

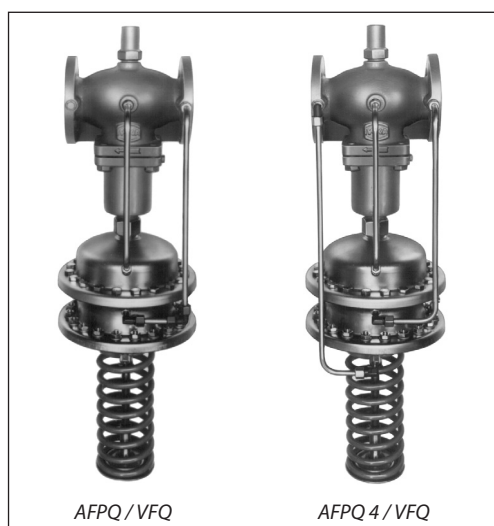
Data sheet

Differential pressure and flow controller (PN 16, 25, 40)

AFPQ / VFQ 2(1) - return mounting, adjustable setting

AFPQ 4 / VFQ 2(1) - flow mounting, adjustable setting

Description



The controller 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 spring for differential pressure setting. Differential pressure control and flow control are independent.

Further on two valve versions are available:

- VFQ 2 with metallic sealing cone
- VFQ 21 with soft sealing cone (on special request)

Main data:

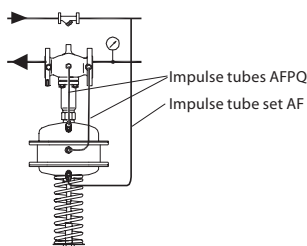
- DN 15-250
- k_{vs} 4,0-400 m³/h
- Flow range: 0,1-250 m³/h
- PN 16, 25, 40
- Setting range: 0,1-0,7 bar / 0,15-1,5 bar
- Flow restrictor Δp_b : 0,2 bar or 0,5 bar
- Temperature:
 - Circulation water / glycolic water up to 30 %: 2 ... 140 / 150 / 200 °C
- Connections:
 - Flange

Ordering

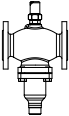
Example 1:
Differential pressure and flow controller; return mounting;
DN 15; k_{vs} 4,0; PN 16; metallic sealing; setting range 0,1-0,7 bar;
flow restrictor Δp_b 0,2 bar;
 T_{max} 150 °C; flange;

- 1x VFQ 2 DN 15 valve
Code no: **065B2654**
- 1x AFPQ actuator
Code no: **003G1029**
- 1x AFPQ DN 15 impulse tubes
Code no: **003G1365**
- 1x Impulse tube set AF
Code no: **003G1391**

Products will be delivered separately.



VFQ 2 Valves (metallic sealing cone)

Picture	DN (mm)	k _{vs} (m³/h)	T _{max} (°C)	Connections	Code No.			
					PN 16	PN 25	PN 40	
	15	4,0	150	200 ¹⁾	Flanges acc. to EN 1092-1	065B2654	065B2667	065B2677
	20	6,3				065B2655	065B2668	065B2678
	25	8,0				065B2656	065B2669	065B2679
	32	16				065B2657	065B2670	065B2680
	40	20				065B2658	065B2671	065B2681
	50	32				065B2659	065B2672	065B2682
	65	50				065B2660	065B2673	065B2683
	80	80				065B2661	065B2674	065B2684
	100	125				065B2662	065B2675	065B2685
	125	160				065B2663	065B2676	065B2686
	150	280	140	-		065B2664	-	065B2687
	200	320				065B2758	-	065B2688
	250	400				065B2759	-	065B2689

Note: other valves available on special request.

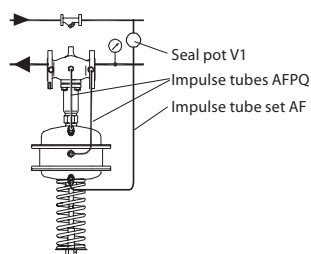
¹⁾ at temperatures above 150 °C only with seal pots (see Accessories)

Ordering (continuous)

Example 2:
Differential pressure and flow controller; return mounting;
DN 15; k_{VS} 4,0; PN 16; metallic sealing; setting range 0,1-0,7 bar;
flow restrictor Δp_b 0,2 bar;
 T_{max} 200 °C; flange;

- 1x VFQ 2 DN 15 valve
Code no: **065B2654**
- 1x AFPQ actuator
Code no: **003G1029**
- 1x AFPQ DN 15 impulse tubes
Code no: **003G1365**
- 1x Impulse tube set AF
Code no: **003G1391**
- 1x Seal pot V1
Code no: **003G1392**

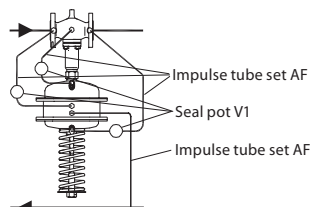
Products will be delivered separately.



