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ADD FURNACE CO.,LTD.
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Honeywell

krom schroder

Pressure regulators with solenoid valve VAD, VAG, VAV, VAH Flow rate regulator VRH

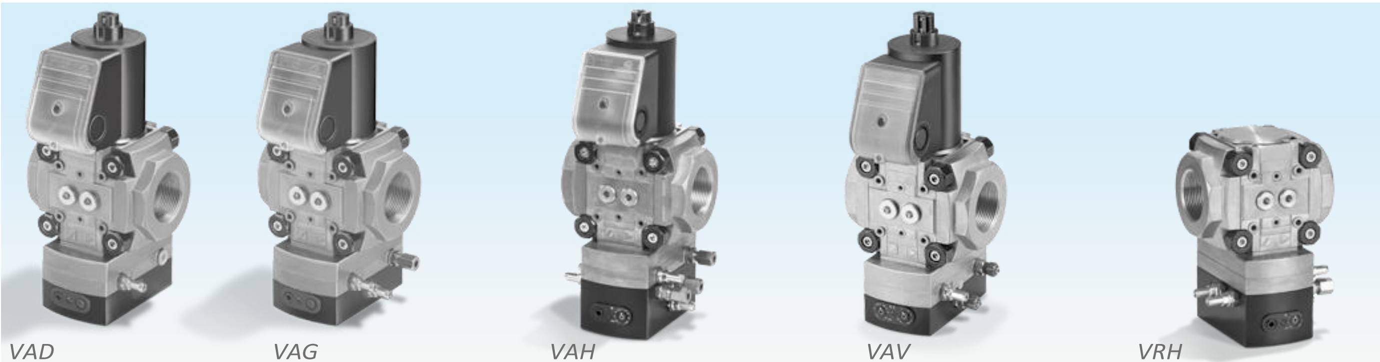
Pressure regulators with double solenoid valve VCD, VCG, VCV, VCH

Technical Information · GB
3 Edition 06.17

- 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
- Setting options from two sides

AGA · CSA C US · c UL US LISTED · FM APPROVED · EAC · PL · SIL · CE

Contents



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 ap- pliances. They are used in gas control and safety sys- tems 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 food- stuffs industries.

VAD

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

VAG

Air/gas ratio control, Class A, for maintaining a con- stant air/gas pressure ratio for modulating-controlled burners or with VAS 1 bypass valve for stage-controlled burners. Pressure preset by the air control line.

The VAG..N can also be used as a zero governor for gas engines.

VAH, VRH

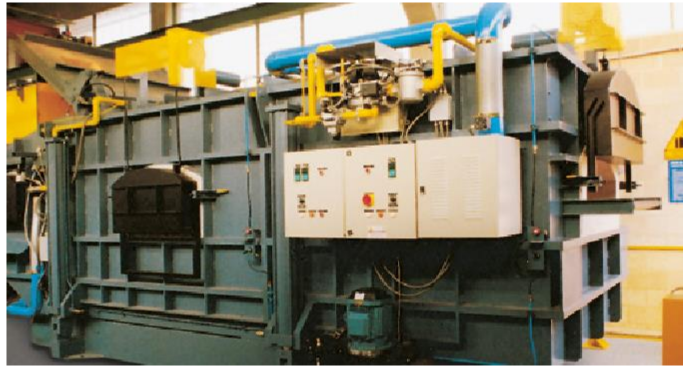
Flow rate regulators VAH and VRH are used to maintain a constant gas/air ratio for modulating-controlled and stage-controlled burners. The gas flow rate is cont- rolled proportionally to the air flow rate.

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

VAV

Variable air/gas ratio control, Class A, for maintaining a constant gas/air pressure ratio for modulating-con- trolled burners. Pressure 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.

Pressure regulator on excess air burners in the ceram- ics 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 air deficiency cut-out

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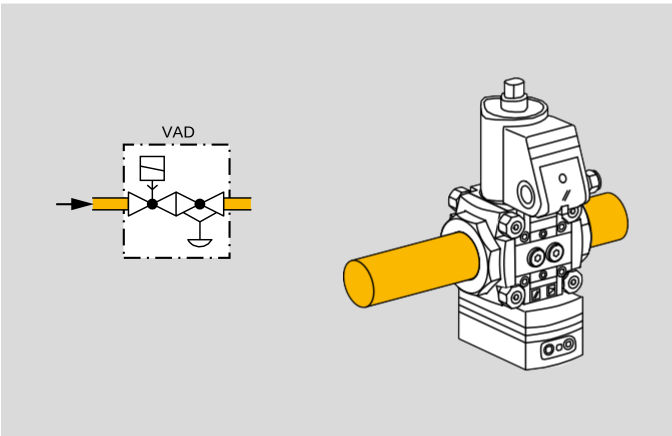
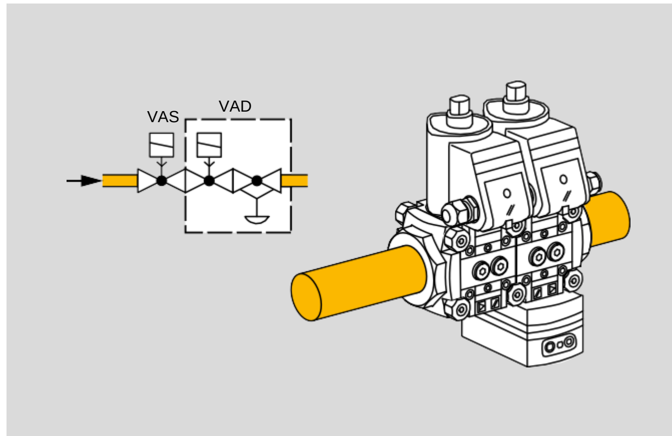
1.1 Examples of application

1.1.1 Constant pressure control



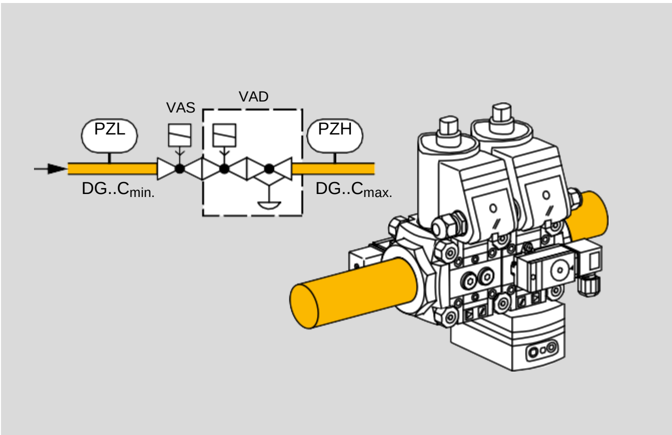
The pressure regulator with gas solenoid valve VAD maintains the set gas outlet pressure p_d constant when subject to differing flow rates. If a second gas solenoid valve is used upstream of the VAD, this complies with the requirements of EN 746-2 for two Class A gas solenoid valves connected in series.

1.1.2 Constant pressure control with two gas solenoid valves



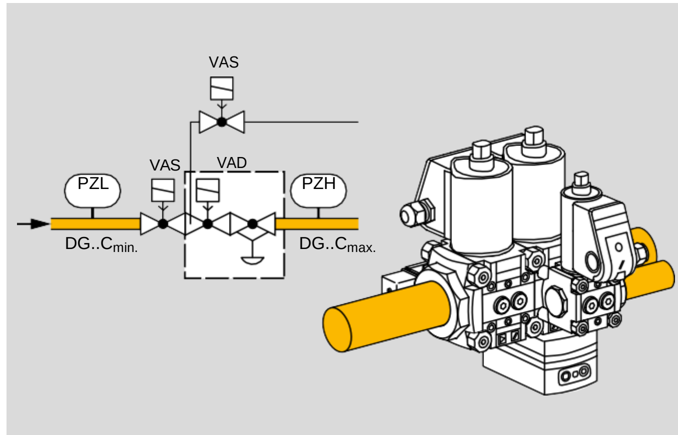
The pressure regulator with gas solenoid valve VAD maintains the set gas outlet pressure p_d constant when subject to differing flow rates.

1.1.3 Constant pressure control with max. pressure switch



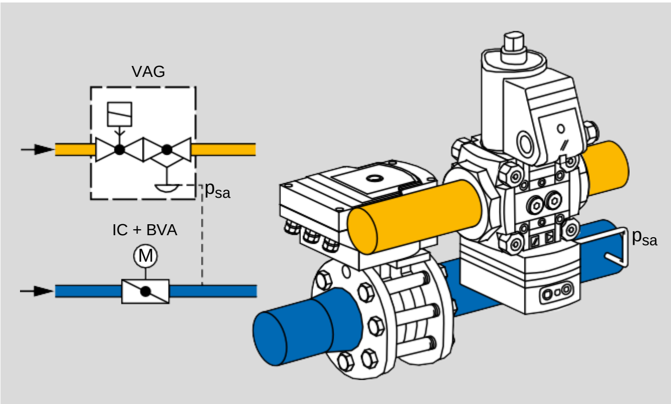
In this example, the minimum inlet pressure p_u and the maximum outlet pressure p_d are monitored with the pressure switches DG..C. The simple attachment of the pressure switch module makes installation easier.

1.1.4 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.

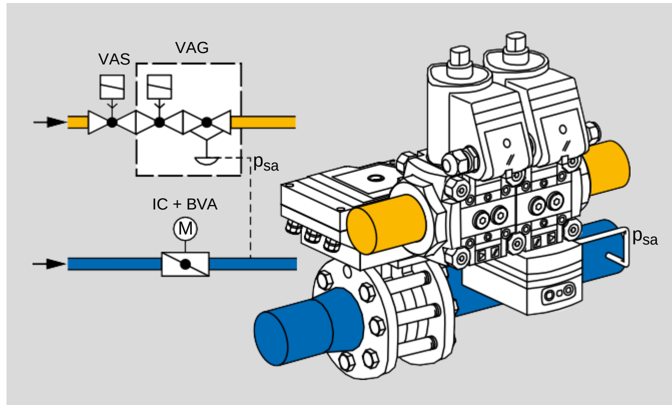
1.1.5 Modulating control



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 control range 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.

1.1.6 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 control range up to 10:1.

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

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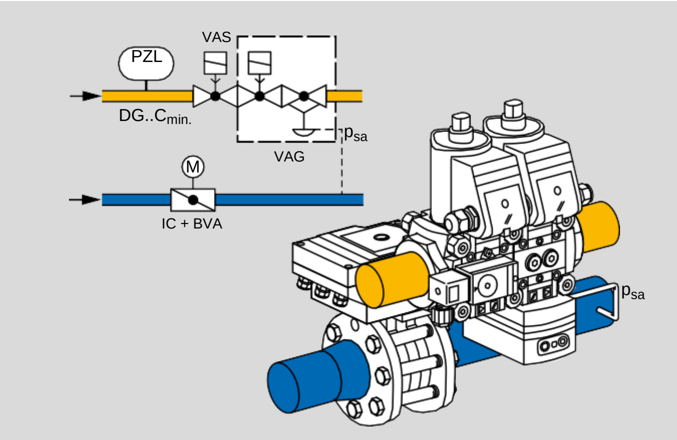
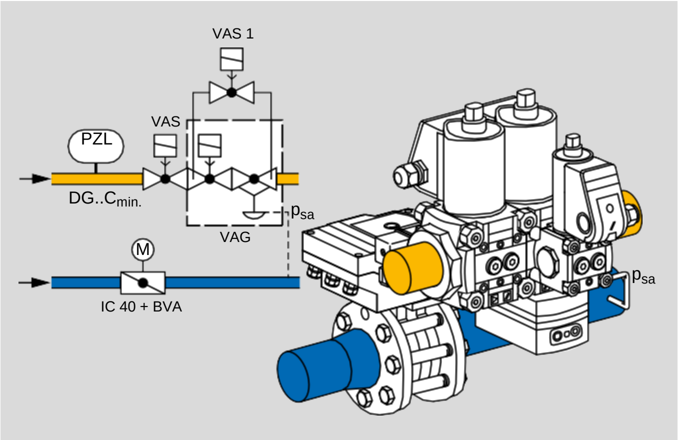
1.1.7 Modulating control with two gas solenoid valves and inlet pressure switch



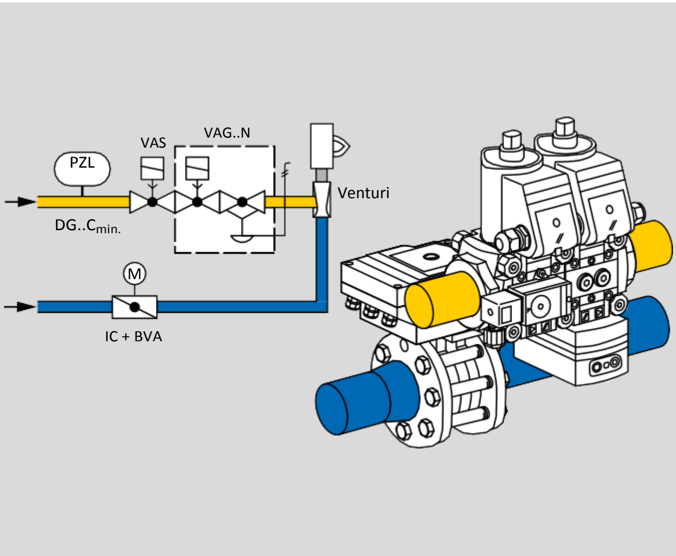
monitored by the pressure switch DG..C. The simple attachment of the pressure switch module makes installation easier.

