Data sheet

Pressure flow controllers

AFPB 2 / AFPB-F 2 / VFQ 2 / VFQ 22(1)

Differential pressure controllers with flow limitation

Description

The controller 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 spring for differential pressure setting.

Further on two valve versions are available:
- VFQ 2 / 22 with metallic sealing cone
- VFQ 221 with soft sealing cone

Together with Danfoss intelligent electrical actuator AMEi 6 intelligent optimization functions are available:
- iNET-intelligent network balancing

Main data:
- DN15-250
- k_{VS} 4.0-800 m^3/h
- Flow limitation range 0.1-500 m^3/h
- PN 16, 25, 40
- Setting range: 0.1-1 bar / 0.4 (0.5)-1.5 bar
- Temperature:
  - Circulation water / glycolic water up to 30 %: 2 … 150°C (200 °C)
- Connections: Flange

Features & benefits

- Automated System Stability
  - Provides self-acting differential pressure control with an adjustable flow limiter, which automatically closes on rising pressure or when the set maximum flow is exceeded to ensure stable and efficient system operation.
- Intelligent Optimization & Energy Savings
  - Unlocks advanced optimization functions for remote balancing (iNET) when paired with the Danfoss AMEi 6 intelligent electrical actuator, leading to significant energy savings and enhanced performance.
- Application Flexibility
  - Offers two distinct valve versions—VFQ 2 / 22 with a metallic sealing cone and VFQ 221 with a soft sealing cone—to suit various application needs within district heating systems.

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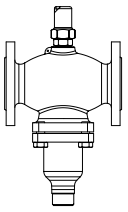
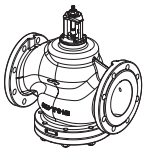
Ordering

Product code numbers

VFQ 2 / VFQ 22 Valve (soft sealing cone)

Picture	DN (mm)	k_{VS} (m^3/h)	Connections	$T_{max.}$ (°C)	Code No.		
					PN 16	PN 25	PN 40
	15[2]	4.0	Flanges acc. to EN 1092-1	150 (PN16) 200[1] (PN25, 40)	065B2654	065B2667	065B2677
	20[2]	6.3			065B2655	065B2668	065B2678
	25[2]	8.0			065B2656	065B2669	065B2679
	32[2]	16			065B2657	065B2670	065B2680
	40[2]	20			065B2658	065B2671	065B2681
	50[2]	32			065B2659	065B2672	065B2682
	65	60		150	065B5570	065B5577	065B5584
	80	80			065B5571	065B5578	065B5585
	100	160			065B5572	065B5579	065B5586
	125	250			065B5573	065B5580	065B5587
	150	380			065B5574	065B5581	065B5588
	200	650			065B5575	065B5582	065B5589
	250	800			065B5576	065B5583	065B5590

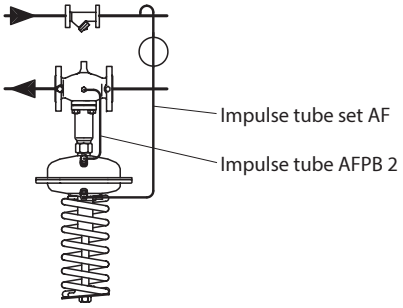
[1] At temperatures above 150°C only with seal pots (see Accessories)

[2] VFQ 2 valves require ordering of 003G1780 adapter for a combination with AFPB(-F) 2 pressure actuators

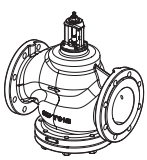
Example 1:
Differential pressure controller with flow limitation; return mounting; DN 65; k_{VS} 60; PN 16; metallic sealing; setting range 0.5 - 1.5 bar; T_{max} 150 °C; flange;

– 1× VFQ 22 DN 65 valve
Code no: **065B5570**
– 1× AFPB 2 actuator
Code no: **003G5608**
– 1× AFPB DN 65 impulse tubes
Code no: **003G1842**
– 1× Impulse tube set AF
Code no: **003G1391**

Products will be delivered separately.



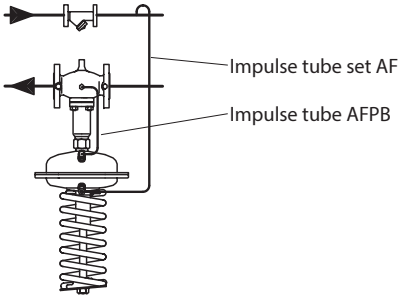
VFQ 221 Valve (soft sealing cone)

Picture	DN (mm)	k_{VS} (m^3/h)	Connections	$T_{max.}$ (°C)	Code No.		
					PN 16	PN 25	PN 40
	65	60	Flanges acc. to EN 1092-1	150	065B5600	065B5607	065B5614
	80	80			065B5601	065B5608	065B5615
	100	160			065B5602	065B5609	065B5616
	125	250			065B5603	065B5610	065B5617
	150	380			065B5604	065B5611	065B5618
	200	650			065B5605	065B5612	065B5619
	250	800			065B5606	065B5613	065B5620

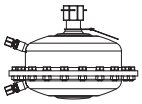
Example 2:
Differential pressure controller with flow limitation; return mounting; DN 15; k_{VS} 4.0; PN 16; metallic sealing; setting range 0.1 - 1 bar; t_{max} 150 °C; flange;

– 1× VFQ 2 DN 15 valve
Code no: **065B2654**
– 1× AFPB 2 actuator
Code no: **003G5612**
– 1× AFPB DN 15 impulse tube
Code no: **003G1820**
– 1× Impulse tube set AF
Code no: **003G1391**
– 1× Adapter VFQ 2 - AFx 2
Code no: **003G1780**

Products will be delivered separately.



