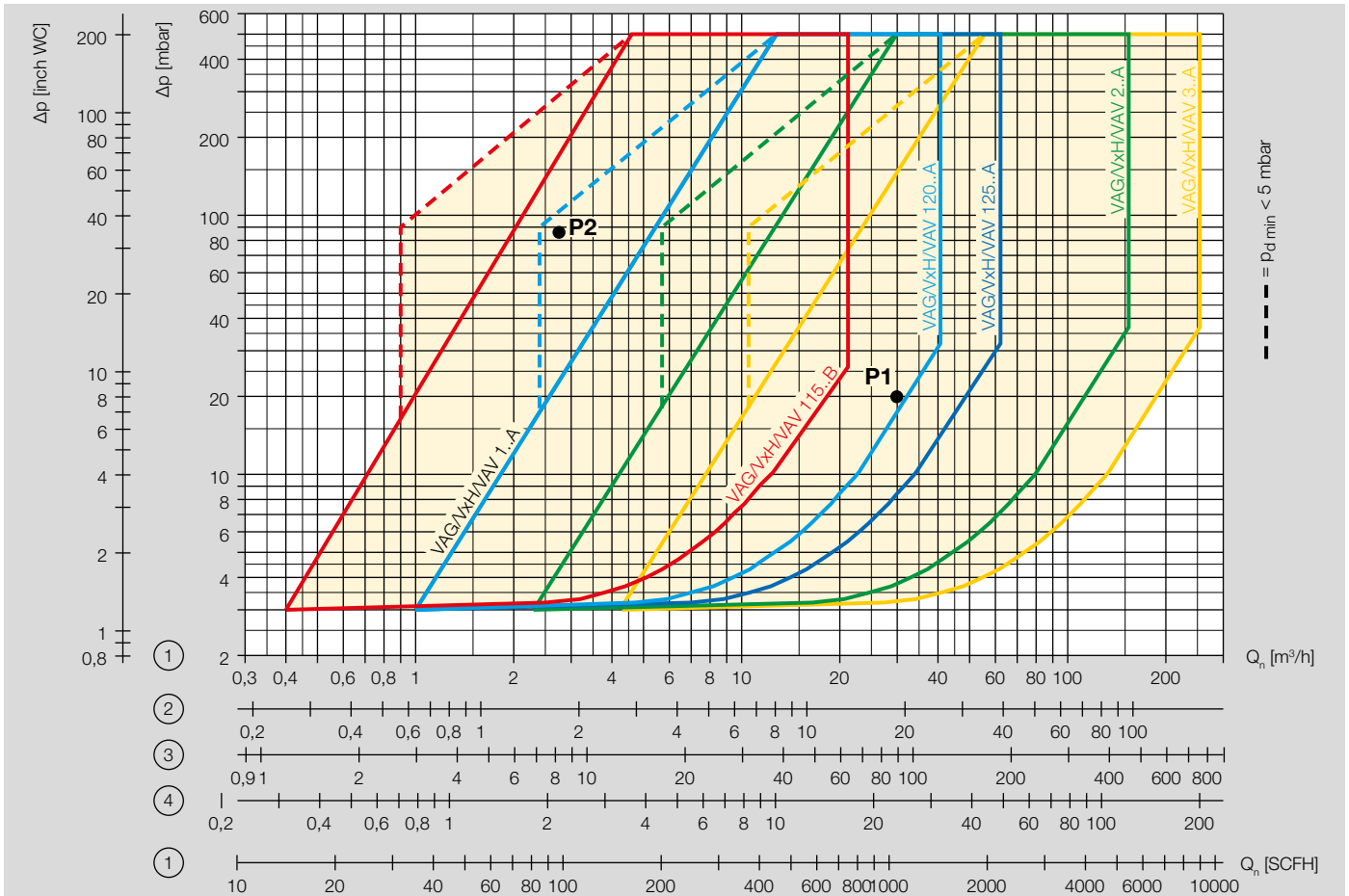
The characteristic flow rate curves have been measured with the specified flanges and a fitted strainer. If two or more valves are combined, the pressure loss of each additional valve drops by approx. 5%.

Selection example for VAD

Gas type: natural gas
Inlet pressure p_u = 80 mbar
Outlet pressure p_d = 60 mbar
Desired control ratio from high-fire to low-fire rate R_V = 10:1
High-fire rate: $\Delta p = p_u - p_d$ = 20 mbar -> point P1
Low-fire rate: -> point P2: $Q_{min.}$ = 2.6 m^3/h for Δp = 20 mbar
$R_V = Q_{max.} / Q_{min.}$ = 11.5:1

Point P1 and point P2 must be within the working range of a unit size. We recommend that you select the smallest size to achieve the best control properties.

4.3 VAG, VAH, VRH, VAV



1 = natural gas (ρ = 0.80 kg/m³)
2 = propane (ρ = 2.01 kg/m³)
3 = hydrogen (ρ = 0.09 kg/m³)
4 = air (ρ = 1.29 kg/m³)

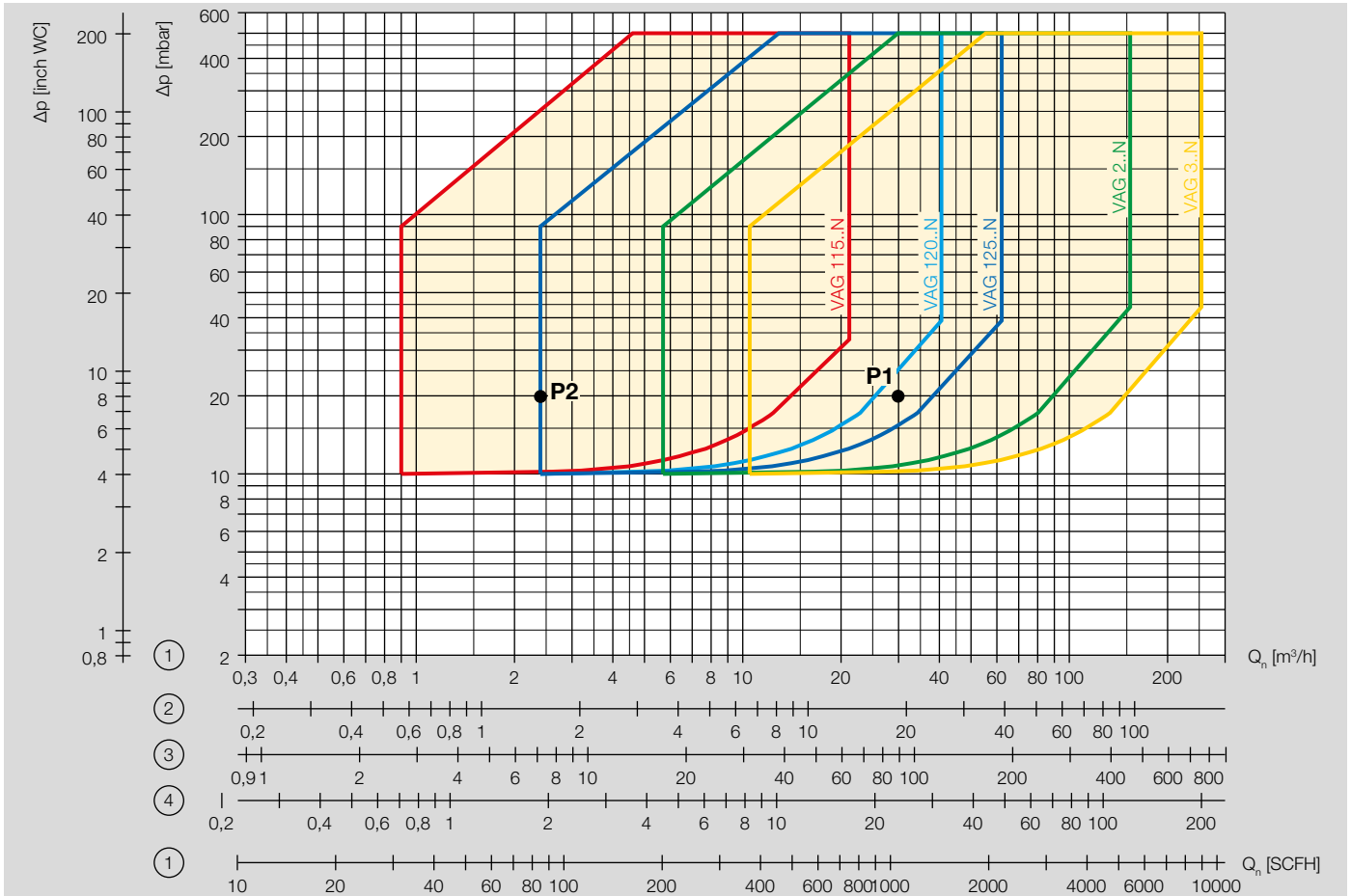
The characteristic flow rate curves have been measured with the specified flanges and a fitted strainer. If two or more valves are combined, the pressure loss of each additional valve drops by approx. 5%.