1.1.8 High/Low control



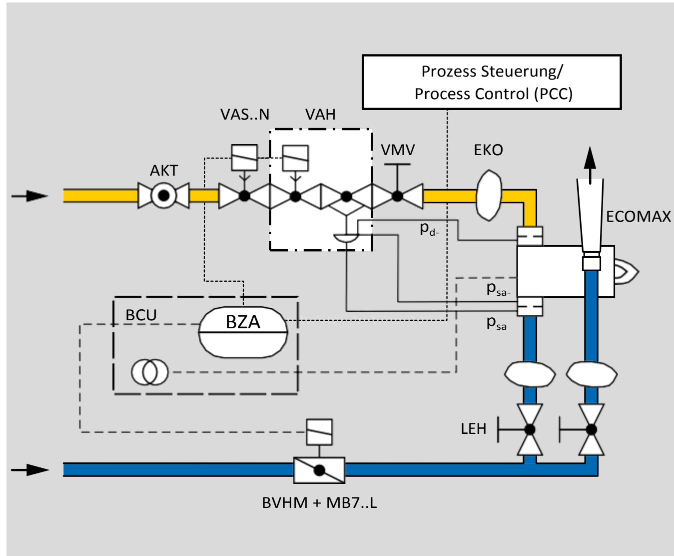
At high fire, the gas outlet pressure p_d follows the air control pressure p_{sa}. The ratio of gas pressure to air pressure remains constant. Low fire is determined via the bypass valve VAS 1. Here as well, the simple attachment of the bypass valve module makes installation easier.

1.1.9 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.

1.1.10 Staged flow rate control

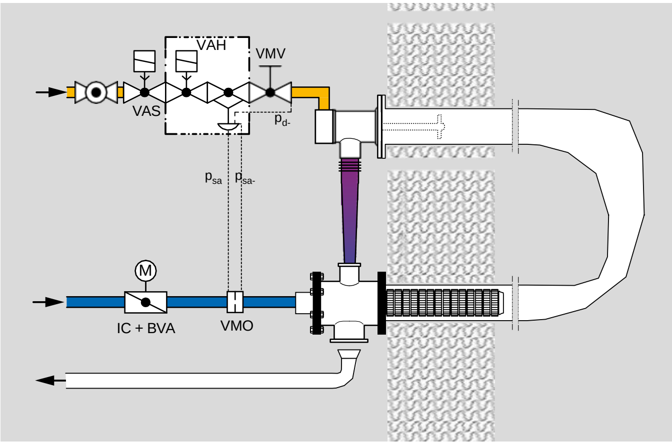


This application shows the VAH on a self recuperative burner.

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.

1.1.11 Continuous or staged flow rate control

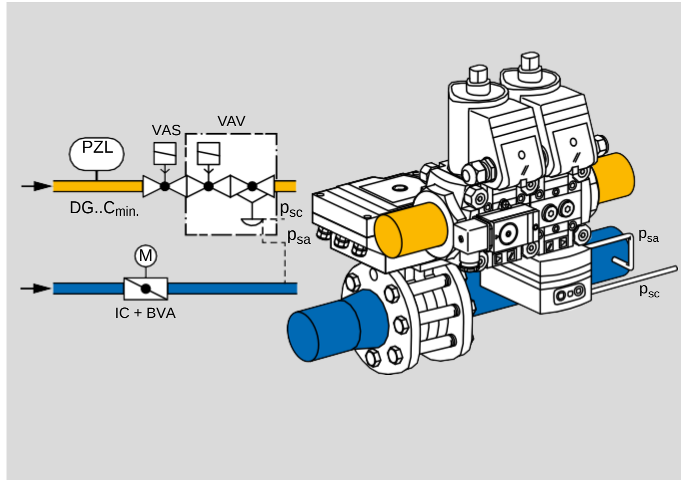


This application shows flow rate control for a radiant tube burner system with plug-in recuperator for air pre- heating.

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.

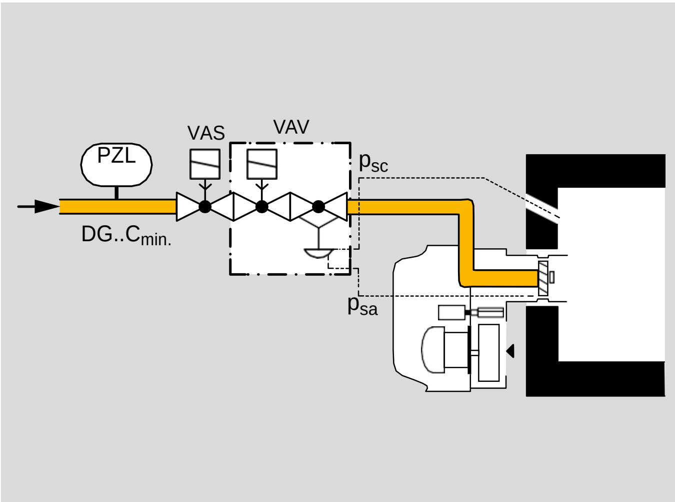
The air index (lambda) can be set using the fine-adjusting valve VMV.

1.1.12 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 15 (Function).

1.1.13 Modulating control in residential heat generation



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

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

2 Certification

Certificates – see Docuthek.

VAD, VAG, VAV, VAH: certified to SIL and PL

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

VAD, VAG, VAV, VAH

EU certified pursuant to

– Gas Appliances Directive (2009/142/EC) in conjunc- tion with EN 13611, EN 161, EN 88-1, EN 126 and EN 1854.

Meets the requirements of the

– Low Voltage Directive (2014/35/EU),

– EMC Directive (2014/30/EU).

VAD, VAG, VAV, VAH: FM approved*

Factory Mutual Research Class: 7400 Process Control Valves. Designed for applications pursuant to NFPA 85 and NFPA 86. www.approvalguide.com

VAD, VAG: ANSI/CSA approved*

American National Standards Institute/Canadian Standards Association – ANSI Z21.21/CSA 6.5, ANSI Z21.18 and CSA 6.3

www.csagroup.org – Class number: 3371-83 (natural gas, LPG), 3371-03 (natural gas, propane).

VAD, VAG, VAV: UL listed

(for 120 V only)

Underwriters Laboratories – UL 429 "Electrically operated valves".

www.ul.com Tools (at the bottom of the page) On-
line Certifications Directory

VAD, VAG, VAV: AGA approved*

Australian Gas Association, Approval No.: 5319

http://www.aga.asn.au/product_directory

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

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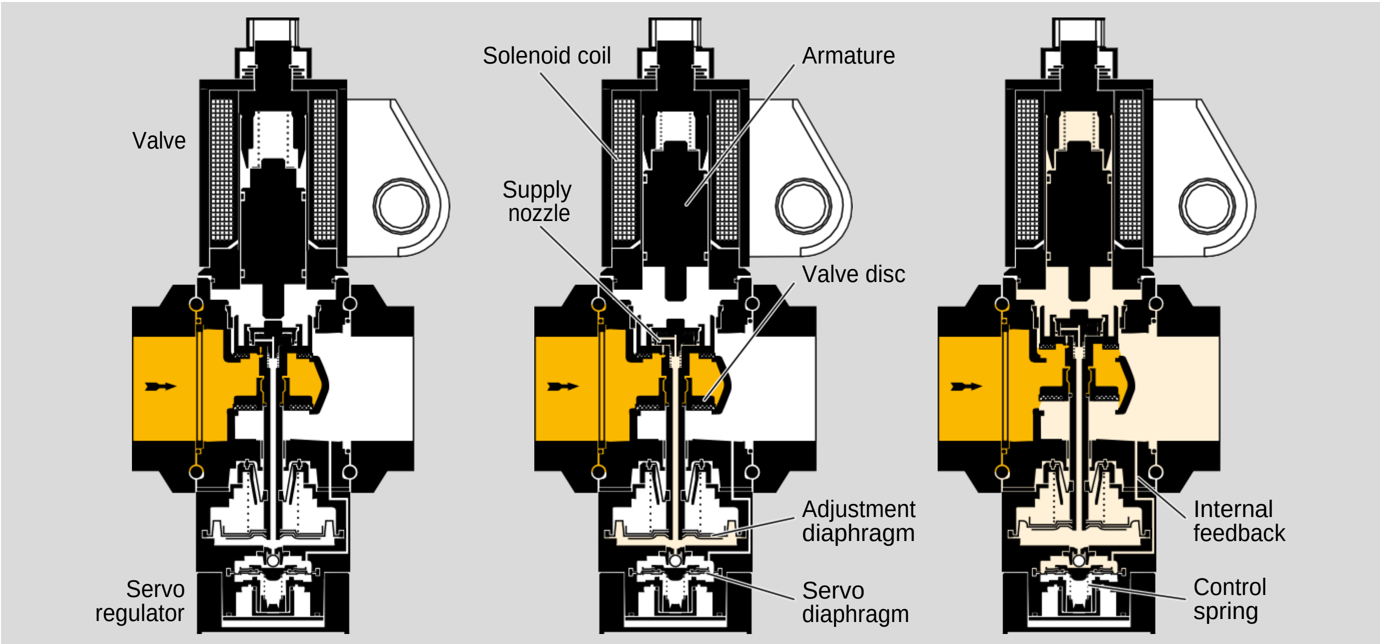
Eurasian Customs Union

EAC

The product VAD, VAG, VAV, VAH, VCD, VCG, VCV, VCH meets the technical specifications of the Eurasian Cus- toms Union.



3 Function

3.1 VAD, VAG, VAH, VRH, VAV

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

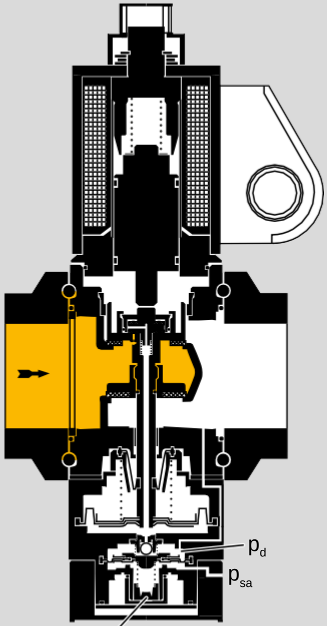
Opening: connect the system to the electrical power supply (alternating voltage will be rectified). The blue LED lights up. The coil's magnetic field pulls the armature upwards and clears the supply nozzle for the gas inlet pressure p_u.

The gas passes through the internal impulse tube to the adjustment diaphragm and then pushes the valve disc 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.

3.1.1 Pressure regulator for gas VAD

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

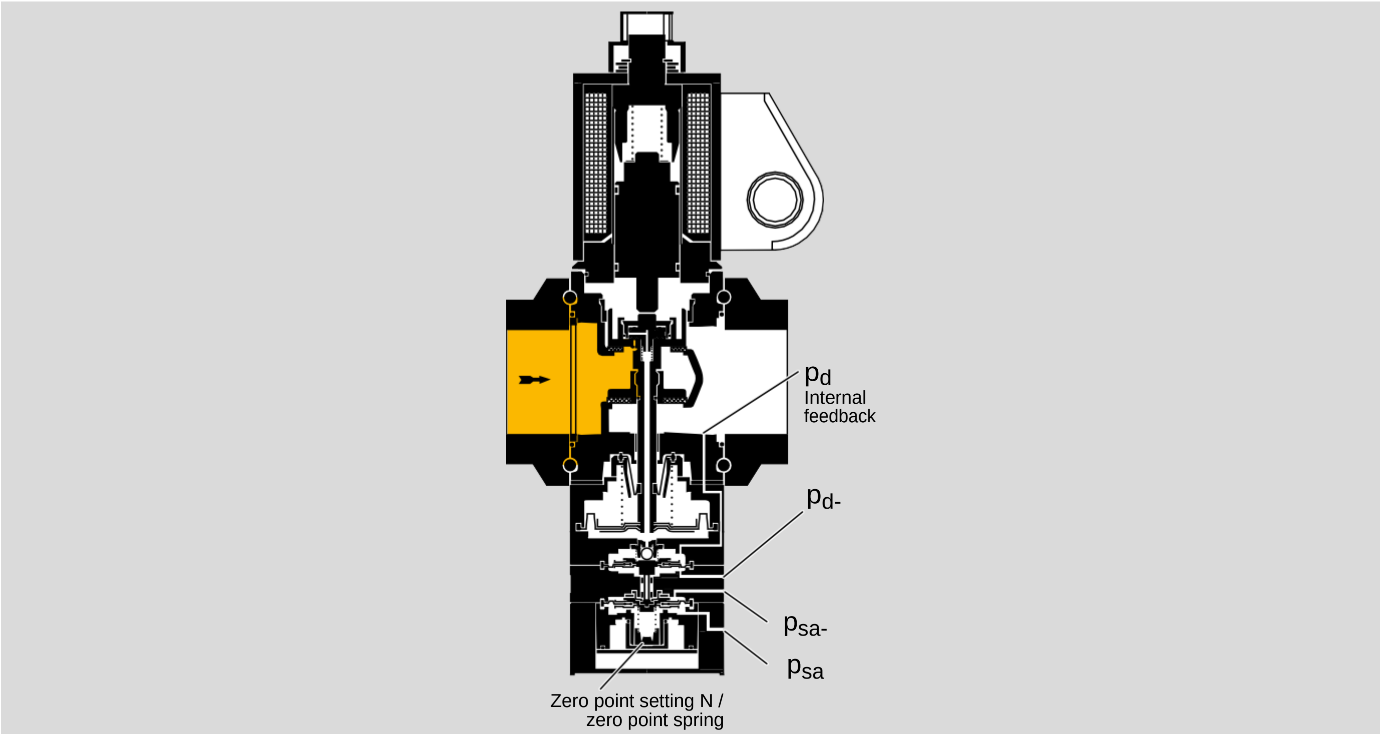


3.1.2 Air/gas ratio control VAG

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

The ratio of gas pressure to air pressure remains con- stant: 1:1. The VAG is suitable for a control range up to 10:1.