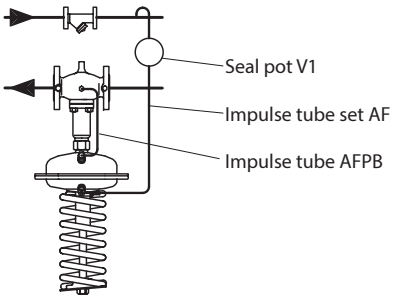
AFPB 2 / AFPB-F 2 Actuators

Picture	Δp setting range (bar)	for DN	Actuator size (cm²)	Spring colour	Code No.	
					PN16	PN40
	0.5 - 1.5	DN15-125	160	yellow	**003G5608**	**003G5618**
	0.4 - 1.5	DN150-250	320	red	**003G5609**	**003G5619**
	0.1 - 1	DN15-125	160	blue	**003G5612**	**003G5622**
	0.1 - 1	DN150-250	320	orange	**003G5610**	**003G5620**
	0.2	DN15-125	160	-	**003G5600**	**003G5602**
	0.5			-	**003G5601**	**003G5603**
	0.2	DN150-250	320	-	**003G5596**	**003G5598**
	0.5			-	**003G5597**	**003G5599**

Example 3:
Differential pressure controller with flow limitation; return mounting; DN 15; k_{VS} 4.0; PN 25; metallic sealing; setting range 0.1 - 1 bar; t_{max} 200 °C; flange;

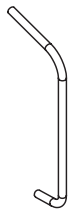
– 1× VFQ 2 DN 15 valve
Code no: **065B2667**
– 1× AFPB 2 actuator
Code no: **003G5622**
– 1× AFPB DN 15 impulse tube
Code no: **003G1820**
– 1× Impulse tube set AF
Code no: **003G1391**
– 1× Seal pot V1
Code no: **003G1392**
– 1× Adapter VFQ 2 - AFx 2
Code no: **003G1780**

Products will be delivered separately.

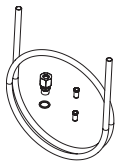
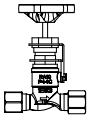
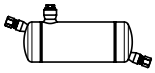
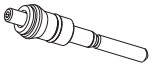
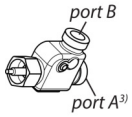
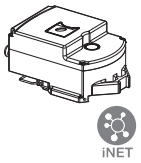


Accessories code numbers

Accessories - Impulse tubes

Picture	Type	For controller	Actuator size (cm²)	Valve (DN)	Code No.
	Impulse tubes (stainless steel)	AFPB(-F) 2	160	15	**003G1820**
				20	
				25	**003G1821**
				32	
				40	**003G1822**
				50	**003G1823**
				65	**003G1842**
				80	**003G1856**
				100	**003G1857**
				125	**003G1858**
			320	150	**003G1859**
				200	**003G1860**
				250	**003G1861**

Accessories

Picture	Type designation	Description	Connections	Code No.
	Impulse tube set AF	– 1× Copper tube Ø10 × 1 × 1500 mm – 1× compression fitting for imp. tube connection to pipe (G ¼) – 2× socket	–	**003G1391**
	Compression fitting [2]	For impulse tube Ø10 connections to controller	G ¼	**003G1468**
	Shut off valve	For impulse tube Ø10	–	**003G1401**
	Static throttle valve			**065B2909**
	Seal pot V1 [1]	Capacity 1 liter; with compression fittings for imp. tube Ø10	–	**003G1392**
	Adapter VFQ 2 - AFPB(-F) 2	For combination of new Virtus pressure actuators AFx 2, with old generation of valves VFx 2	–	**003G1780**
	Combination piece KF3	For combination with pressure actuators. Electrical actuator connected on side (port B) only for ON/OFF function	G 1 ¼ 2 × G 1 ¼	**003G1441**
	Combination piece KF2	For combination with thermostat - side connection to port B		**003G1440**
	AMEi 6 **iNET** el. actuator 230 V	Intelligent Δp actuator with **iNET** function [4]	–	**082G4302**
	AMEi 6 **iNET** el. actuator 24 V			**082G4303**

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

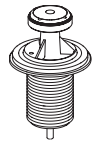
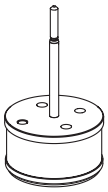
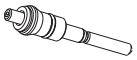
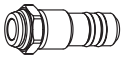
[2] Consist of a nipple, compression ring and nut