Selection example for VAG, VAH, VRH, VAV

Gas type: natural gas
Flow rate $Q_{max.}$ = 30 m^3/h
Inlet pressure p_u = 80 mbar
Outlet pressure $p_{d\,max.}$ VAG = 60 mbar
Desired control ratio from high-fire to low-fire rate R_V = 10:1
High-fire rate: $\Delta p = p_u - p_d$ = 20 mbar -> point P1
Low-fire rate: $p_{d\,min.} = p_{d\,max.} / R_V^2$ = 0.6 mbar
$Q_{min.} = Q_{max.} / R_V$ = 3 m^3/h
$\Delta p = p_u - p_{d\,min.}$ = 79.4 mbar
-> point P2, selected: VAG 120..A

Point P1 and point P2 must be within the working range of a unit size. We recommend that you select the smallest size to achieve the best control properties.

4.4 Zero governor VAG..N



1 = natural gas (ρ = 0.80 kg/m³)
2 = propane (ρ = 2.01 kg/m³)
3 = hydrogen (ρ = 0.09 kg/m³)
4 = air (ρ = 1.29 kg/m³)

The characteristic flow rate curves have been measured with the specified flanges and a fitted strainer. If two or more valves are combined, the pressure loss of each additional valve drops by approx. 5%.

Selection example for VAG..N

Gas type: natural gas
Flow rate $Q_{max.}$ = 30 m^3/h
Inlet pressure p_u = 20 mbar
Outlet pressure $p_{d\,max.}$ = 0 mbar (atmospheric pressure)
Desired control ratio from high-fire to low-fire rate R_V = 10:1
High-fire rate: $\Delta p = p_u - p_d$ = 20 mbar -> point P1
Low-fire rate: -> point P2: $Q_{min.}$ = 2.4 m^3/h for Δp = 20 mbar
$R_V = Q_{max.} / Q_{min.}$ = 12.3:1

Point P1 and point P2 must be within the working range of a unit size. We recommend that you select the smallest size to achieve the best control properties.

4.4.1 Calculating the nominal size

A web app for calculating the nominal size is available at www.adlatus.org.

5 Selection

5.1 ProFi

A web app selecting the correct product is available at www.adlatus.org.

5.2 VAD selection table

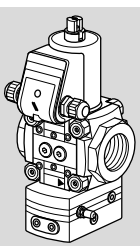
Option	VAD 115	VAD 120, VAD 125	VAD 240	VAD 350
DN – inlet	15, 20, 25	15, 20, 25	25, 32, 40, 50	40, 50, 65
DN – outlet	15, 20, 25	15, 20, 25	40	50
Pipe connection	R, N	R, N	R, N, F	R, N, F
Opening properties	/N	/N	/N	/N
Mains voltage	W, Y, Q, P, K	W, Y, Q, P, K	W, Y, Q, P, K	W, Y, Q, P, K
Feedback[1)]	S, G	S, G	S, G	S, G
Viewing side	R, L	R, L	R, L	R, L
Electrical connection	M20, plug, plug with socket	M20, plug, plug with socket	M20, plug, plug with socket	M20, plug, plug with socket
Outlet pressure p_d	-25, -50, -100	-25, -50, -100	-25, -50, -100	-25, -50, -100
Valve seat	B	A	A	A
Accessories, right	Screw plug, test nipple, DG 17–300[2)], VBY[1)], VAS 1	Screw plug, test nipple, DG 17–300[2)], VBY[1)], VAS 1	Screw plug, test nipple, DG 17–300[2)], VAS 1[1)]	Screw plug, test nipple, DG 17–300[2)], VAS 1[1)]
Accessories, left	Screw plug, test nipple, DG 17–300[2)], VBY[1)],VAS 1	Screw plug, test nipple, DG 17–300[2)], VBY[1)], VAS 1	Screw plug, test nipple, DG 17–300[2)], VAS 1[1)]	Screw plug, test nipple, DG 17–300[2)], VAS 1[1)]

[1)] Closed position indicator and bypass/pilot gas valve cannot be fitted together on the same side.

[2)] Specify the test point for inlet pressure p_u or outlet pressure p_d.

Order example

VAD 240R/NW-100A



5.3 VAG, VAH, VAV selection table

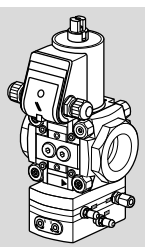
Option	VAG/VAH/VAV 115	VAG/VAH/VAV 120, VAD/VAH/VAV 125	VAG/VAH/VAV 240	VAG/VAH/VAV 350
DN – inlet	–, 15, 20, 25	–, 15, 20, 25	–, 25, 32, 40, 50	–, 40, 50, 65
DN – outlet	15, 20, 25	15, 20, 25	40	50
Pipe connection	R, N	R, N	R, N, F	R, N, F
Opening properties	/N	/N	/N	/N
Mains voltage	W, Y, Q, P, K	W, Y, Q, P, K	W, Y, Q, P, K	W, Y, Q, P, K
Feedback[1)]	S, G	S, G	S, G	S, G
Viewing side	R, L	R, L	R, L	R, L
Electrical connection	M20, plug, plug with socket	M20, plug, plug with socket	M20, plug, plug with socket	M20, plug, plug with socket
Valve seat	B	A	A	A
Connection kit for VAG	E, K, A, N	E, K, A, N	E, K, A, N	E, K, A, N
Connection kit for VAH	E, A	E, A	E, A	E, A
Connection kit for VAV	E, K, A	E, K, A	E, K, A	E, K, A
Accessories, right	Screw plug, test nipple, DG 17–300[2)], VBY[1)], VAS 1	Screw plug, test nipple, DG 17–300[2)], VBY[1)], VAS 1	Screw plug, test nipple, DG 17–300[2)], VAS 1[1)]	Screw plug, test nipple, DG 17–300[2)], VAS 1[1)]
Accessories, left	Screw plug, test nipple, DG 17–300[2)], VBY[1)], VAS 1	Screw plug, test nipple, DG 17–300[2)], VBY[1)], VAS 1	Screw plug, test nipple, DG 17–300[2)], VAS 1[1)]	Screw plug, test nipple, DG 17–300[2)], VAS 1[1)]

[1)] Closed position indicator and bypass/pilot gas valve cannot be fitted together on the same side.

[2)] Specify the test point for inlet pressure p_u or outlet pressure p_d.

Order example

VAG 240R/NWAE

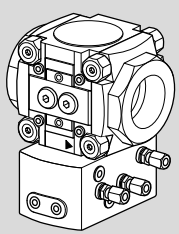


5.4 VRH selection table

Option	VRH 115	VRH 120, VRH 125	VRH 240	VRH 350
DN – inlet	-, 15, 20, 25	-, 15, 20, 25	-, 25, 32, 40, 50	-, 40, 50, 65
DN – outlet	15, 20, 25	15, 20, 25	40	50
Pipe connection	R, N	R, N	R, N, F	R, N, F
Inlet pressure p_u	05	05	05	05
Valve seat	B	A	A	A
Connection kit	E, A	E, A	E, A	E, A
Accessories, right	Screw plug, test nipple	Screw plug, test nipple	Screw plug, test nipple	Screw plug, test nipple
Accessories, left	Screw plug, test nipple	Screw plug, test nipple	Screw plug, test nipple	Screw plug, test nipple

Order example

VRH 240R05AE/PP/PP



5.5 Type code

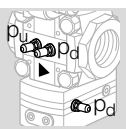
VAD	Pressure regulator with solenoid valve
VAG	Air/gas ratio control with solenoid valve
VAH	Flow rate regulator with solenoid valve
VAV	Variable air/gas ratio control with solenoid valve
VRH	Flow rate regulator
1-3	Sizes
15–50	Inlet and outlet flange nominal size
R	Rp internal thread
F	Flange to ISO 7005
/N	Quick opening, quick closing
W	Mains voltage 230 V AC, 50/60 Hz
Y	Mains voltage 200 V AC, 50/60 Hz
Q	Mains voltage 120 V AC, 50/60 Hz
P	Mains voltage 100 V AC, 50/60 Hz
K	Mains voltage 24 V DC
SR	Closed position switch with visual position indicator, right
SL	Closed position switch with visual position indicator, left
GR	Closed position switch for 24 V and visual position indicator, right
GL	Closed position switch for 24 V and visual position indicator, left
-25	Outlet pressure p_d for VAD: 2.5–25 mbar
-50	Outlet pressure p_d for VAD: 20–50 mbar
-100	Outlet pressure p_d for VAD: 35–100 mbar
A	Standard valve seat
B	Reduced valve seat
E	VAG, VAV, VAH, VRH: connection for air control pressure: compression fitting
K	VAG, VAV: connection for air control pressure: plastic hose coupling
A	VAG, VAV, VAH, VRH: connection for air control pressure: 1/8" NPT adapter
N	VAG: zero governor
	VRH: no solenoid valve

6 Project planning information

6.1 Test points

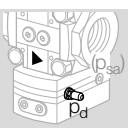
For further information on outlet pressure, air control pressure and combustion chamber control pressure, see page 46 (8 Technical data).