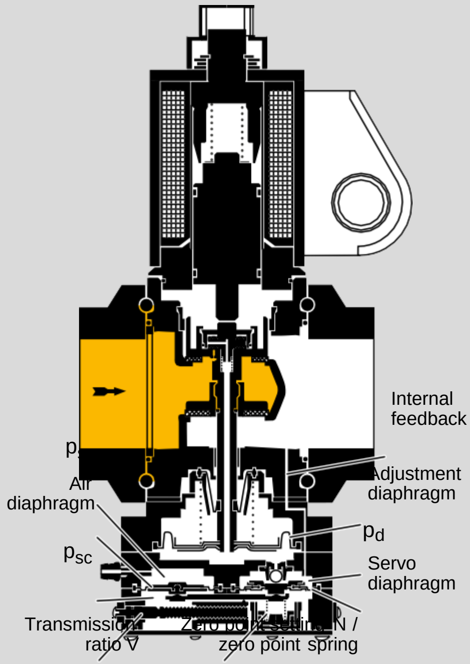
If the burner operates at low-fire rate, the gas/air mixture can be changed by adjusting the zero point spring "N".



3.1.3 Flow rate regulators VAH, VRH

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.



3.1.4 Variable air/gas ratio control 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 36 (Project planning information).

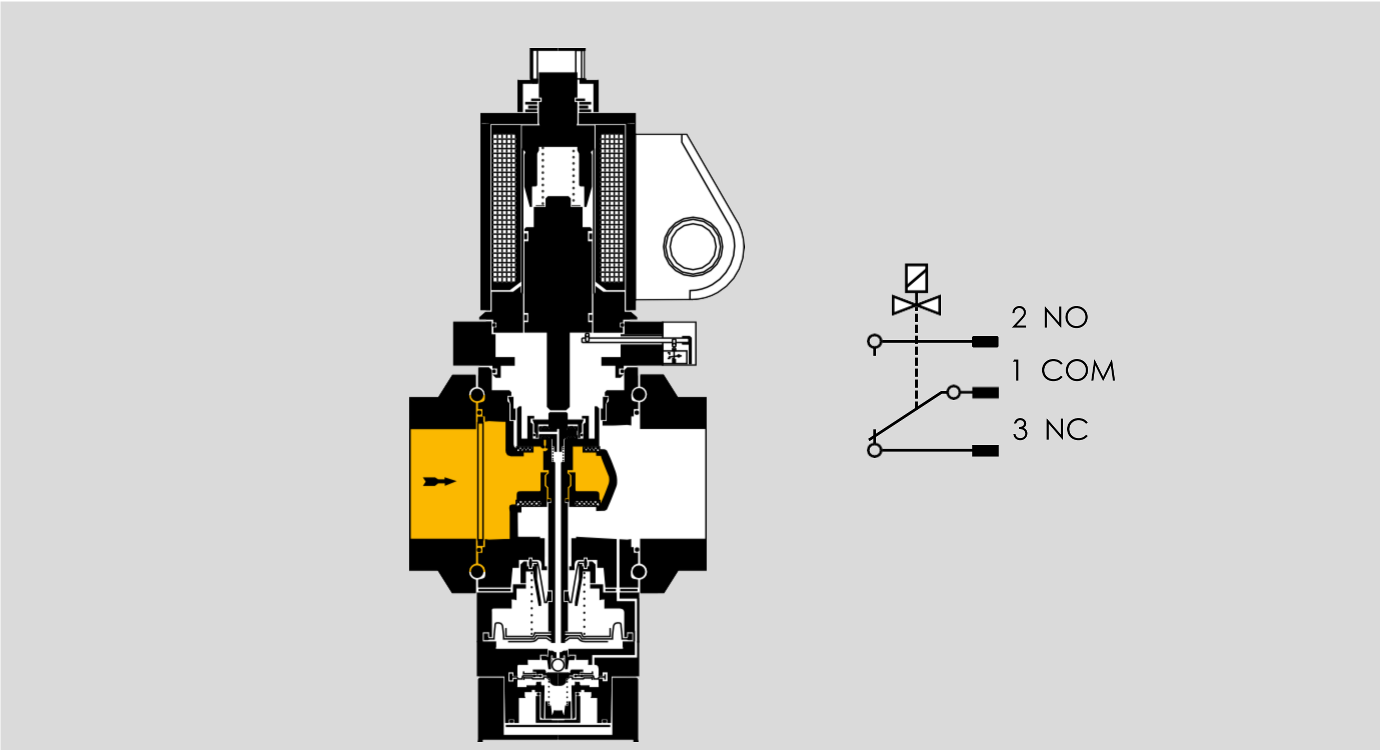
The high-fire rate is set by turning the adjusting screw "V" until the required flue gas values are achieved, see page 36 (Project planning information). The ratio of gas pressure to air pressure can be set from 0.6:1 to 3:1.

The settings N and V influence each other and the adjustment process 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 fluctua- tions in the combustion chamber can be compensated. The flue gas values remain constant in the case of fluctuations in the combustion chamber pressure

$(p_d - p_{sc}) = (p_{sa} - p_{sc}) \times V + N$.



3.1.5 Pressure regulator with gas solenoid valve VAx..S, closed position switch with visual position indicator

Opening: when the pressure regulator is opened, the closed position switch 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 disc on to the valve seat. The closed position switch is actuated. The visual position indicator is white for "closed".

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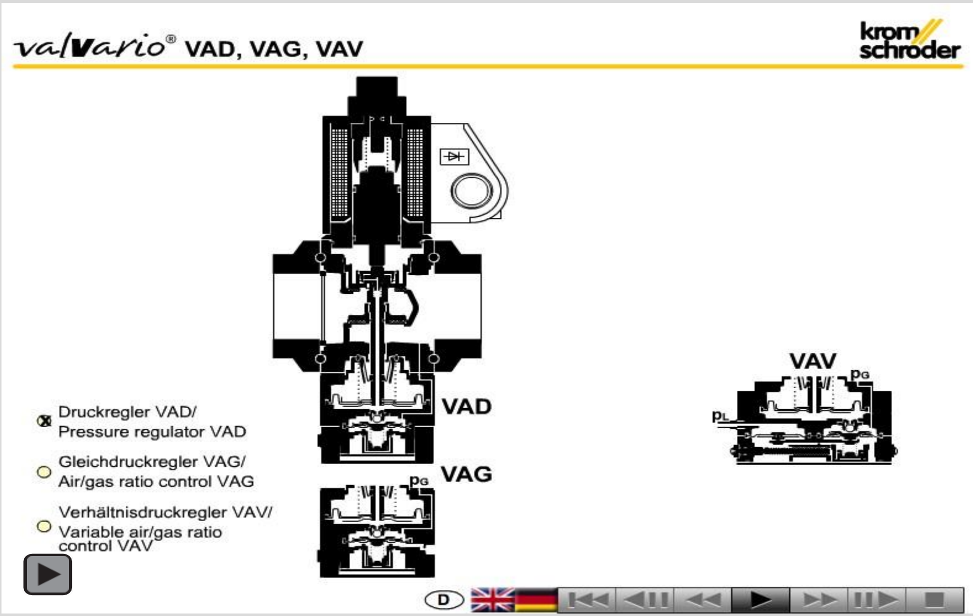
The actuator cannot be rotated on a pressure regulator with a closed position switch with visual position indicator.

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



3.2 Animation

The interactive animation shows the function of the valVario controls VAD/VAG/VAH/VAV.

Click on the picture . The animation can be controlled using the control bar at the bottom of the window (as on a DVD player).

To play the animation, you will need Adobe Reader 7 or a newer version. If you do not have Adobe Reader on your system, you can download it from the Internet.

If the animation does not start to play, you can down- load it from the document library (www.docuthek.com) as an independent application.

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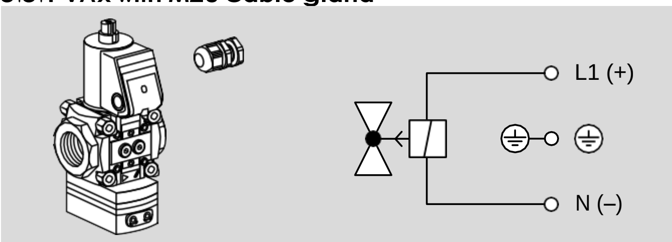
3.3 Connection diagram

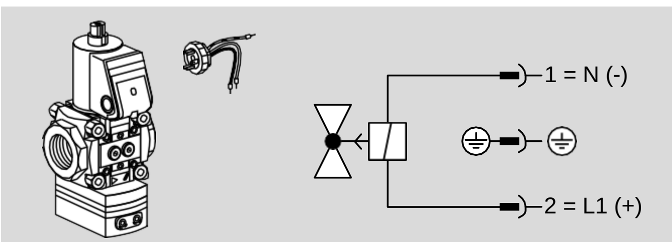
Wiring to EN 60204-1.

Connection diagram for VAx..S with closed position switch – see page 20 (Pressure regulator with gas solenoid valve VAx..S, closed position switch with visual position indicator).

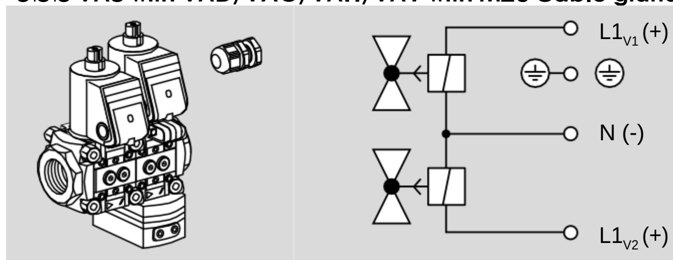
3.3.1 VAx with M20 cable gland



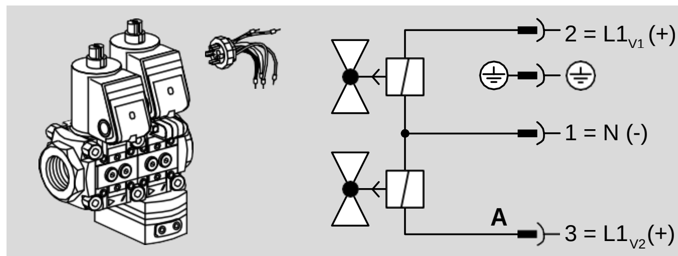
3.3.2 VAx with plug



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



3.3.4 VAS with VAD/VAG/VAH/VAV with plug



4 Replacement possibilities for MODULINE pressure regulators with gas solenoid valve

4.1 GVS, GVI, GVIB, GVR and GVRH are to be replaced by VAD, VAG, VAG+VAS, VAH and VAV

Type					Type
GVS	Pressure regulator with gas solenoid valve			Pressure regulator with gas solenoid valve	VAD
GVI	Air/gas ratio control with gas solenoid valve			Air/gas ratio control with gas solenoid valve	VAG
GVIB	Air/gas ratio control with gas solenoid valve and bypass valve			Air/gas ratio control with gas solenoid valve and bypass valve	VAG+VAS
GVRH	Flow rate regulator with gas solenoid valve			Flow rate regulator with gas solenoid valve	VAH
GVR	Variable air/gas ratio control with gas solenoid valve			Variable air/gas ratio control with solenoid valve	VAV
115 125	Flange 3/8"	Size 115 Size 125		–	–
115 125	Flange ½"	Size 115 Size 125		Size 1, DN 15	115
115 125	Flange ¾"	Size 115 Size 125		Size 1, DN 20	120
115 125	Flange 1"	Size 115 Size 125		Size 1, DN 25	125
232 240	Flange 1"	Size 232 Size 240		Size 2, DN 25/40	225/40
232 240	Flange 1½"	Size 232 Size 240		Size 2, DN 40	240
350	Flange 1½"	Size 350		Size 3, DN 40/50	340/50
350	Flange 2"	Size 350		Size 3, DN 50	350
ML	MODULINE + Rp internal thread connection flanges			Rp internal thread	R
TML	MODULINE + NPT internal thread connection flanges			NPT internal thread	N
01	$p_{u max.}$: 100 mbar (1.5 psig)			$p_{u max.}$: 500 mbar (7 psig)	
02	200 mbar (3 psig)			500 mbar (7 psig)	