[3] Port A - for connection of any type of actuator

[4] Only available for AFPB 2 with external spring

Spare parts code numbers

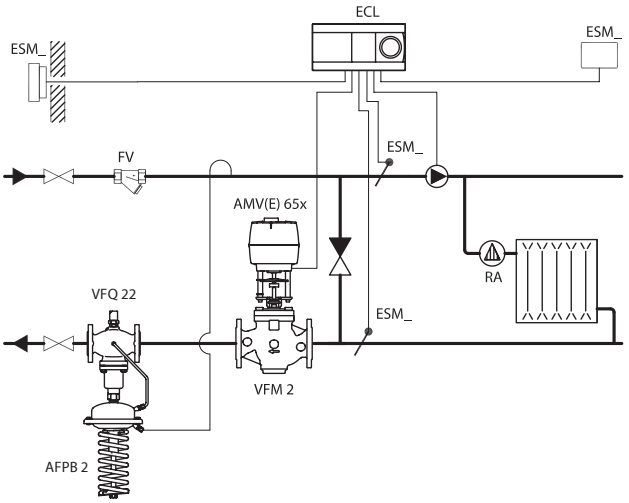
Service kits

Picture	Type designation	DN (mm)	k_{vs} (m^3/h)	Code No.
	Valve insert for VFQ 2	15	4.0	**065B2796**
		20	6.3	**065B2797**
		25	8.0	**065B2798**
		32	16	
		40	20	**065B2799**
		50	32	
	Pressure control insert VFG/Q 22	65	60	**003G1800**
		80	80	**003G1801**
		100	160	**003G1802**
		125	250	**003G1803**
		150	380	**On demand**
		200	650	**On demand**
		250	800	**On demand**
	Pressure control insert VFG/Q 221	65	60	**003G1807**
		80	80	**003G1808**
		100	160	**003G1809**
		125	250	**003G1810**
		150	380	**On demand**
		200	650	**On demand**
		250	800	**On demand**
	Adapter (sealing cone) VFQ 2 - AFPB(-F) 2	15-250	-	**003G1780**
	Pressure stuffing box VFG/Q 22(1)	65-125	-	**003G1730**
		150-200		**003G1731**
		250		**003G1732**

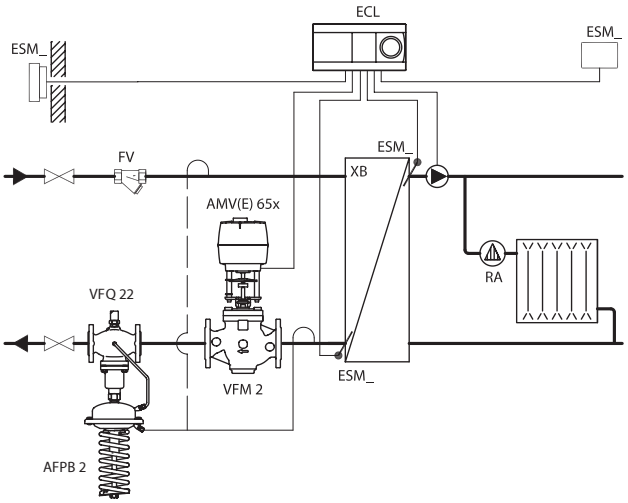
Overview

Application examples

Return mounting



Direct-connected heating system



Indirectly connected heating system

Product details

General data

VFQ 2 / VFQ 22(1) Valve

Nominal diameter					**DN**	**15**	**20**	**25**	**32**	**40**	**50**	**65**	**80**	**100**	**125**	**150**	**200**	**250**
k_{VS} value of Δp controller						4.0	6.3	8.0	16	20	32	60	80	160	250	380	650	800
Range of max. flow setting 1)	Δp_{SP}	Δp_{SYSTEM}	Δp_b	from	m^3/h	0.05	0.15	0.25	0.4	0.6	0.9	3	4	7	9	13	15	22
	0.2	0.1	0.1	to		1.4	2.1	2.5	5	6.5	10	19	25	51	79	120	206	253
	0.5	0.3	0.2	to		2	3	4	7	11	16	28	40	63	100	160	270	360
	1.0	0.5	0.5	to		3	4.5	6	10	16	24	42	60	95	150	240	340	500
Cavitation factor z						0.6	0.6	0.6	0.55	0.55	0.5	0.65	0.55	0.4	0.4	0.4	0.35	0.3
Leakage acc. to standard IEC 534 (% of k_{VS})	VFQ 2 / VFQ 22					≤ 0.03										≤ 0.05		
	VFQ 221					≤ 0.01												
Nominal pressure					PN	16, 25, 40												
Min. differential pressure					bar	see remark 2)												
Max. differential pressure PN 16						16						16		15	15	12	10	10
Max. differential pressure PN 25/40						20						20						
Pressure relieve system						Bellows (Stainless steel 1.4571)						Chamber relieved						
Media						Circulation water / glycolic water up to 30 %												
Media pH						Min. 7, Max. 10												
Media temperature		VFQ 2			°C	2 ... 150 / 2 ... 200 3)						2 ... 150						
		VFQ 22(1)				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												
Valve cone						Stainless steel, mat. No. 14404						Stainless steel, mat. No. 14021						
Sealing	VFQ 2					Metal												
	VFQ 22																	
	VFQ 21					EPDM												
	VFQ 221																	

[1] Max. flow rate depends on the differential pressure over the system (dp System). System is part of the application where differential pressure is controlled by AFPB(-F) and for this part the resistance is well known/defined. Flow rates in table are specified for 3 different situations.

