

Data sheet

Differential pressure controller with flow limitation (PN 16)

AVPB - return mounting, adjustable setting

AVPB-F - return mounting, fixed setting

Description



AVPB (-F) is a self-acting differential pressure controller with flow limitation primarily for use in district heating systems. The controller closes on rising differential pressure or when set max. flow is exceeded.

The controller has a control valve with adjustable flow restrictor, an actuator with one control diaphragm and handle for differential pressure setting (fixed setting version is without handle).

Main data:

- DN 15-32
- k_{vs} 1.6-10 m³/h
- Flow range 0.06-7.3 m³/h
- PN 16
- Setting range (AVPB): 0.05-0.5 bar / 0.2-1.0 bar / 0.8-1.6 bar ¹⁾
- Fixed setting (AVPB-F): 0.2 bar / 0.3 bar / 0.5 bar
- Temperature: Circulation water/glycolic water up to 30%: 2 ... 150 °C
- Connections:
 - Ext. thread (weld-on, thread and flange tailpieces)

¹⁾ On special request

Ordering

Example:

Differential pressure controller with flow limitation, DN 15; k_{vs} 1.6; PN 16; setting range 0.2-1.0 bar; T_{max} 150 °C; ext. thread


- 1x AVPB DN 15 controller
Code No: **003H6399**
- 1x Impulse tube set AV, R 1/8
Code No: **003H6852**

Option:

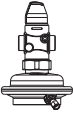
- 1x Weld-on tailpieces
Code No: **003H6908**

The controller will be delivered completely assembled. External impulse tube (AV) must be ordered separately.

AVPB Controller

Picture	DN (mm)	k_{vs} (m ³ /h)	Connection	Δp sett. range (bar)	Code No.	Δp sett. range (bar)	Code No.
	15	1.6	Cylindr. ext. thread acc. to ISO 228/1	0.05-0.5	003H6393	0.2-1.0	003H6399
		2.5			003H6394		003H6400
		4.0			003H6395		003H6401
	20	6.3			003H6396		003H6402
	25	8.0			003H6397		003H6403
	32	10			003H6398		003H6404



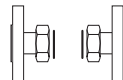



AVPB-F Controller

Picture	DN (mm)	k_{vs} (m ³ /h)	Connection	Δp sett. range (bar)	Code No.	Δp sett. range (bar)	Code No.	Δp sett. range (bar)	Code No.
	15	1.6	Cylindr. ext. thread acc. to ISO 228/1	0.2	003H6411	0.3	0.5	0.5	003H6423
		2.5			003H6412				003H6424
		4.0			003H6413				003H6425
	20	6.3			003H6414				003H6426
	25	8.0			003H6415				003H6427
	32	10			003H6416				003H6428

Ordering (continuous)

Accessories




Accessories

Picture	Type designation	DN	Connection	Code No.
	Weld-on tailpieces	15	-	003H6908
		20		003H6909
		25		003H6910
		32		003H6911
	External thread tailpieces	15	Conical ext. thread acc. to EN 10226-1	R 1/2 003H6902
		20		R 3/4 003H6903
		25		R 1 003H6904
		32		R 1 1/4 003H6905
	Flange tailpieces	15	Flanges PN 25, acc. to EN 1092-2	003H6915
		20		003H6916
		25		003H6917
	Impulse tube set AV	Description: - 1x copper tube Ø6 × 1 × 1500 mm - 1x compression fitting ¹⁾ for imp. tube connection to pipe Ø6 × 1 mm	R 1/8 003H6852	
			R 3/8 003H6853	
			R 1/2 003H6854	
	¹⁾ 10 compression fittings for imp. tube connection to pipe, Ø6 × 1 mm R 1/8			003H6857
	¹⁾ 10 compression fittings for imp. tube connection to pipe, Ø6 × 1 mm R 3/8			003H6858
	¹⁾ 10 compression fittings for imp. tube connection to pipe, Ø6 × 1 mm R 1/2			003H6859
	¹⁾ 10 compression fittings for imp. tube connection to actuator, Ø6 × 1 mm G 1/8			003H6931
	Shut off valve Ø6 mm			003H0276

¹⁾ Compression fitting consists of a nipple, compression ring and nut.

