ENGINEERING
TOMORROW

Data sheet

Differential pressure controller with flow limitation (PN 25)
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 15-50
- k_{VS} 1.6-25 m^3/h
- Flow range 0.03-15 m^3/h
- PN 25
- Setting range (AVPB): 0.2-1.0 bar/0.3-2.0 bar
- Fixed setting (AVPB-F): 0.5 bar
- Temperature:
  Circulation water/glycolic water up to 30%:
  2 … 150 °C
- Connections:
  - Ext. thread (weld-on, thread and flange tailpieces)
  - Flange

Ordering

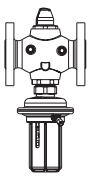
Example:
Differential pressure controller with flow limitation; DN 15; k_{VS} 1.6; PN 25; setting range 0.2-1.0 bar; t_{max} 150 °C; ext. thread

- *1×* *AVPB DN 15 controller*
  Code No: ***003H6444***
- *1×* *Impulse tube set AV, R ⅛*
  Code No: ***003H6852***

Option:
- *1×* *Weld-on tailpieces*
  Code No: ***003H6908***

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

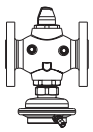
AVPB Controller

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	G ¾ A	0.2-1.0	**003H6444**	0.3-2.0	**003H6452**
		2.5				**003H6445**		**003H6453**
		4.0				**003H6446**		**003H6454**
	20	6.3		G 1 A		**003H6447**		**003H6455**
	25	8.0		G 1¼ A		**003H6448**		**003H6456**
	32	12.5		G 1¾ A		**003H6449**		**003H6457**
	40	16		G 2 A		**003H6450**		**003H6458**
	50	20		G 2½ A		**003H6451**		**003H6459**
	32	12.5	Flanges PN 25, acc. to EN 1092-2			**003H6468**		-
	40	20				**003H6469**		-
	50	25				**003H6470**		-

Note: *other controllers available on special request.*

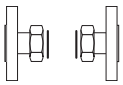
Ordering *(continuous)*

AVPB-F Controller

Picture	DN (mm)	k_{VS} (m^3/h)	Connection		Δp setting range (bar)	Code No.
	15	1.6	Cylindr. ext. thread acc. to ISO 228/1	G ¾ A	0.5	**003H6460**
		2.5				**003H6461**
		4.0				**003H6462**
	20	6.3		G 1 A		**003H6463**
	25	8.0		G 1¼ A		**003H6464**
	32	12.5	Flanges PN 25, acc. to EN 1092-2			**003H6474**
	40	20				**003H6475**
	50	25				**003H6476**

Note: *other controllers available on special request.*

Accessories

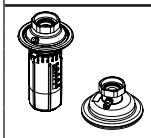
Picture	Type designation	DN	Connection		Code No.
	Weld-on tailpieces	15	-		**003H6908**
		20			**003H6909**
		25			**003H6910**
		32			**003H6911**
		40			**003H6912**
		50			**003H6913**
	External thread tailpieces	15	Conical ext. thread acc. to EN 10226-1	R ½	**003H6902**
		20		R ¾	**003H6903**
		25		R 1	**003H6904**
		32		R 1¼	**003H6905**
		40		R 1½	**065B2004**
		50		R 2	**065B2005**
	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 fitting1) for imp. tube connection to pipe Ø6 × 1 mm		R ⅛	**003H6852**
				R ⅜	**003H6853**
				R ½	**003H6854**
	[1] 10 compression fittings for imp. tube connection to pipe, Ø6 × 1 mm R ⅛				**003H6857**
	[1] 10 compression fittings for imp. tube connection to pipe, Ø6 × 1 mm R ⅜				**003H6858**
	[1] 10 compression fittings for imp. tube connection to pipe, Ø6 × 1 mm R ½				**003H6859**
	[1] 10 compression fittings for imp. tube connection to actuator, Ø6 × 1 mm G ⅛				**003H6931**
	Shut off valve Ø6 mm				**003H0276**

[1] *Compression fitting consists of a nipple, compression ring and nut.*

Ordering *(continuous)*

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	6.3	**003H6866**
		25	8.0	**003H6867**
		32/40/50	12.5/16/20/25	**003H6868**

Picture	Type designation	Δp setting range (bar)	Code No.
	Actuator with adjustable handle (AVPB)	0.2-1.0	**003H6829**
		0.3-2.0	**003H6830**
	Actuator without adjustable handle (AVPB-F)	0.5	**003H6841**

