

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 setting range (bar)	Code No.	Δp setting 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
		6.3			003H6396		003H6402
	20	8.0		0.2-1.0	003H6397		003H6403
		10			003H6398		003H6404
		1.6					
		2.5					

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	003H6417	0.5	003H6423
		2.5			003H6412		003H6418		003H6424
		4.0			003H6413		003H6419		003H6425
		6.3			003H6414		003H6420		003H6426
	20	8.0		0.3	003H6415		003H6421		003H6427
		10			003H6416		003H6422		003H6428
		1.6							
		2.5							

Ordering (continuous)
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 x 1 x 1500 mm - 1x compression fitting ¹⁾ for imp. tube connection to pipe Ø6 x 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 x 1mm R 1/8			003H6857		
		1) 10 compression fittings for imp. tube connection to pipe, Ø6 x 1 mm R 3/8			003H6858		
		1) 10 compression fittings for imp. tube connection to pipe, Ø6 x 1 mm R 1/2			003H6859		
	Shut off valve Ø6 mm				003H6931		
					003H0276		

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

Service kits

Picture	Type designation	DN	k_{vs} (m ³ /h)	Code No.
	Valve insert	15	1.6	003H6863
			2.5	003H6864
			4.0	003H6865
			20	003H6866
			25	003H6867
			32	10
	Actuator with adjustable handle (AVPB)			Δp setting range (bar)
				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 _{vs} value Range of max. flow setting	from to	m ³ /h	1.6	2.5	4.0	6.3	8.0					
			0.03	0.08	0.09	0.1	0.1					
			0.9	1.4	1.8	2.7	4.5					
Cavitation factor z					≥ 0.6	≥ 0.55						
Leakage acc. to standard IEC 534		% of k _{vs}	≤ 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										

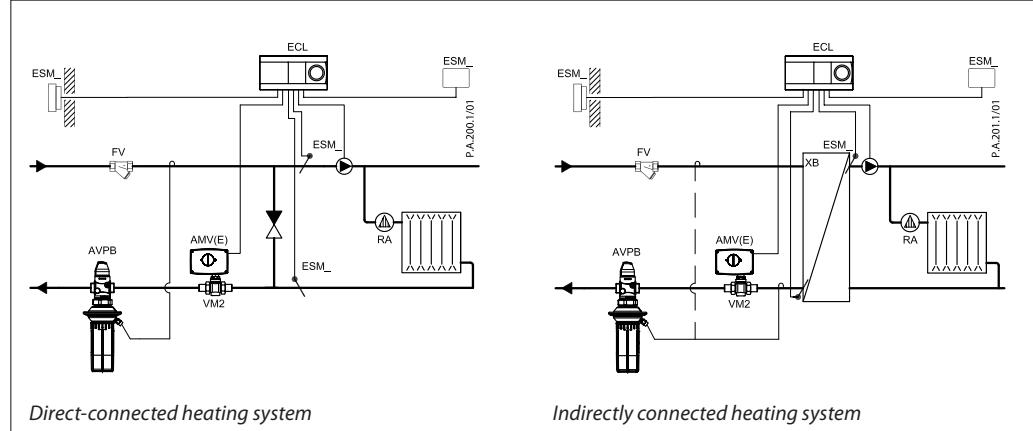
¹⁾ Δp_b - differential pressure over flow restrictor

²⁾ Depends on the flow rate and valve k_{vs}; For Q_{set} = Q_{max} > Δp_{min} ≥ 0.5 bar; For Q_{set} < Q_{max} > Δp_{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 grey	0.2-1.0 black	0.2 (fixed setting)	0.3 0.5
Materials					
Actuator housing	Zinc plated, DIN 1624, No. 1.0338				
Diaphragm	EPDM				
Impulse tube	Copper tube Ø 6 x 1 mm				