The inlet pressure p_u and the outlet pressure p_d can be measured on both sides of the valve body.



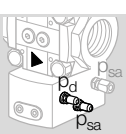
To increase the control accuracy, an external impulse line can be connected, instead of pressure test point p_d.

VAD



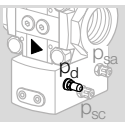
Test point for the gas outlet pressure p_d on the regulator body. A combustion chamber control line (p_{sc}) can be connected to connection p_{sa} for maintaining a constant burner capacity.

VAG



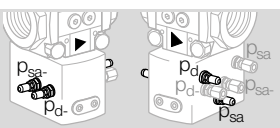
Additional test point for the air control pressure p_{sa} on the regulator body. For burners which are operated with excess air, the values for p_d and p_{sa} may be below the limit. No situation which would jeopardize safety must arise. Avoid CO formation.

VAV



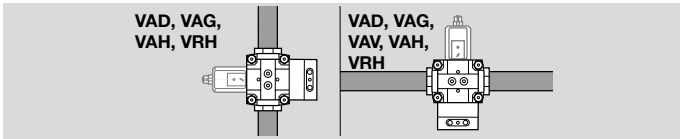
Test point for the outlet pressure p_d on the regulator body.

VAH



Additional test points for the outlet pressure p_{d-} and the air control pressure p_{sa}/p_{sa-} on the regulator body. A gas/air mixture may be applied at the p_{sa-} connection for the air control pressure.

6.2 Installation

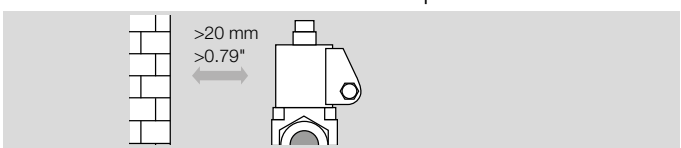


Sealing material and thread cuttings must not be allowed to get into the valve housing. Install a filter upstream of every system.

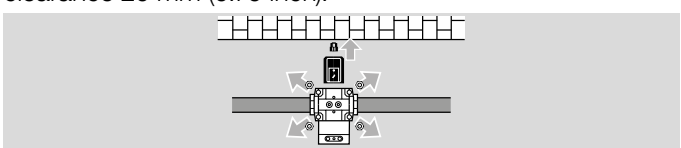
Always install an activated carbon filter upstream of the regulator when air is the medium. Otherwise, the ageing of elastomer materials will be accelerated.

The pipe system must be designed in such a way so as to avoid strain at the connections.

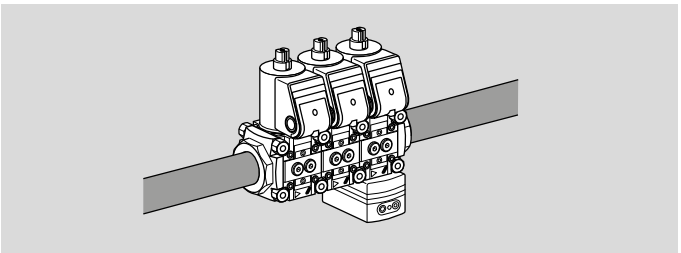
Do not store or install the unit in the open air.



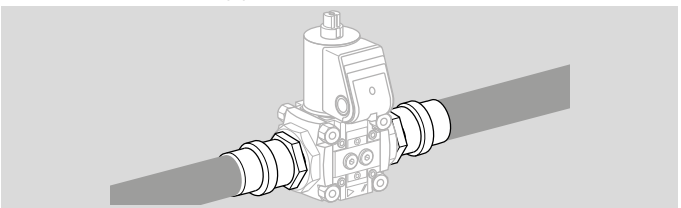
The device must not be in contact with masonry. Minimum clearance 20 mm (0.79 inch).



Ensure that there is sufficient space for installation, adjustment and maintenance work. Minimum clearance of 25 cm (9.8 inch) above the black solenoid actuator.



If more than three valVario controls are installed in line, the controls must be supported.



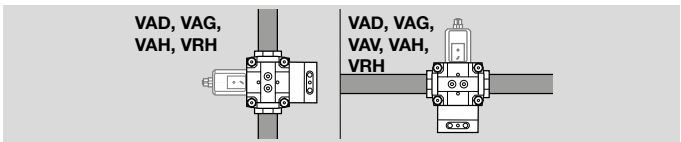
The seals in some gas compression fittings are approved for temperatures of up to 70°C (158°F). This temperature limit will not be exceeded if the flow through the pipe is at least 1 m^3/h (35.31 SCFH) of gas and the maximum ambient temperature is 50°C (122°F).

In the case of a VCx combination, it is recommended to always install the bypass/pilot gas valve on the rear of the second valve and the tightness control on the viewing side of the first valve, together with the connection box.

6.2.1 Installation position

VAD, VAG, VAH: black solenoid actuator in the vertical upright position or tilted up to the horizontal, not upside down.
VRH: in the vertical upright position or tilted up to the horizontal, not upside down.

VAV: Installation in the vertical position only, black solenoid actuator in the vertical upright position.

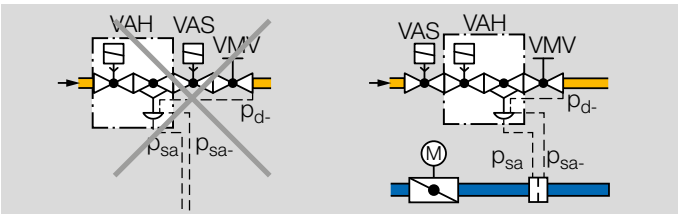


For VAG/VAH/VRH in the horizontal position with modulating control: min. inlet pressure $p_{u\ min.}$ = 80 mbar (32 "WC).

To ensure that the air/gas ratio control VAG, the flow rate regulator VAH, VRH or the variable air/gas ratio control VAV can react quickly when the load is changed, the impulse line for the air control pressure p_{sa} and for VAV, the impulse line for the combustion chamber control pressure p_{sc} should be kept as short as possible. The tube internal diameter for the impulse line must always be ≥ 3.9 mm (0.15").

VAH, VRH

It is not permitted to install a gas solenoid valve VAS downstream of flow rate regulator VAH, VRH and upstream of fine-adjusting valve VMV. The VAS would no longer be able to perform its function as a second safety valve if installed in the above-mentioned position.



The measuring orifice in the air line for impulse lines p_{sa} and p_{sa-} must always be installed downstream of the air control valve.

VAV

The impulse line for the combustion chamber control pressure p_{sc} must be fitted so that no condensation can enter the pressure regulator, but rather flows back into the combustion chamber.

6.3 Setting the low-fire rate on VAG, VAH, VRH, VAV

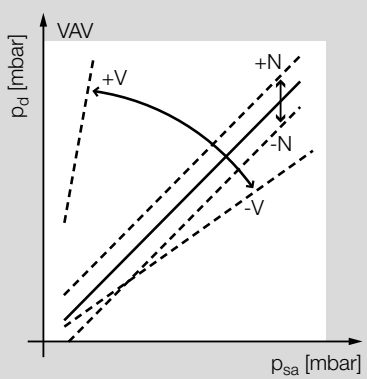


VAG, VAH, VRH VAV

If the burner operates at low-fire rate, the gas/air mixture can be changed using the parallel shift of the characteristic curve by turning the adjusting screw “N”.

Adjusting range at low fire:
VAG, VAH, VRH: -5 to +5 mbar (-1.95 to +1.95 "WC).
VAV: -1.5 to +1.5 mbar (-0.6 to +0.6 "WC).

6.4 Setting the high-fire rate on VAV



To set the high-fire rate, the transmission ratio is changed using the adjusting screw “V” until the required flue gas values are achieved.