▼

Continuation

Type				Type
●	Quick opening		Quick opening	/N
F1	Control ratio 1:1		Control ratio 1:1	●
K	Mains voltage: 24 V DC		Mains voltage: 24 V DC	K
	–		100 V AC	P
Q	120 V AC		120 V AC	Q
	–		200 V AC	Y
T	220/240 V AC		230 V AC	W
3	Electrical connection via terminals		Electrical connection via terminals	●
6	Electrical connection via socket		Electrical connection via socket	O
9	Metal terminal connection box		Electrical connection via terminals	●
S	Closed position switch		CPS with visual position indicator**	S
G	Closed position switch for 24 V		CPS for 24 V with visual position indicator**	G
M	Suitable for biogas		Suitable for biogas	●
●	Pressure test point at the inlet		Pressure test point at the inlet and outlet*	O
			Outlet pressure p_d:	-25
	Outlet pressure p_d:		2.5 – 25 mbar (1 – 10 "WC)	
●	2 – 90 mbar (0.8 – 36 "WC)		20 – 50 mbar (8 – 20 "WC)	-50
			35 – 100 mbar (14 – 40 "WC)	-100
			Standard seat	A

GVS 350ML01T3 with Rp 2 connection flanges **Example** **Example** VAD 350R/NW-100A with test points

● = *standard,* O = *available*

* *Pressure test points may be attached at the left- and/or right-hand side.*

** *Closed position switch with visual position indicator can be attached at the left- or right-hand side.*

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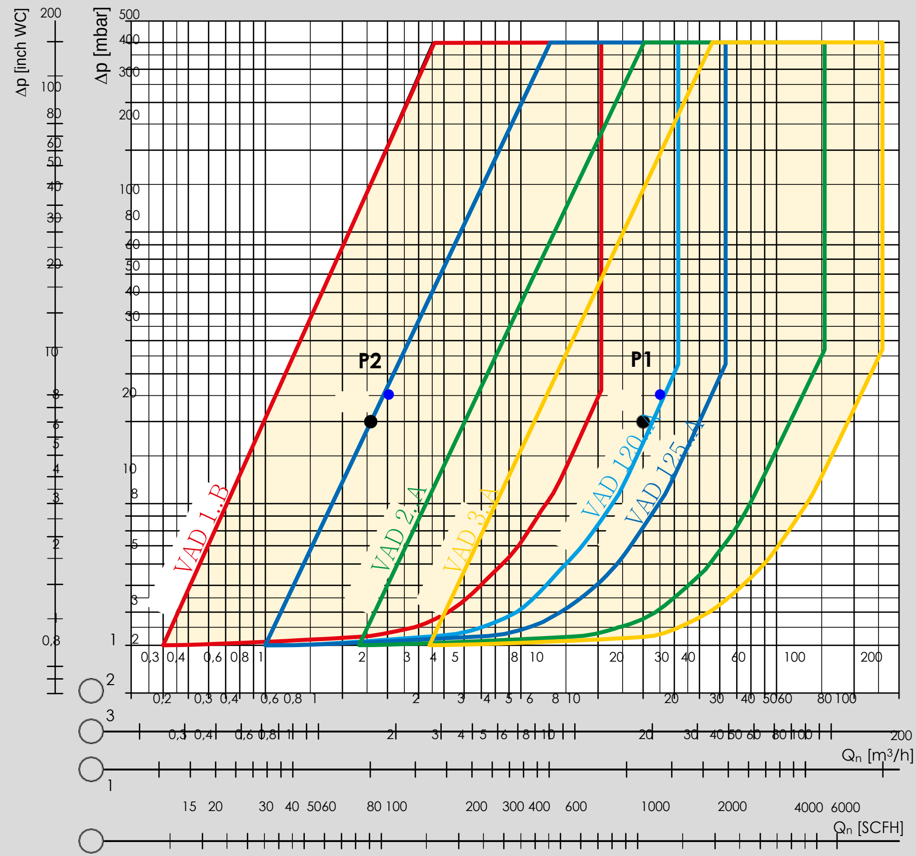
5 Flow rate

5.1 Selection example for VAD

Natural gas,
Flow rate $Q_{max.}$ = 30 m³/h,
Inlet pressure p_u = 80 mbar,
Outlet pressure p_d = 60 mbar.
The desired control ratio from high-fire to low-fire rate is R_V = 10:1.
High fire:
$\Delta p = p_u - p_d$ = 20 mbar Point P1
Low fire:
Point P2 $Q_{min.}$ = 2.6 m³/h
at 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 small- est size to achieve the best control properties.



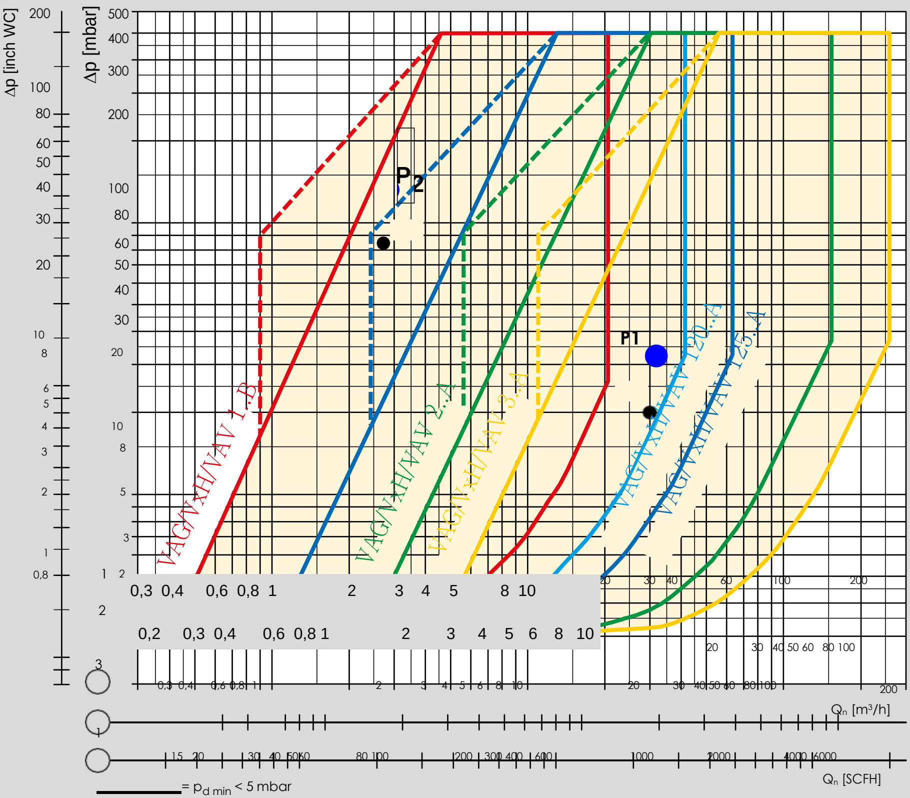
= natural gas (ρ = 0.80 kg/m³)
= propane (ρ = 2.01 kg/m³)
= air (ρ = 1.29 kg/m³)

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

5.1.1 Calculate VAD

metric	imperial	
Natural gas	0.80	kg/m3
Flow rate Q	30.0	m3/h
Inlet pressure p	80.0	mbar
Outlet pressure p	60.0	mbar
Pressure loss Δp	20.0	mbar

Product	R_V	$\Delta p_{min.}$ [mbar]	v [m/s]
VAD 120..A	11.5:1	17.5	21
VAD 125..A	11.5:1	8.5	13
VAD 240..A	5.1:1	3.8	6
VAD 350..A	2.7:1	3.2	4



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

= natural gas (ρ = 0.80 kg/m³)

= propane (ρ = 2.01 kg/m³)

= air (ρ = 1.29 kg/m³)

5.2 Selection example for VAG, VAH, VRH, VAV

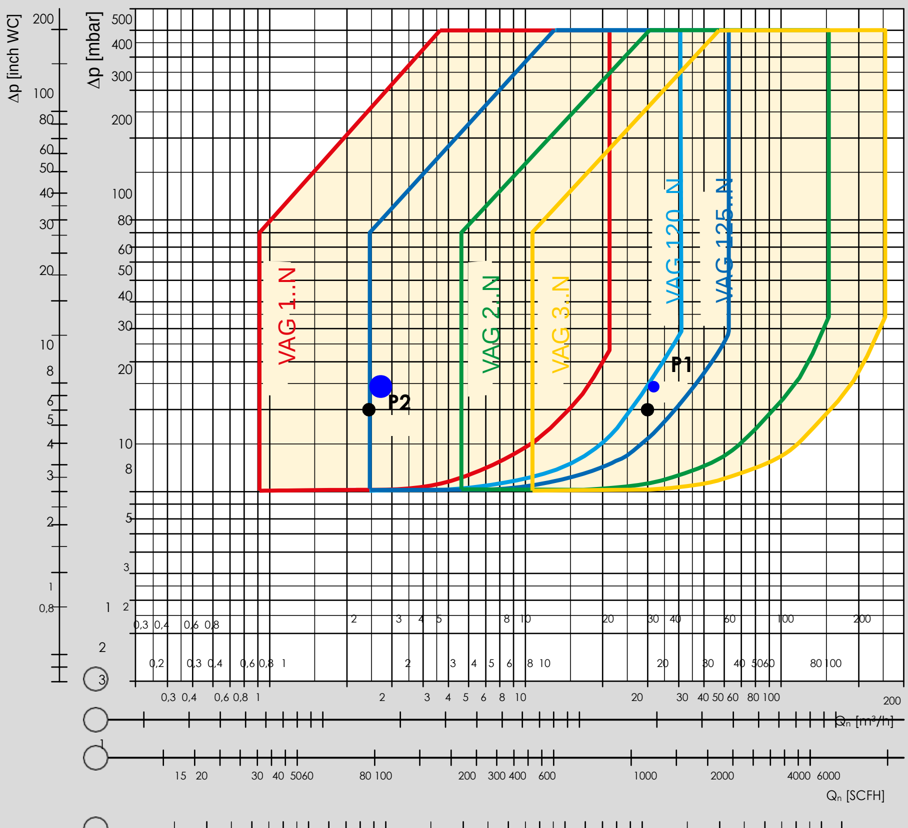
Natural gas,
Flowrate $Q_{max.}$ = 30 m³/h, Inlet pressure p_u = 80 mbar,
Outlet pressure $p_{d\,max.}$ VAG = 60 mbar.
The desired control ratio from high-fire to low-fire rate is R_V = 10:1. High fire:
$\Delta p = p_u - p_{d\,max.}$ = 20 mbar Point P1
Low fire:
$p_{d\,min.} = p_{d\,max.} / R_V^2$ = 0.6 mbar
$Q_{min.} = Q_{max.} / R_V$ = 3 m³/h
$\Delta p = p_u - p_{d\,min.}$ = 79.4 mbar
Point P2, select: 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.

5.2.1 Calculate VAG, VxH VAV

metric imperial

Natural gas	0.80	kg/m3
Flow rate Q_n	30.0	m3/h
Inlet pressure p_u	80.0	mbar
Outlet pressure p_d	60.0	mbar
Pressure loss Δp	20.0	mbar

Product	R_V	$\Delta p_{min.}$	V
VAG 120..A	11.0:1	17.5	21
VAG 125..A	11.0:1	8.5	13
VAG 240..A	2.7:1	3.8	6
VAG 350..A	1.6:1	3.2	4



= natural gas (ρ = 0.80 kg/m³)

= propane (ρ = 2.01 kg/m³)

= air (ρ = 1.29 kg/m³)

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

5.3 Selection example for zero governor VAG..N

Natural gas,
Flow rate $Q_{max.}$ = 30 m³/h,
Inlet pressure p_u = 20 mbar,
Outlet pressure p_d = 0 mbar (atmos- pheric pressure).

The desired control ratio from high-fire to low-fire rate is R_V = 10:1.

High fire:

$\Delta p = p_u - p_{d\ max.}$ = 20 mbar Point P1

Low fire:

Point P2 $Q_{min.}$ = 2.4 m³/h at

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 recom- mend that you select the smallest size to achieve the best control properties.

