Data sheet

Differential pressure and flow controller (PN 25)

AVPQ – return mounting, adjustable setting
AVPQ 4 – flow mounting, adjustable setting

Description

AVPQ

AVPQ 4

AVPQ(4) is a self-acting differential pressure and flow controller 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 two control diaphragms and handle for differential pressure setting.

Main data:
- DN 15-50
- k_{VS} 0.4-25 m³/h
- Flow range: 0.015-15 m³/h
- PN 25
- Setting range: 0.2-1.0 bar/0.3-2.0 bar
- Flow restrictor Δp_b: 0.2 bar
- Temperature:
  Circ. water / glycolic water up to 30% :
  2 … 150 °C
- Connections:
  - Ext. thread (weld-on, ext. thread and flange tailpieces)
  - Flange

Ordering

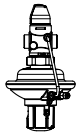
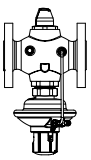
Example:
Differential pressure and flow controller; return mounting;
DN 15; k_{VS} 1.6; PN 25;
setting range 0.2-1.0 bar;
T_{max} 150 °C; ext. thread

- *1× AVPQ DN 15 controller*
  Code No: ***003H6531***
- *1× Impulse tube set AV, R ⅛*
  Code No: ***003H6852***

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

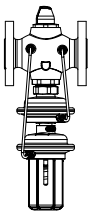
The controller will be delivered completely assembled, inclusive impulse tube(s) between valve and actuator. External impulse tube (AV) must be ordered separately.

AVPQ Controller (return mounting)

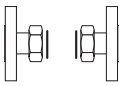
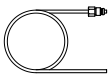
Picture	DN (mm)	k_{VS} (m³/h)	Connection		Δp setting range (bar)	Code No.	Δp setting range (bar)	Code No.
	15	0.4	Cylindr. ext. thread acc. to ISO 228/1	G ¾ A	0.2-1.0	**003H6918**	0.3-2.0	**003H6920**
		1.0				**003H6919**		**003H6921**
		1.6				**003H6531**		**003H6539**
		2.5				**003H6532**		**003H6540**
		4.0				**003H6533**		**003H6541**
	20	6.3		G 1 A		**003H6534**		**003H6542**
	25	8.0		G 1¼ A		**003H6535**		**003H6543**
	32	12.5		G 1¾ A		**003H6536**		**003H6544**
	40	16		G 2 A		**003H6537**		**003H6545**
	50	20		G 2½ A		**003H6538**		**003H6546**
	32	12.5	Flanges PN 25, acc. to EN 1092-2			**003H6563**		**003H6566**
	40	20				**003H6564**		**003H6567**
	50	25				**003H6565**		**003H6568**

Ordering *(continuous)*

AVPQ 4 Controller (flow mounting)

Picture	DN (mm)	k_{vs} (m^3/h)	Connection		Δp setting range (bar)	Code No.	Δp setting range (bar)	Code No.
	15	0.4	Cylindr. ext. thread acc. to ISO 228/1	G ¾ A	0.2-1.0	**003H6922**	0.3-2.0	**003H6924**
		1.0				**003H6923**		**003H6925**
		1.6				**003H6547**		**003H6555**
		2.5				**003H6548**		**003H6556**
		4.0				**003H6549**		**003H6557**
	20	6.3		G 1 A		**003H6550**		**003H6558**
	25	8.0		G 1¼ A		**003H6551**		**003H6559**
	32	12.5		G 1¾ A		**003H6552**		**003H6560**
	40	16		G 2 A		**003H6553**		**003H6561**
	50	20		G 2½ A		**003H6554**		**003H6562**
	32	12.5	Flanges PN 25, acc. to EN 1092-2			**003H6569**		**003H6572**
	40	20				**003H6570**		**003H6573**
	50	25				**003H6571**		**003H6574**

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 fitting 1) 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	0.4	**003H6861**
			1.0	**003H6862**
			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.	
			AVPQ	AVPQ 4
	Actuator with adjustable handle	0.2-1.0	**003H6833**	**003H6838**
		0.3-2.0	**003H6850**	**003H6851**