Service kits

Service kits

Picture	Type designation	DN	k _{VS} (m³/h)	Code No.
	Valve insert	15	1.6	003H6863
			2.5	003H6864
			4.0	003H6865
		20	6.3	003H6866
		25	8.0	003H6867
		32	10	
 			Δp setting range (bar)	Code No.
	Actuator with adjustable handle (AVPB)		0.05-0.5	003H6821
			0.2-1.0	003H6822
	Actuator without adjustable handle (AVPB-F)		0.2	003H6825
			0.3	
			0.5	

Technical data

Valve

Nominal diameter			DN	15			20	25	32
k _{v5} value			m ³ /h	1.6	2.5	4.0	6.3	8.0	10
Range of max. flow setting	Δp _b ¹⁾ = 0.2 bar	from		0.03	0.08	0.09	0.1	0.1	0.15
		to		0.9	1.4	1.8	2.7	4.5	6.0
Cavitation factor z				≥ 0.6				≥ 0.55	
Leakage acc. to standard IEC 534			% of k _{v5}	≤ 0.02					≤ 0.05
Nominal pressure			PN	25					
Min. differential pressure			bar	see remark ²⁾					
Max. differential pressure				12					
Medium				Circulation water/glycolic water up to 30%					
Medium pH				Min. 7, Max. 10					
Medium temperature			°C	2 ...150					
Connections	valve		External thread						
	tailpieces		Weld-on and external thread						
			Flange					-	
Materials									
Valve body				Red bronze CuSn5ZnPb (Rg5)					
Valve seat				Stainless steel, mat. No. 1.4571					
Valve cone				Dezincing free brass CuZn36Pb2As					
Sealing				EPDM					
Pressure relieve system				Piston					

¹⁾ Δp_b - differential pressure over flow restrictor

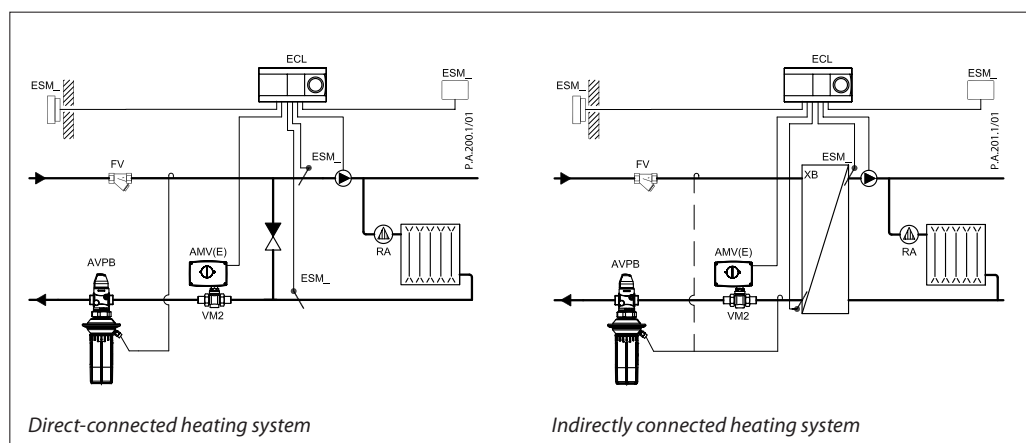
²⁾ Depends on the flow rate and valve k_{VS} ; For $Q_{set} = Q_{max} \rightarrow \Delta p_{min} \geq 0.5 \text{ bar}$; For $Q_{set} < Q_{max} \rightarrow \Delta p_{min} = \left(\frac{Q}{k_{VS}}\right)^2 + \Delta p_b$

Actuator

Type		AVPB		AVPB-F		
Actuator size	cm ²	39				
Nominal pressure	PN	16				
Diff. pressure setting ranges and spring colours	bar	0.05-0.5	0.2-1.0	0.2	0.3	0.5
		grey	black	(fixed setting)		
Materials						
Actuator housing		Zinc plated, DIN 1624, No. 1.0338				
Diaphragm		EPDM				
Impulse tube		Copper tube Ø 6 x 1 mm				

Application principles

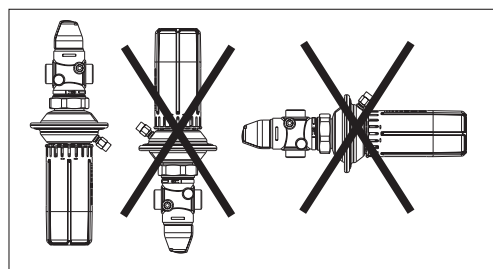
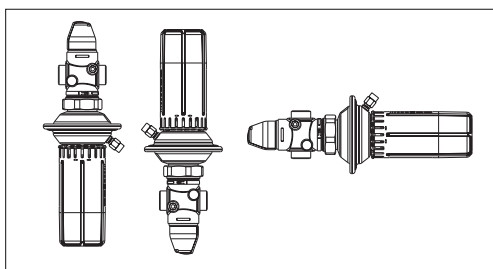
AVPB controller must be installed in the return pipe only.