$\Delta p_{SP} = \Delta p_{SYSTEM} + \Delta p_b$

Δp_{SP} - differential pressure set point

Δp_{SYSTEM} - system differential pressure

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 $Q_{set} < Q_{max} \rightarrow \Delta p_{min} = (\frac{Q}{kVS})^2 + \Delta p_b$

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

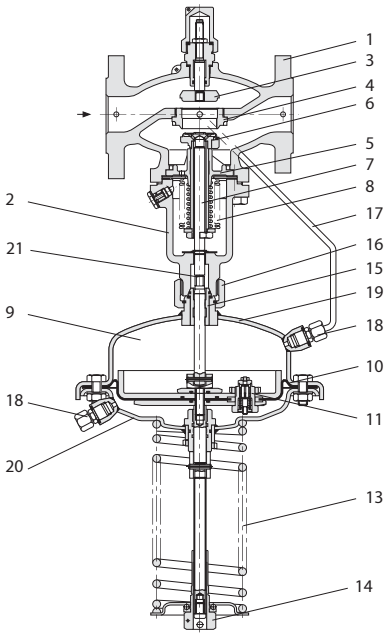
AFPB(-F) 2 Actuator

Type		**AFPB 2**				**AFPB(-F) 2**	
Actuator size	**cm^2**	**160**		**320**		**160**	**320**
Max. operating pressure	bar	16, 40					
Diff. pressure setting ranges and spring colour		0.1 - 1	0.5 - 1.5	0.1 - 1	0.4 - 1.5	0.2 / 0.5	
		blue	yellow	orange	red	-	-
For valve DN		15-125		150-250		15-125	150-250
Materials							
Actuator housing		Steel, mat. No. 1.0345, zinc plated					
Control diaphragm		EPDM (Rolling; fibre enforced)					

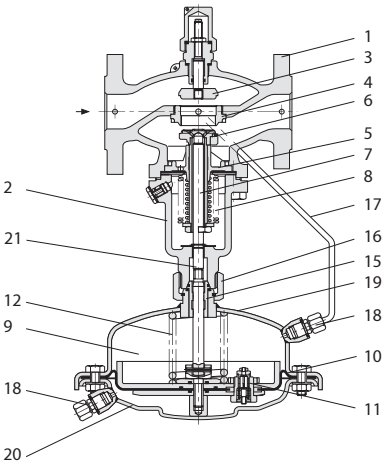
Design

DN 15-50

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. Actuator
10. Control diaphragm for differential pressure and flow control
11. Excess pressure safety valve
12. Built in spring for differential pressure and flow control
13. Setting spring for diff. pressure control
14. Adjuster for diff. pressure setting, prepared for sealing
15. Stuffing cone
16. Union nut
17. Impulse tube
18. Compression fitting for impulse tube
19. Upper casing of diaphragm
20. Lower casing of diaphragm
21. Adapter VFQ 2 - AFPB(-F) 2



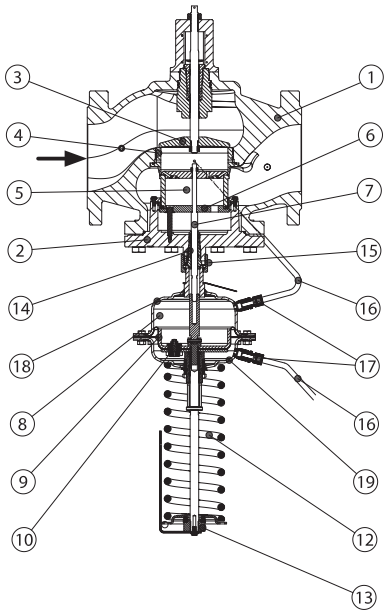
AFPB 2 / VFQ 2, DN15-50



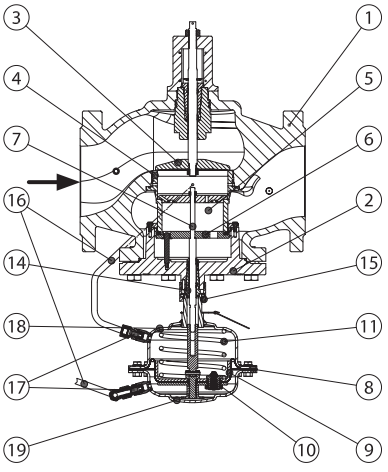
AFPB(-F) 2 / VFQ 2, DN15-50

DN 65-250

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



AFPB 2 VFQ 22(1), DN 65-250



AFPB-F 2 VFQ 22(1), DN 65-250

Function

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 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

Differential pressure setting

Differential pressure setting is being done by the adjustment of the setting spring for diff. pressure control. This is done by rotating the differential pressure setting nut. Set differential pressure should be checked by observing the pressure indicators.