Technical data

Valve

Nominal diameter			**DN**	**15**					**20**	**25**	**32**	**40**	**50**
k_{VS} value				0.4	1.0	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	m^3/h	0.015	0.02	0.03	0.07	0.07	0.16	0.2	0.4	0.8	0.8
		to		0.18	0.4	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 AVPQ(4) controller. In general at $\Delta p > 1$-1.5 bar*

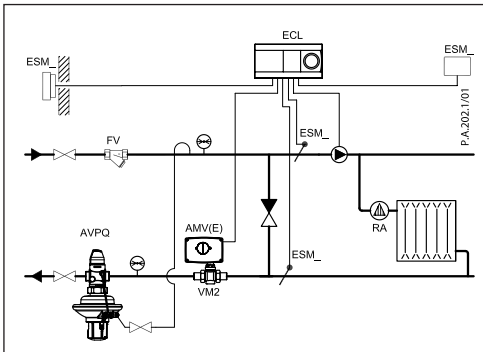
[4] *Flange valve body*

Technical data *(continuous)*

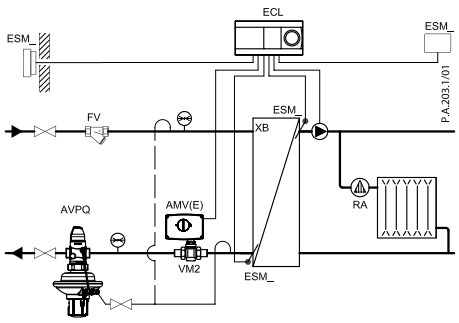
Actuator

Type			AVPQ		AVPQ 4	
Actuator size		cm_2	54			
Nominal pressure		PN	25			
Flow restrictor diff. pressure, Δpb		bar	0.2			
Diff. pressure setting ranges and spring colours		bar	0.2-1.0	0.3-2.0	0.2-1.0	0.3-2.0
			yellow	red	yellow	red
Materials						
Housing	Upper casing of actuator		Stainless steel, mat. No.1.4301			
	Lower casing of actuator		Dezincing free brass CuZn36Pb2As			
Diaphragm			EPDM			
Impulse tube			Copper tube Ø6 × 1 mm			

Application principles
- Return mounting

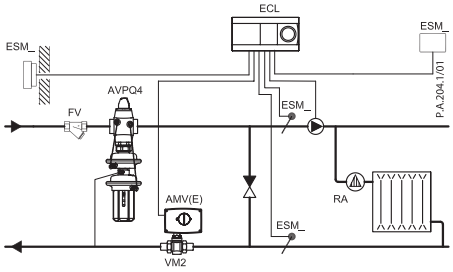


Direct-connected heating system

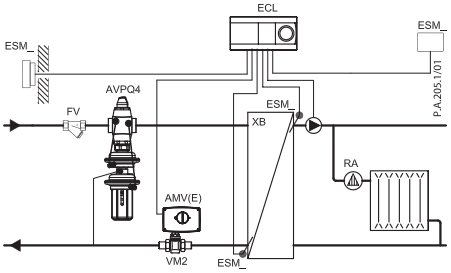


Indirectly connected heating system

- Flow mounting



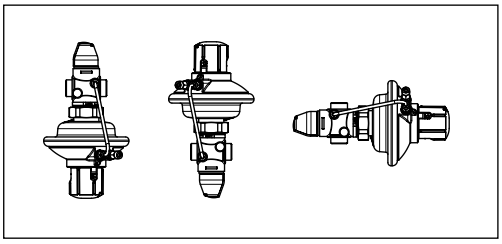
Direct-connected heating system



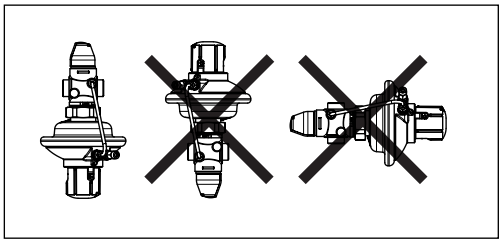
Indirectly connected heating system

Installation positions

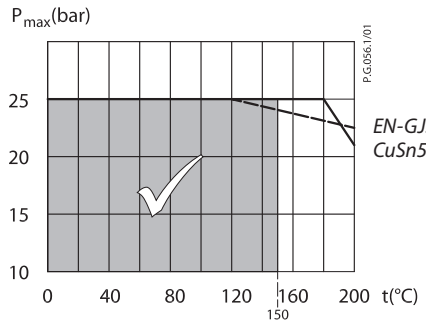
Up to medium temperature of 100 ˚C the controllers can be installed in any position.