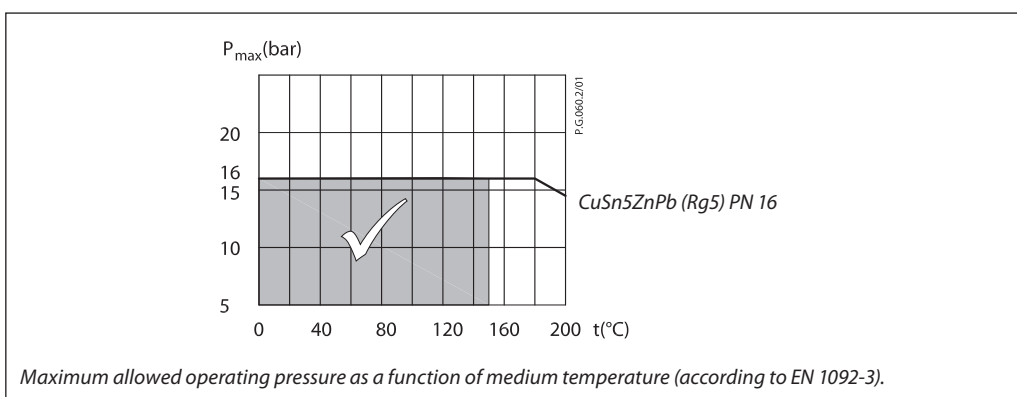
Installation positions

Up to medium temperature of 100 °C the controllers can be installed in any position.

For higher temperatures the controllers have to be installed in horizontal pipes only, with a pressure actuator oriented downwards.



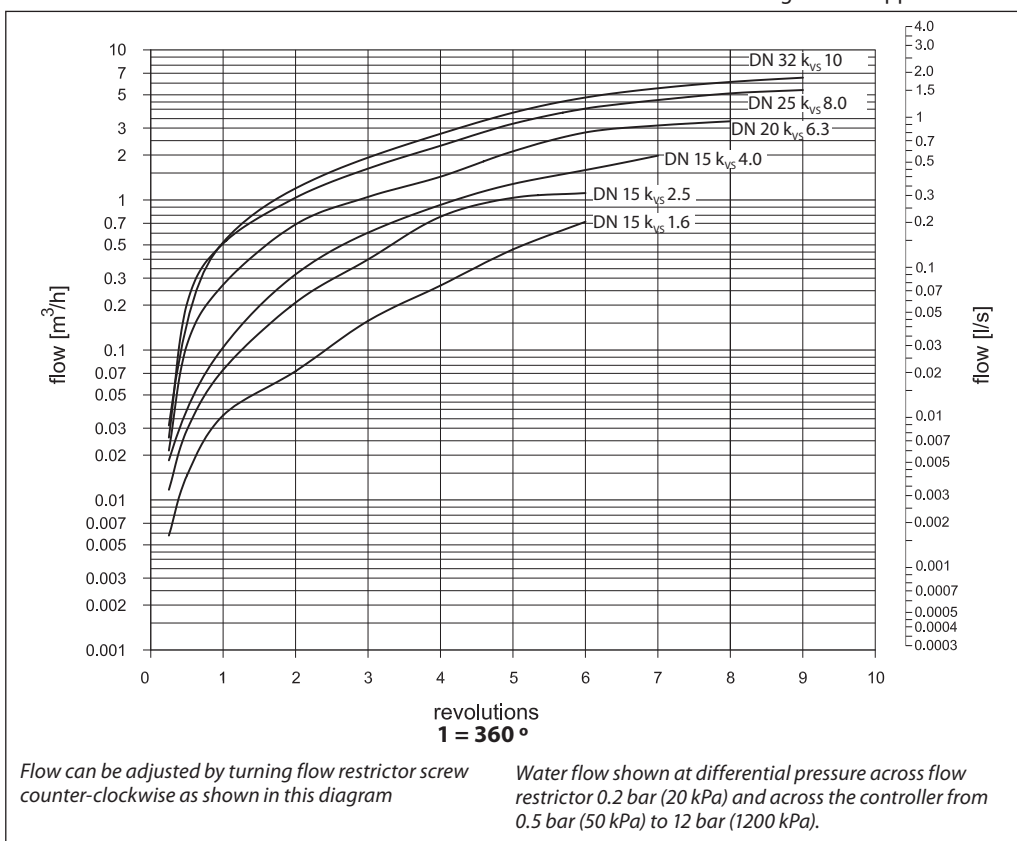
Pressure temperature diagram



Flow diagram

Sizing and setting diagram

Relation between actual flow and number of revolutions on flow restrictor. Values given are approximate.