Technical data

Valve

Nominal diameter			**DN**	**15**			**20**	**25**	**32**	**40**	**50**
k_{vs} value			m^3/h	1.6	2.5	4.0	6.3	8.0	12.5	16/20[4]	20/25[4]
Range of max. flow setting	Δp_b [1] = 0.2 bar	from		0.03	0.07	0.07	0.16	0.2	0.4	0.8	0.8
		to		0.86	1.4	2.2	3.0	3.5	8.0	10	12
		or to [3]		0.9	1.6	2.4	3.5	4.5	10	12	15
Cavitation factor z				≥ 0.6				≥ 0.55		≥ 0.5	
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				20					16		
Medium				Circulation water/glycolic water up to 30%							
Medium pH				Min. 7, max. 10							
Medium temperature			°C	2 … 150							
Connections	valve			External thread					Ext. thread and flange		
	tailpieces			Weld-on and external thread							
				Flange					-		
Materials											
Valve body	thread			Red bronze CuSn5ZnPb (Rg5)					Ductile iron EN-GJS-400-18-LT (GGG 40.3)		
	flange			-							
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 $Q_{set} = Q_{max}$ -> $\Delta p_{min} \geq 0.5$ bar; For $Q_{set} < Q_{max}$ ->* $\Delta p_{min} = \left(\frac{Q}{k_{VS}}\right)^2 + \Delta p_b$

[3] *Higher max flow are achieved at higher differential pressures over AVPB(-F) controller. In general at Δp > 1-1.5 bar*

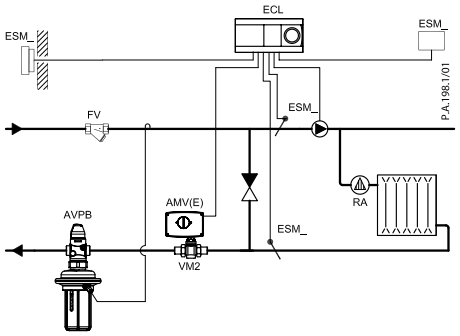
[4] *Flange valve body*

Actuator

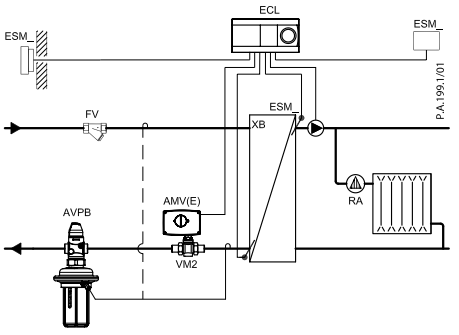
Type			**AVPB**		**AVPB-F**
Actuator size		cm^2	54		
Nominal pressure		PN	25		
Diff. pressure setting ranges and spring colours		bar	0.2-1.0	0.3-2.0	0.5
			yellow	red	(fixed setting)
Materials					
Actuator housing	Upper casing of diaphragm		Stainless steel, mat. No.1.4301		
	Lower casing of diaphragm		Dezincing free brass CuZn36Pb2As		
Diaphragm			EPDM		
Impulse tube			Copper tube Ø6 × 1 mm		

Application principles

The controller must be installed in the return pipe only.