5.3.1 Calculate VAG..N

metric imperial

Natural gas	0.80	kg/m3
Flow rate Q_n	30.0	m3/h
Inlet pressure p_u	20.0	mbar
Outlet pressure p_d	0	mbar
Pressure loss Δp	20.0	mbar

Product	RV	$\Delta p_{min.}$ [mbar]	v [m/s]
VAG 125..N	12.3:1	15.5	13
VAG 240..N	5.2:1	10.8	6
VAG 350..N	2.8:1	10.2	4

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6 Selection

6.1 Selection table for pressure regulator with solenoid valve VAD

	T-product	Rp	NPT	ISO	quick opening, -closing	24 V DC	100 V AC	120 V AC	200 V AC	230 V AC	Closed position switch	Position indicator 24 V	Viewed right	Viewed left	M20 cable gland	Plug with socket	Plug without socket	Outlet pressure p_d			valve seat		Accessories right								Accessories left							
																							Screw plug	Pressure test point	DG 17VC 3)	DG 40VC 3)	DG 110VC 3)	DG 300VC 3)	Bypass valve VBY	Bypass valve VAS 1	Screw plug	Pressure test point	DG 17VC 3)	DG 40VC 3)	DG 110VC 3)	DG 300VC 3)	Bypass valve VBY	Bypass valve VAS 1
Type1)	T	R	N	F	/N	K	P	Q	Y	W	S2)	G2)	R2)	L2)				-25	-50	-100	A	B																
VAD 115	○	●	○		●	○	○	○	○	●	○	○	○	○	●	○	○	●	●	●		●	●	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○
VAD 120	○	●	○		●	○	○	○	○	●	○	○	○	○	●	○	○	●	●	●	●		●	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○
VAD 125	○	●	○		●	○	○	○	○	●	○	○	○	○	●	○	○	●	●	●	●		●	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○
VAD 240	○	●	○	●	●	○	○	○	○	●	○	○	○	○	●	○	○	●	●	●	●		●	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○
VAD 350	○	●	○	●	●	○	○	○	○	●	○	○	○	○	●	○	○	●	●	●	●		●	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○

●= standard, O= available

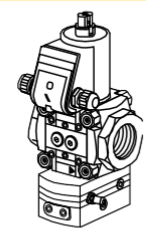
1) Nominal inlet flange diameters: size 1 with nominal diameter DN 15 to 25, size 2 with nominal diameters DN 25 to DN 50, size 3 with nominal diameters DN 40 to DN 65.
Nominal outlet flange diameters: size 1 with nominal diameter DN 15 to 25, size 2 with nominal diameter DN 40, size 3 with nominal diameter DN 50.

2) Closed position switch and bypass/pilot gas valve cannot be fitted together on the same side.

3) Specify the test point for inlet pressure p_u or outlet pressure p_d.
Help for selecting the pressure regulator VAD can be found on the ProFi DVD
www.kromschroeder.com
Products DVD Product finder "ProFi".

Order example

VAD 240R/NW-100A



6.2Type code for VAD

Code	Description
VAD	Pressure regulator with solenoid valve
1 – 3	Size
T	T-product
15 – 65 /15 – /50	Nominal inlet diameter Nominal outlet diameter
R N F	Rp internal thread NPT internal thread ISO flange
/N	Quick opening, quick closing
K P Q Y W	Mains voltage 24 V DC Mains voltage: 100 V AC; 50/60 Hz Mains voltage: 120 V AC; 50/60 Hz Mains voltage: 200 V AC; 50/60 Hz Mains voltage: 230 V AC; 50/60 Hz
S G	CPS with visual position indicator CPS for 24 V with visual position indicator
R L	Viewed from the right (in the direction of flow) Viewed from the left (in the direction of flow)
-25 -50 -100	Outlet pressure p_d: 2.5 – 25 mbar 20 – 50 mbar 35 – 100 mbar
A B	Standard valve seat Reduced valve seat

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6.3 Selection table for air/gas ratio control with solenoid valve VAG, flow rate regulators VAH, VRH

Type[1]	T-product T	Rp R	NPT N	ISO F	quick opening, -closing /N	24 V DC K	100 V AC P	120 V AC Q	200 V AC Y	230 V AC W	Position indicator S[2]	Position indicator 24 V G[2]	Viewed right R[2]	Viewed left L[2]	M20 cable gland	Plug with socket	Plug without socket	valve seat A	B	Connection kit E	K	A	N
VAG 115	○	●	○		●	○	○	○	○	●	○	○	○	○	●	○	○		●	●	●	●	●
VAG 120	○	●	○		●	○	○	○	○	●	○	○	○	○	●	○	○	●		●	●	●	●
VAG 125	○	●	○		●	○	○	○	○	●	○	○	○	○	●	○	○	●		●	●	●	●
VAG 240	○	●	○	●	●	○	○	○	○	●	○	○	○	○	●	○	○	●		●	●	●	●
VAG 350	○	●	○	●	●	○	○	○	○	●	○	○	○	○	●	○	○	●		●	●	●	●
VAH 115	○	●	○		●	○	○	○	○	●	○	○	○	○	●	○	○		●	●		●	
VAH 120	○	●	○		●	○	○	○	○	●	○	○	○	○	●	○	○	●		●		●	
VAH 125	○	●	○		●	○	○	○	○	●	○	○	○	○	●	○	○	●		●		●	
VAH 240	○	●	○	●	●	○	○	○	○	●	○	○	○	○	●	○	○	●		●		●	
VAH 350	○	●	○	●	●	○	○	○	○	●	○	○	○	○	●	○	○	●		●		●	
VRH 115	○	●	○																●	●		●	
VRH 120	○	●	○															●		●		●	
VRH 125	○	●	○															●		●		●	
VRH 240	○	●	○	●														●		●		●	
VRH 350	○	●	○	●														●		●		●	

Type[1]	Accessories right: Screw plug	Pressure test point	DG 17VC[3]	DG 40VC[3]	DG 110VC[3]	DG 300VC[3]	Bypass valve VBY	Bypass valve VAS 1	Accessories left: Screw plug	Pressure test point	DG 17VC[3]	DG 40VC[3]	DG 110VC[3]	DG 300VC[3]	Bypass valve VBY	Bypass valve VAS 1
VAG 115	●	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○
VAG 120	●	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○
VAG 125	●	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○
VAG 240	●	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○
VAG 350	●	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○
VAH 115	●	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○
VAH 120	●	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○
VAH 125	●	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○
VAH 240	●	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○
VAH 350	●	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○
VRH 115	●	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○
VRH 120	●	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○
VRH 125	●	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○
VRH 240	●	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○
VRH 350	●	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○

● = standard, ○ = available

1) *Nominal inlet flange diameters: size 1 with nominal diameter DN 15 to 25, size 2 with nominal diameters DN 25 to DN 50, size 3 with nominal diameters DN 40 to DN 65.*
Nominal outlet flange diameters: size 1 with nominal diameter DN 15 to 25, size 2 with nominal diameter DN 40, size 3 with nominal diameter DN 50.

2) *Position indicator and bypass/pilot gas valve cannot be fitted together on the same side.*

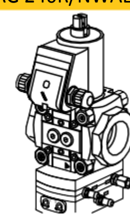
3) *Specify the test point for inlet pressure p_u or outlet pressure p_d.*

Help for selecting the regulators can be found on the ProFi DVD www.kromschroeder.com Products

DVD Product finder "ProFi".

Order example

VAG 240R/NWAE



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6.3.1 Type code for VAG, VAH, VRH

Code	Description
VA G VA H VRH	Air/gas ratio control with solenoid valve Flow rate regulator with solenoid valve Flow rate regulator
1 – 3	Size
T	T-product
15 – 65 /15 – /50	Nominal inlet diameter Nominal outlet diameter
R N F	Rp internal thread NPT internal thread ISO flange
/N[1)]	Quick opening, quick closing
K[1)] P[1)] Q[1)] Y[1)] W[1)]	Mains voltage 24 V DC Mains voltage: 100 V AC; 50/60 Hz Mains voltage: 120 V AC; 50/60 Hz Mains voltage: 200 V AC; 50/60 Hz Mains voltage: 230 V AC; 50/60 Hz
S[1)] G[1)]	CPS with visual position indicator CPS for 24 V with visual position indicator
R L	Viewed from the right (in the direction of flow) Viewed from the left (in the direction of flow)
A B	Standard valve seat Reduced valve seat
E K A N	Connection kit for air control pressure p_{sa}: VAG, VAH, VRH: compression fitting VAG: plastic hose coupling VAG, VAH, VRH: NPT ⅛ adapter VAG: zero governor

[1)] *Only available for VAG, VAV, VAH.*

6.4 Selection table for variable air/gas ratio control with solenoid valve VAV

Type[1]	T-product T	Connection R	N	F	quick opening, -closing /N	24 V DC K	100 V AC P	120 V AC Q	200 V AC Y	230 V AC W	Closed position switch S[2]	Position indicator 24 V G[2]	Viewed right R[2]	Viewed left L[2]	M20 cable gland	Plug with socket	Plug without socket	valve seat A	B	Connection kit E	K	A	Accessories right: Screw plug	Pressure test point	DG 17VC[3]	DG 40VC[3]	DG 110VC[3]	DG 300VC[3]	Bypass valve VBY	Bypass valve VAS 1	Accessories left: Screw plug	Pressure test point	DG 17VC[3]	DG 40VC[3]	DG 110VC[3]	DG 300VC[3]	Bypass valve VBY	Bypass valve VAS 1
VAV 115	○	●	○		●	○	○	○	○	●	○	○	○	○	●	○	○		●	●	●	●	●	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○
VAV 120	○	●	○		●	○	○	○	○	●	○	○	○	○	●	○	○	●		●	●	●	●	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○
VAV 125	○	●	○		●	○	○	○	○	●	○	○	○	○	●	○	○	●		●	●	●	●	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○
VAV 240	○	●	○	●	●	○	○	○	○	●	○	○	○	○	●	○	○	●		●	●	●	●	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○
VAV 350	○	●	○	●	●	○	○	○	○	●	○	○	○	○	●	○	○	●		●	●	●	●	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○

● = *standard*, ○ = *available*

[1] *Nominal inlet flange diameters: size 1 with nominal diameter DN 15 to 25, size 2 with nominal diameters DN 25 to DN 50, size 3 with nominal diameters DN 40 to DN 65.*
Nominal outlet flange diameters: size 1 with nominal diameter DN 15 to 25, size 2 with nominal diameter DN 40, size 3 with nominal diameter DN 50.

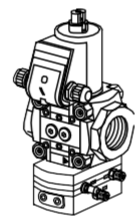
[2] *Closed position switch and bypass/pilot gas valve cannot be fitted together on the same side.*

[3] *Specify the test point for inlet pressure p_u or outlet pressure p_d.*

Help for selecting the variable air/gas ratio control VAV can be found on the ProFi DVD
www.kromschroeder.com Products DVD Product finder "ProFi".

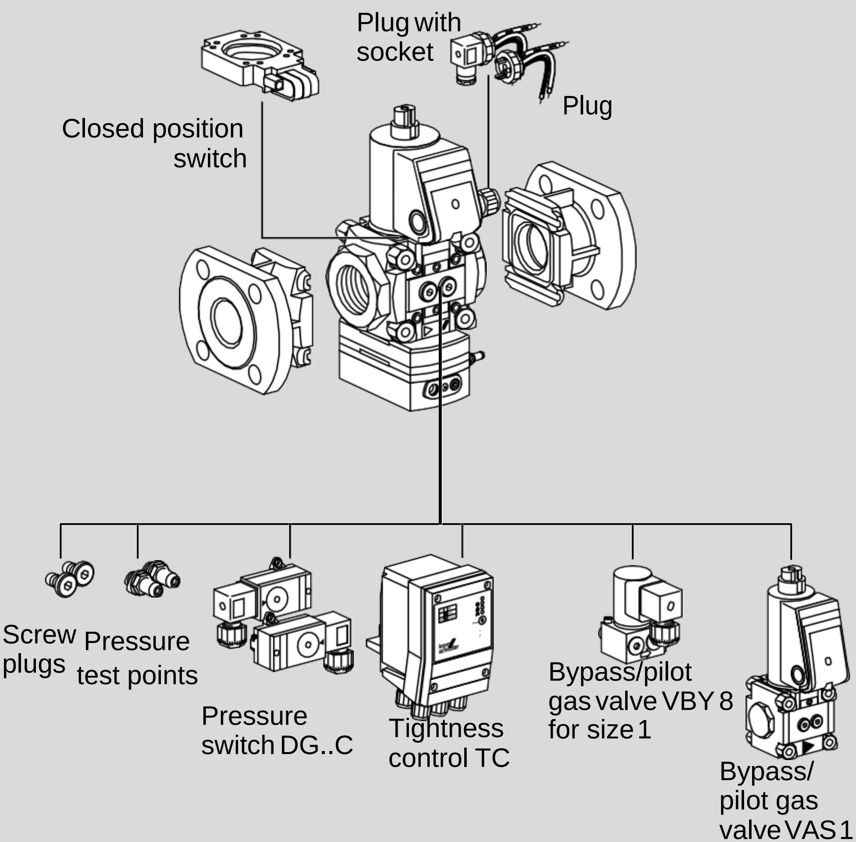
Order example

VAV 240R/NWAK



6.4.1 Type code for VAV

Code	Description
VAV	Variable air/gas ratio control with solenoid valve
1 – 3	Size
T	T-product
15 – 65 /15 – /50	Nominal inlet diameter Nominal outlet diameter
R N F	Rp internal thread NPT internal thread ISO flange
/N	Quick opening, quick closing
K P Q Y W	Mains voltage 24 V DC Mains voltage: 100 V AC; 50/60 Hz Mains voltage: 120 V AC; 50/60 Hz Mains voltage: 200 V AC; 50/60 Hz Mains voltage: 230 V AC; 50/60 Hz
S G	CPS with visual position indicator CPS for 24 V with visual position indicator
R L	Viewed from the right (in the direction of flow) Viewed from the left (in the direction of flow)
A B	Standard valve seat Reduced valve seat
E K A	Connection kit for air control pressure p_{sa} and combustion chamber control pressure p_{sc}: compression fitting plastic hose coupling NPT ⅛ adapter



6.5 Accessories

Modularly configurable with:

– Screw plugs
– Pressure test points
– Pressure switch DG..VC for inlet and/or outlet pressure
– Tightness control TC
– Bypass/pilot gas valve VBY 8 for size 1
– Bypass/pilot gas valve VAS 1

For further information, see page 40 (Accessories).