Transmission ratio:
$V = p_d:p_{sa}$ = 0,6:1 to 3:1.

The settings N and V can influence each other and must be repeated if necessary.

Calculation

With connection to the combustion chamber control pressure p_{sc}:
$(p_d - p_{sc}) = V \times (p_{sa} - p_{sc}) + N$

If the combustion chamber control pressure p_{sc} is not connected:
$p_d = V \times p_{sa} + N$

6.5 Hydrogen



Other hydrogen-compatible products can be found here: Technical Information, Products for hydrogen.

6.6 Electrical connection

Use temperature-resistant cable (> 90°C) for the electrical connection.



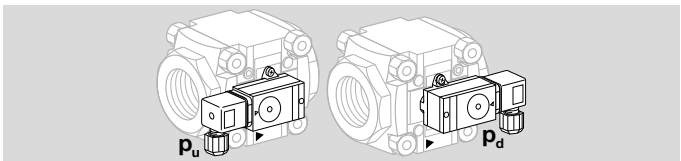
The solenoid actuator heats up during operation. Surface temperature approx. 85°C (185°F) pursuant to EN 60730-1.

In the case of double solenoid valves, the position of the connection box can only be changed by removing the actuator and reinstalling it rotated by 90° or 180°. The solenoid actuator cannot be rotated on solenoid valves with proof of closure switch VCx..S or VCx..G.

7 Accessories

7.1 Pressure switch for gas DG..C

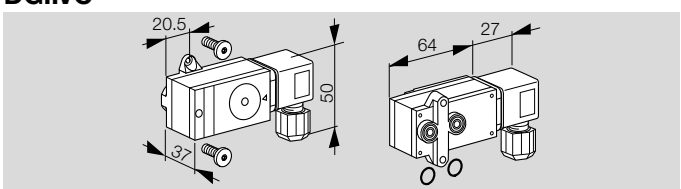
Monitoring the inlet pressure p_u: the electrical plug of the pressure switch for gas points towards the inlet flange.
Monitoring the outlet pressure p_d: the electrical plug of the pressure switch for gas points towards the outlet flange.



Scope of delivery:
1 x pressure switch for gas,
2 x retaining screws,
2 x sealing rings.

Also available with gold-plated contacts for voltages of 5 to 250 V.

DG..VC

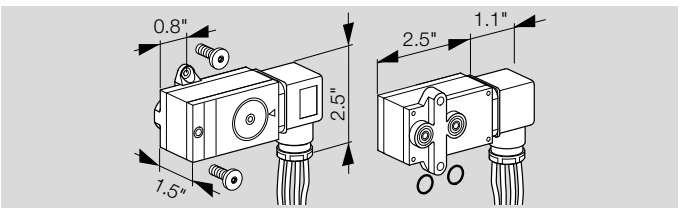


Type	Adjusting range [mbar]	Order No.
DG 17VC	2 to 17	75455241
DG 40VC	5 to 40	75455243
DG 45VC	10 to 45	75455244
DG 110VC	30 to 110	75455245
DG 300VC	100 to 300	75455246

Type	Adjusting range [mbar]	Order No.
With gold-plated contacts for voltages of 5 to 250 V		
DG 17VC..G	2 to 17	75455247
DG 40VC..G	5 to 40	75455249
DG 45VC..G	10 to 45	75455250
DG 110VC..G	30 to 110	75455251
DG 300VC..G	100 to 300	75455252

DG..VCT

With AWG 18 connection conductors



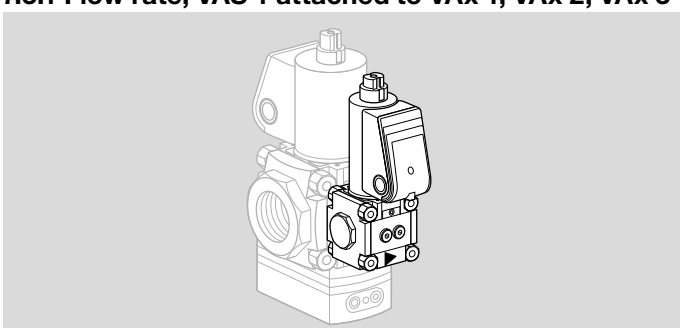
Type	Adjusting range ["WC]	Order No.
DG 17VCT	0,8 to 6,8	75454583
DG 40VCT	2 to 16	74214174
DG 110VCT	12 to 44	75454585
DG 300VCT	40 to 120	75454586
With gold-plated contacts for voltages of 5 to 250 V		
DG 17VCT..G	0,8 to 6,8	75454587
DG 40VCT..G	2 to 16	75454588
DG 110VCT..G	12 to 44	75454589
DG 300VCT..G	40 to 120	75454590

7.2 DG..C fastening set for VAx 1–3

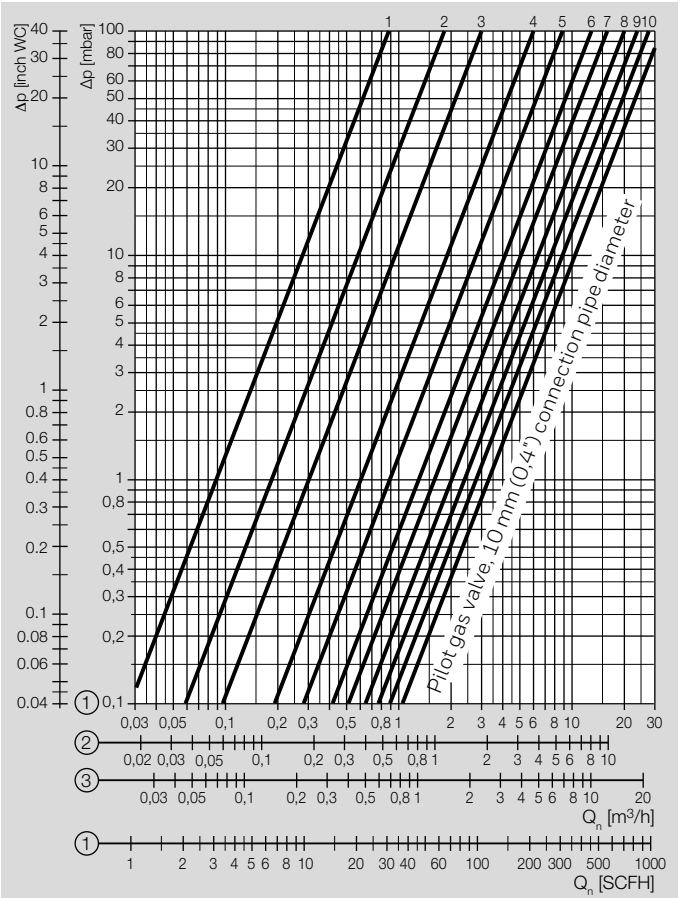
Order No.: 74922376,
scope of delivery:
2 x retaining screws,
2 x sealing rings.

7.3 Bypass/pilot gas valve VAS 1

7.3.1 Flow rate, VAS 1 attached to VAx 1, VAx 2, VAx 3

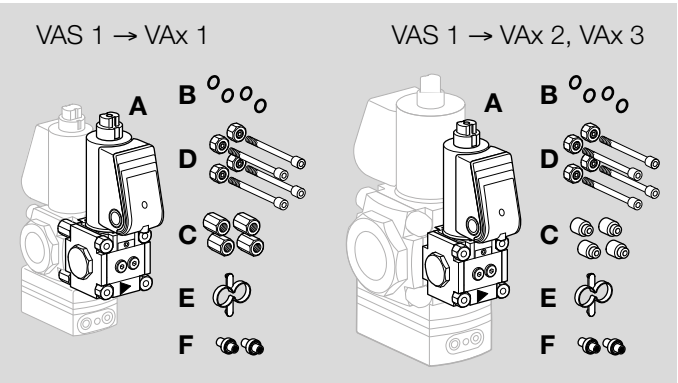


The characteristic flow rate curves have been measured for bypass valve VAS 1 with connection pipe diameter 1 to 10 mm (0.04–0.4") and for the pilot gas valve with 10 mm connection pipe.



1 = natural gas (ρ = 0.80 kg/m³)
2 = propane (ρ = 2.01 kg/m³)
3 = air (ρ = 1.29 kg/m³)

7.3.2 Scope of delivery of VAS 1 for VAx 1, VAx 2, VAx 3



A 1 x bypass/pilot gas valve VAS 1,
B 4 x O-rings,
C 4 x double nuts for VAS 1 –> VAx 1,
C 4 x spacer sleeves for VAS 1 –> VAx 2/VAx 3,
D 4 x connection parts,
E 1 x mounting aid.