Direct-connected heating system

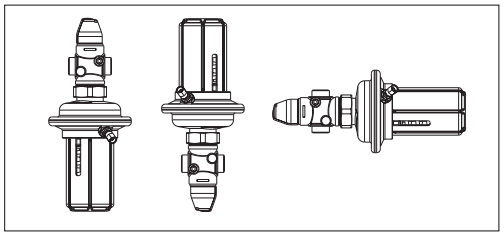


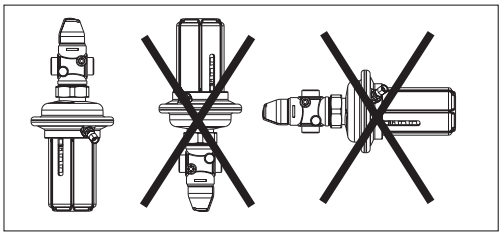
Indirectly connected heating system

Installation positions

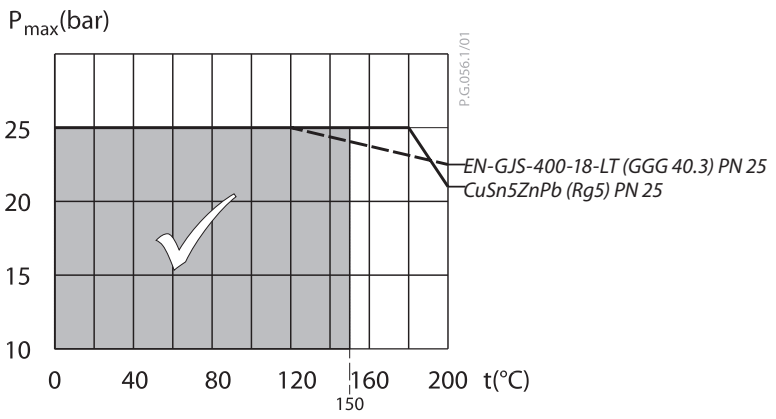
Up to medium temperature of 100 °C the controllers can be installed in any position.

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





Pressure temperature diagram

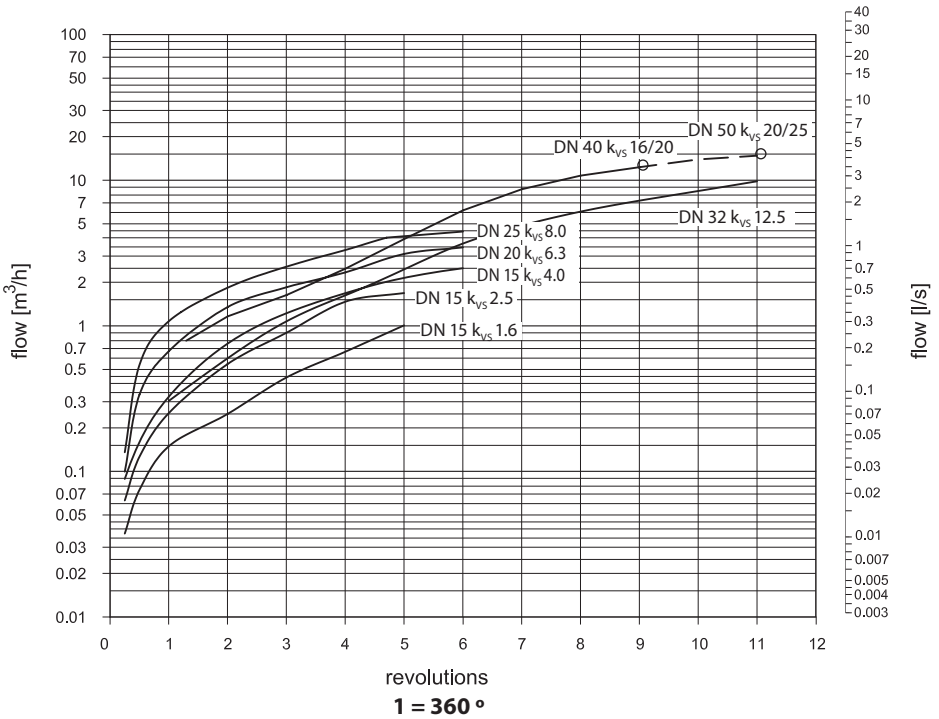


Maximum allowed operating pressure as a function of medium temperature (according to EN 1092-2 and EN 1092-3).

Flow diagram

Sizing and setting diagram

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



Flow can be adjusted by turning flow restrictor screw counter-clockwise as shown in this diagram. Water flow shown at differential pressure across flow restrictor 0.2 bar (20 kPa) and across the controller from 0.5 bar (50 kPa) to 16/20 bar (1600/2000 kPa).

Remark:
Controllers DN 40 and DN 50 have the same curve up to 9 revolutions.

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 0.3 bar (30 kPa) and flow less than 1800 l/h.