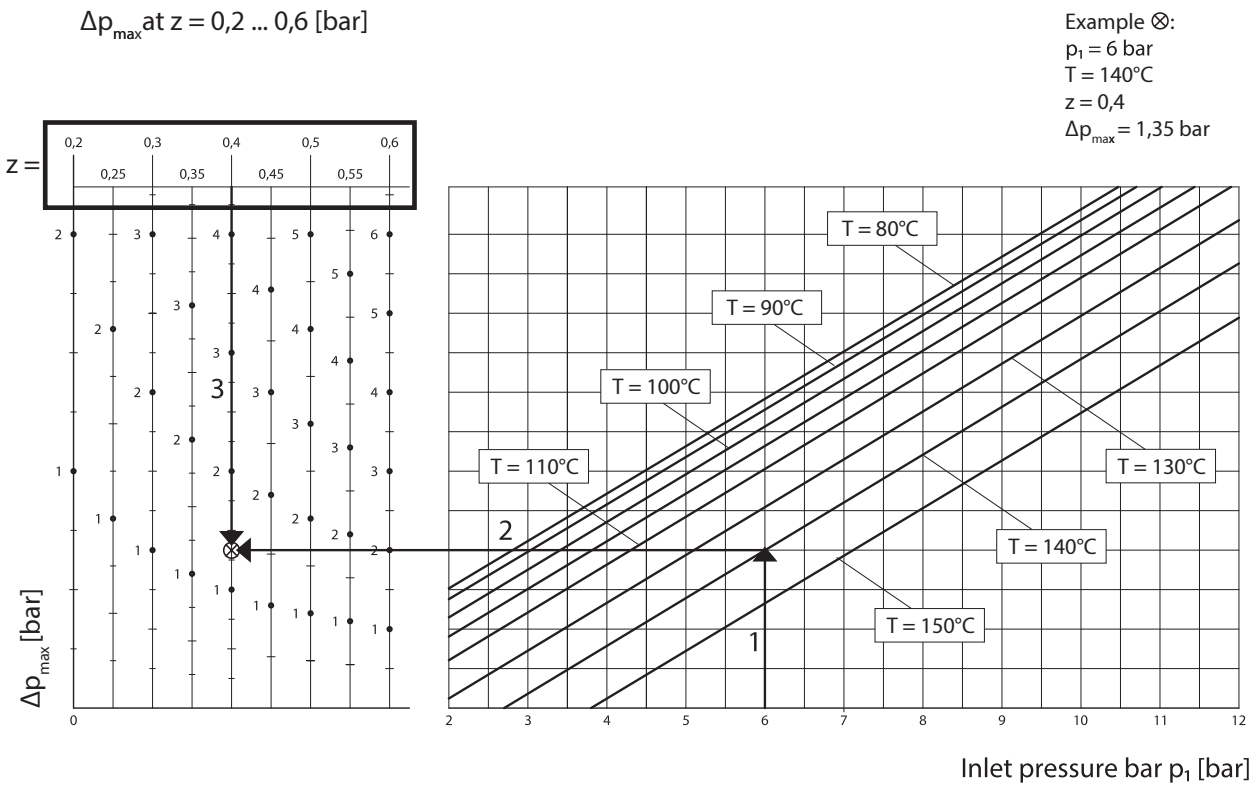
Flow setting

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.

Pressure and temperature data

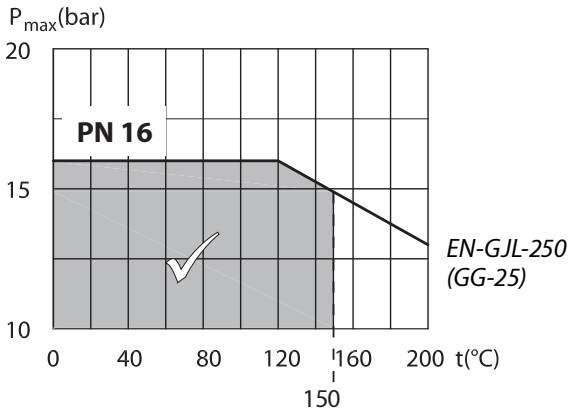
Operating area

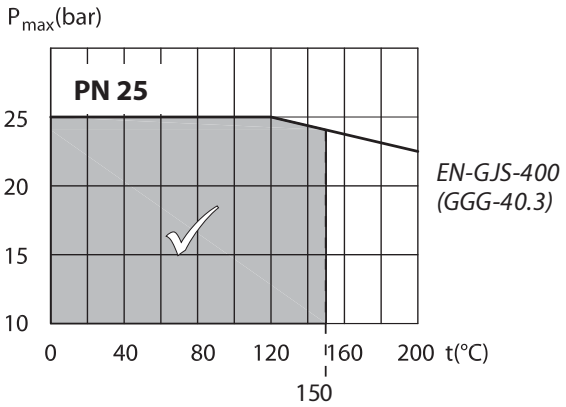
Maximum allowed differential pressure over the controller (Δp_{max}) at different cavitation factors (z)