Note:

For max flow setting on the controller diagrams from Instructions should be used.

Sizing

- *Directly connected heating system*

Example 1

Motorised control valve (MCV) for mixing circuit in direct-connected heating system requires differential pressure of 0.2 bar (20 kPa) and flow less than 900 l/h.

Given data:

$Q_{\max} = 0.9 \text{ m}^3/\text{h} \text{ (900 l/h)}$
 $\Delta p_{\min} = 0.5 \text{ bar (50 kPa)}$
 $\Delta p_{\text{circuit}}^{1)} = 0.1 \text{ bar (10 kPa)}$
 $\Delta p_{\text{MCV}} = 0.2 \text{ bar (20 kPa)}$ selected
 $\Delta p_h^{2)} = 0.1 \text{ bar (10 kPa)}$ assumption

Remark:

¹⁾ $\Delta p_{\text{circuit}}$ corresponds to the required pump pressure in the heating circuit and is not to be considered when sizing the AVPB(-F).

²⁾ Δp_h is differential pressure over flow restrictor.

The differential pressure set value is:

$$\Delta p_{\text{set value}} = \Delta p_b + \Delta p_{\text{MCV}} = 0.1 + 0.2$$

$$\Delta p_{\text{set value}} = 0.3 \text{ bar (30 kPa)}$$

The total pressure loss across the controller is:

$$\Delta p_{AVPR} = \Delta p_{min} - \Delta p_{MCV} = 0.5 - 0.2$$

$$\Delta p_{\text{AVPB}} = 0.3 \text{ bar (30 kPa)}$$

Possible pipe pressure losses in tubes, shut-off fittings, heatmeters, etc. are not included.

k_v value is calculated according to formula:

$$k_v = \frac{Q_{\max}}{\sqrt{\Delta p_{\text{AVPR}} - \Delta p_b}} = \frac{0.9}{\sqrt{0.3 - 0.1}}$$

$$k_v = 2.0 \text{ m}^3/\text{h}$$

or read from the sizing diagram, page 7, by taking a line from Q-scale (0.9 m³/h) through Δp_v -scale ($\Delta p_v = \Delta p_{AVPB} - \Delta p_b = 0.3 - 0.1 = 0.2$ bar) to intersect k_v -scale at 2.0 m³/h.

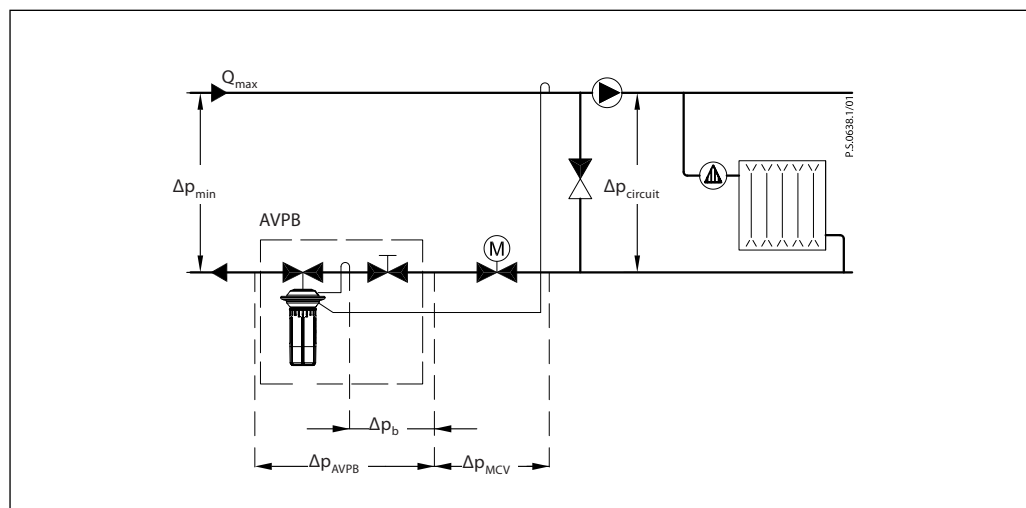
Solution:

The example selects AVPB DN 15; k_{VS} value 2.5; with differential pressure setting range 0.05-0.5 bar; flow setting range 0.08-1.8 m³/h.