7 Project planning information

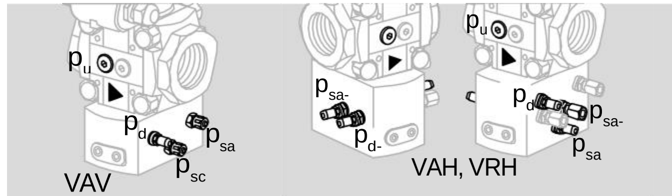
Do not store or install the unit in the open air.

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 the pressure test point p_d.

VAD: measurement 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 main- taining a constant burner capacity.

VAG: additional measurement point for the air control pressure p_{sa} on the regulator body.

For burners which are operated with excess air, the minimum values for p_d and p_{sa} may be below the li- mit. Technical data, see page 51 (VAG). No situation which would jeopardize safety must arise.

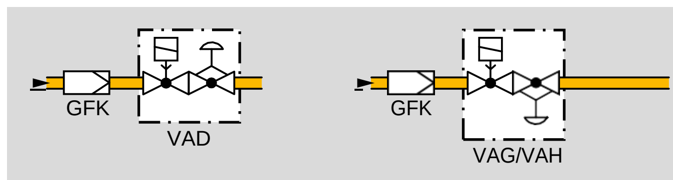


VAV: measurement point for the outlet pressure p_d on the regulator body.

VAH: additional measurement points for the outlet pressure p_{d-} and the air control pressure p_{sa}/p_{sa-} on the regulator body.

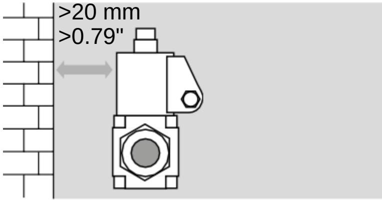
A gas/air mixture may be applied at the p_{sa-} connection for the air control pressure.

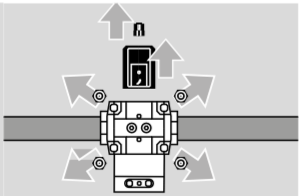
7.1 Installation



Sealing material and thread cuttings must not be al- lowed to get into the valve housing. Install a filter up- stream 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.





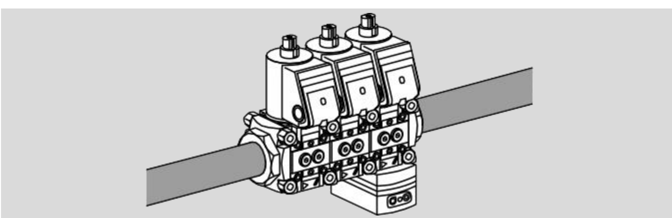
The unit must not be in contact with masonry. Minimum clearance 20 mm (0.79 inches).

Ensure that there is sufficient space for installation and adjustment.

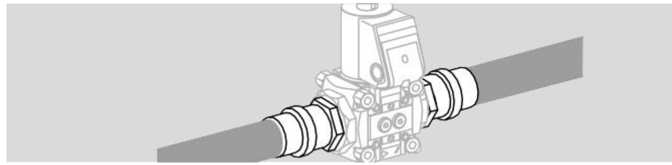
The pipe system must be designed in such a way so as to avoid strain at the connections.

The solenoid actuator heats up during operation. Surface temperature approx. 85°C (approx. 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 offset by 90° or 180°.

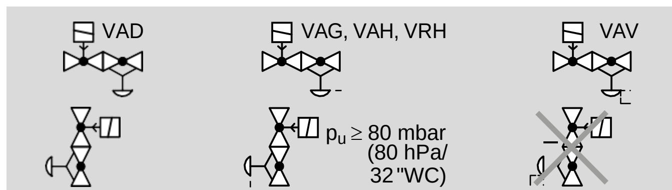


If more than three valVario controls are installed in line, the controls must be supported.



The seals in some gas compression fittings are approved for temperatures of up to 70°C (158°F). This tempera- ture limit will not be exceeded if the flow through the pipe is at least 1 m³/h (35.31 SCFH) of gas and the maximum ambient temperature is 50°C (122°F).

7.1.1 Installation position



vertical upright position only.

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

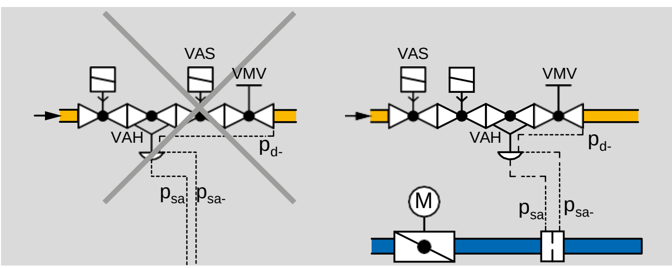
VAG, VAH: horizontal position only, if $p_u \geq$ 80 mbar (32 "WC)).

VAV: installation in the vertical position only, black sole- noid actuator in the vertical upright position.

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 con- trol pressure p_{sc} should be kept as short as possible.
The tube internal diameter for the impulse line must al- ways 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 up- stream of fine-adjusting valve VMV. The VAS would no longer be able to perform its function as a second safe- ty valve if installed in the above-mentioned position.

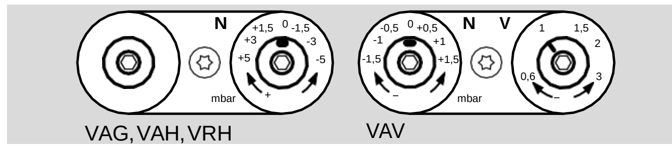


The measuring orifice in the air line for impulse lines p_{sa} and p_{sa-} must always be installed downstream of the air control valve.

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.

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



If the burner operates at low-fire rate, the gas/air mix- ture can be changed using the parallel shift of the char- acteristic curve by turning the adjusting screw "N".

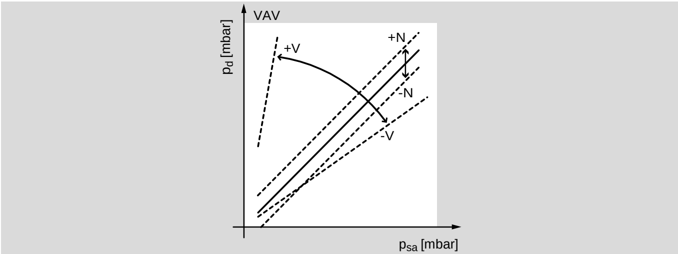
Adjusting range at low fire:
VAG, VAH, VRH: -5 to +5 mbar (-1.95 to +1.95 "WC).
VAV: -1.5 to +1.5 mbar (-0.6 to +0.6 "WC).

7.3 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 $3:1$.

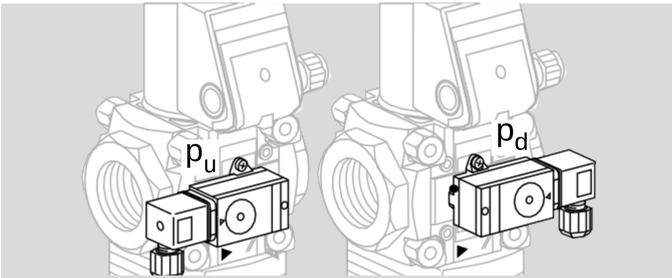
The settings N and V can influence each other and must be repeated if necessary.

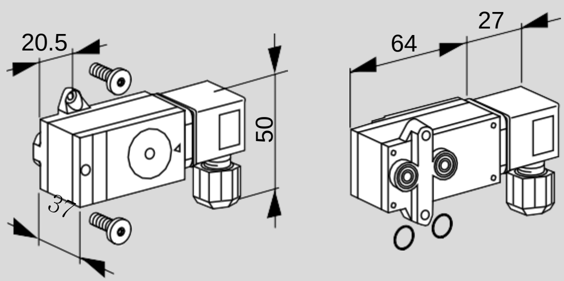


7.3.1 Calculation

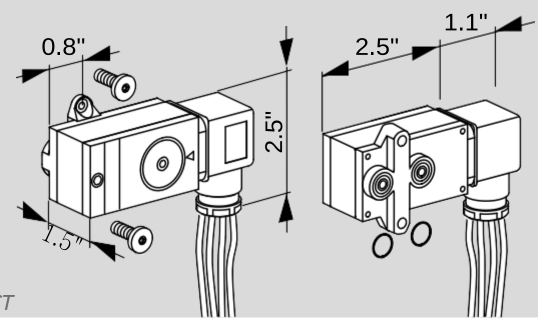
With no connection to the combustion chamber control pressure p_{sc}: $p_d = V \times p_{sa} + N$

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





DG..VC



DG..VCT

8 Accessories

8.1 Gas pressure switch 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 × pressure switch for gas, 2 × retaining screws,

2 × sealing rings.

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

DG..VC for VAx, VRH

Type	Adjusting range [mbar]
DG 17VC	2 to 17
DG 40VC	5 to 40
DG 110VC	30 to 110
DG 300VC	100 to 300

DG..VCT for VAx..T, VRH..T

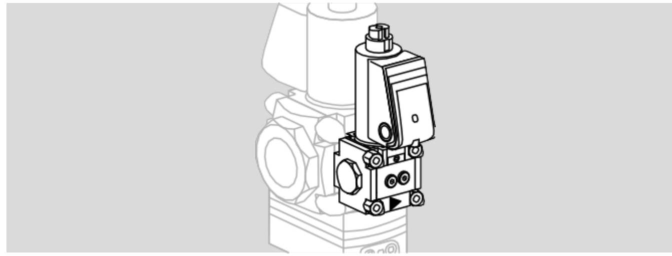
with AWG 18 connection wires

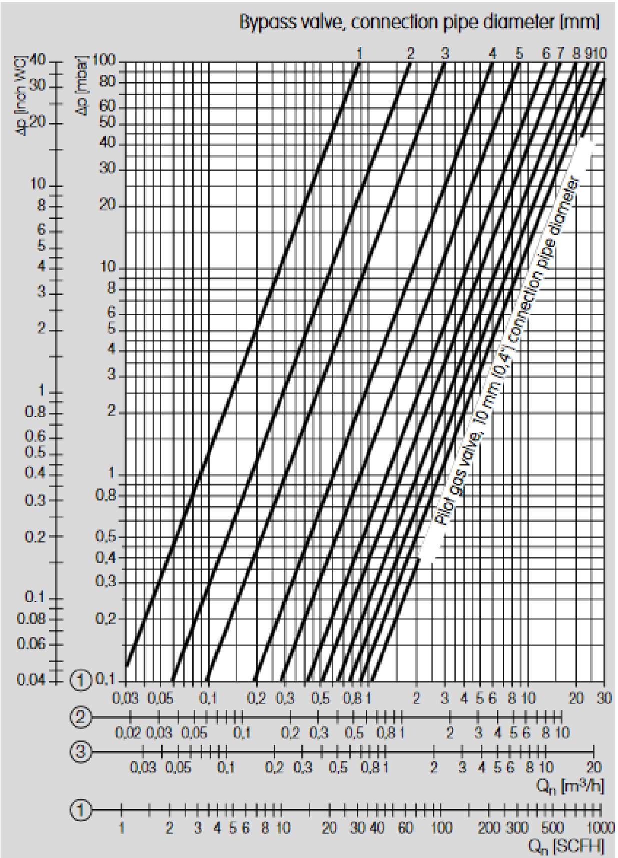
Type	Adjusting range ["WC]
DG 17VCT	0.8 to 6.8
DG 40VCT	2 to 16
DG 110VCT	12 to 44
DG 300VCT	40 to 120

Fastening set DG..C for VAx 1 – 3 Order No.: 74921507, Scope of delivery: 2 × retaining screws,

2 × sealing rings.