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



Pressure temperature diagram

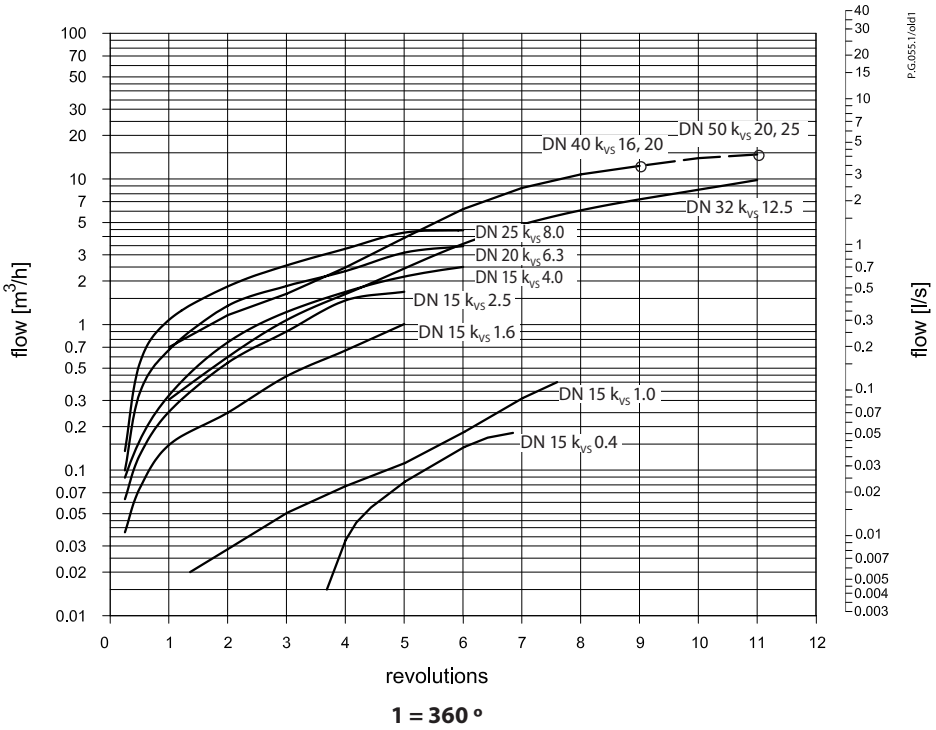


Maximum allowed operating pressure as a function of medium temperature (according to EN 1092-2 and EN 1092-3).

Flow diagram

Sizing and setting diagram

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



1 = 360 °

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 1900 l/h.

Given data:
Q_{max} = 1.9 m³/h (1900 l/h)
Δp_{min} = 0.9 bar (90 kPa)
$\Delta p_{circuit}$ [1)] = 0.1 bar (10 kPa)
Δp_{MCV} = 0.3 bar (30 kPa) selected
Δp_b [2)] = 0.2 bar (20 kPa)
Remark:
[1)] *$\Delta p_{circuit}$ corresponds to the required pump pressure in the heating circuit and is not to be considered when sizing the AVPQ(4).*
[2)] *Δp_b is differential pressure over flow restrictor.*

The differential pressure set value is:
$\Delta p_{set\ value} = \Delta p_{MCV}$
$\Delta p_{set\ value}$ = 0.3 bar (30 kPa)

The total pressure loss across the controller is:
$\Delta p_{AVPQ} = \Delta p_{min} - \Delta p_{MCV} = 0.9 - 0.3$
Δp_{AVPQ} = 0.6 bar (60 kPa)