The P-band (X_p) can also be read from the sizing diagram. Take a horizontal line from the k_v -scale (2.0 m³/h) to the right to intersect the X_p -scale (0.045 bar). At a set value of 0.3 bar and a X_p of 0.045 bar the AVPB controller controls between 0.3 bar with open motorised control valve and $0.3 + 0.045 = 0.345$ bar at almost closed motorised control valve (i.e. total pressure loss across the motorised control valve).

If another differential pressure is assumed than $\Delta p_b = 0.1$ bar, in order to maintain the k_{VS} value, the flow has to be adjusted using the flow restrictor screw. The new set value (Q -setting) of the assumed differential pressure ($\Delta p_{b\text{ NEW}} = 0.2$ bar) is calculated according to formula:

$$Q_{\text{setting}} = \frac{\sqrt{\Delta p_b}}{\sqrt{\Delta p_{b\text{NEW}}}} \times Q_{\text{max}}$$



Sizing (continuous)

- Indirectly connected heating system

Example 2

Motorised control valve (MCV) for indirectly connected heating system requires differential pressure of 0.2 (20 kPa) bar and flow less than 800 l/h.

Given data:

$$\begin{aligned} Q_{\max} &= 0.8 \text{ m}^3/\text{h} \text{ (800 l/h)} \\ \Delta p_{\min} &= 0.9 \text{ bar (90 kPa)} \\ \Delta p_{\text{exchanger}} &= 0.05 \text{ bar (5 kPa)} \\ \Delta p_{\text{MCV}} &= 0.2 \text{ bar (20 kPa) selected} \\ \Delta p_b^{1)} &= 0.2 \text{ bar (20 kPa) assumption} \end{aligned}$$

Remark:

¹⁾ Δp_b is differential pressure over flow restrictor

The differential pressure set value is:

$$\Delta p_{\text{set value}} = \Delta p_b + \Delta p_{\text{exchanger}} + \Delta p_{\text{MCV}}$$

$$= 0.2 + 0.05 + 0.2$$

$$\Delta p_{\text{set value}} = 0.45 \text{ bar (45 kPa)}$$

The total pressure loss across the controller is:

$$\Delta p_{\text{AVPB}} = \Delta p_{\min} - \Delta p_{\text{exchanger}} - \Delta p_{\text{MCV}}$$

$$= 0.9 - 0.05 - 0.2$$

$$\Delta p_{\text{AVPB}} = 0.65 \text{ bar (65 kPa)}$$

Possible pipe pressure losses in tubes, shut-off fittings, heatmeters, etc. are not included.

k_v value is calculated according to formula:

$$k_v = \frac{Q_{\max}}{\sqrt{\Delta p_{\text{AVPB}} - \Delta p_b}} = \frac{0.8}{\sqrt{0.65 - 0.2}}$$

$$k_v = 1.2 \text{ m}^3/\text{h}$$

or read from the sizing diagram, page 7, by taking a line from Q-scale (0.8 m³/h) through Δp_v -scale ($\Delta p_v = \Delta p_{\text{AVPB}} - \Delta p_b = 0.65 - 0.2 = 0.45 \text{ bar}$) to intersect k_v -scale at 1.2 m³/h.

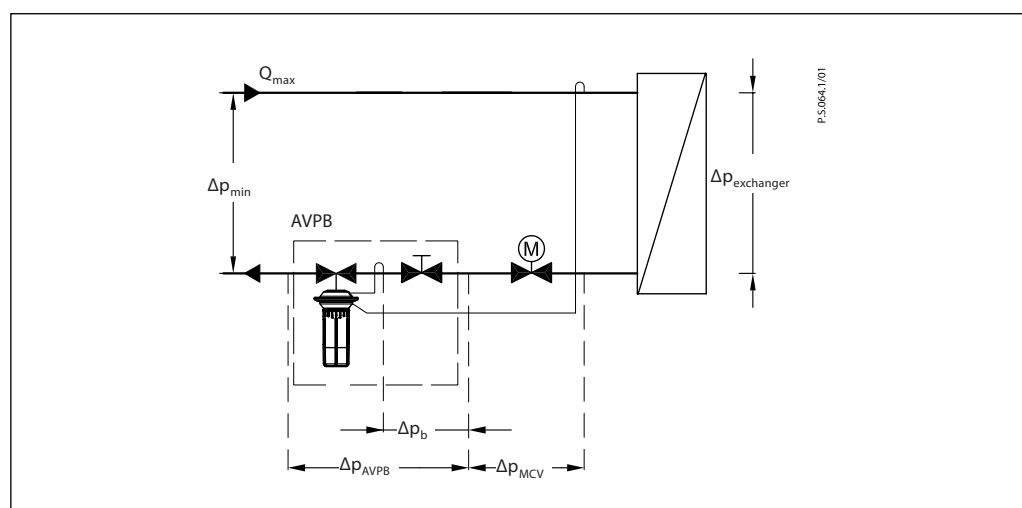
Solution:

The example selects AVPB DN 15; k_{vS} value 1.6; with differential pressure setting range 0.05-0.5 bar; flow setting range 0.06-1.4 m³/h.

