

Data sheet

Flow controller (PN 16, 25, 40) AFQ / VFQ 2(1) – return and flow mounting

Description



The controller has a control valve with adjustable flow restrictor and an actuator with one control diaphragm.

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
- Flow restrictor Δp_b : 0.2 bar or 0.5 bar
- Temperature:
 - Circulation water / glycolic water up to 30 %: 2 ... 150/200 °C
- Connections:
 - Flange

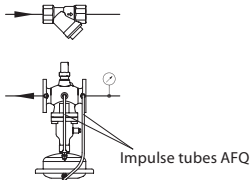
The controller is a self-acting flow controller primarily for use in district heating systems. The controller closes when set max. flow is exceeded.

Ordering

Example 1:
 Flow controller; DN 15; k_{vs} 4.0; PN 16; metallic sealing; flow restrictor Δp_b 0.2 bar; T_{max} 150 °C; flange;

- 1x VFQ 2 DN 15 valve
 Code no: **065B2654**
- 1x AFQ actuator
 Code no: **003G1024**
- 1x AFQ DN 15 impulse tubes
 Code no: **003G1338**

Products will be delivered separately.



VFQ 2 Valves (metallic sealing cone)

Picture	DN (mm)	k_{vs} (m ³ /h)	Connections	T_{max} (°C)	Code No.	T_{max} (°C)	Code No.	
					PN 16		PN 25	PN 40
	15	4.0	Flanges acc. to EN 1092-1	150	065B2654	200 ¹⁾	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		150	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)

AFQ Actuators

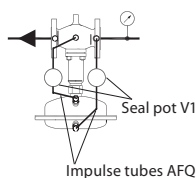
Picture	Flow restrictor Δp_b (bar)	Max. oper. pressure (PN)	Code No.
	0.2	25	003G1024
	0.5		003G1025

Ordering (continuous)

Example 2:
Flow controller; DN 15; k_{vs} 4.0; PN 25; metallic sealing; flow restrictor Δp_b 0.2 bar; T_{max} 200 °C; flange;

- 1x VFQ 2 DN 15 valve
Code no: **065B2667**
- 1x AFQ actuator
Code no: **003G1024**
- 2x AFQ DN 15 impulse tubes
Code no: **003G1391**
- 2x Seal pot V1
Code no: **003G1392**

Products will be delivered separately.



Accessories

Picture	Type designation	For controller	DN (mm)	PN	Code No.
	Impulse tubes ¹⁾ (Stainless steel)	AFQ	15	16, 25, 40	003G1338
			20		
			25		
			32		
			40		
			50		
			65		
			80		
			100		
			125		
			150		
			200	16	003G1414
			200	40	003G1349
			250	16	003G1350
250	40	003G1404			

¹⁾ With combination piece KF2 or KF3 use 2x **003G1391** at PN 16 and $T < 150$ °C. Otherwise impulse tubes on special request.

Accessories

Picture	Type designation	Description	Ordering number		Code No.
	Impulse tube set AF	- 1x Copper tube $\varnothing 10 \times 1 \times 1500$ mm - 1 x compression fitting for imp. tube connection to pipe (G 1/4) - 2 x socket	DN 15-150	2x	003G1391
			DN 200, 250	3x	
	Seal pot V1 ¹⁾	Capacity 1 liter; with compression fittings for imp. tube $\varnothing 10$	AFQ	2x	003G1392
	Compression fitting ²⁾	For impulse tube $\varnothing 10$ connections to controller	G 1/4		003G1468
	Combination piece KF3	For combination with pressure actuators. Electrical actuator connected on side (port B) only for ON/OFF function	G 1 1/4 / 2x G 1 1/4		003G1441
	Combination piece KF2	For combination with thermostat - side connection to port B			003G1440
	Shut off valve	For impulse tube $\varnothing 10$	-		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