8.2 Bypass valve/pilot gas valve VAS 1



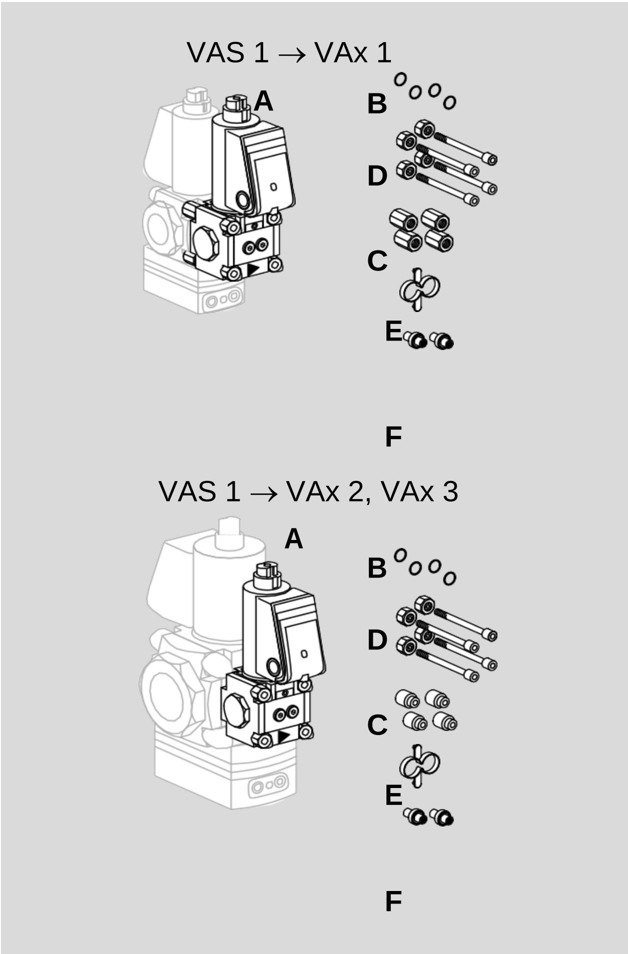


① = natural gas (ρ = 0.80 kg/m³)
② = propane (ρ = 2.01 kg/m³)
③ = air (ρ = 1.29 kg/m³)

8.2.1 Flow rate

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

Scope of delivery and connection pipes, see page 42 (Scope of delivery of VAS 1 for VAx 1, VAx 2, VAx 3).



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

A 1 × bypass/pilot gas valve VAS 1,

B 4 × 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 × connection parts,

E 1 × mounting aid.

Pilot gas valve VAS 1:

F 1 × connection pipe, 1 × sealing plug, if the pilot gas valve has a threaded flange at the outlet side.

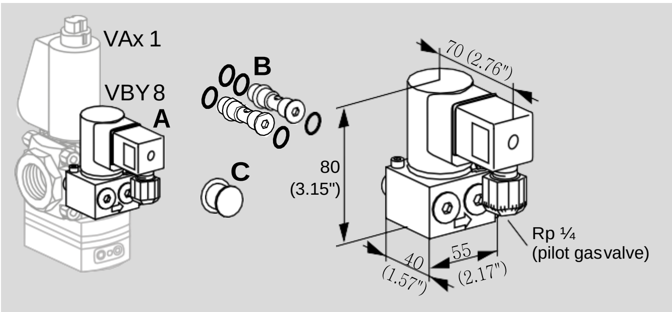
Bypass valve VAS 1:

F 2 × connection pipes, if the bypass valve has a blind flange at the outlet side.
Standard: bypass diameter 10 mm.

Other connection pipes with bypass diameter as of 1 mm are available.

Ø	Order No.
1 mm	74923877
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

8.3 Bypass valve/pilot gas valve VBY 8 for VAD/VAG/VAH/VAV 1



For mounting on VAD, VAG, VAH, VAV 1 and double sole- noid valve VCD, VCG, VCH, VCV 1.

8.3.1 Scope of delivery, VBY 8I as bypass valve

A 1 × bypass valve VBY 8I,

B 2 × retaining screws with 4 × O-rings: both retaining screws have a bypass orifice,

C 1 × grease for o-rings.

8.3.2 Scope of delivery, VBY 8R as pilot gas valve

A 1 × pilot gas valve VBY 8R,

B 2 × 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 1 × grease for O-rings.

8.3.3 Selection

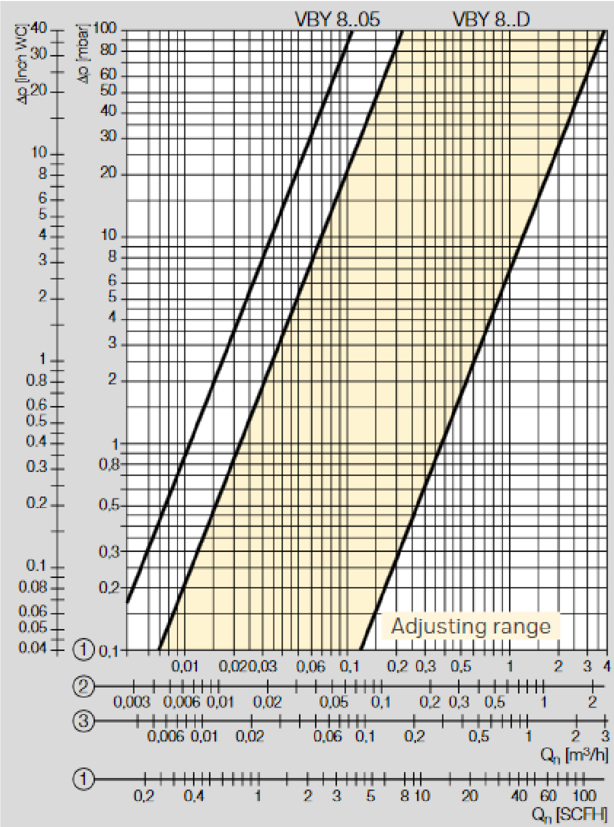
Type	I	R	W	Q	K	6L	-R	-L	E	B	D	05
VBY 8												

Order example

VBY 8RW6L-LED

8.3.4 Type code

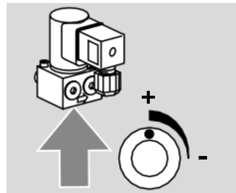
Code	Description
VBY	Gas solenoid valve
8	Nominal size
I R	For internal gas pick-up as bypass valve For external gas pick-up as pilot gas valve
K Q W	Mains voltage: 24 V DC Mains voltage: 120 V AC; 50/60 Hz Mains voltage: 230 V AC; 50/60 Hz
6L	Electrical connection via plug and socket with LED
-R -L	Attachment side of main valve: right-hand side Attachment side of main valve: left-hand side
E B	Attached on the VAx Enclosed (separate packing unit)
D 05	Flow adjustment Nozzle diameter = 0.5 mm (0.02")



① = Natural gas (ρ = 0.80 kg/m³)
② = Propane (ρ = 2.01 kg/m³)
③ = Air (ρ = 1.29 kg/m³)

8.3.5 Flow rate

VBY 8..D



The flow rate can be set by turning the flow rate restric- tor (4 mm/0.16" Allen screw) ¼ of a turn. Flow rate: 10 to 100%.

VBY 8..05

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

8.3.6 Technical data

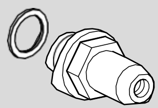
Inlet pressure p_u max: 500 mbar (7 psig).

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.



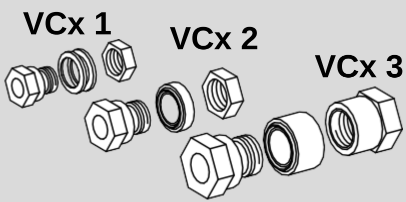
8.4 Pressure test points

Test points to check the inlet pressure p_u and outlet pressure p_d.

Scope of delivery:

1 x test points with 1 x profiled sealing rings.

Rp ¼: Order No. 74923390, ¼ NPT: Order No. 75455894.

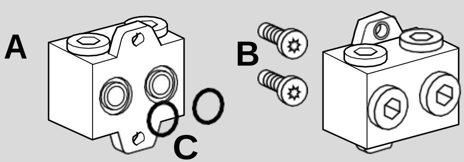


8.5 Cable gland set

When wiring a double solenoid valve with pressure regulator VCx, 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.



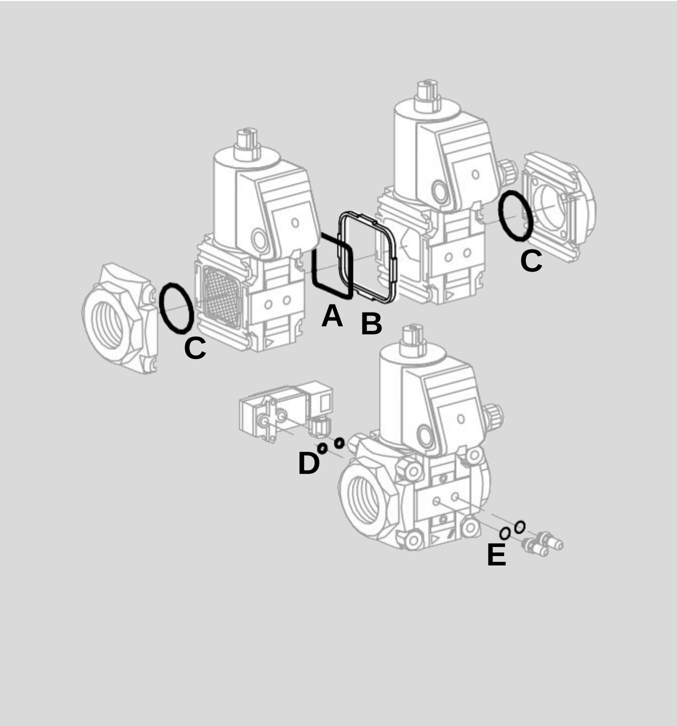
8.6 Attachment block

For locked installation of pressure gauge or other accessories.

Attachment block Rp ¼, order No. 74922228,
Attachment block ¼ 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.



8.7 Seal set VA 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 pressure test point/screw plug: **E** 2 x sealing rings (flat sealing),
2 x profiled sealing rings.

8.8 Seal set VCS 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.

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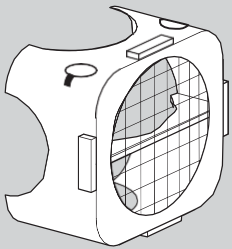
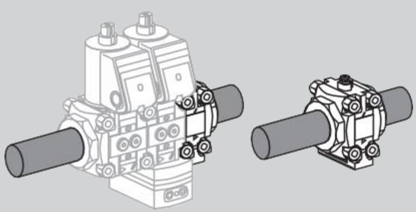


8.9 Differential pressure orifice

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 up- stream 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.



8.10 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. See www.docuthek.com Technical Information, VMO

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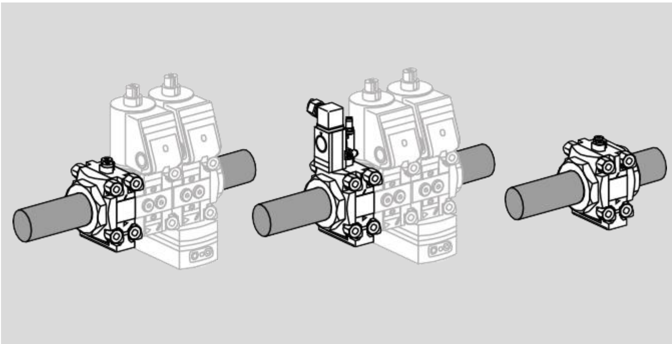
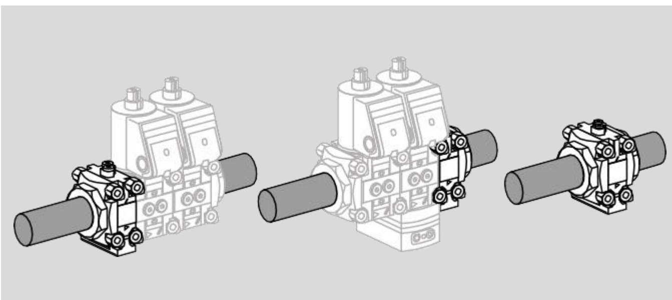


8.11 Filter module VMF

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.

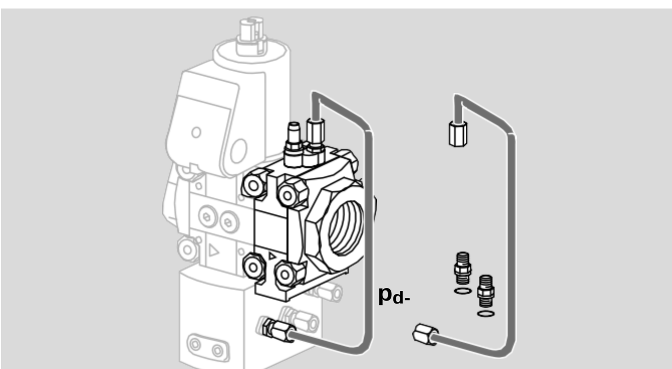
See www.docuthek.com Technical Information, VMF



8.12 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.

See www.docuthek.com Technical Information, VMV

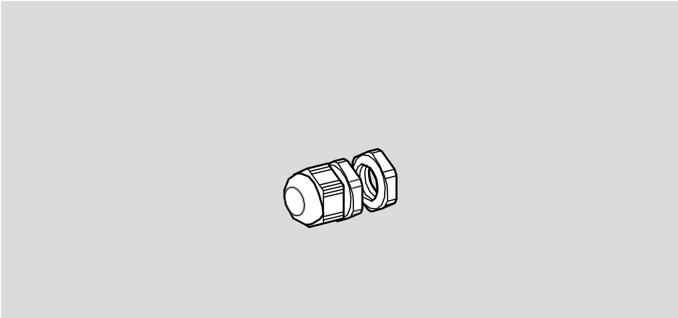


8.13 Gas control line

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 avail- able with 2 ⅛" compression fittings.