Example 3:
Differential pressure and flow controller; flow mounting; DN 15;
 k_{VS} 4,0; PN 16; metallic sealing;
setting range 0,1-0,7 bar; flow restrictor Δp_b 0,2 bar; T_{max} 200 °C; flange;

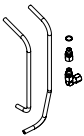
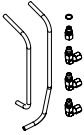
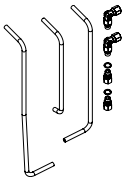
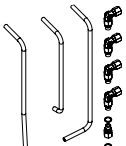
- 1x VFQ 2 DN 15 valve
Code no: **065B2654**
- 1x AFPQ actuator
Code no: **00G1033**
- 4x Impulse tube set AF
Code no: **003G1391**
- 3x Seal pot V1
Code no: **003G1392**

Products will be delivered separately.


AFPQ / AFPQ 4 Actuators

Picture	Δp setting range (bar)	Flow restrictor Δp_b (bar)	Nominal pressure (PN)	Code No.	
				AFPQ (return)	AFPQ 4 (flow)
	0,1-0,7	0,2	40	003G1029	003G1033
		0,5		003G1030	003G1034
	0,15-1,5	0,2		003G1031	003G1035
		0,5		003G1032	003G1036

Accessories

Picture	Type designation	For controller	DN (mm)	PN	Code No.
	Impulse tubes (Stainless steel)	AFPQ	15	16, 25, 40	003G1365
			20		003G1367
			25		
			32		
			40		003G1369
			50		003G1370
			65		003G1371
			80		
			100		003G1373
			125		003G1374
150			003G1375		
			200	16	003G1416
				40	003G1376
			250	16	003G1417
		40		003G1405	
		AFPQ 4	15	16, 25, 40	003G1378
			20		003G1380
			25		
			32		
			40		003G1382
			50		003G1383
			65		003G1384
			80		
			100		003G1386
			125		003G1387
	150		003G1388		
			200	16	003G1418
				40	003G1389
			250	16	003G1419
				40	003G1406

Picture	Type designation	Description	Ordering number		Code No.
	Impulse tube set AF	- 1x Copper tube Ø10 x 1 x 1500 mm - 1 x compression fitting for imp. tube connection to pipe (G 1/4) - 2 x socket	-		003G1391
	Seal pot V1 ¹⁾	Capacity 1 liter; with compression fittings for imp. tube Ø10	AFPQ	1x	003G1392
			AFPQ 4	3x	
	Compression fitting ²⁾	For impulse tube Ø10 connections to controller	G 1/4		003G1468
	Combination piece KF3	For combination with pressure and electrical actuators	G 1 1/4 / 2x G 1 1/4		003G1397
	Combination piece KF2	For combination with thermostat			003G1398
	Shut off valve	For impulse tube Ø10	-		003G1401
	Throttle valve				065B2909

¹⁾ Seal pot has to be used on impulse tubes always when $T_{max} \geq 150$ °C

²⁾ Consist of a nipple, compression ring and nut

Ordering (continuous)

Service kits

Picture	Type designation	For valve	DN (mm)	k _{vs} (m³/h)	Code No.
	Valve insert	VFQ 2	15	4.0	065B2796
			20	6.3	065B2797
			25	8	065B2798
			32	16	
			40	20	065B2799
			50	32	
			65	50	065B2800
			80	80	
			100	125	065B2801
			125	160	
			150	280	065B2964
			250	400	065B2965
	Stuffing cone (with EPDM O-rings)				003G1464

Technical data

Valve

Nominal diameter			DN	15	20	25	32	40	50	65	80	100	125	150	200	250
k _{v5} value			m³/h	4,0	6,3	8,0	16	20	32	50	80	125	160	280	320	400
Range of max. flow setting	Δp _b ¹⁾ = 0,2 bar	from		0,1	0,2	0,2	0,4	0,6	0,8	3	4	6	8	12	15	18
		to		2	3	4	7	11	16	28	40	63	80	125	150	180
	Δp _b ¹⁾ = 0,5 bar	from		0,2	0,3	0,3	0,5	0,8	1,2	4	6	9	12	18	22	25
		to		3	4.5	6	10	16	24	40	58	90	120	180	220	250
Cavitation factor z				0,6	0,6	0,6	0,55	0,55	0,5	0,5	0,45	0,4	0,35	0,3	0,2	0,2
Leakage acc. to standard IEC 534 (% of k _{v5})		VFQ 2	≤ 0,03											≤ 0,05		
		VFQ 21	≤ 0,01													
Nominal pressure		PN	16, 25, 40													
Min. differential pressure		bar	see remark ²⁾													
Max. differential pressure	PN 16		16										15		12	10
	PN 25, 40		20													
Medium			Circulation water / glycolic water up to 30 %													
Medium pH			Min. 7, max. 10													
Medium temperature	VFQ 2	°C	2 ... 150 / 2 ... 200 ³⁾											2 ... 140		
	VFQ 21		2 ... 150													
Connections			Flange													
Materials																
Valve body	PN 16	Grey cast iron EN-GJL-250 (GG-25)														
	PN 25	Ductile iron EN-GJS-400(GGG-40.3)														
	PN 40	Cast steel GP240GH (GS-C 25)														
Valve seat			Stainless steel, mat. No. 1.4021											Stainless steel, mat. No. 1.4313		
Valve cone			Stainless steel, mat. No. 1.4404											Stainless steel, mat. No. 1.4021		
Sealing	VFQ 2	Metal														
	VFQ 21	EPDM														
Pressure relieve system			Bellows (Stainless steel, mat. No. 1.4571)											Diaphragm (EPDM)		