³⁾ Port A - for connection of any type of actuator

Service kits

Picture	Type designation	For valve	DN (mm)	k_{vs} (m ³ /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 _{vs} value of Δp regulator				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	m ³ /h	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 _{vs})			VFQ 2	≤0.03											≤0.05			
			VFQ 21	≤0.01														
Nominal pressure			PN	16, 25, 40														
Min. differential pressure for max flow ²⁾	Δp _b ¹⁾ = 0.2	bar	0.5	0.4	0.5	0.4	0.5					0.4						
	Δp _b ¹⁾ = 0.5		0.8	0.7	0.8	0.7	0.8					0.7						
Max. differential pressure	PN 16		16									15	12	10				
	PN 25, 40		20															
Media			Circulation water / glycolic water up to 30 %															
Media pH			Min. 7, max. 10															
Media temperature	VFQ 2	°C	2 ... 150 / 2 ... 200 ²⁾											2 ... 150				
	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⁾ For flows smaller than Q_{max} → Δp_{min} = $\left(\frac{Q}{k_{vs}}\right)^2 + \Delta p_b$

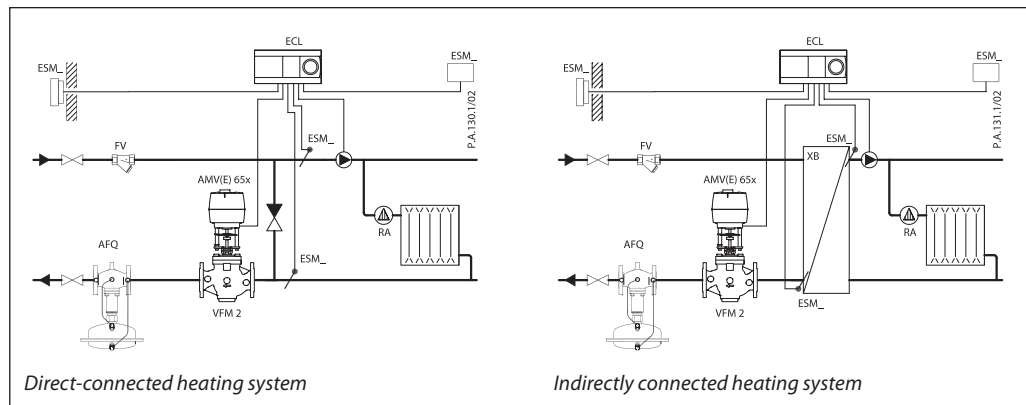
³⁾ at temperatures above 150 °C only with seal pots (see Accessories)

Actuator

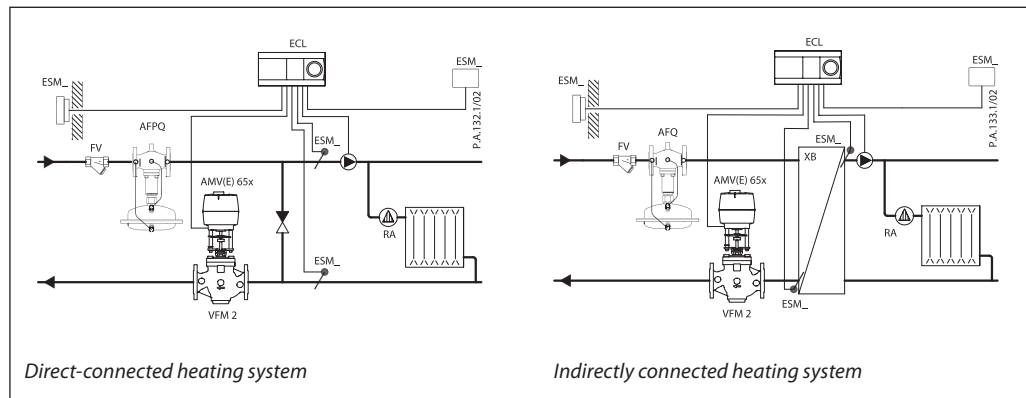
Type	AFQ	
Actuator size	cm ²	250
Max. operational pressure	PN	25
Flow restrictor diff. press. Δp _b	bar	0.2 / 0.5
Materials		
Actuator housing	Stainless steel, mat. No.1.0338, zinc plated	
Control diaphragm	EPDM (Rolling; fibre enforced)	