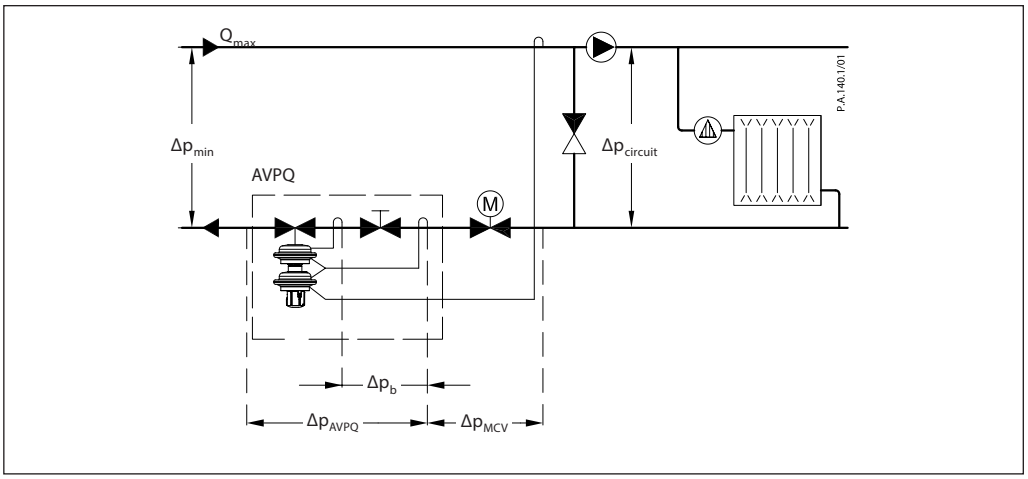
Possible pipe pressure losses in tubes, shut-off fittings, heatmeters, etc. are not included.

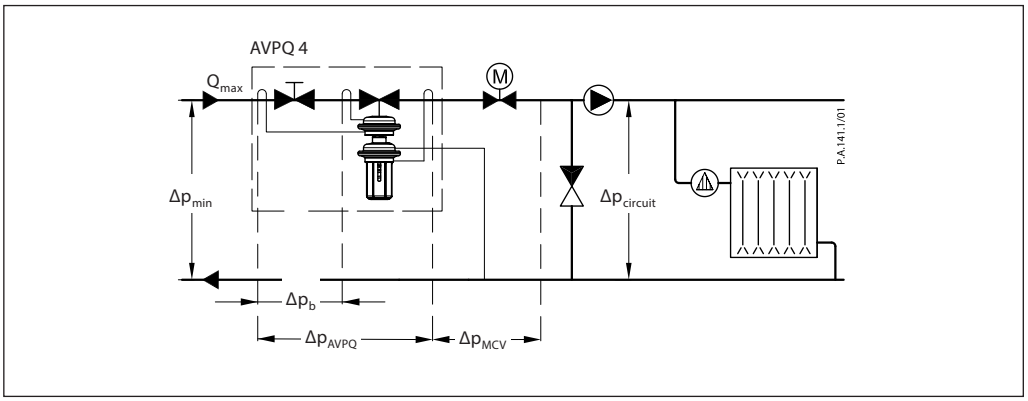
k_v value is calculated according to formula:

$$k_v = \frac{Q_{max}}{\sqrt{\Delta p_{AVPQ} - \Delta p_b}} = \frac{1.9}{\sqrt{0.6 - 0.2}}$$

k_v = 3.0 m³/h

Solution:
The example selects AVPQ(4) 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.





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 1150 l/h.

Given data:
Q_{max} = 1.15 m³/h (1150 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)
Remark:
[1)] *Δp_b is differential pressure over flow restrictor*

The differential pressure set value is:
$\Delta p_{set\ value} = \Delta p_{exchanger} + \Delta p_{MCV}$
$\Delta p_{set\ value} = 0.05 + 0.3$
$\Delta p_{set\ value} = 0.35$ bar (35 kPa)

The total pressure loss across the controller is:
$\Delta p_{AVPQ} = \Delta p_{min} - \Delta p_{exchanger} - \Delta p_{MCV}$
$\Delta p_{AVPQ} = 1.0 - 0.05 - 0.3$
$\Delta p_{AVPQ} = 0.65$ bar (65 kPa)