Pilot gas valve VAS 1:
F 1 x connection pipe, 1 x sealing plug, if the pilot gas valve has a threaded flange on the outlet side.

Bypass valve VAS 1:
F 2 x connection pipes, if the bypass valve has a blind flange on the outlet side.
Standard: Ø 10 mm.

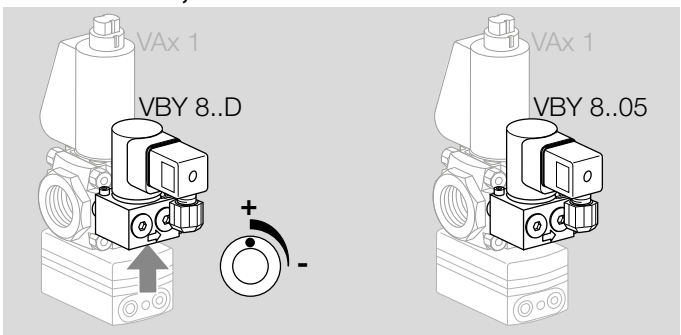
Other connection pipes (**F**) with bypass diameter as of 1 mm are available.

Ø	Order No.
1 mm	74923877

Ø	Order No.
2 mm	74923910
3 mm	74923911
4 mm	74923912
5 mm	74923913
6 mm	74923914
7 mm	74923915
8 mm	74923916
9 mm	74923917
10 mm	74923918

7.4 Bypass/pilot gas valve VBY 8

7.4.1 Flow rate, VBY



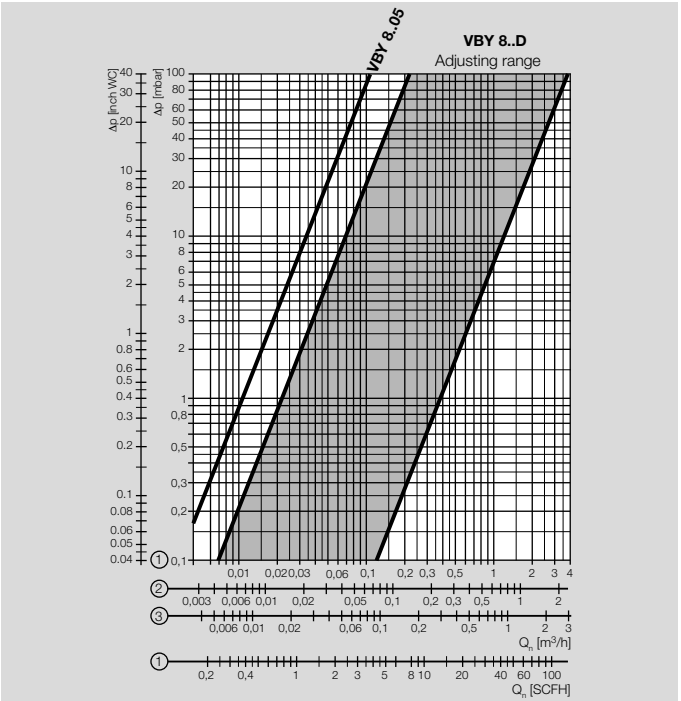
VBY 8..D

The flow rate can be set by turning the flow rate restrictor (4 mm/0.16" hexagon socket) ¼ of a turn. Flow rate: 10 to 100%.

» Only adjust the flow rate restrictor in the marked range; otherwise, the required gas volume will not be reached.

VBY 8..05

The flow is routed through a 0.5 mm (0.02") nozzle and thus has a fixed characteristic flow rate curve. Adjustment is not possible.



1 = natural gas (ρ = 0.80 kg/m³)
2 = propane (ρ = 2.01 kg/m³)
3 = air (ρ = 1.29 kg/m³)

7.4.2 Technical data VBY 8

Inlet pressure $p_{u\,max}$: 500 mbar (7 psig).

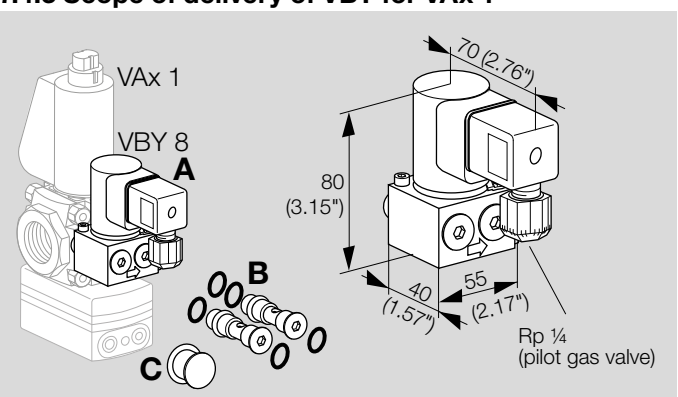
Ambient temperature:
0 to +60 °C (32 to 140 °F), no condensation permitted.

Storage temperature:
0 to +40 °C (32 to 104 °F).

Power consumption:
24 V DC = 8 W,
120 V AC = 8 W,
230 V AC = 9,5 W.

Enclosure: IP 54.

7.4.3 Scope of delivery of VBY for VAx 1



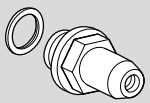
Scope of delivery of VBY 8I as bypass valve
A 1 x bypass valve VBY 8I,
B 2 x retaining screws with 4 x O-rings: both retaining screws have a bypass orifice,
C grease for O-rings.

Scope of delivery of VBY 8R as a pilot gas valve
A 1 x pilot gas valve VBY 8R,
B 2 x retaining screws with 5 x O-rings: one retaining screw has a bypass orifice (2 x O-rings), the other does not (3 x O-rings),
C grease for O-rings.

7.4.4 Type code

VBY	Gas valve
8	Nominal size
I	For internal gas pick-up as bypass valve
R	For external gas pick-up as pilot gas valve
Q	Mains voltage 120 V AC, 50/60 Hz
K	Mains voltage 24 V DC
W	Mains voltage 230 V AC, 50/60 Hz
6L	Electrical connection via plug and socket with LED
-R	Attachment side of main valve: right
-L	Attachment side of main valve: left
B	Enclosed (separate packing unit)
05	Nozzle: 0.5 mm
D	With flow adjustment

7.5 Pressure test nipples



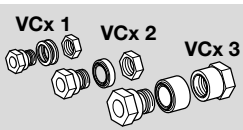
Scope of delivery

1 x test nipple with 1 x profiled sealing ring,
Rp 1/4: Order No. 74923390.

1 x test nipple (steel) with 1 x profiled sealing ring (Viton),
1/4 NPT: Order No. 74921869.

7.6 Cable gland set

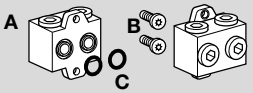
When wiring double solenoid valve VCx 1–3, the connection boxes are to be connected using a cable gland set.
The cable gland set can only be used if the connection boxes are at the same height and on the same side and if both valves are equipped either with or without a proof of closure switch.



VA 1, Order No. 74921985,
VA 2, Order No. 74921986,
VA 3, Order No. 74921987.

7.7 Attachment block VA 1–3

For locked installation of pressure gauge or other accessories on the gas solenoid valve VAS 1–3.

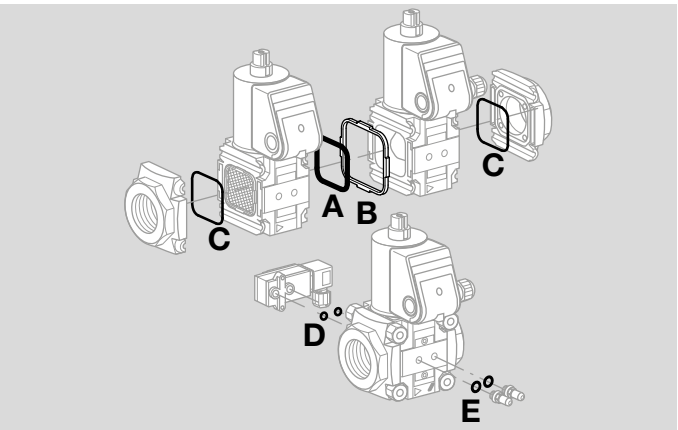


Attachment block Rp 1/ 4, Order No. 74922228,
Attachment block 1/4 NPT, Order No. 74926048.

Scope of delivery:
A 1 x attachment block,
B 2 x self-tapping screws for installation,
C 2 x O-rings.

7.8 Seal set for sizes 1–3

When retrofitting accessories or a second valVario control or when servicing, we recommend replacing the seals.