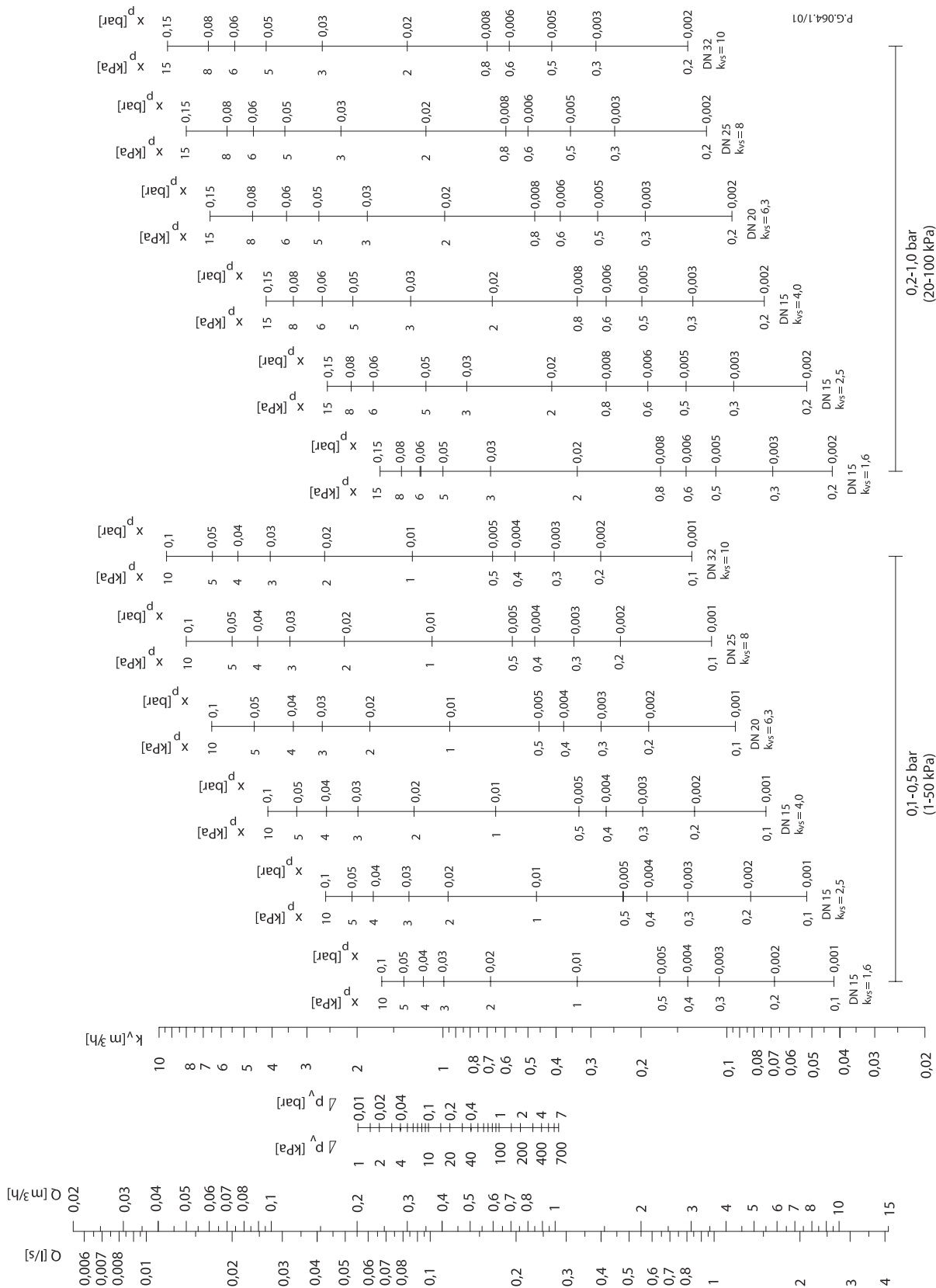
The P-band (X_p) can also be read from the sizing diagram. Take a horizontal line from the k_v -scale (1.2 m³/h) to the right to intersect the X_p -scale (0.04 bar). At a set value of 0.45 bar and a X_p of 0.04 bar the AVPB controller controls between 0.45 bar with open motorised control valve and $0.45 + 0.04 = 0.49 \text{ bar}$ at almost closed motorised control valve (i.e. total pressure loss across the motorised control valve)