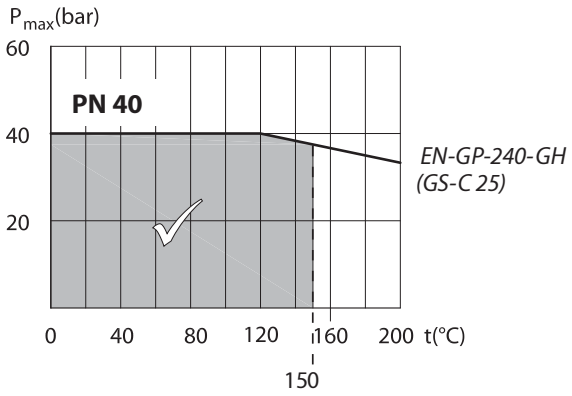
Pressure temperature diagram

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 1092-1)

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 25.000 l/h.

Given data:

Q_{max} = 25 m³/h (25.000 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 AFPB.

[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:
$\Delta p_{AFPB} = \Delta p_{min} - \Delta p_{MCV} = 0.7 - 0.3$
Δp_{AFPB} = 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:

$$k_v = \frac{Q_{max}}{\sqrt{\Delta p_{AFPB} - \Delta p_b}} = \frac{25}{\sqrt{0.4 - 0.1}}$$

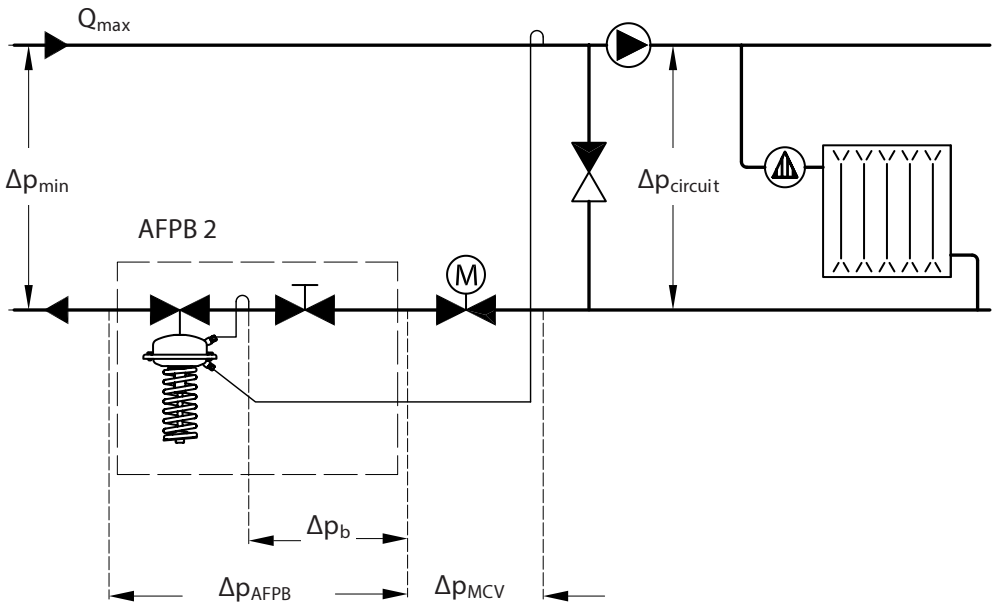
k_v = 45.6 m³/h

Solution:

The example selects AFPB 2/VFQ 22 DN 80; k_{VS} value 80 m³/h; with differential pressure setting range 0.1-1 bar; maximum flow 25 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 (Δp_{bNEW} = 0.2 bar) is calculated according to formula:

$$Q_{setting} = \frac{\sqrt{\Delta p_b}}{\sqrt{\Delta p_{bNEW}}} \times Q_{max}$$



Indirectly connected heating system

Example 2
Motorised control valve (MCV) for indirectly connected heating system requires differential pressure of 0.5 (50 kPa) bar and flow less than 24.000 l/h.

Given data:

Q_{max} = 24 m³/h (24.000 l/h)
Δp_{min} = 1 bar (100 kPa)
$\Delta p_{exchanger}$ = 0.1 bar (10 kPa)
Δp_{MCV} = 0.5 bar (50 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:
$\Delta p_{set\ value} = \Delta p_b + \Delta p_{exchanger} + \Delta p_{MCV} = 0.2 + 0.1 + 0.5$
$\Delta p_{set\ value}$ = 0.8 bar (80 kpa)

The total pressure loss across the controller is:
$\Delta p_{AFPB} = \Delta p_{min} - \Delta p_{exchanger} - \Delta p_{MCV} = 1 - 0.1 - 0.5$
Δp_{AFPB} = 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:

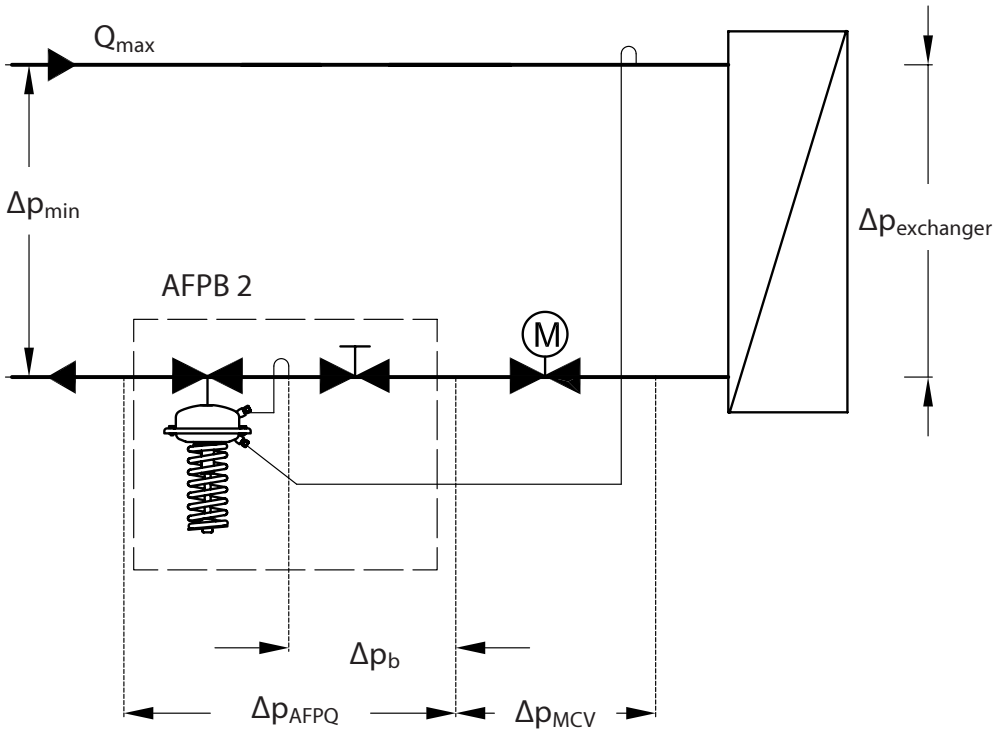
$$k_v = \frac{Q_{max}}{\sqrt{\Delta p_{AFPB} - \Delta p_b}} = \frac{24}{\sqrt{0.4-0.2}}$$

k_v = 53.7 m³/h

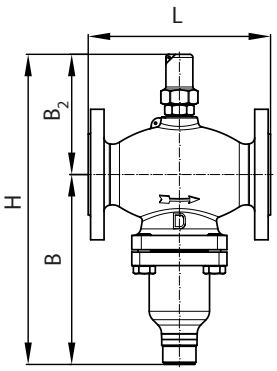
Solution:

The example selects AFPB 2/VFQ 22 DN 65; k_{VS} value 60 m³/h; with differential pressure setting range 0.1-1 bar; maximum flow 28 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:

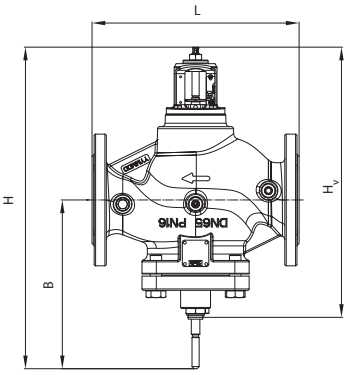
$$Q_{setting} = \frac{\sqrt{\Delta p_b}}{\sqrt{\Delta p_{bNEW}}} \times Q_{max}$$



Dimensions



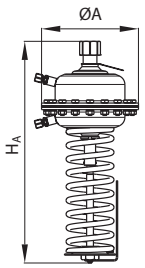
VFQ 2 DN15-50



VFQ 22(1) DN65-250

VFQ 2, VFQ 22, VFQ 221 Valves

DN	L	B	B_2	H	H_v	Weight		
						PN16	PN25	PN40
15	130	213	124	337	-	8	8	8
20	150	213	124	337	-	9	9	9
25	160	239	135	374	-	10.5	10.5	10.5
32	180	239	135	374	-	12.5	12.5	12.5
40	200	241	152	393	-	15.5	15.5	15.5
50	230	241	152	393	-	18.5	18.5	18.5
65	290	237	-	473	396	28	29	31
80	310	237	-	473	396	33	34	36
100	350	272	-	547	472	52	53	57
125	400	268	-	582	514	71	72	79
150	480	326	-	670	610	123	126	135
200	600	361	-	773	713	230	236	286
250	730	419	-	843	783	382	392	441