VAx 1–3

VA 1, Order No. 74921988,
VA 2, Order No. 74921989,
VA 3, Order No. 74921990.

Scope of delivery:
A 1 x double block seal,
B 1 x retaining frame,
C 2 x O-rings (flange),
D 2 x O-rings (pressure switch),

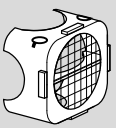
for test nipple/screw plug:
E 2 x sealing rings (flat sealing),
2 x profiled sealing rings.

VCx 1-3

VA 1, Order No. 74924978,
VA 2, Order No. 74924979,
VA 3, Order No. 74924980.

Scope of delivery:
A 1 x double block seal,
B 1 x retaining frame.

7.9 Differential pressure orifice

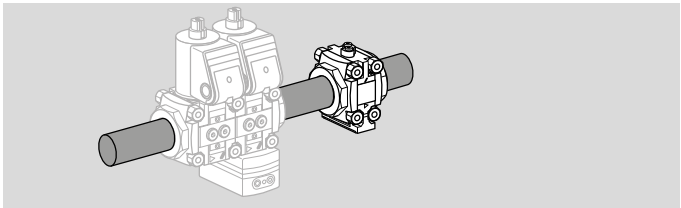


Size	Pipe DN	Differential pressure orifice			
		Colour	Outlet dia.		Order No.
1	15	yellow	18.5 mm	0.67"	74922238
1	20	green	25 mm	0.98"	74922239
1	25	transparent	30 mm	1.18"	74922240
2	40	transparent	46 mm	1.81"	74924907
3	50	transparent	58 mm	2.28"	74924908

If pressure regulator VAD/VAG/VAV 1 is retrofitted upstream of gas solenoid valve VAS 1, a DN 25 differential pressure orifice with outlet opening d = 30 mm (1.18") must be inserted at the outlet of the pressure regulator.

In the case of pressure regulator VAx 115 or VAx 120, the DN 25 differential pressure orifice must be ordered separately and retrofitted, Order No. 74922240.

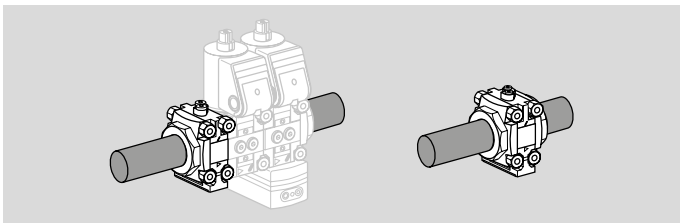
7.10 Measuring orifice VMO



The measuring orifice VMO is designed to reduce the gas and air flow rates and is installed downstream of the valVario control. The measuring orifice is available with Rp internal thread (NPT internal thread) or flange to ISO 7005.

Technical Information VMO, see www.docuthek.com.

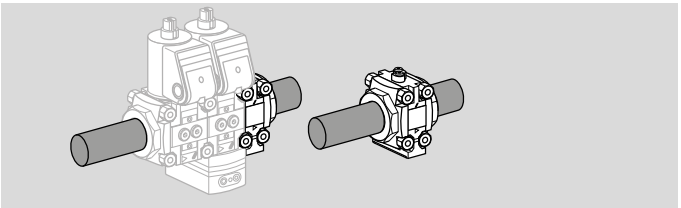
7.11 Filter module VMF



Using the filter module VMF, the gas flow upstream of the gas solenoid valve VAS and the air/gas ratio control is cleaned. The filter module is available with Rp internal thread (NPT internal thread) or flange to ISO 7005 and can also be supplied with fitted pressure switch as an option.

Technical Information VMF, see www.docuthek.com.

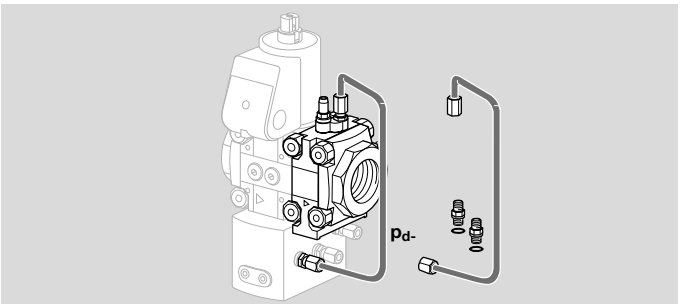
7.12 Fine-adjusting valve VMV



The flow rate is set using the fine-adjusting valve VMV. The fine-adjusting valve is available with Rp internal thread (NPT internal thread) or flange to ISO 7005.

Technical Information VMV, see www.docuthek.com.

7.13 Gas control line



Fine-adjusting valve VMV can be installed on the flow rate regulator VAH for fine adjustment of the gas flow rate.

The gas control line for gas outlet pressure p_{d-} is available with two 1/8" compression fittings.

Size 1: Order No. 74924458,
Size 2: Order No. 74924459,
Size 3: Order No. 74926055.

8 Technical data

8.1 Ambient conditions

Icing, condensation and dew in and on the unit are not permitted.

Avoid direct sunlight or radiation from red-hot surfaces on the unit. Note the maximum medium and ambient temperatures!

Avoid corrosive influences, e.g. salty ambient air or SO_2.

The unit may only be stored/installed in enclosed rooms/ buildings.

The unit is suitable for a maximum installation height of 2000 m AMSL.

Ambient temperature: -20 to +60°C (-4 to +140°F), no condensation permitted.
Long-term use in the upper ambient temperature range accelerates the ageing of the elastomer materials and reduces the service life (please contact manufacturer).

Storage temperature = transport temperature: -20 to +40°C (-4 to +104°F).

Enclosure: IP 65.

This unit is not suitable for cleaning with a high-pressure cleaner and/or cleaning products.

8.2 Mechanical data

Gas types: natural gas, LPG (gaseous), biogas (max. 0.1 %-by-vol. H_2S), hydrogen or clean air; other types of gas on request. The gas must be clean and dry in all temperature conditions and must not contain condensate.

Medium temperature = ambient temperature.

CE and FM approved, UL listed, max. inlet pressure p_u: 10–500 mbar (1–200 "WC).
FM approved, non operational pressure: 700 mbar (10 psig).
ANSI/CSA approved: 350 mbar (5 psig).

Opening times:
VAx../N, quick opening: ≤ 1 s,
VAx../N, quick closing: < 1 s.

Valve housing: aluminium, valve seal: NBR.

Connection flanges with internal thread: Rp to ISO 7-1, NPT to ANSI/ASME.

Safety valve:
Class A, Group 2 pursuant to EN 13611 and EN 161,
230 V AC, 120 V AC, 24 V DC:
Factory Mutual (FM) Research Class: 7400 and 7411,
ANSI Z21.21 and CSA 6.5, ANSI Z21.18 and CSA 6.3.

Turndown: up to 10:1.

Control class A to EN 88-1.

VAD

Outlet pressure p_d:
VAD..-25: 2.5–25 mbar (1–10 "WC),
VAD..-50: 20–50 mbar (8–19.7 "WC),
VAD..-100: 35–100 mbar (14–40 "WC).

Combustion chamber control pressure p_{sc} (connection p_{sa}): -20 to +20 mbar (-7.8 to +7.8 "WC).

VAG

Outlet pressure p_d: 0.5–100 mbar (0.2–40 "WC).

Air control pressure p_{sa}: 0.5–100 mbar (0.2–40 "WC).

In applications with excess air, p_d and p_{sa} may be below the limit of 0.5 mbar. No situation which would jeopardize safety must arise. Avoid CO formation.

Adjusting range at low fire: ±5 mbar (±2 "WC).

Transmission ratio of gas to air: 1:1.

The inlet pressure must always be higher than the air control pressure p_{sa} + pressure loss Δp + 5 mbar (2 "WC).

Connection options for air control pressure p_{sa}:
VAG..K: 1 x 1/8" coupling for plastic hose (internal dia. 3.9 mm (0.15"), external dia. 6.1 mm (0.24")),
VAG..E: 1 x 1/8" coupling with compression fitting for 6 x 1 tube,
VAG..A: 1 x 1/8" NPT adapter,
VAG..N: zero governor with breathing orifice.

VAV

Outlet pressure p_d:
0.5–30 mbar (0.2–11.7 "WC).

Air control pressure p_{sa}:
0.4–30 mbar (0.15–11.7 "WC).

Combustion chamber control pressure p_{sc}:
-20 to +20 mbar (-7.8 to +7.8 "WC).

Min. control pressure differential p_{sa} - p_{sc}:
0.4 mbar (0.15 "WC).