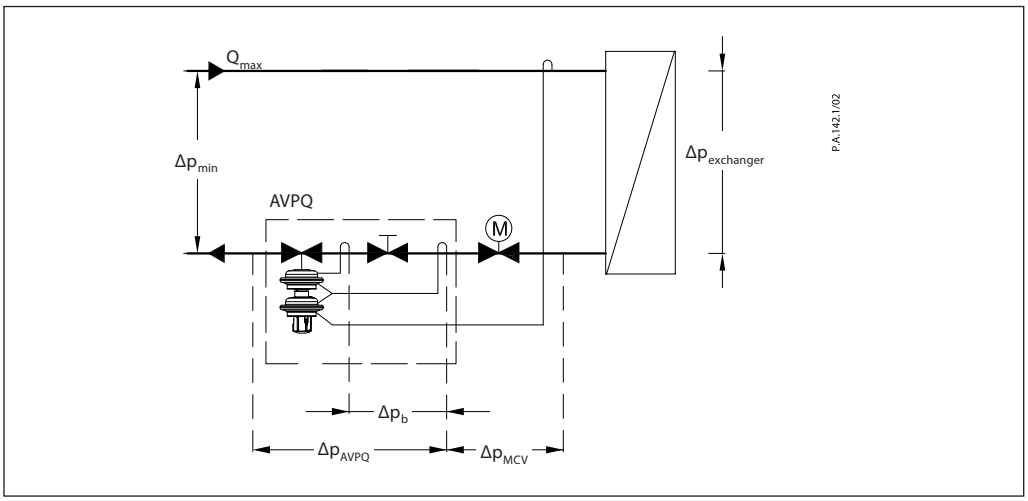
Possible pipe pressure losses in tubes, shut-off fittings, heatmeters, etc. are not included.

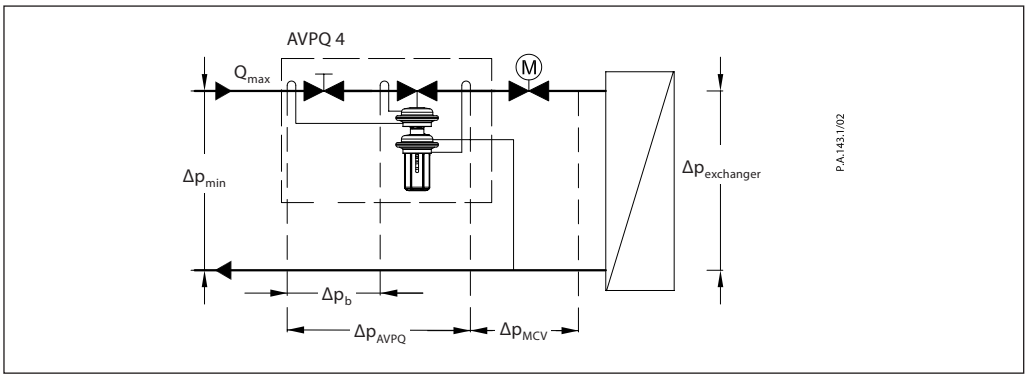
k_v value is calculated according to formula:

$$k_v = \frac{Q_{max}}{\sqrt{\Delta p_{AVPQ} - \Delta p_b}} = \frac{1.15}{\sqrt{0.65 - 0.2}}$$

$k_v = 1.7$ m³/h

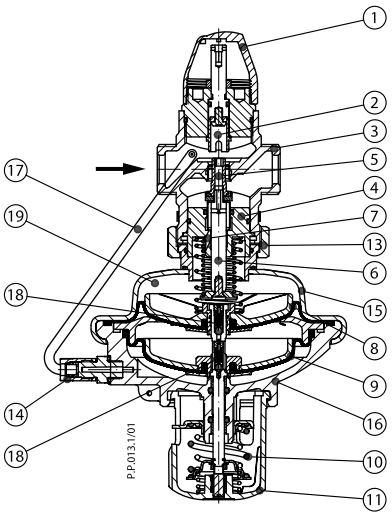
Solution:
The example selects AVPQ(4) DN 15, k_{VS} value 2.5, with differential pressure setting range 0.2-1.0 bar, flow setting range 0.07-1.6 m³/h.