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



8.14 Cable gland with pressure equalization element

To avoid the formation of condensation, the cable gland with pressure equalization element can be used instead of the standard M20 cable gland. The diaphragm in the gland is designed to ventilate the device, without allow- ing water to enter.

1 x cable gland, Order No.: 74924686

9 Technical data

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

CE and FM approved, UL listed, max. inlet pressure p_u: 10 – 500 mbar (4 – 200 "WC),
FM approved (230 V AC, 120 V AC, 24 V DC), non operational pressure: 700 mbar (10 psig).

ANSI/CSA approved (230 V AC, 120 V AC, 24 V DC) up to 350 mbar (5 psig).

Opening time of the solenoid valve:
quick opening: ≤ 0.5 s,
Closing time: quick closing: < 1 s.

Medium and ambient temperatures:
-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: -20 to +40°C (-4 to +104°F).

Enclosure: IP 65.

Valve housing: aluminium, valve seal: NBR.

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

Safety valve: Class A to EN 161,
Factory Mutual Research Class: 7400 Process

Control Valves (230 V AC, 120 V AC, 24 V DC), ANSI Z21.21 and CSA 6.5, ANSI Z21.18 and CSA 6.3.

Control class A to EN 88-1. Control

range: up to 10:1. 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%.

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	–
	100 V AC	25 W	(26 VA)
	120 V AC	25 W	(26 VA)
	200 V AC	25 W	(26 VA)
	230 V AC	25 W	(26 VA)
VAx 2, VAx 3	24 V DC	36 W	–
	100 V AC	36 W	(40 VA)
	120 V AC	40 W	(44 VA)
	200 V AC	40 W	(44 VA)
	230 V AC	40 W	(44 VA)
VBY	24V DC	8 W	–
	120 V AC	8 W	–
	230 V AC	9,5 W	–

Cable gland: M20 × 1.5.

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

Closed position switch contact rating:

Type	Voltage	Min. current (resistive load)	Max. current (resistive load)
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

Closed position switch switching frequency: max. 5 × per minute.

Switching current [A]	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*

9.1 VAD

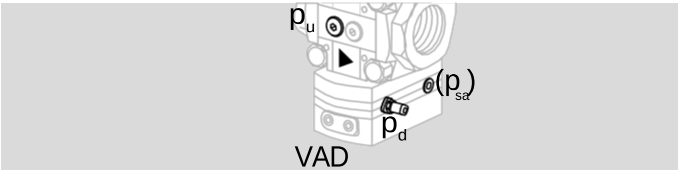
Outlet pressure p_d:

VAD..-25: 2.5 – 25 mbar (1 – 10 "WC),

VAD..-50: 20 – 50 mbar (8 – 20 "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).



9.2 VAG

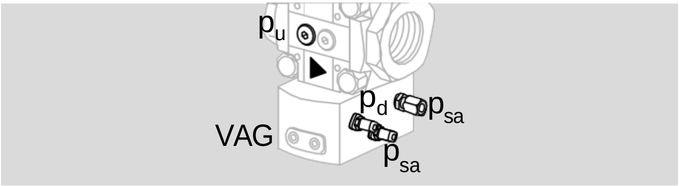
Outlet pressure p_d: 0.5 – 100 mbar (0.2 – 40 "WC).

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

For burners which are operated with excess air, p_d and p_{sa} may be below the limit of 0.5 mbar, see page 36 (Project planning information).

Adjusting range at low fire: ±5 mbar (±2 "WC). Transmission ratio of air to gas: 1:1.

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



VAG..K: 1 x ⅛" coupling for plastic hose (internal dia. 3.9 mm (0.15"), external dia. 6.1 mm (0.24")) or

VAG..E: 1 x ⅛" compression fitting for 6 × 1 tube or VAG..A: 1 x NPT ⅛ adapter or

VAG..N: zero governor with breathing orifice.

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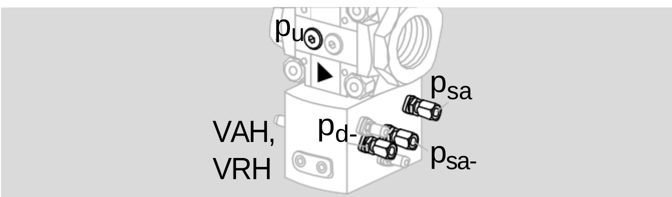
9.3 VAH, VRH

Air control pressure p_{sa}:
0.6 – 100 mbar (0.24 – 40 "WC).
Differential air pressure Δp_{sa} (p_{sa} - p_{sa-}):
0.6 – 50 mbar (0.24 – 19.7 "WC).
Differential gas pressure Δp_d (p_d - p_{d-}): 0.6 – 50 mbar (0.24 – 19.7 "WC).

Transmission ratio of gas to air: 1:1.

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

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



VAH..E, VRH..E: 3 x ⅛" compression fitting for 6 × 1 tube or VAH..A, VRH..A: 3 x NPT ⅛ adapter.

9.4 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).

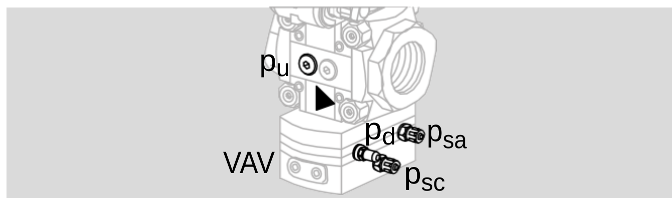
Min. control pressure differential p_{sa} - p_{sc}: 0.4 mbar (0.15 "WC).

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 air to gas:
0.6:1 to 3:1.

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



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 ⅛" compression fitting for 6 × 1 tube or VAV..A: 2 x NPT ⅛ adapter.

9.5 Safety-specific characteristic values for VAx 1 – 3

For SIL	
Suitable for Safety Integrity Level	SIL 1, 2, 3
Diagnostic coverage DC	0
Type of subsystem	Type A to EN 61508-2, 7.4.3.1.2
Operating mode	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	Operating cycles: VAD, VAG, VAV, VAH 1: 10,094,360 VAD, VAG, VAV, VAH 2: 8,229,021 VAD, VAG, VAV, VAH 3: 6,363,683
Hardware fault tolerance (1 valve) HFT	0
Hardware fault tolerance (2 valves) HFT	1
Safe failure fraction SFF	> 90%
Fraction of undetected common cause failures β	≥ 2%

Max. service life under operating conditions:

10 years after date of production, plus max. 1/2 year in storage prior to first use, or once the given number of operating cycles has been reached, depending on which is achieved first.

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 valves are installed in a double-channel architecture (HFT = 1), provided that the complete system complies with the requirements of EN 61508/ ISO 13849.

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

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

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

9.5.2 Calculating the PFH_D and PFD_{avg}

Type	VAx 3	
n_{op}	2	1/h
n_{op}	8760	1/a
Cycle time	3600	s
B_{10d}	6363683	
T_{10d}	10	a
$PFH_{D\,(1\,VAx)}$	1.57141705518643	1/h
$PFD_{avg\,(1\,VAx)}$		
suitable for	PL d, SIL 2	
$PFH_{D\,(2\,VAx)}$	3.35058322535326	1/h
$PFD_{avg\,(2\,VAx)}$		
suitable for	PL e, SIL 3	

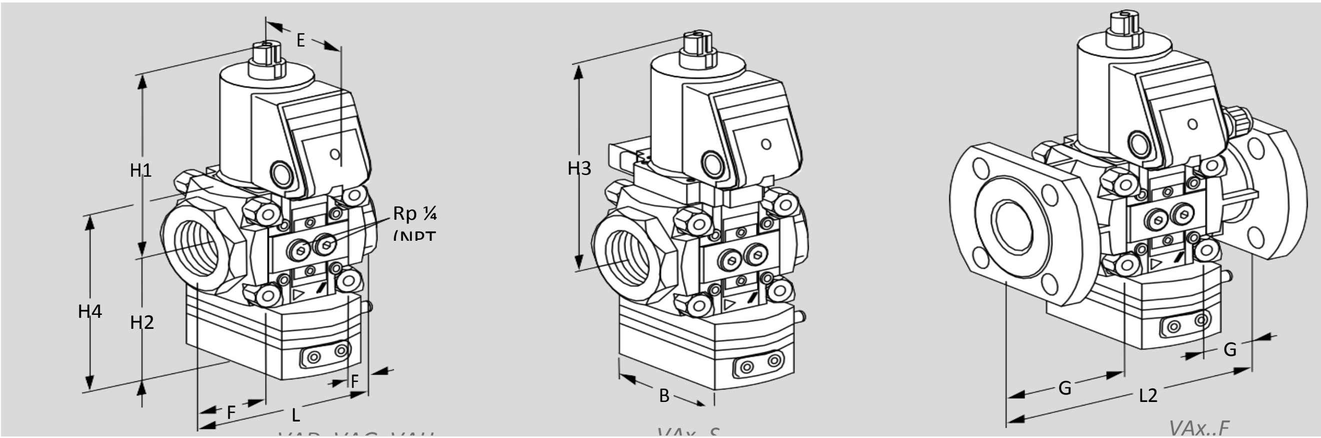
PFH_D = Probability of dangerous failure (HDM = high demand mode) [1/hour]

PFD_{avg} = Average probability of dangerous failure 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]



9.6 Dimensions

Type	Connection		Dimensions																				Weight	
	Rp/ NPT	DN	L		L2		E		F		G		H1		H2		H3		H4		B			
			mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	kg	lbs
VAx 115	½	15	75	2.9	–	–	75	2.9	15	0.6	–	–	143	5.6	82	3.2	161	6.3	117	4.6	97	3.8	1.8	4.0
VAH 115	½	15	75	2.9	–	–	75	2.9	15	0.6	–	–	143	5.6	100	3.9	161	6.3	135	5.3	97	3.8	2	4.4
VAx 120	¾	20	91	3.6	–	–	75	2.9	23	0.9	–	–	143	5.6	82	3.3	161	6.3	117	4.6	97	3.8	1.9	4.2
VAH 120	¾	20	91	3.6	–	–	75	2.9	23	0.9	–	–	143	5.6	100	3.9	161	6.3	135	5.3	97	3.8	2.1	4.6
VAx 125	1	25	91	3.6	–	–	75	2.9	23	0.9	–	–	143	5.6	82	3.3	161	6.3	117	4.6	97	3.8	1.9	4.2
VAH 125	1	25	91	3.6	–	–	75	2.9	23	0.9	–	–	143	5.6	100	3.9	161	6.3	135	5.3	97	3.8	2.1	4.6
VAx 240	1½	40	127	5.0	200	7.9	85	3.3	29	1.1	66	2.6	170	6.7	112	4.4	191	7.5	162	6.4	125	4.9	4.4	9.7
VAH 240	1½	40	127	5.0	200	7.9	85	3.3	29	1.1	66	2.6	170	6.7	132	5.2	191	7.5	182	7.2	125	4.9	4.7	10.4
VAx 350	2	50	155	6.1	230	9.1	85	3.3	36	1.4	74	2.9	180	7.0	135	5.3	201	7.9	196	7.7	160	6.3	6.1	13.4
VAH 350	2	50	155	6.1	230	9.1	85	3.3	36	1.4	74	2.9	180	7.0	156	6.1	201	7.9	217	8.5	160	6.3	6.4	14.1

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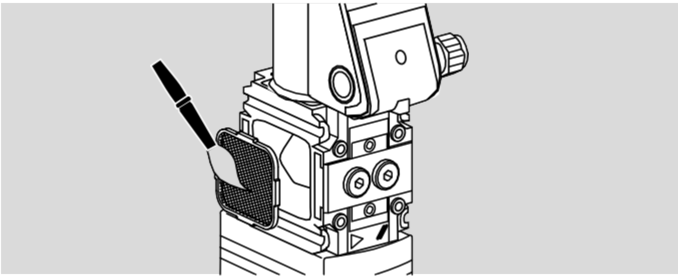
9.7 Converting units

see www.adlatus.org

10 Maintenance cycles

At least once per annum, at least twice per annum for biogas.

If the flow rate drops, clean the strainer.



11 Glossary

11.1 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, diagnos- tic coverage could exist for sensors and/or logic system and/or final elements. Unit: %

see EN ISO 13849-1

11.2 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

11.3 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

11.4 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

11.5 Fraction of undetected common cause failures β

Fraction of undetected failures of redundant compo- nents 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

11.6 B_{10d} value

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

see EN ISO 13849-1

11.7 T_{10d} value

Mean time until 10% of the components fail danger- ously

see EN ISO 13849-1

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11.8 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

11.9 Mean dangerous failure rate λ_D

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

see EN ISO 13849-1

11.10 Safe failure fraction SFF

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

see EN 13611/A2

11.11 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

11.12 Mean time to dangerous failure $MTTF_d$

Expectation of the mean time to dangerous failure *see EN ISO 13849-1*

reserved.

11.13 Demand rate n_{op}

Mean number of annual operations *see EN ISO 13849-1*

11.14 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