Min. pressure differential p_d - p_{sc}:
0.5 mbar (0.2 "WC).

Adjusting range at low fire:
±1.5 mbar (±0.6 "WC).

Transmission ratio of gas to air: 0.6:1–3:1.

The inlet pressure p_u must always be higher than the air control pressure p_{sa} x transmission ratio V + pressure loss Δp + 1.5 mbar (0.6 "WC).

Connection of air control pressure p_{sa} and combustion chamber control pressure p_{sc}:
VAV..K: 2 x plastic hose couplings (internal dia. 3.9 mm (0.15"); external dia. 6.1 mm (0.24"))
or
VAV..E: 2 x 1/8" compression fittings for 6 x 1 tube
or
VAV..A: 2 x 1/8" NPT adapters.

VAH, VRH

The inlet pressure must always be higher than the differential air pressure Δp_{sa} + max. gas pressure on burner + pressure loss Δp + 5 mbar(2 "WC).

Differential air pressure Δp_{sa} (p_{sa} - $p_{sa\text{-}}$) = 0.6–50 mbar (0.24–19,7 "WC).

Differential gas pressure Δp_d (p_d - $p_{d\text{-}}$) = 0.6–50 mbar (0.24–19.7 "WC).

Adjusting range at low fire: ±5 mbar (±2 "WC).

Transmission ratio of gas to air: 1:1.

Connection of the air control pressure p_{sa}:
VAH..E, VRH..E: 3 x 1/8" couplings with compression fitting for 6 x 1 tube
or
VAH..A, VRH..A: 3 x 1/8" NPT adapters.

8.3 Electrical data

Mains voltage:
230 V AC, +10/-15%, 50/60 Hz;
200 V AC, +10/-15%, 50/60 Hz;
120 V AC, +10/-15%, 50/60 Hz;
100 V AC, +10/-15%, 50/60 Hz;
24 V DC, ±20%.

Cable gland: M20 x 1.5.

Electrical connection: cable with max. 2.5 mm^2 (AWG 12) or plug with socket to EN 175301-803.

Duty cycle: 100%.

Power factor of the solenoid coil: cos φ = 0.9.

Power consumption:

Type	Voltage	Power
VAx 1	24 V DC	25 W
VAx 1	100 V AC	25 W (26 VA)
VAx 1	120 V AC	25 W (26 VA)
VAx 1	200 V AC	25 W (26 VA)
VAx 1	230 V AC	25 W (26 VA)
VAx 2, VAx 3	24 V DC	36 W
VAx 2, VAx 3	100 V AC	36 W (40 VA)
VAx 2, VAx 3	120 V AC	40 W (44 VA)
VAx 2, VAx 3	200 V AC	40 W (44 VA)
VAx 2, VAx 3	230 V AC	40 W (44 VA)
VBY	24 V DC	8 W
VBY	120 V AC	8 W
VBY	230 V AC	9.5 W

Contact rating of POC/CPI:

Type	Voltage	Current (resistive load)	
		min.	max.
VAx..S, VCx..S	12–250 V AC, 50/60 Hz	100 mA	3 A
VAx..G, VCx..G	12–30 V DC	2 mA	0.1 A

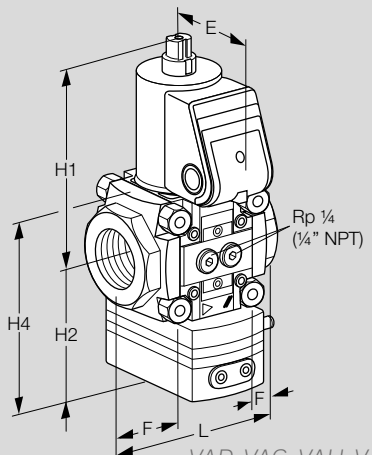
Switching frequency of POC/CPI: max. 5 x per minute.

Switching current	Switching cycles*	
	cos φ = 1	cos φ = 0.6
0.1	500,000	500,000
0.5	300,000	250,000
1	200,000	100,000
3	100,000	–

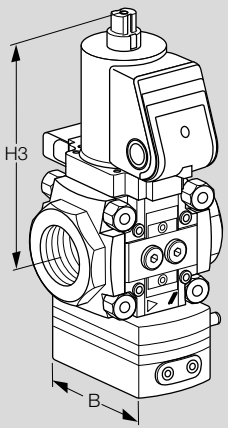
** Limited to max. 200,000 cycles for heating systems.*

9 Dimensions

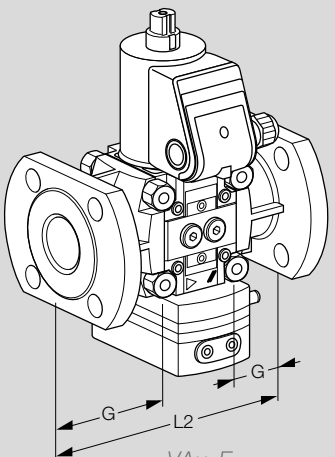
9.1 Rp internal thread, ISO flange



VAD, VAG, VAH, VAV



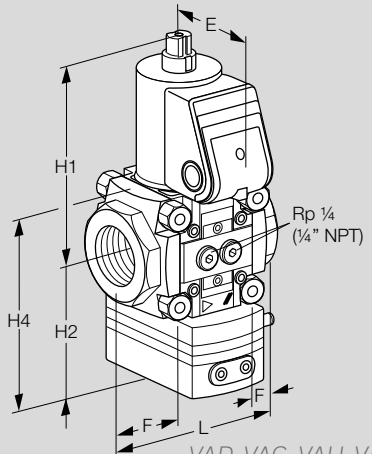
VAx..S



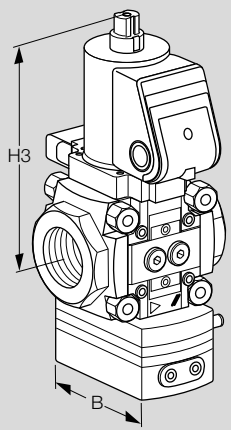
VAx..F

Type	Connection		Dimensions [mm]										Weight [kg]
	Rp	DN	L	L2	E	F	G	H1	H2	H3	H4	B	
VAx 115	1/2	15	75	–	75	15	–	143	82	161	117	97	1.8
VAH 115	1/2	15	75	–	75	15	–	143	100	161	135	97	2
VAx 120	3/4	20	91	–	75	23	–	143	82	161	117	97	1.9
VAH 120	3/4	20	91	–	75	23	–	143	100	161	135	97	2.1
VAx 125	1	25	91	–	75	23	–	143	82	161	117	97	1.9
VAH 125	1	25	91	–	75	23	–	143	100	161	135	97	2.1
VAx 240	1 1/2	40	127	200	85	29	66	170	112	191	162	125	4.4
VAH 240	1 1/2	40	127	200	85	29	66	170	132	191	182	125	4.7
VAx 350	2	50	155	230	85	36	74	180	135	201	196	160	6.1
VAH 350	2	50	155	230	85	36	74	180	156	201	217	160	6.4

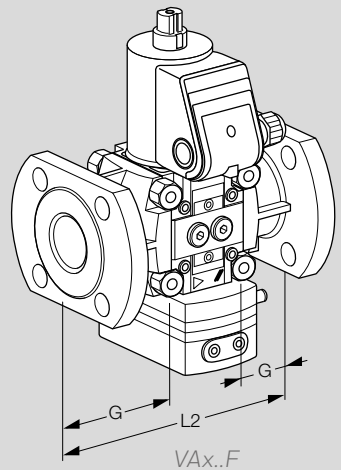
9.2 NPT internal thread, ANSI flange



VAD, VAG, VAH, VAV



VAx..S



VAx..F

Type	Connection		Dimensions [inch]										Weight [lbs]
	NPT	DN	L	L2	E	F	G	H1	H2	H3	H4	B	
VAx 115	1/2	15	2.9	–	2.9	0.6	–	5.6	3.2	6.3	4.6	3.8	4.0
VAH 115	1/2	15	2.9	–	2.9	0.6	–	5.6	3.9	6.3	5.3	3.8	4.4
VAx 120	3/4	20	3.6	–	2.9	0.9	–	5.6	3.3	6.3	4.6	3.8	4.2
VAH 120	3/4	20	3.6	–	2.9	0.9	–	5.6	3.9	6.3	5.3	3.8	4.6
VAx 125	1	25	3.6	–	2.9	0.9	–	5.6	3.3	6.3	4.6	3.8	4.2
VAH 125	1	25	3.6	–	2.9	0.9	–	5.6	3.9	6.3	5.3	3.8	4.6
VAx 240	1 1/2	40	5.0	7.9	3.3	1.1	2.6	6.7	4.4	7.5	6.4	4.9	9.7
VAH 240	1 1/2	40	5.0	7.9	3.3	1.1	2.6	6.7	5.2	7.5	7.2	4.9	10.4
VAx 350	2	50	6.1	9.1	3.3	1.4	2.9	7.0	5.3	7.9	7.7	6.3	13.4
VAH 350	2	50	6.1	9.1	3.3	1.4	2.9	7.0	6.1	7.9	8.5	6.3	14.1

10 Converting units

See www.adlatus.org

11 Safety-specific characteristic values for SIL and PL

Certificates – see www.docuthek.com.