Application principles

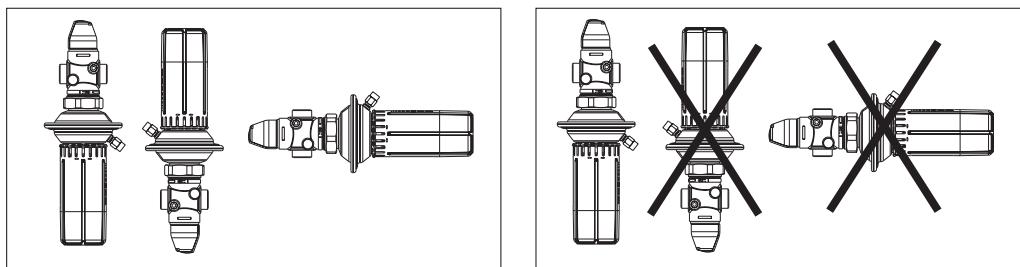
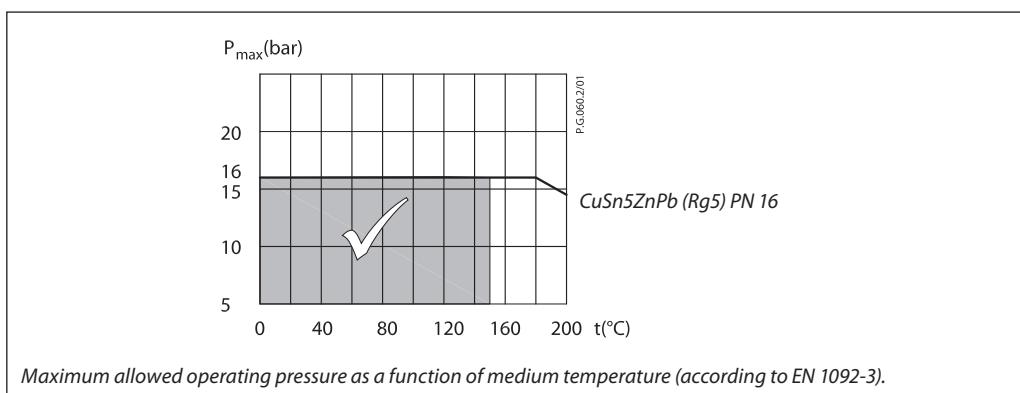
AVPB controller must be installed in the return pipe only.