¹⁾ Δp_b - differential pressure over flow restrictor

²⁾ Depends on the flow rate and valve k_{vs} ; For $Q_{set} = Q_{max} \rightarrow \Delta p_{min} \geq 0,5$ bar; For $Q_{set} < Q_{max} \rightarrow \Delta p_{min} = \left(\frac{Q}{k_{vs}} \right)^2 + \Delta p_b$
³⁾ at temperatures above 150 °C only with seal pots (see Accessories)

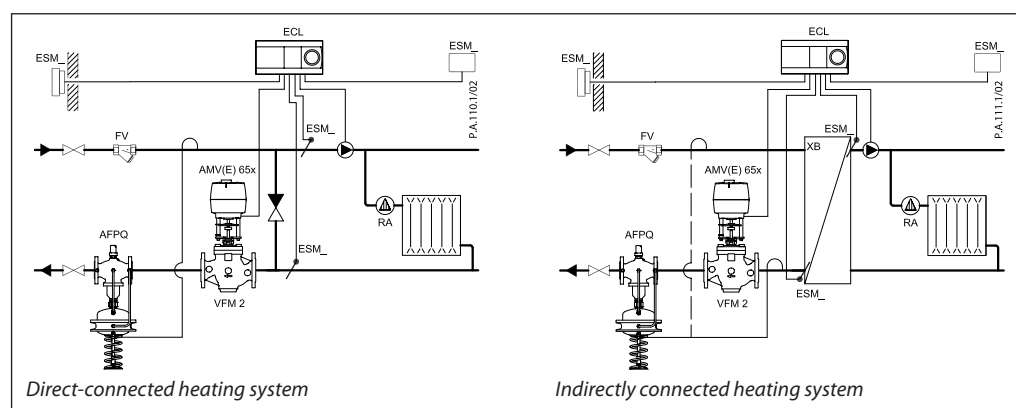
Technical data (continuous)

Actuator

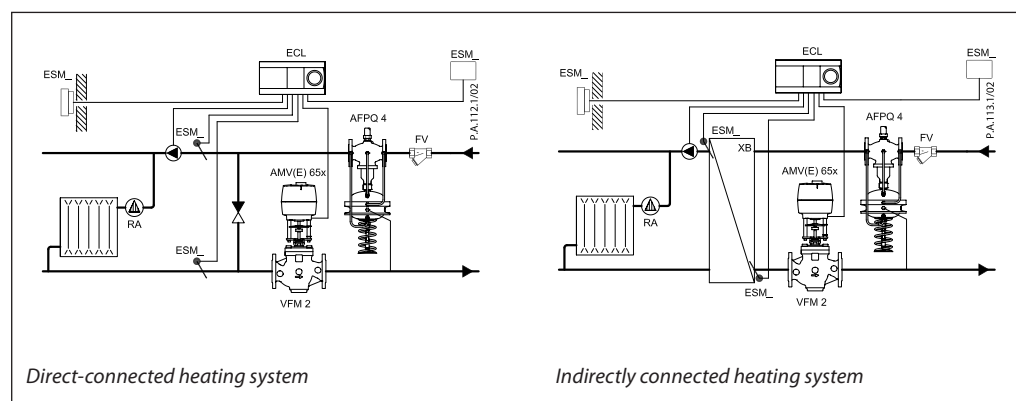
Type		AFPQ, AFPQ 4	
Actuator size	cm²	250	
Nominal pressure	PN	40	
Flow restrictor diff. pressure Δp _b	bar	0,2 / 0,5	
Diff. pressure setting ranges and spring colours		0,1-0,7	0,15-1,5
		yellow	red
Materials			
Actuator housing		Stainless steel, mat. No.1.0338, zinc plated and yellow chromate	
Control diaphragm		EPDM (Rolling; fibre enforced)	
Impulse tube		Stainless steel tube Ø10 × 0,8 mm copper tube Ø10 × 1 mm, threaded fitting G ¼, ISO 228	

Application principles

- Return mounting



- Flow mounting



Combinations

Example:

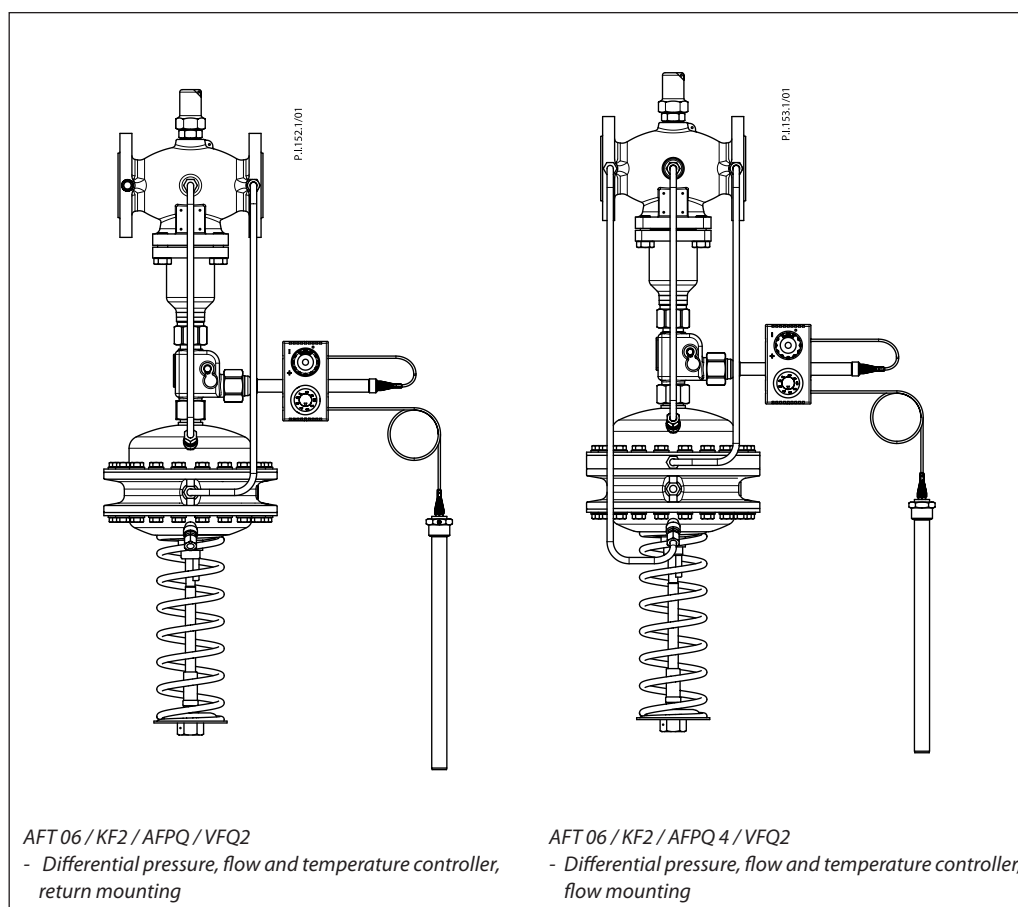
Differential pressure, flow and temperature controller, return mounting; DN 15; k_{vs} 4,0; PN 16; metallic sealing; setting range 0,1-0,7 bar; flow restrictor Δp_b 0,2 bar; T_{max} 150 °C; flange;

- 1× VFQ 2 DN 15 valve
Code no: **065B2654**
- 1× AFPQ actuator
Code no: **003G1029**
- 3× Impulse tube set AF
Code no: **003G1391**
- 1× AFT06 thermostat
Code no: **065-4390**
- 1× Combination piece KF2
Code no: **003G1398**

Products will be delivered separately.

Note:

For AFT 06 thermostat data see relevant data sheet



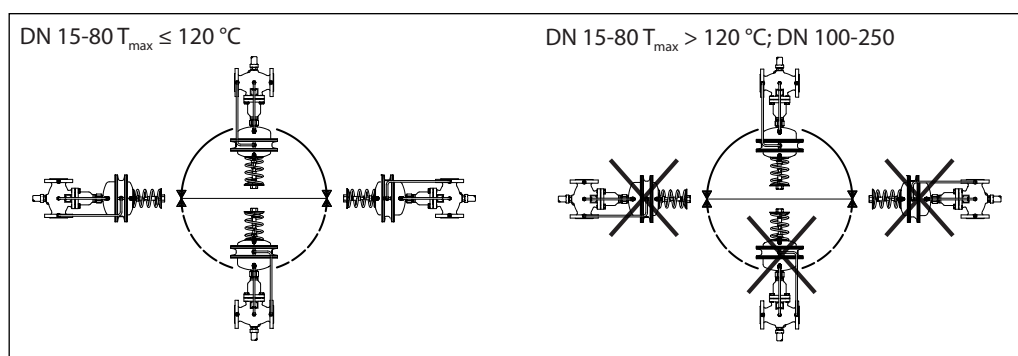
Installation positions

DN 15-80 $T_{max} \leq 120$ °C

The controllers can be installed in any position.

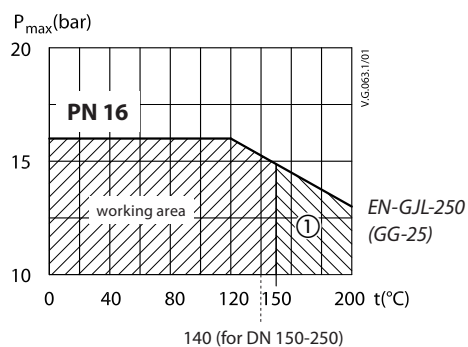
DN 15-80 $T_{max} > 120$ °C; DN 100-250

The controllers can be installed in horizontal pipes only, with a pressure actuator oriented downwards.