For a glossary of terms, see page 57 (14 Glossary).

For SIL	
Suitable for Safety Integrity Level	SIL 1, 2, 3
Diagnostic coverage DC	0
Type of subsystem	Type A to EN 61508-4, 3.5.12
Mode of operation	High demand mode pursuant to EN 61508-4, 3.5.12
For PL	
Suitable for Performance Level	PL a, b, c, d, e
Category	B, 1, 2, 3, 4
Common cause failure CCF	> 65
Application of essential safety requirements	Satisfied
Application of tried-and-tested safety requirements	Satisfied
For SIL and PL	
B_{10d} value of VAD, VAG, VAV, VAH 1	10,094,360 operating cycles
B_{10d} value of VAD, VAG, VAV, VAH 2	8,229,021 operating cycles
B_{10d} value of VAD, VAG, VAV, VAH 3	6,363,683 operating cycles
Hardware fault tolerance (1 component/ switch) HFT	0
Hardware fault tolerance (2 components/ switches, redundant operation) HFT	1
Safe failure fraction SFF	> 90%
Fraction of undetected common cause failures β	± 2%

Relationship between the Performance Level (PL) and the Safety Integrity Level (SIL)

PL	SIL
a	–
b	1
c	1
d	2
e	3

11.1 Determining the PFH_D value, λ_D value and $MTTF_d$ value

$$PFH_D = \lambda_D = \frac{1}{MTTF_d} = \frac{0{,}1}{B_{10d}} \times n_{op}$$

PFH_D = Probability of dangerous failure (HDM = high demand mode) [1/hour]

PFD_{avg} = Average probability of a dangerous failure of the safety function on demand (LDM = low demand mode)

λ_D = Mean dangerous failure rate [1/hour]

$MTTF_d$ = Mean time to dangerous failure [hours]

n_{op} = Demand rate (mean number of annual operations) [1/hour]

11.2 Designed lifetime

Max. service life under operating conditions in accordance with EN 13611, EN 161 for VAD, VAG, VAV, VAH: designed lifetime after date of production, plus max. ½ year in storage prior to first use, or once the given number of operating cycles has been reached, depending on which is achieved first:

Type	Designed lifetime	
	Switching cycles	Time (years)
VAx 110 to 225	500,000	10
VAx 232 to 365	200,000	10
VRH	–	10

11.3 Use in safety-related systems

For systems up to SIL 3 pursuant to EN 61508 and PL e pursuant to ISO 13849.

The devices are suitable for single-channel systems (HFT = 0) up to SIL 2/PL d, and up to SIL 3/PL e when two redundant devices are installed in a double-channel architecture (HFT = 1), provided that the complete system complies with the requirements of EN 61508/ISO 13849.

12 Safety information in accordance with EN 61508-2

12.1 Scope of application

Regulators with solenoid valves are designed for shut-off, and thanks to the servo technology, for precise control of the gas supply to gas burners and gas appliances.

For further information, see page 4 (1 Application) and on the certificates, see www.docuthek.com.

12.2 Product description

See page 16 (3 Function) and page 4 (1 Application). for information about the product description and the device functions.

12.3 Reference documents

Operating instructions, see www.docuthek.com.

Certificate, see www.docuthek.com.

A web app for spare parts is available at www.adlatus.org.

A web app selecting the correct product is available at www.adlatus.org.

12.4 Applicable standards

Standards used for certification, see www.docuthek.com.

12.5 Safety function

The safety function involves interrupting a gas flow by adopting the safety position using the internal energy accumulator within the closing time and guaranteeing internal and external tightness.

12.6 Safety instructions concerning operating limits

The function is only guaranteed when used within the specified limits – see page 46 (8 Technical data) or operating instructions at www.docuthek.com.

12.7 Installation and commissioning

Installation and commissioning procedures are described in the operating instructions.

12.8 Maintenance/Checks

Internal and external tightness and the function once per annum, twice per annum for biogas.
Further information can be found in the operating instructions.

12.9 Troubleshooting

In the event of faults after maintenance work or function checks: remove the unit and return it to the manufacturer for inspection.

12.10 Safety instructions concerning design verification

A Failure Mode and Effects Analysis has been carried out to assess possible design-related failures and to classify these into safe and dangerous failures.

12.11 Characteristic safety data/SIL capability

See page 52 (11 Safety-specific characteristic values for SIL and PL) and page 46 (8 Technical data).

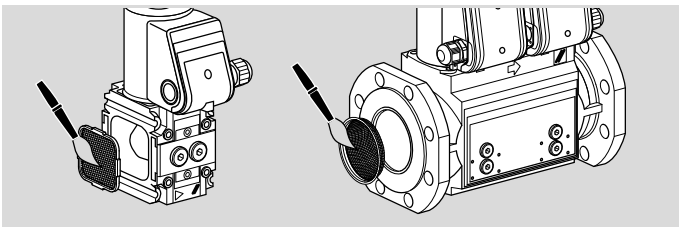
12.12 Mode of operation

The regulators with solenoid valve are suitable for a 100% duty cycle.

13 Maintenance cycles

At least once a year, at least twice a year in the case of biogas.

If the flow rate drops, clean the strainer.



14 Glossary

14.1 Diagnostic coverage DC

Measure of the effectiveness of diagnostics, which may be determined as the ratio between the failure rate of detected dangerous failures and the failure rate of total dangerous failures

NOTE: Diagnostic coverage can exist for the whole or parts of a safety-related system. For example, diagnostic coverage could exist for sensors and/or logic system and/or final elements. Unit: %

see EN ISO 13849-1

14.2 Mode of operation

High demand mode or continuous mode

Operating mode, where the frequency of demands for operation made on a safety-related system is greater than one per year or greater than twice the proof-test frequency

see EN 61508-4

14.3 Category

Classification of the safety-related parts of a control system in respect of their resistance to faults and their subsequent behaviour in the fault condition, and which is achieved by the structural arrangement of the parts, fault detection and/or by their reliability

see EN ISO 13849-1

14.4 Common cause failure CCF

Failures of different items, resulting from a single event, where these failures are not consequences of each other

see EN ISO 13849-1

14.5 Fraction of undetected common cause failures β

Fraction of undetected failures of redundant components due to a single event, whereby these failures are not based on mutual causes

NOTE: β is expressed as a fraction in the equations and as a percentage elsewhere.

see EN 61508-6

14.6 B_{10d} value

Mean number of cycles until 10% of the components fail dangerously

see EN ISO 13849-1

14.7 T_{10d} value

Mean time until 10% of the components fail dangerously

see EN ISO 13849-1

14.8 Hardware fault tolerance HFT

A hardware fault tolerance of N means that N + 1 is the minimum number of faults that could cause a loss of the safety function

see IEC 61508-2

14.9 Mean dangerous failure rate λ_D

Mean rate of dangerous failures during operation time (T_{10d}). Unit: 1/h

see EN ISO 13849-1

14.10 Safe failure fraction SFF

Fraction of safe failures related to all failures, which are assumed to appear

see EN 13611/A2

14.11 Probability of dangerous failure PFH_D

Value describing the likelihood of dangerous failure per hour of a component for high demand mode or continuous mode. Unit: 1/h

see EN 13611/A2

14.12 Mean time to dangerous failure $MTTF_d$

Expectation of the mean time to dangerous failure

see EN ISO 13849-1:2008

14.13 Demand rate n_{op}

Mean number of annual operations

see EN ISO 13849-1

14.14 Average probability of dangerous failure on demand PFD_{avg}

(LDM = 1 – 10 switching cycles/year)

Average probability of a dangerous failure of the safety function on demand (LDM = low demand mode)

see EN 61508-6

For more information

The Honeywell Thermal Solutions family of products includes Honeywell Combustion Safety, Eclipse, Exothermics, Hauck, Kromschröder and Maxon. To learn more about our products, visit ThermalSolutions.honeywell.com or contact your Honeywell Sales Engineer.

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