Application principles

– Return mounting



– Flow mounting



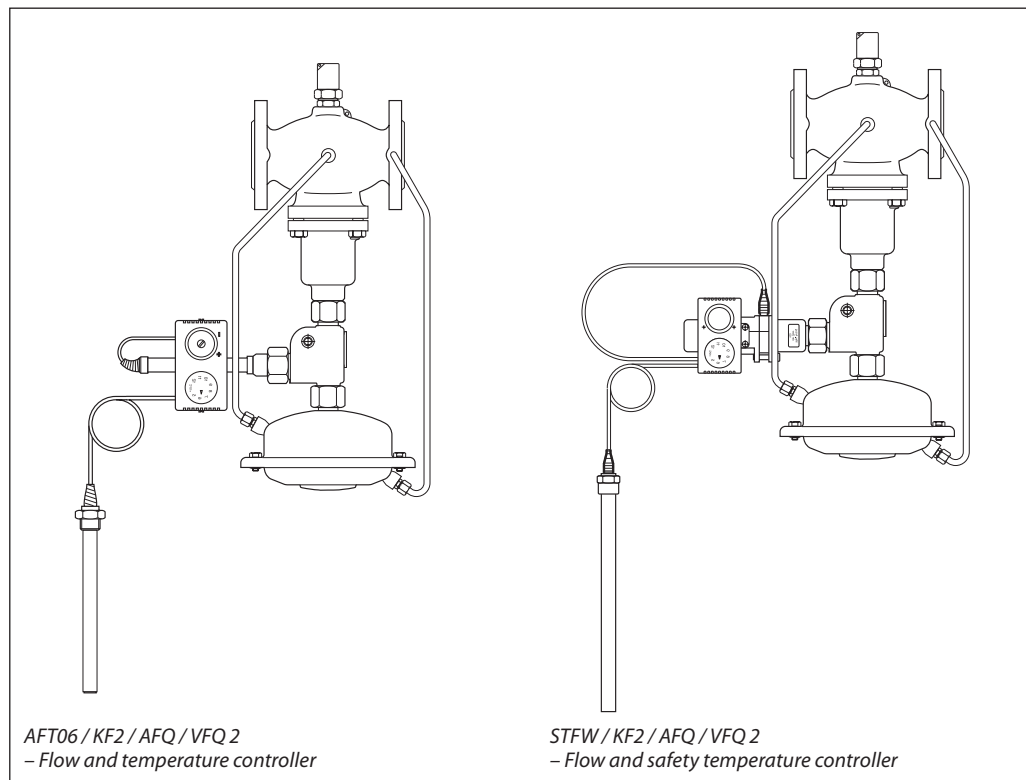
Combinations

Example:
Flow temperature controller, return mounting; DN 15; k_{vs} 4.0; PN 16; metallic sealing; flow restrictor Δp_b 0.2 bar; T_{max} 150 °C; flange;

- 1× VFQ 2 DN 15 valve
Code no: **065B2654**
- 1× AFQ actuator
Code no: **003G1038**
- 2× 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 AFT06 and STFW thermostats data see relevant data sheets



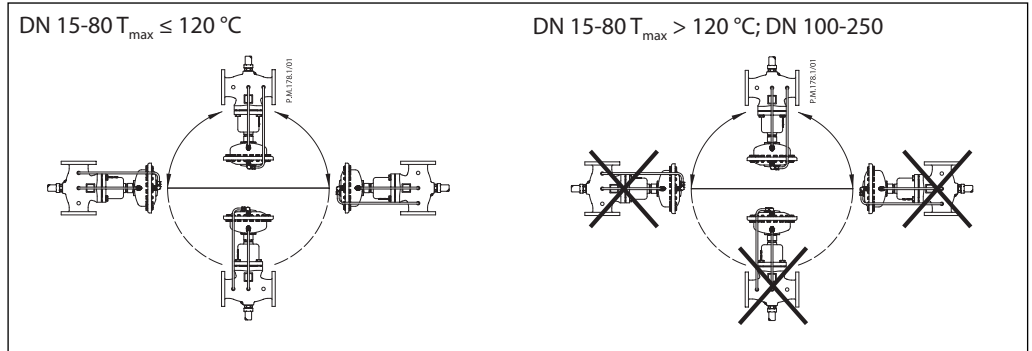
Installation positions

DN 15-80 $T_{max} \leq 120\text{ }^{\circ}\text{C}$

The controllers can be installed in any position.