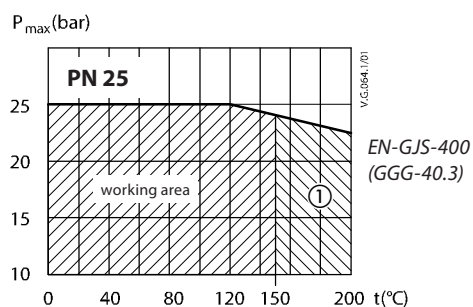


Pressure temperature diagram

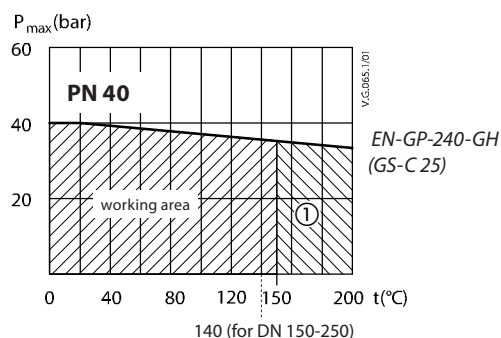
Working area is below P-T line and it ends at T_{max} for each valve



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



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



Maximum allowed operating pressure as a function of medium temperature (according to EN 1092-1)

Note: ① at temperatures above 150 °C only with seal pots (see Accessories)

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 1.900 l/h.

Given data:

$Q_{\max} = 1,9 \text{ m}^3/\text{h}$ (1.900 l/h)
 $\Delta p_{\min} = 0,9 \text{ bar}$ (90 kPa)
 $\Delta p_{\text{circuit}}^{1)} = 0,1 \text{ bar}$ (10 kPa)
 $\Delta p_{\text{MCV}} = 0,3 \text{ bar}$ (30 kPa) selected
 $\Delta p_b^{2)} = 0,2 \text{ bar}$ (20 kPa)

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 AFPQ(4).

²⁾ Δp_b is differential pressure over flow restrictor.

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

k_v value is calculated according to formula:

$$k_v = \frac{Q_{\max}}{\sqrt{\Delta p_{\text{AFPQ}} - \Delta p_b}} = \frac{1,9}{\sqrt{0,6 - 0,2}}$$

$$k_v = 3,0 \text{ m}^3/\text{h}$$

Solution:

The example selects AFPQ 4 DN 15, k_{vs} value 4,0, with differential pressure setting range 0,1-0,7 bar, flow setting range 0,1-2,0 m^3/h .

The differential pressure set value is:

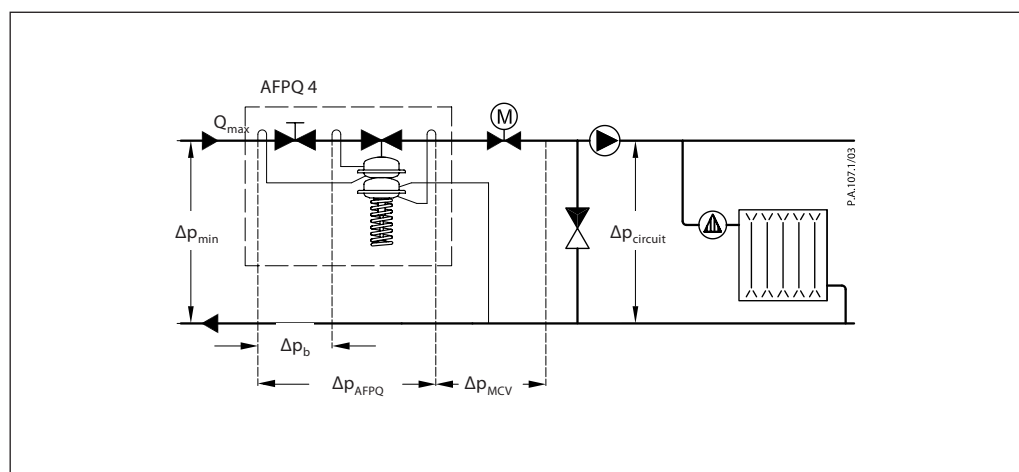
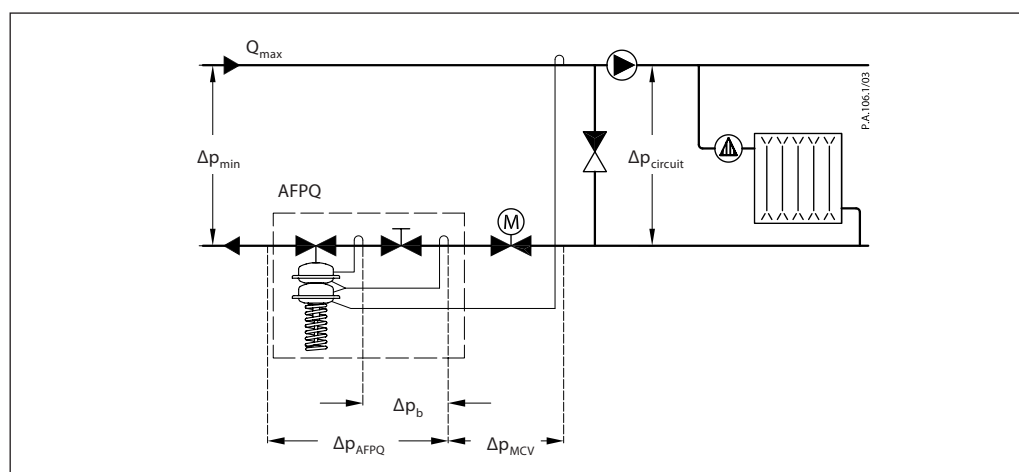
$$\Delta p_{\text{set value}} = \Delta p_{\text{MCV}}$$