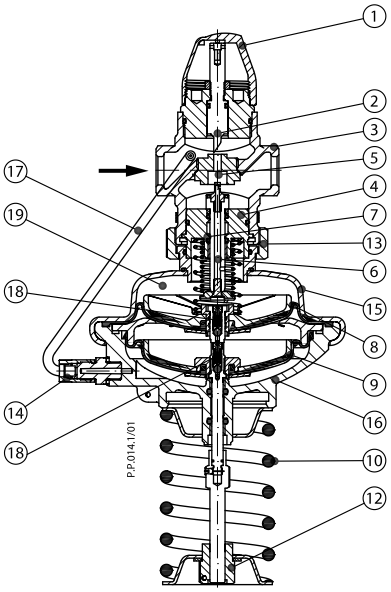


Design

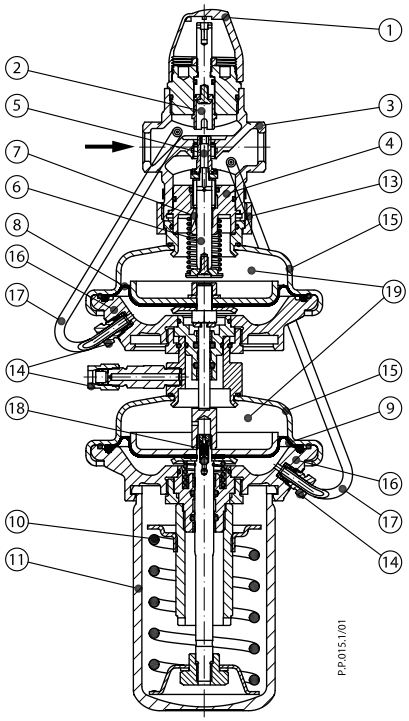
1. Cover
2. Adjustable flow restrictor
3. Valve body
4. Valve insert
5. Pressure relieved valve cone
6. Valve stem
7. Control drain
8. Control diaphragm for flow control
9. Control diaphragm for diff. pressure control
10. Setting spring for diff. pressure control
11. Handle for diff. pressure setting, prepared for sealing
12. Adjuster for diff. pressure setting, prepared for sealing
13. Union nut
14. Compression fitting for impulse tube
15. Upper casing of actuator
16. Lower casing of actuator
17. Impulse tube
18. Excess pressure safety valve
19. Actuator



AVPQ (0.2-1.0 bar) - return mounting



AVPQ (0.3-2.0 bar) - return mounting



AVPQ 4 - flow mounting

Function

Flow volume causes pressure drop across the adjustable flow restrictor. Resulting pressures 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 flow control. The flow restrictor diff. pressure is controlled and limited by means of built-in spring for flow control. Control valve closes on rising differential pressure and opens on falling differential pressure to control max flow.

Pressure changes from flow and return pipes are being transferred through the impulse tubes to the actuator chambers and act on control diaphragm for diff. pressure 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.

Controller is equipped with excess pressure safety valve, which protects control diaphragm for diff. pressure control from too high differential pressure. In addition return version of controller is equipped with second excess pressure safety valve, which protects control diaphragm for flow control from too high differential pressure.

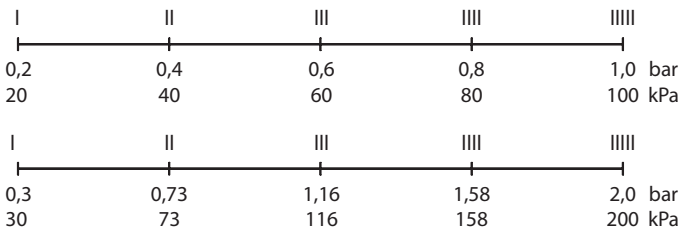
Settings

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.

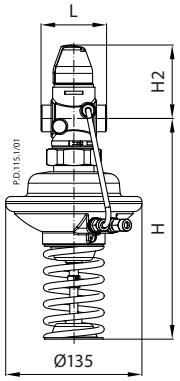
Differential pressure setting
Differential pressure setting is being done by the adjustment of the setting spring for diff. pressure control. The adjustment can be done by means of handle for diff. pressure setting and/or pressure indicators.

Adjustment diagram

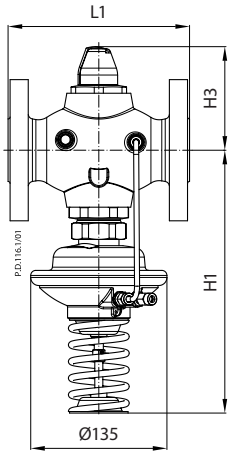
Relation between scale figures and differential pressure. Values given are approximate.