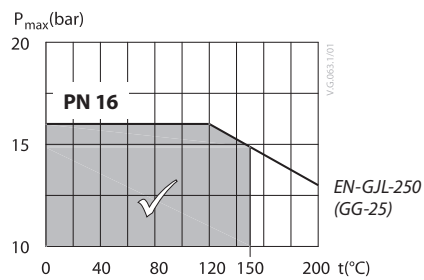
DN 15-80 $T_{max} > 120\text{ }^{\circ}\text{C}$; DN 100-250

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

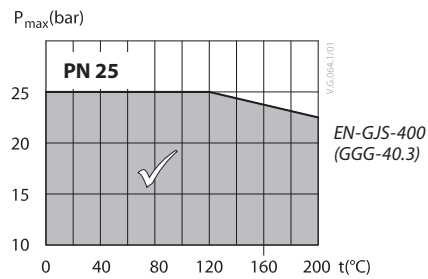


Pressure temperature diagram

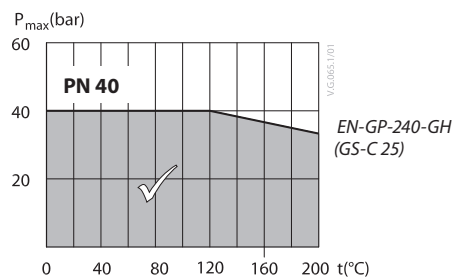
Working area is below P-T line and it ends at T_{max} for each valve



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



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



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

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 600 l/h.

Select controller from table, page 3, with the smallest possible k_{VS} value considering available flow ranges.

$$k_{VS} = 4.0 \text{ m}^3/\text{h}$$

Given data:

- $Q_{max} = 0.6 \text{ m}^3/\text{h}$ (600 l/h)
- $\Delta p_{min} = 0.9 \text{ bar}$ (90 kPa)
- $\Delta p_{circuit}^1 = 0.1 \text{ bar}$ (10 kPa)
- $\Delta p_{MCV} = 0.3 \text{ bar}$ (30 kPa) selected
- $\Delta p_b^2 = 0.2 \text{ bar}$ (20 kPa)

The min. required differential pressure across the selected controller is calculated from the formula:

$$\Delta p_{AFQ,MIN} = \left(\frac{Q_{max}}{k_{VS}} \right)^2 + \Delta p_b = \left(\frac{0.6}{4} \right)^2 + 0.2$$

$$\Delta p_{AFQ,MIN} = 0.22 \text{ bar} \text{ (22 kPa)}$$

$$\Delta p_{AFQ,A} > \Delta p_{AFQ,MIN}$$

$$0.6 \text{ bar} > 0.22 \text{ bar}$$

Solution:

The example selects AFQ DN 15; k_{VS} value 4.0; flow setting range 0.1-2.0 m^3/h .

Remark:

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

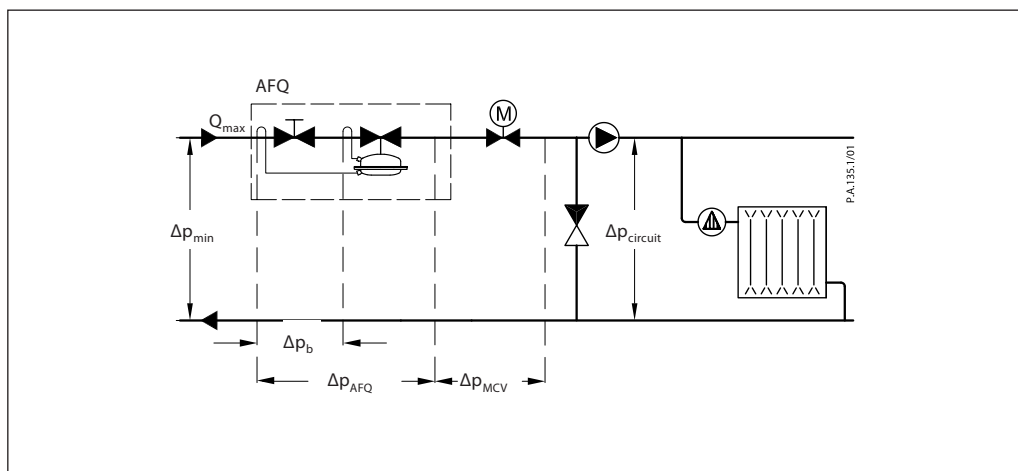
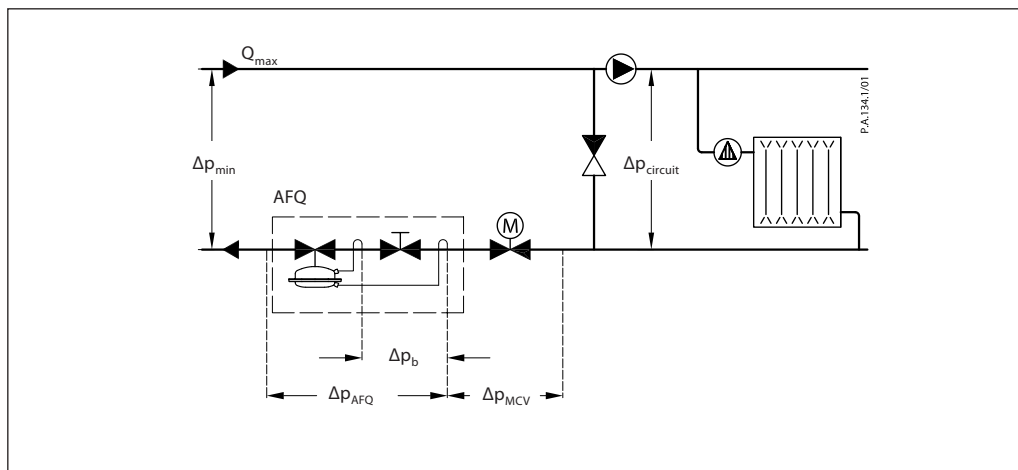
²⁾ Δp_b is differential pressure over flow restrictor.

The total (available) pressure loss across the controller is:

$$\Delta p_{AFQ,A} = \Delta p_{min} - \Delta p_{MCV} = 0.9 - 0.3$$

$$\Delta p_{AFQ,A} = 0.6 \text{ bar} \text{ (60 kPa)}$$

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



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 1900 l/h.

Select controller from table, page 3, with the smallest possible k_{VS} value considering available flow ranges.

$$k_{VS} = 4.0 \text{ m}^3/\text{h}$$

The min. required differential pressure across the selected controller is calculated from the formula:

$$\Delta p_{AFQ,MIN} = \left(\frac{Q_{max}}{k_{VS}} \right)^2 + \Delta p_b = \left(\frac{1.9}{4.0} \right)^2 + 0.2$$

Given data:

- $Q_{max} = 1.9 \text{ m}^3/\text{h}$ (1900 l/h)
- $\Delta p_{min} = 1.1 \text{ bar}$ (110 kPa)
- $\Delta p_{exchanger} = 0.1 \text{ bar}$ (10 kPa)
- $\Delta p_{MCV} = 0.3 \text{ bar}$ (30 kPa) selected
- $\Delta p_b^{1)} = 0.2 \text{ bar}$ (20 kPa)

Remark:

¹⁾ Δp_b is differential pressure over flow restrictor

The total (available) pressure loss across the controller is:

$$\begin{aligned} \Delta p_{AFQ,A} &= \Delta p_{min} - \Delta p_{exchanger} - \Delta p_{MCV} \\ &= 1.1 - 0.1 - 0.3 \\ \Delta p_{AFQ,A} &= 0.7 \text{ bar} \text{ (70 kPa)} \end{aligned}$$

$$\Delta p_{AFQ,MIN} = 0.43 \text{ bar} \text{ (43 kPa)}$$

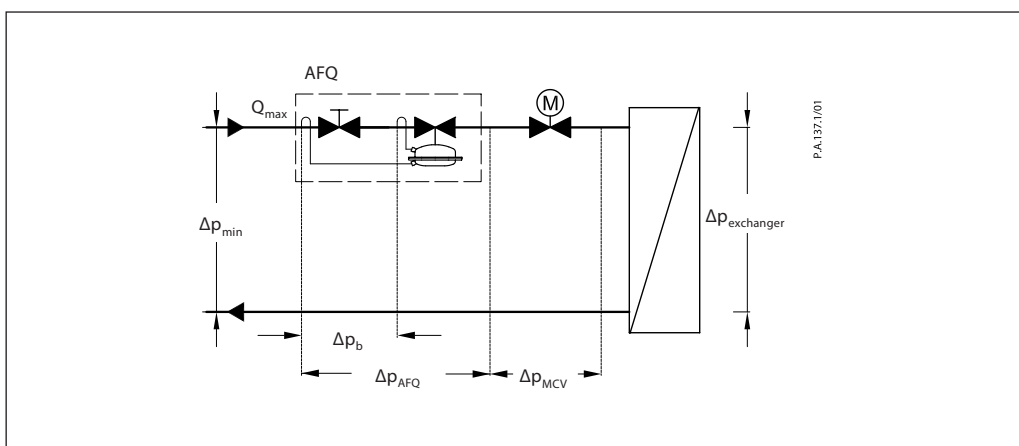
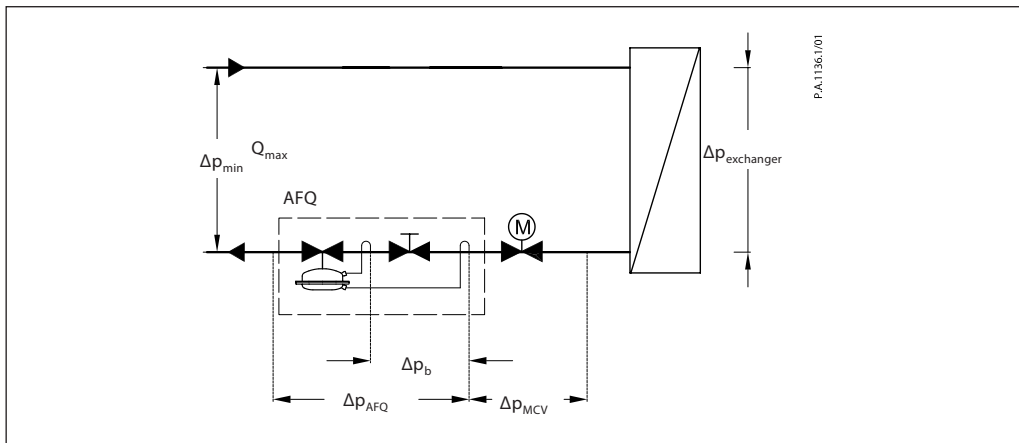
$$\Delta p_{AFQ,A} > \Delta p_{AFQ,MIN}$$