Given data:

Q_{max} = 1.8 m³/h (1800 l/h)
Δp_{min} = 0.7 bar (70 kPa)
$\Delta p_{circuit}$ [1)] = 0.1 bar (10 kPa)
Δp_{MCV} = 0.3 bar (30 kPa) selected
Δp_b [2)] = 0.1 bar (10 kPa) assumption

Remark:
[1)] *$\Delta p_{circuit}$ corresponds to the required pump pressure in the heating circuit and is not to be considered when sizing the AVPB.*
[2)] *Δp_b is differential pressure over flow restrictor.*

The differential pressure set value is:
$\Delta p_{set\ value} = \Delta p_b + \Delta p_{MCV} = 0.1 + 0.3$
$\Delta p_{set\ value} = 0.4$ bar (40 kPa)

The total pressure loss across the controller is:
$\Delta p_{AVPB} = \Delta p_{min} - \Delta p_{MCV} = 0.7 - 0.3$
$\Delta p_{AVPB} = 0.4$ bar (40 kPa)

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

k_v value is calculated according to formula:

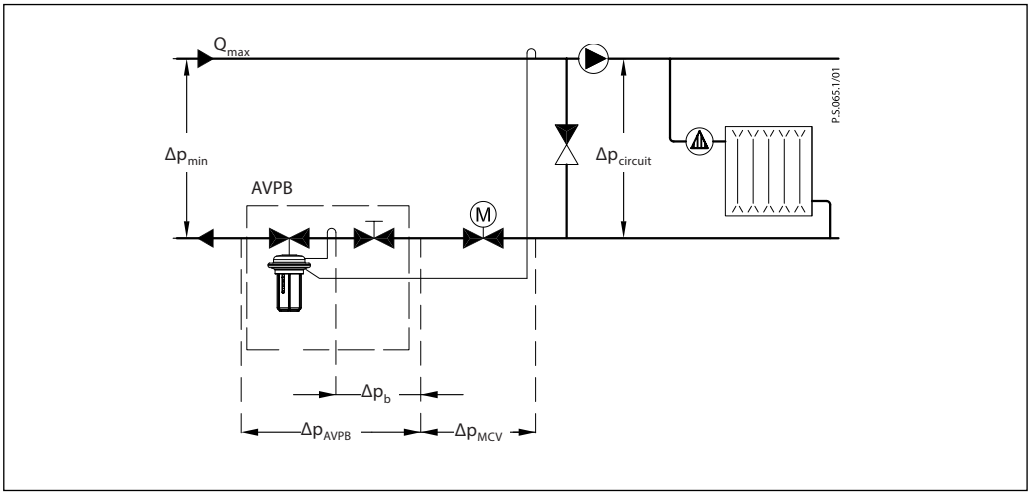
$$k_v = \frac{Q_{max}}{\sqrt{\Delta p_{AVPB} - \Delta p_b}} = \frac{1.8}{\sqrt{0.4 - 0.1}}$$

$k_v = 3.3$ m³/h

Solution:
The example selects AVPB DN 15; k_{VS} value 4.0; with differential pressure setting range 0.2-1.0 bar; flow setting range 0.07-2.4 m³/h.

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

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



Sizing *(continuous)*

- *Indirectly connected heating system*

Example 2
Motorised control valve (MCV) for indirectly connected heating system requires differential pressure of 0.3 (30 kPa) bar and flow less than 1300 l/h.

Given data:
Q_{max} = 1.3 m³/h (1300 l/h)
Δp_{min} = 1.0 bar (100 kPa)
$\Delta p_{exchanger}$ = 0.05 bar (5 kPa)
Δp_{MCV} = 0.3 bar (30 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:
$\Delta p_{set\ value} = \Delta p_b + \Delta p_{exchanger} + \Delta p_{MCV}$
$\Delta p_{set\ value} = 0.2 + 0.05 + 0.3$
$\Delta p_{set\ value} = 0.55$ bar (55 kPa)

The total pressure loss across the controller is:
$\Delta p_{AVPB} = \Delta p_{min} - \Delta p_{exchanger} - \Delta p_{MCV}$
$\Delta p_{AVPB} = 1.0 - 0.05 - 0.3$
$\Delta p_{AVPB} = 0.65$ 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:

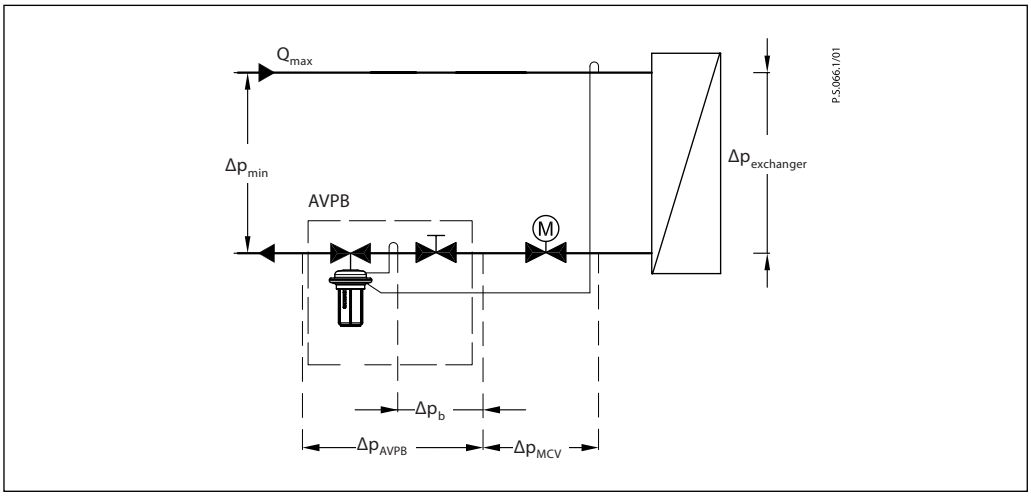
$$k_v = \frac{Q_{max}}{\sqrt{\Delta p_{AVPB} - \Delta p_b}} = \frac{1.3}{\sqrt{0.65 - 0.2}}$$

$k_v = 1.9$ m³/h

Solution:
The example selects AVPB DN 15; k_{VS} value 2.5; with differential pressure setting range 0.2-1.0 bar; flow setting range 0.07-1.6 m³/h.

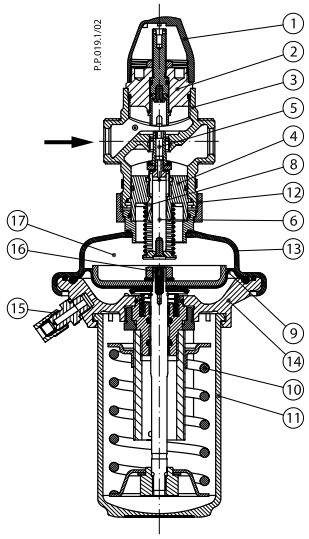
If other differential pressure is assumed than Δp_b = 0.2 bar, in order to maintain the k_{VS} value, the flow has to be adjusted using the flow restrictor screw. The new set value (Q-setting) of the assumed differential pressure ($\Delta p_{b\ NEW}$ = 0.1 bar) is calculated according to formula:

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

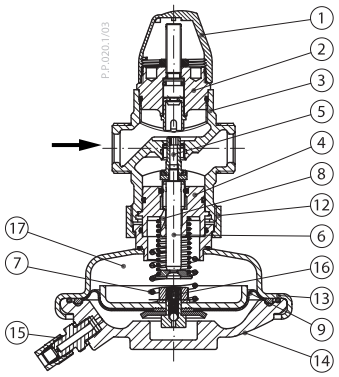


Design

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 rate control
8. Control drain
9. Control diaphragm for diff. pressure and flow control
10. Setting spring for diff. pressure control
11. Handle for diff. pressure setting, prepared for sealing
12. Union nut
13. Upper casing of diaphragm
14. Lower casing of diaphragm
15. Compression fitting for impulse tube
16. Excess pressure safety valve
17. Actuator



AVPB



AVPB-F

Function

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

Controller with adjustable setting is equipped with excess pressure safety valve, which protects actuator from too high differential pressure.

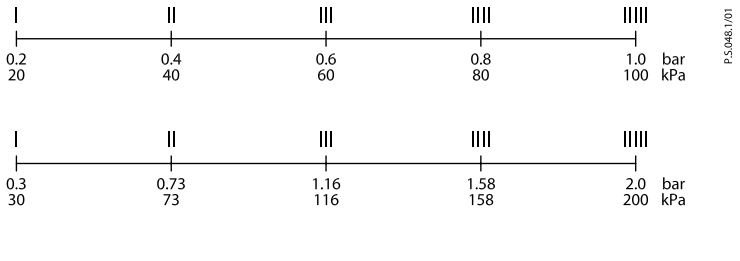
Settings

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.

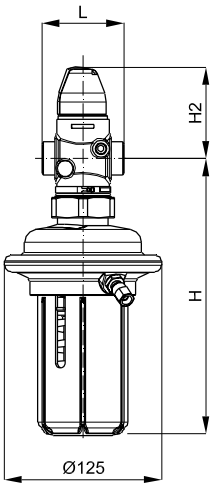
Differential pressure setting
Differential pressure setting is being done by the adjustment of the setting spring for diff. pressure control. The adjustment can be performed on the basis of diff. pressure adjustment diagram (see relevant instructions) and/or pressure indicators.