Dimensions



AVPQ
DN 15-50
Δp = 0.3-2.0 bar

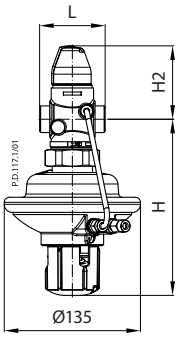


AVPQ
DN 32-50
Δp = 0.3-2.0 bar

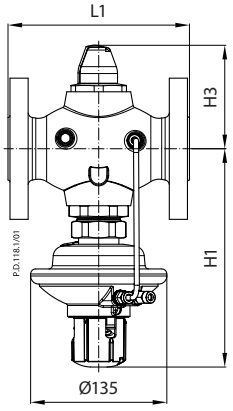
AVPQ (Δp = 0.3-2.0 bar)

DN		15	20	25	32	40	50
L	mm	65	70	75	100	110	130
L1		-	-	-	180	200	230
H		219	219	219	260	260	260
H1		-	-	-	260	260	260
H2		73	73	76	103	103	103
H3		-	-	-	103	103	103
Weight (thread)	kg	3.2	3.2	3.4	5.9	6.0	6.7
Weight (flange)		-	-	-	10.4	12.0	14.0

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



AVPQ
DN 15-50
Δp = 0.2-1.0 bar



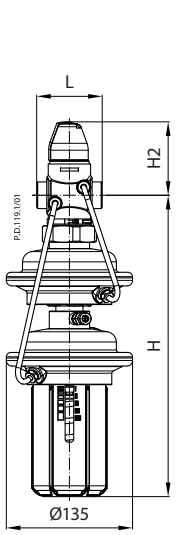
AVPQ
DN 32-50
Δp = 0.2-1.0 bar

AVPQ (Δp = 0.2-1.0 bar)

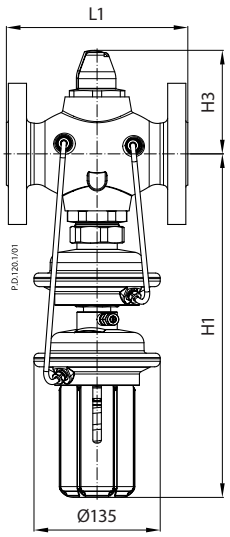
DN		15	20	25	32	40	50
L	mm	65	70	75	100	110	130
L1		-	-	-	180	200	230
H		175	175	175	217	217	217
H1		-	-	-	217	217	217
H2		73	73	76	103	103	103
H3		-	-	-	103	103	103
Weight (thread)	kg	3.2	3.2	3.4	5.9	6.0	6.7
Weight (flange)		-	-	-	10.4	12.0	14.0

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

Dimensions *(continuous)*



AVPQ 4
DN 15-50

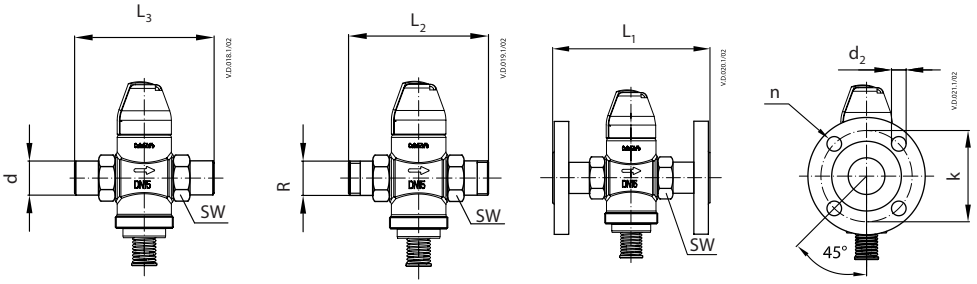


AVPQ 4
DN 32-50

AVPQ 4

DN		15	20	25	32	40	50
L	mm	65	70	75	100	110	130
L1		-	-	-	180	200	230
H		298	298	298	340	340	340
H1		-	-	-	340	340	340
H2		73	73	76	103	103	103
H3		-	-	-	103	103	103
Weight (thread)	kg	5.4	5.4	5.6	8.1	8.2	8.9
Weight (flange)		-	-	-	12.5	14.1	16.2

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



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