$$0.7 \text{ bar} > 0.43 \text{ bar}$$

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

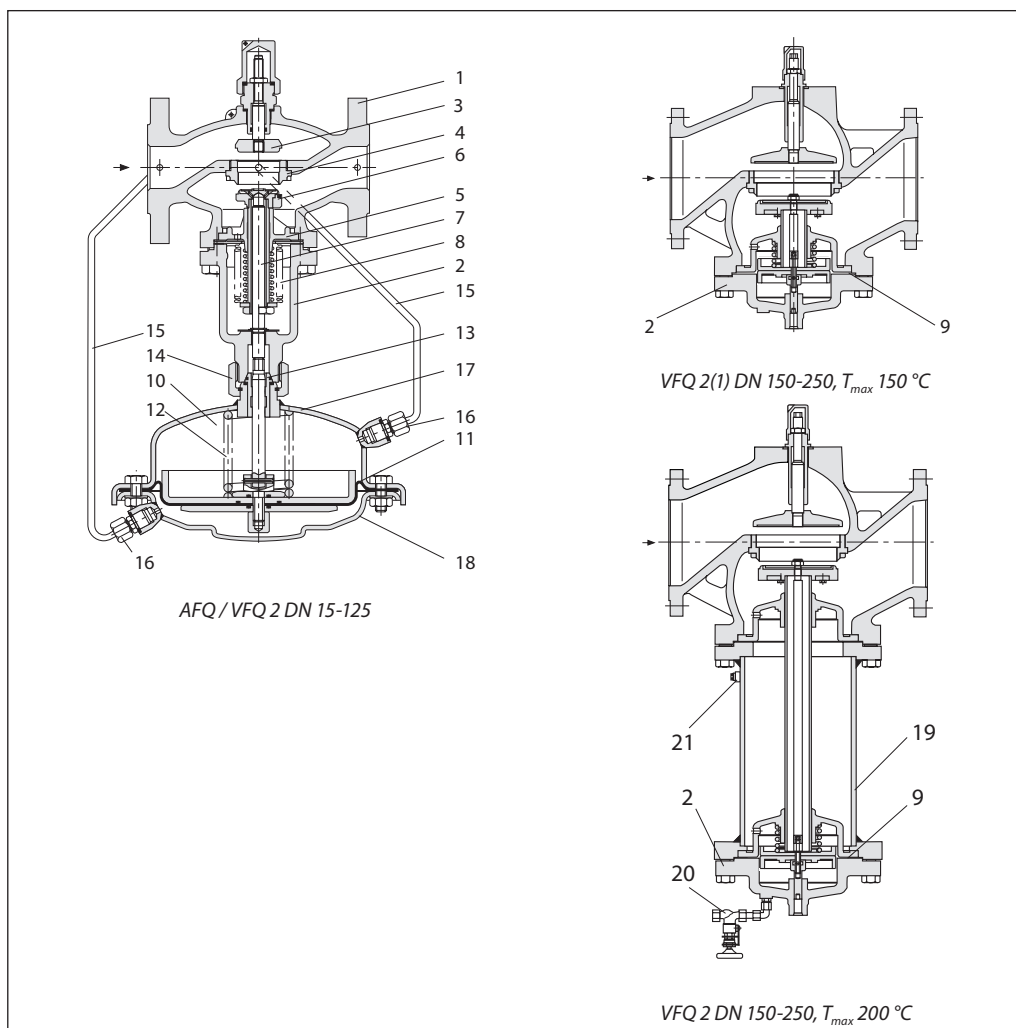
Solution:

The example selects AFQ; DN 15; k_{VS} value 4.0; flow setting range 0.1-2.0 m^3/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. Built-in spring for flow control
13. Stuffing cone
14. Union nut
15. Impulse tube
16. Compression fitting for impulse tube
17. Upper casing of diaphragm
18. Lower casing of diaphragm
19. Valve body extension
20. Shut off valve for water filling
21. Closing plug