If other differential pressure is assumed than $\Delta p_b = 0.2 \text{ bar}$, in order to maintain the k_{vS} value, the flow has to be adjusted using the flow restrictor screw. The new set value (Q-setting) of the assumed differential pressure ($\Delta p_{b\text{NEW}} = 0.1 \text{ bar}$) is calculated according to formula:

$$Q_{\text{setting}} = \frac{\sqrt{\Delta p_b}}{\sqrt{\Delta p_{b\text{NEW}}}} \times Q_{\max}$$



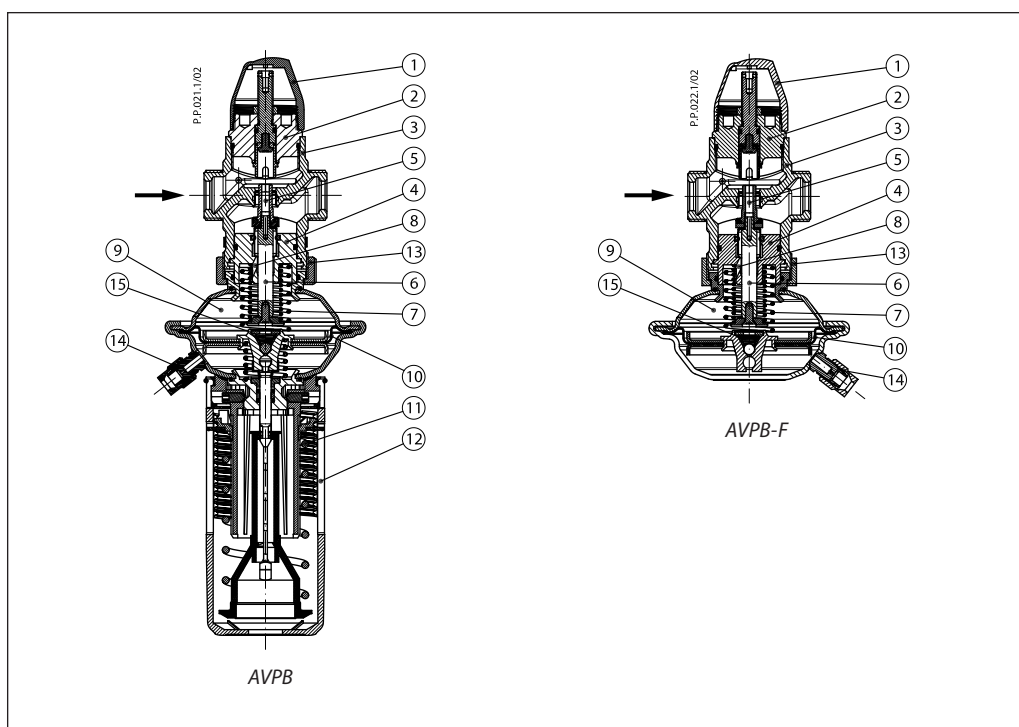
Sizing (continuous)



Select suitable controller size. X_p should not exceed 50 % of controller differential pressure setting.

Design

1. Cover
2. Adjustable flow restrictor
3. Valve body
4. Valve insert
5. Pressure relieved valve cone
6. Valve stem
7. Built-in spring for flow control
8. Control drain
9. Actuator
10. Control diaphragm for diff. pressure and flow control
11. Setting spring for diff. pressure control
12. Handle for diff. pressure setting, prepared for sealing
13. Union nut
14. Compression fitting for impulse tube
15. Excess pressure safety valve



Function

Pressure changes from flow and return pipes are being transferred through the impulse tubes and/or control drain in the actuator stem to the actuator chambers and act on control diaphragm for diff. pressure and flow control. The diff. pressure is controlled by means of setting spring for diff. pressure control. Control valve closes on rising differential pressure and opens on falling differential pressure to maintain constant differential pressure. Flow volume is limited by means of the flow restrictor.

Controller is equipped with excess pressure safety valve, which protects control diaphragm for diff. pressure and flow control from too high differential pressure.