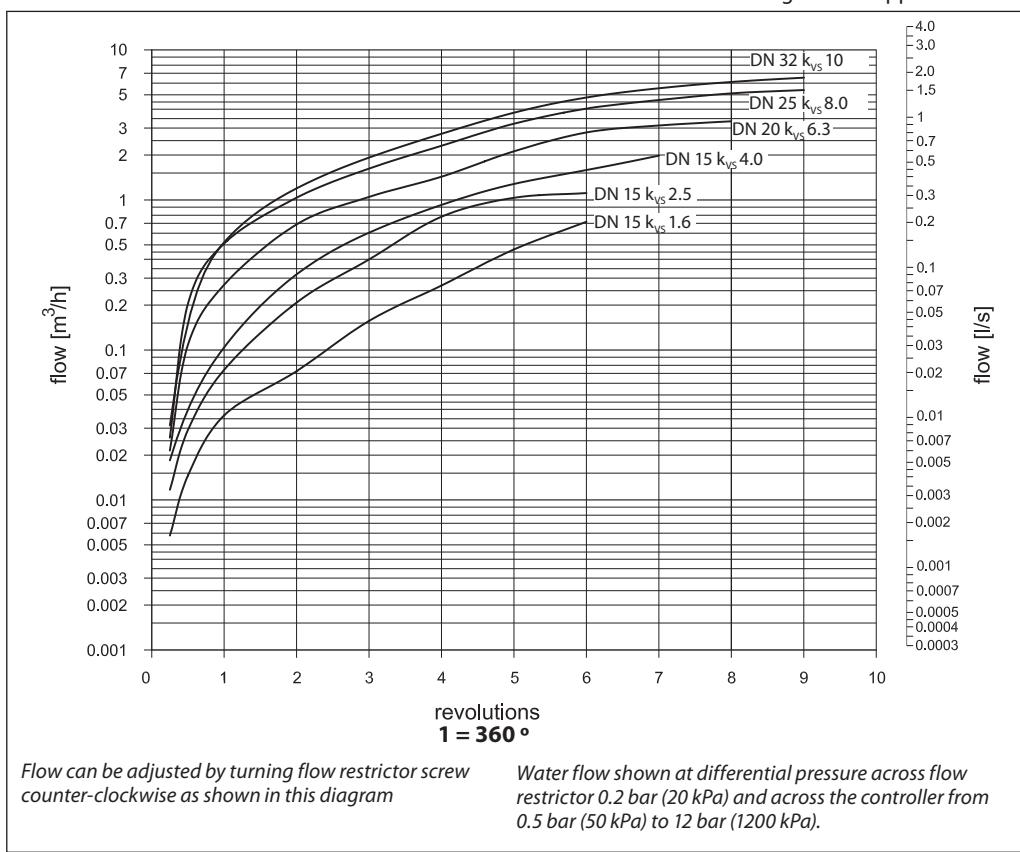
Installation positions

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:

$Q_{\max} = 0.9 \text{ m}^3/\text{h}$ (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
 $\Delta p_b^2) = 0.1 \text{ bar}$ (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_b is differential pressure over flow restrictor.

The differential pressure set value is:

$$\begin{aligned}\Delta p_{\text{set value}} &= \Delta p_b + \Delta p_{\text{MCV}} = 0.1 + 0.2 \\ \Delta p_{\text{set value}} &= 0.3 \text{ bar} (30 \text{ kPa})\end{aligned}$$

The total pressure loss across the controller is:

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

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

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

k_v value is calculated according to formula:

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

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

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

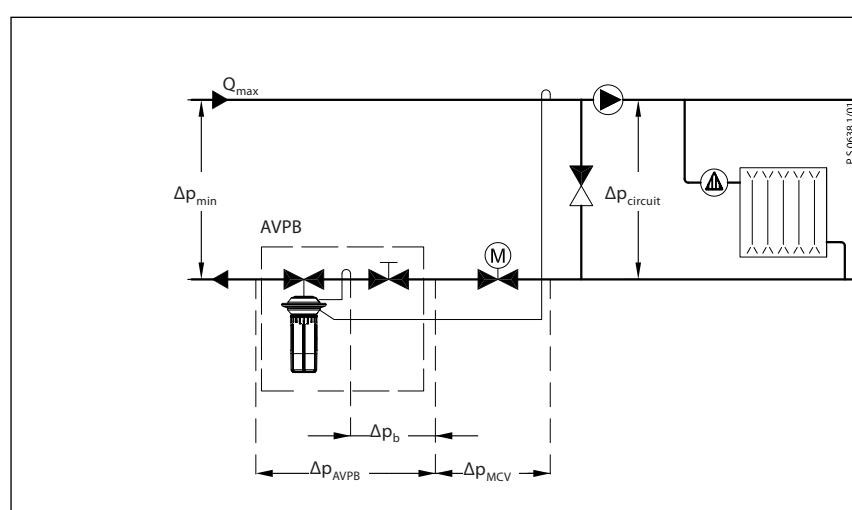
Solution:

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 $\Delta p_b = 0.1 \text{ bar}$, 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 ($\Delta p_{b \text{ NEW}} = 0.2 \text{ bar}$) is calculated according to formula:

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



Sizing (continuous)

- 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:

Q_{\max} = 0.8 m³/h (800 l/h)
 Δp_{\min} = 0.9 bar (90 kPa)
 $\Delta p_{\text{exchanger}}$ = 0.05 bar (5 kPa)
 Δp_{MCV} = 0.2 bar (20 kPa) selected
 Δp_b ¹⁾ = 0.2 bar (20 kPa) assumption