Function

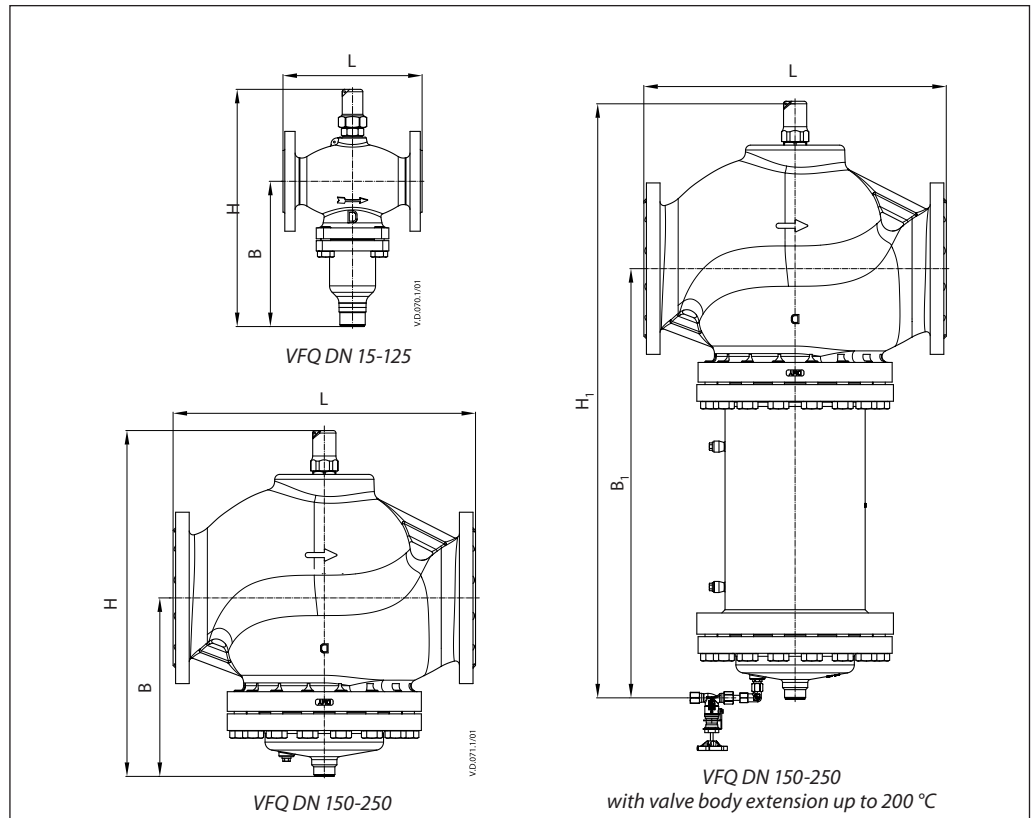
Flow volume causes pressure drop across the adjustable flow restrictor. Resulting pressures are being transferred through the impulse tubes to the actuator chambers and act on control diaphragm for flow control. The flow restrictor diff. pressure is controlled and limited by means of built-in spring for flow rate control. Control valve closes on rising differential pressure and opens on falling differential pressure to control max flow.

Settings

Flow setting

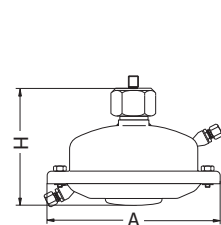
Flow setting is being done by the adjustment of the flow restrictor position. The adjustment can be performed on the basis of flow adjustment diagram (see relevant instructions) and/or by the means of heat meter.

Dimensions



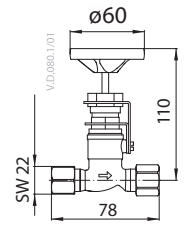
VFQ 2, VFQ 21 Valves

DN		15	20	25	32	40	50	65	80	100	125	150	200	250		
L		130	150	160	180	200	230	290	310	350	400	480	600	730		
B		mm		213	213	239	239	241	241	276	276	381	381	326	354	401
H		mm		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	kg								31	34	63	72	147	264	347
B ₁		mm												620	852	1199
H ₁		mm												889	1184	1555
Weight (valve with body extension)	PN 16 / 25	kg												160	314	489
	PN 40	kg												187	350	526

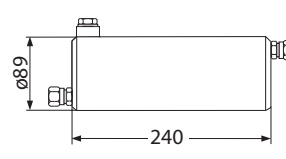


AFQ Actuator

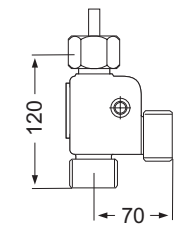
Size	cm ²	250
Ø A	mm	263
H	mm	160
Weight	kg	9



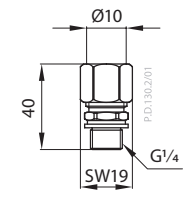
Shut off valve



Seal pot V1



Comb. piece KF2, KF3



Compression fitting



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