$$\Delta p_{\text{set value}} = 0,3 \text{ bar} \text{ (30 kPa)}$$

The total pressure loss across the controller is:

$$\Delta p_{\text{AFPQ}} = \Delta p_{\min} - \Delta p_{\text{MCV}} = 0,9 - 0,3$$

$$\Delta p_{\text{AFPQ}} = 0,6 \text{ bar} \text{ (60 kPa)}$$



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 1.800 l/h.

Given data:

$$\begin{aligned} Q_{\max} &= 1,8 \text{ m}^3/\text{h} (1.800 \text{ l/h}) \\ \Delta p_{\min} &= 1,0 \text{ bar (100 kPa)} \\ \Delta p_{\text{exchanger}} &= 0,05 \text{ bar (5 kPa)} \\ \Delta p_{\text{MCV}} &= 0,3 \text{ bar (30 kPa) selected} \\ \Delta p_b^{1)} &= 0,2 \text{ bar (20 kPa)} \end{aligned}$$

Remark:

¹⁾ Δp_b is differential pressure over flow restrictor

The differential pressure set value is:

$$\begin{aligned} \Delta p_{\text{set value}} &= \Delta p_{\text{exchanger}} + \Delta p_{\text{MCV}} \\ \Delta p_{\text{set value}} &= 0,05 + 0,3 \\ \Delta p_{\text{set value}} &= 0,35 \text{ bar (35 kPa)} \end{aligned}$$

The total pressure loss across the controller is:

$$\begin{aligned} \Delta p_{\text{AFPQ}} &= \Delta p_{\min} - \Delta p_{\text{exchanger}} - \Delta p_{\text{MCV}} \\ \Delta p_{\text{AFPQ}} &= 1,0 - 0,05 - 0,3 \\ \Delta p_{\text{AFPQ}} &= 0,65 \text{ bar (65 kPa)} \end{aligned}$$

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

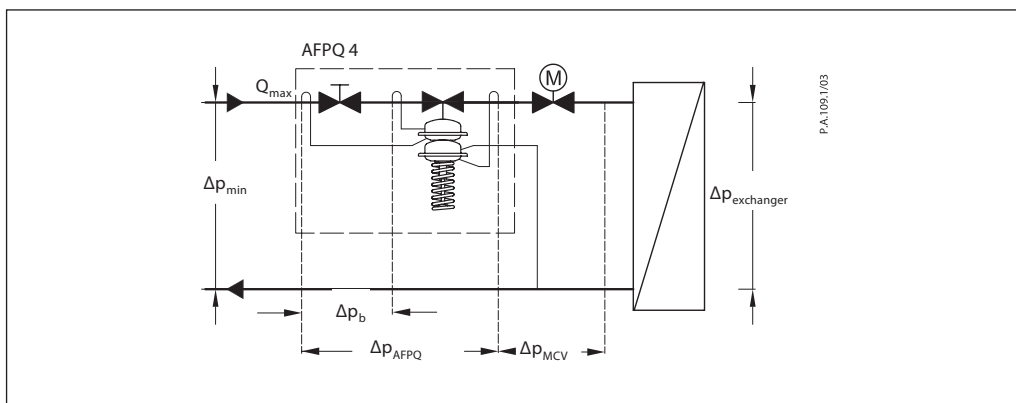
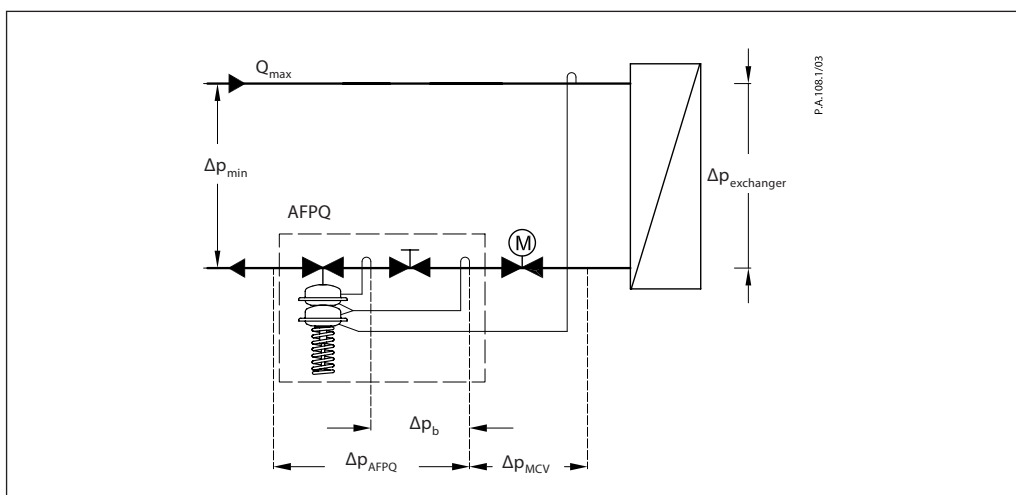
k_v value is calculated according to formula:

$$k_v = \frac{Q_{\max}}{\sqrt{\Delta p_{\text{AFPQ}} - \Delta p_b}} = \frac{1,8}{\sqrt{0,65 - 0,2}}$$

$$k_v = 2,7 \text{ m}^3/\text{h}$$

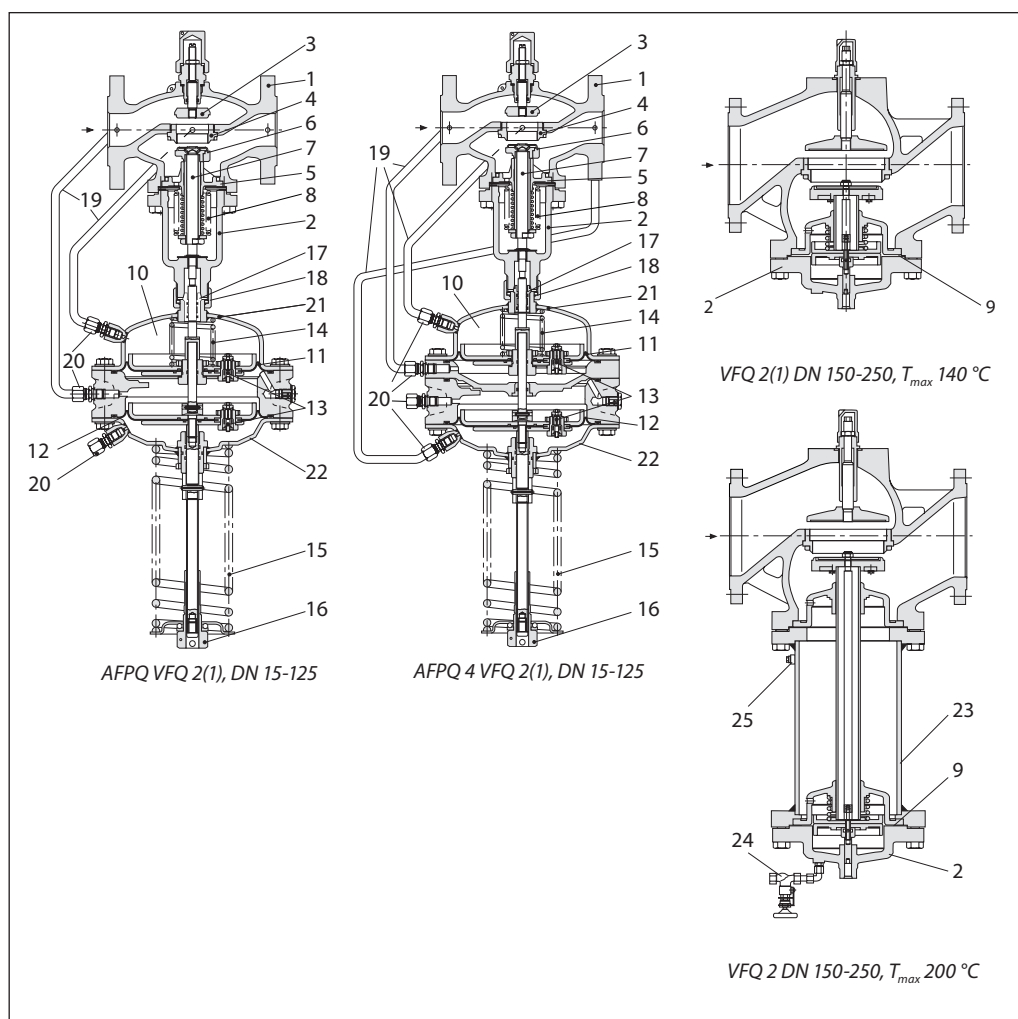
Solution:

The example selects AFPQ 4 DN 15, k_{vs} value 4,0, with differential pressure setting range 0,1-0,7 bar, flow setting range 0,1-2,0 m³/h.