Remark:

¹⁾ Δp_b is differential pressure over flow restrictor

The differential pressure set value is:

$$\begin{aligned}\Delta p_{\text{set value}} &= \Delta p_b + \Delta p_{\text{exchanger}} + \Delta p_{\text{MCV}} \\ &= 0.2 + 0.05 + 0.2 \\ &= 0.45 \text{ bar (45 kPa)}\end{aligned}$$

The total pressure loss across the controller is:

$$\begin{aligned}\Delta p_{\text{AVPB}} &= \Delta p_{\min} - \Delta p_{\text{exchanger}} - \Delta p_{\text{MCV}} \\ &= 0.9 - 0.05 - 0.2 \\ &= 0.65 \text{ bar (65 kPa)}\end{aligned}$$

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 ($\Delta p_v = \Delta p_{\text{AVPB}} - \Delta p_b = 0.65 - 0.2 = 0.45$ bar) to intersect k_v -scale at 1.2 m³/h.

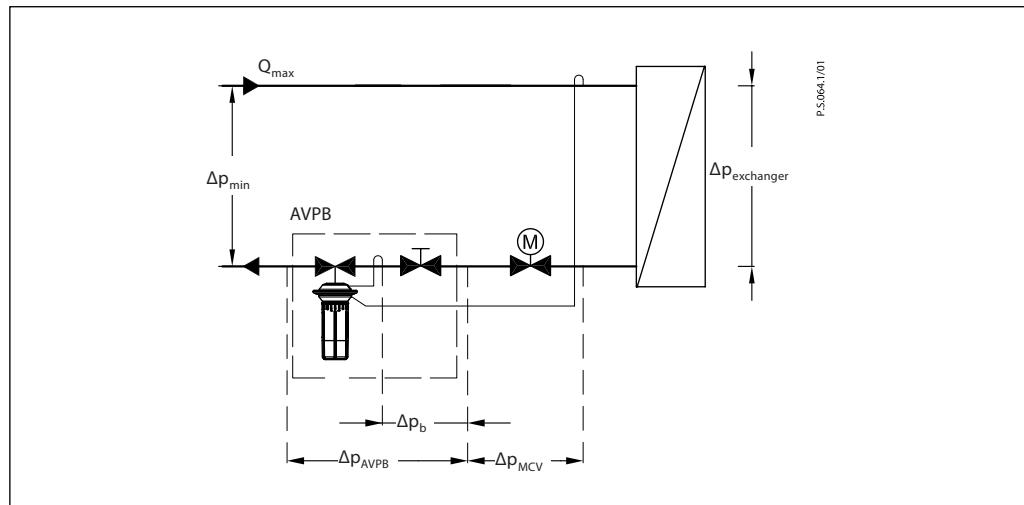
Solution:

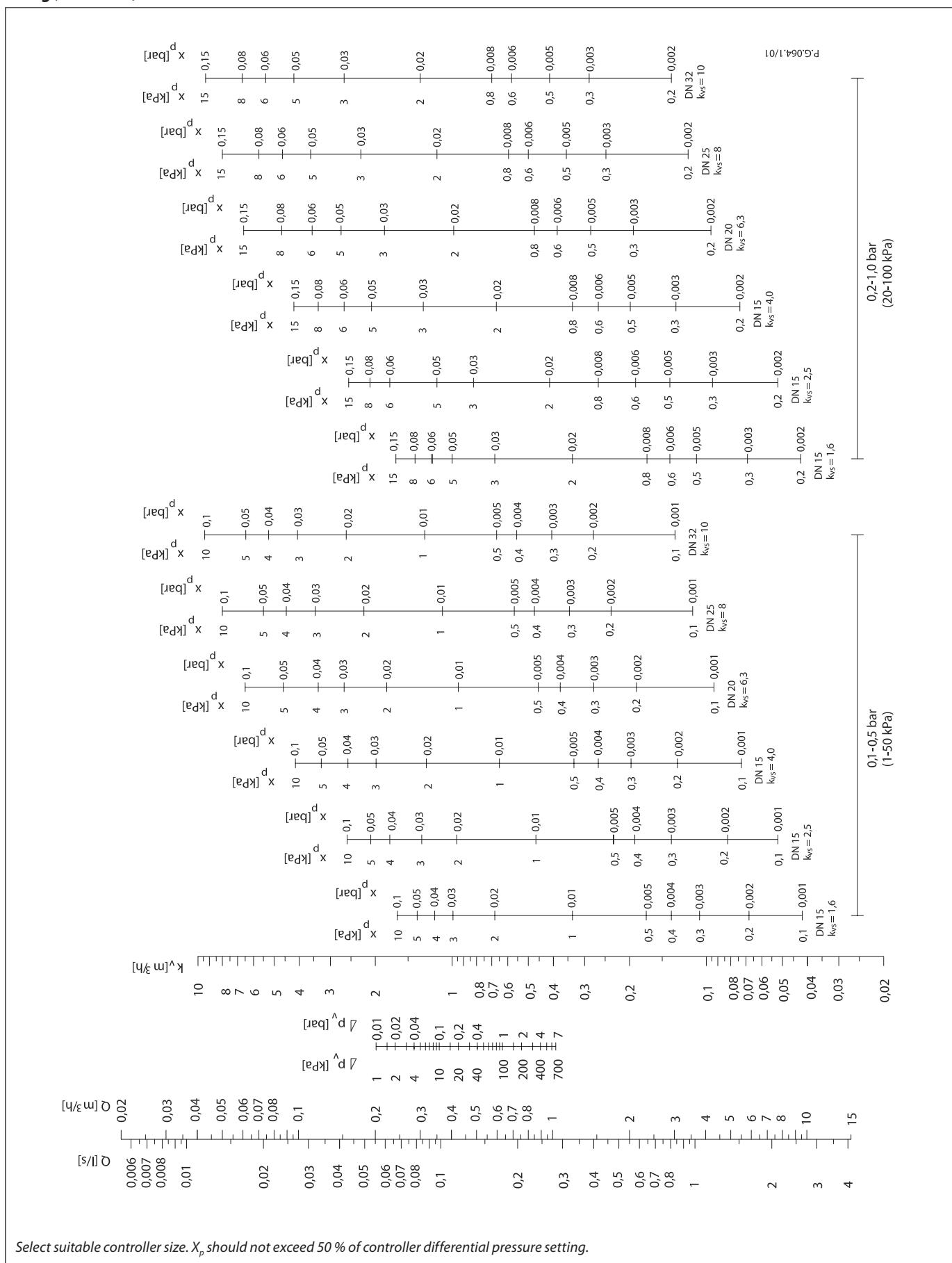
The example selects AVPB DN 15; k_{vs} value 1.6; with differential pressure setting range 0.05-0.5 bar; flow setting range 0.06-1.4 m³/h.

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 bar at almost closed motorised control valve (i.e. total pressure loss across the motorised control valve)

If other differential pressure is assumed than $\Delta p_b = 0.2$ 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 ($\Delta p_{b\text{NEW}} = 0.1$ bar) is calculated according to formula:

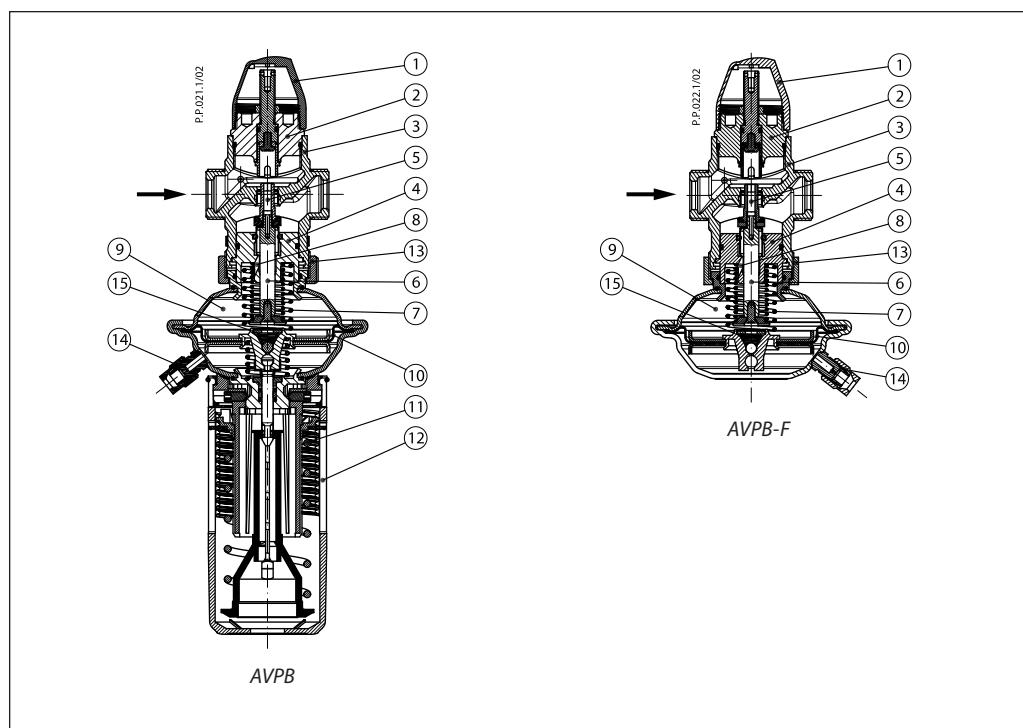
$$Q_{\text{setting}} = \frac{\sqrt{\Delta p_b}}{\sqrt{\Delta p_{b\text{NEW}}}} \times Q_{\max}$$



Sizing (continuous)


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*

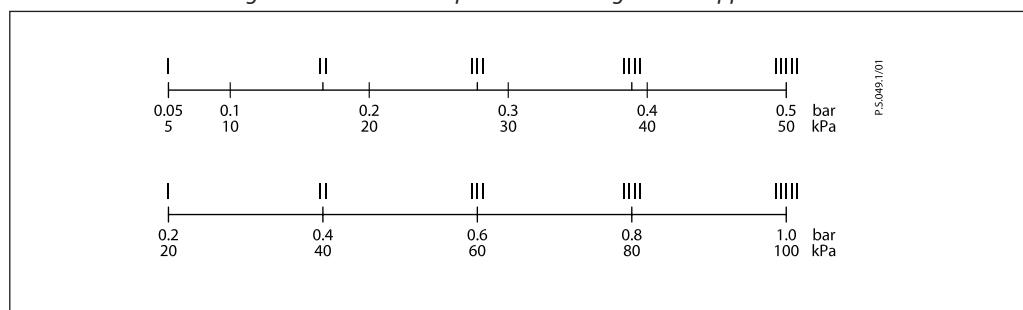
Flow setting is being done by the adjustment of the flow restrictor position. The adjustment can be performed on the basis of flow adjustment diagram (see relevant instructions) and/or by the means of heat meter.

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

AVPB

AVPB-F

DN	15		20		25		32		
	AVPB	AVPB-F	AVPB	AVPB-F	AVPB	AVPB-F	AVPB	AVPB-F	
L	65		70		75		100		
H	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

V0298102

V0299102

V0299102

V0291102

DN	R ¹⁾	mm							n
		SW	d	L1 ²⁾	L2	L3	k	d2	
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 1/4A)	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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