Settings

Flow setting

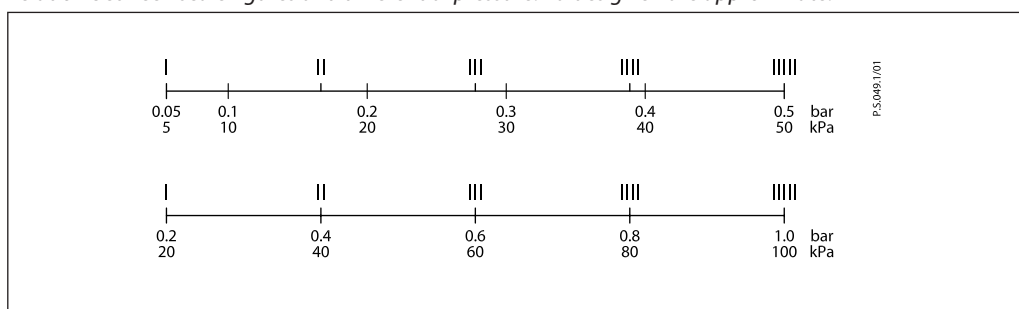
Flow setting is being done by the adjustment of the flow restrictor position. The adjustment can be performed on the basis of flow adjustment diagram (see relevant instructions) and/or by the means of heat meter.

Differential pressure setting

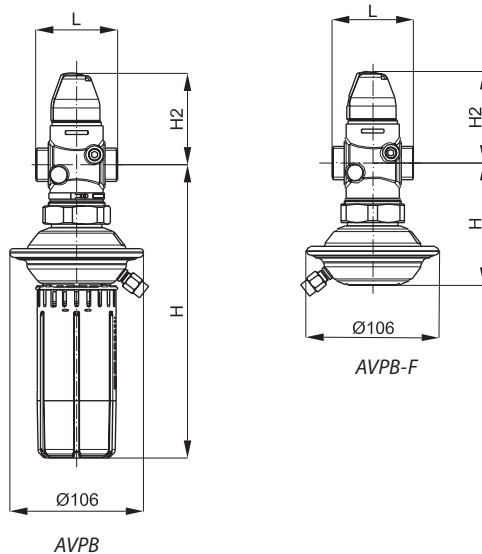
Differential pressure setting (valid for AVPB controller only) is being done by the adjustment of the setting spring for diff. pressure control. The adjustment can be done by means of handle for diff. pressure setting and/or pressure indicators.

Adjustment diagram

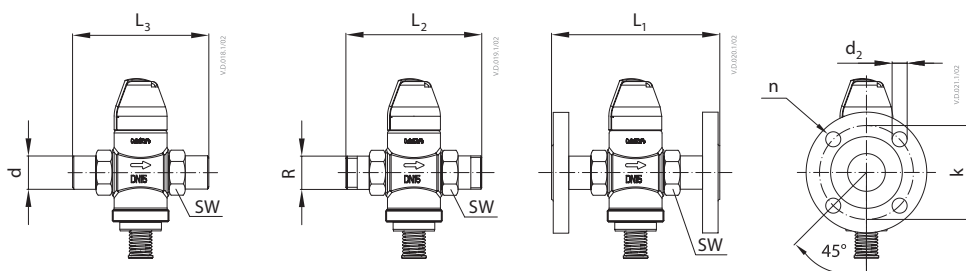
Relation between scale figures and differential pressure. Values given are approximate.



Dimensions



DN		15		20		25		32	
		AVPB	AVPB-F	AVPB	AVPB-F	AVPB	AVPB-F	AVPB	AVPB-F
L		65		70		75		100	
H	mm	232	97	232	97	232	97	232	97
H2		73		73		76		77	
Weight	kg	1.9	1.5	2.0	1.5	2.1	1.8	2.4	2.0

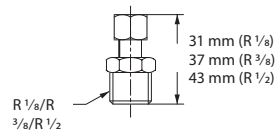


DN	R ¹⁾	SW	d	L1 ²⁾	L2	L3	k	d2	n
		mm							
15	1/2	32 (G 3/4A)	21	130	120	139	65	14	4
20	3/4	41 (G 1A)	26	150	131	154	75	14	4
25	1	50 (G 1 1/4A)	33	160	145	159	85	14	4
32	1 1/4	63 (G 1 3/4A)	42	-	177	184	-	-	-

¹⁾ Conical ext. thread acc. to EN 10226-1

²⁾ Flanges PN 25, acc. to EN 1092-2

Compression fittings





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