Design

1. Valve body
2. Cover
3. Adjustable flow restrictor
4. Valve seat
5. Valve insert
6. Pressure relieved valve cone
7. Valve stem
8. Bellows for pressure relief of valve cone
9. Diaphragm for pressure relief of valve cone
10. Actuator
11. Control diaphragm for flow control
12. Control diaphragm for diff. pressure control
13. Excess pressure safety valve
14. Built-in spring for flow control
15. Setting spring for diff. pressure control
16. Adjuster for diff. pressure setting, prepared for sealing
17. Stuffing cone
18. Union nut
19. Impulse tube
20. Compression fitting for impulse tube
21. Upper casing of diaphragm
22. Lower casing of diaphragm
23. Valve body extension
24. Shut off valve for water filling
25. Closing plug



Function

Flow volume causes pressure drop across the adjustable flow restrictor. Resulting pressures are being transferred through the impulse tubes 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 two excess pressure safety valves, which protect control diaphragms for flow and diff. pressure control from too high differential pressure.

Setting

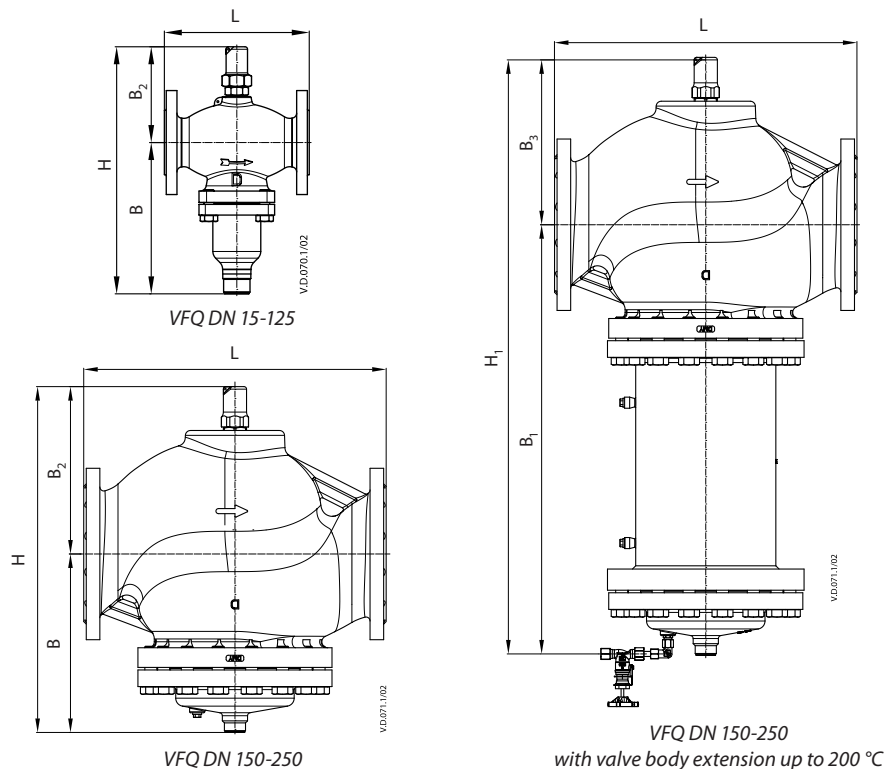
Flow setting

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

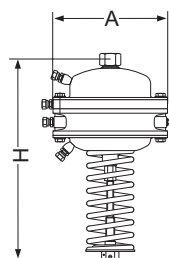
Differential pressure setting is being done by the adjustment of the setting spring for diff. pressure control. The adjustment can be done by means of adjuster for diff. pressure setting and pressure indicators.

Dimensions



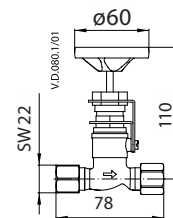
VFQ 2, VFQ 21 Valves

DN		15	20	25	32	40	50	65	80	100	125	150	200	250	
L		mm	130	150	160	180	200	230	290	310	350	400	480	600	730
B			213	213	239	239	241	241	276	276	381	381	326	354	401
B ₂			124	124	135	135	152	152	164	164	194	194	269	332	355
H			337	337	374	374	393	393	440	440	575	575	595	686	756
Weight	PN 16 / 25	kg	8	9	10,5	12,5	15,5	18,5	28,5	31	61	71	120	193	337
	PN 40								31	34	63	72	147	264	347
B ₁		mm											620	852	1199
B ₃													269	332	356
H ₁													889	1184	1555
Weight (valve with body extension)	PN 16 / 25	kg											160	314	489
	PN 40												187	350	526

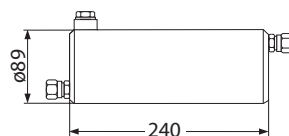


AFPQ, AFPQ 4 Actuators

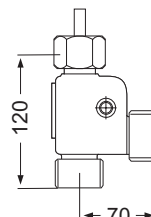
Actuator type		AFPQ / AFPQ 4
Ø A	mm	257
H for xs = 0,1-0,7 / 0,15-1,5		520/540
Weight	kg	34



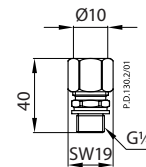
Shut off valve



Seal pot V1



Comb. piece KF2, KF3



Compression fitting