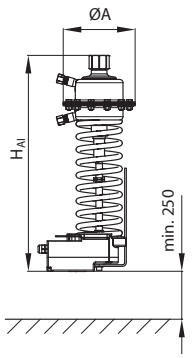


AFPB 2 Actuator

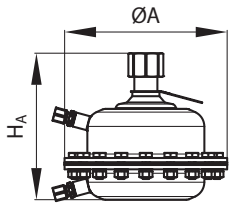
AFPB 2 Actuator

Size	ØA	H_A	H_{AI}	Weight (kg)			
cm²	mm			AFPB 2 PN 16	AFPB 2 PN 16 + AMEi 6	AFPB 2 PN 40	AFPB 2 PN 40 + AMEi 6
160	230	490	590	12.5	15	25	27.5
320	300	490	590	17	19.5	37	39.5

Total installation height of the controller (VFG 22(1) valve + AFPB 2 pressure actuator) is sum of H_V and H_A (H_{AI})



AMEi 6 intelligent actuator with iNET functionality should be ordered separately

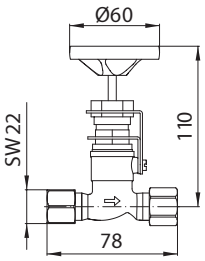


AFPB-F 2 Actuator

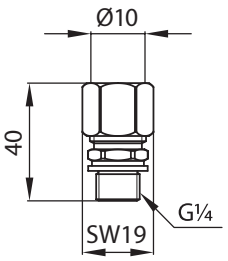
AFPB-F 2 Actuator

Size	ØA	H_A	Weight	
			PN 16	PN 40
cm²	mm		kg	
160	230	200	8	10
320	300	200	13	19

Total installation height of the controller (VFQ 22(1) valve + AFPB-F 2 pressure actuator) is sum of H_V and H_A



Shut off valve

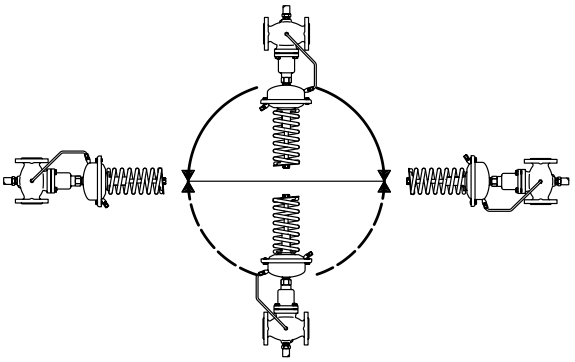


Compression fitting

Installation

DN 15-50

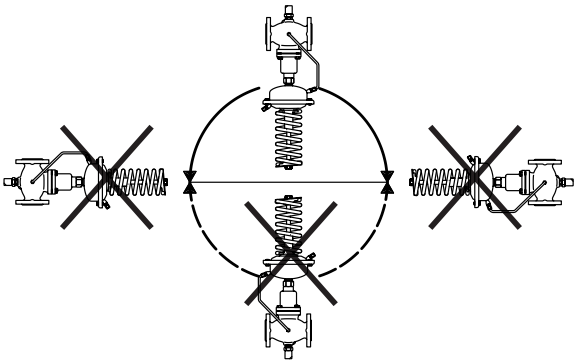
$T_{max} \leq 120°C$



The controllers can be installed in any position.

DN 15-50

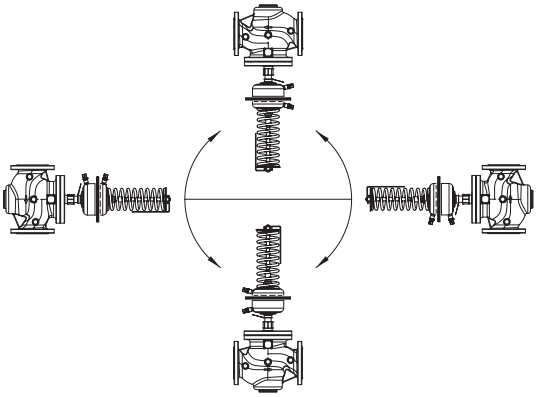
$T_{max} > 120°C$



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

DN 65-250

$T_{max} \leq 150°C$



The controllers can be installed in any position.

Certificates, declarations and approvals

The list contains all certificates, declarations, and approvals for this product type. Individual code number may have some or all of these approvals, and certain local approvals may not appear on the list.

When you click on the link you will be directed to the latest version of the 'Declaration of Conformity'. Products developed and sold before this date of issue conform to the directives/standards in force at the time of their sale.

Approval type	Title	Certification body	Approval topic
EAC Declaration	EAC KZ 7100841.13.12.02339	EAC - Eurasian Customs Union	MD
EU Declaration	Danfoss EU 230612EN0854103.05	Danfoss	PED, Pressure
Export Control Declaration	Actuators pressure flow and temperature	Danfoss	
EU Declaration	Danfoss EU 230530EN0858104.06	Danfoss	PED, Pressure
UA Declaration	Danfoss UA 10.01.23 Heat Control Valves	Danfoss	
Export Control Declaration	Pressure flow controllers	Danfoss	
Pressure Safety Certificate	CE-0062-PED-H-DAF 002-24-DNK-rev-A	BV - Bureau Veritas	PED, Pressure

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