Adjustment diagram

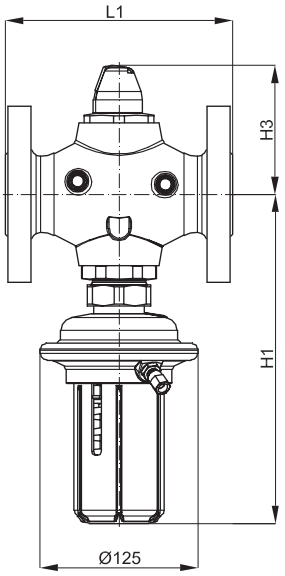
Relation between scale figures and differential pressure. Values given are approximate.



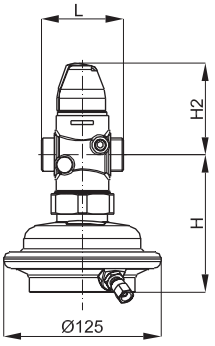
Dimensions



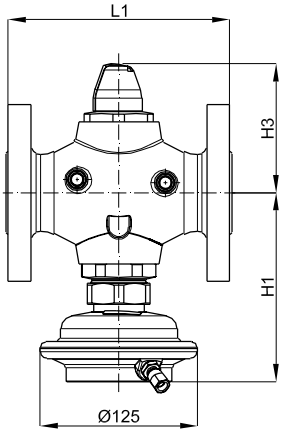
AVPB
DN 15-50



AVPB
DN 32-50



AVPB-F
DN 15-50



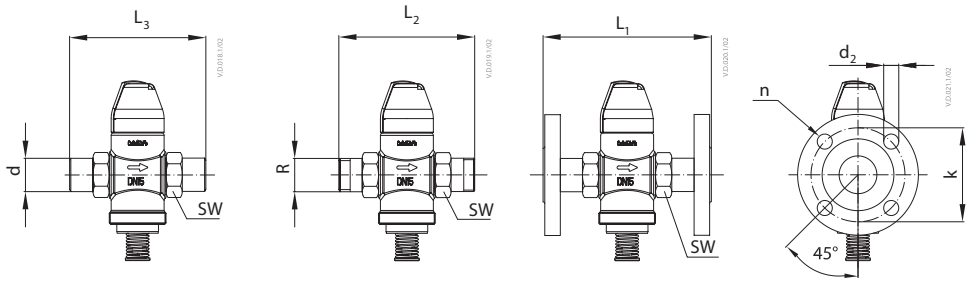
AVPB-F
DN 32-50

AVPB, AVPB-F

DN		15		20		25		32		40		50	
		AVPB	AVPB-F	AVPB	AVPB-F	AVPB	AVPB-F	AVPB	AVPB-F	AVPB	AVPB-F	AVPB	AVPB-F
L	mm	65		70		75		100		110		130	
L1		-						180		200		230	
H		220	109	220	109	220	109	261	-	261	-	261	-
H1		-						261	150	261	150	261	150
H2		73		73		76		103		103		103	
H3		-						103		103		103	
Weight (thread)	kg	3.7	2.7	3.7	2.7	3.9	2.9	6.3	-	6.5	-	7.1	-
Weight (flange)		-						10.8	9.8	12.3	11.3	14.4	13.4

Note: *Other flange dimensions - see table for tailpieces.*

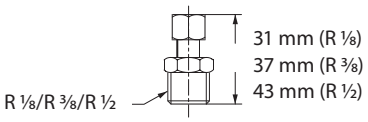
Dimensions *(continuous)*



DN	R [1]	SW	d	L_1 [2]	L_2	L_3	k	d_2	n
		mm							
15	½	32 (G ¾A)	21	130	120	139	65	14	4
20	¾	41 (G 1A)	26	150	131	154	75	14	4
25	1	50 (G 1¼A)	33	160	145	159	85	14	4
32	1¼	63 (G 1¾A)	42	-	177	184	100	18	4
40	1 ½	70 (G 2A)	47	-	200	204	110	18	4
50	2	82 (G 2½A)	60	-	244	234	125	18	4

[1] Conical ext. thread acc. to EN 10226-1
[2] Flanges PN 25, acc. to EN 1092-2

Compression fittings



Danfoss A/S
Climate Solutions • danfoss.com • +45 7488 2222