Data sheet

Pressure flow controllers

AFP 2 / VFG 2(1) / VFG 22(1)

Differential pressure controllers

Description

The controller is a self-acting differential pressure controller primarily for use in district heating systems. Direct operated, reliable and high precise controller closes on rising differential pressure.

The controller has a control valve, an actuator with one control diaphragm and spring for differential pressure setting.

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

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

Main data:
- DN 15-250
- k_{VS} 4.0-800 m^3/h
- PN 16, 25, 40
- Setting range:
  0.1-0.35 bar / 0.1-1 bar / 0.5-1.5 bar / 1-2.5 bar / 1.5-4 bar / 1-3 bar / 1.5-5 bar
- Temperature:
  - Circulation water / glycolic water up to 30 %: 2 … 150 °C (200 °C)
- Connections:
  - Flange

Features & benefits

- Self-acting operation for reliable differential pressure control without auxiliary energy.
- Intelligent network balancing and substation optimization with the AMEi 6 actuator.
- Wide selection of setting ranges for precise control and application flexibility.

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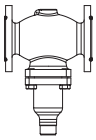
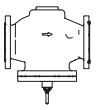
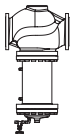
Ordering

Product code numbers

VFG 2 / VFG 22 Valve (metal sealing cone)

Picture	DN (mm)	k_{VS} (m^3/h)	Connections	$T_{max.}$ (°C)	Code No.		
					PN16	PN25	PN40
	15 [2]	4.0	Flanges acc. to EN 1092-1	150 °C (PN16) 200 °C [1] (PN25,40)	**065B2388**	**065B2401**	**065B2411**
	20 [2]	6.3			**065B2389**	**065B2402**	**065B2412**
	25 [2]	8.0			**065B2390**	**065B2403**	**065B2413**
	32 [2]	16			**065B2391**	**065B2404**	**065B2414**
	40 [2]	20			**065B2392**	**065B2405**	**065B2415**
	50 [2]	32			**065B2393**	**065B2406**	**065B2416**
	65	60		150 °C	**065B5500**	**065B5507**	**065B5514**
	80	80			**065B5501**	**065B5508**	**065B5515**
	100	160			**065B5502**	**065B5509**	**065B5516**
	125	250			**065B5503**	**065B5510**	**065B5517**
	150	380			**065B5504**	**065B5511**	**065B5518**
	200	650			**065B5505**	**065B5512**	**065B5519**
	250	800			**065B5506**	**065B5513**	**065B5520**
	150	280		200 °C [1]	**065B2424**	-	**On request**
	200	320			**065B2425**	-	**On request**
	250	400			**065B2426**	-	**On request**

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

[2] VFG 2 valves require ordering of 003G1780 adapter for a combination with AFP 2 pressure actuators

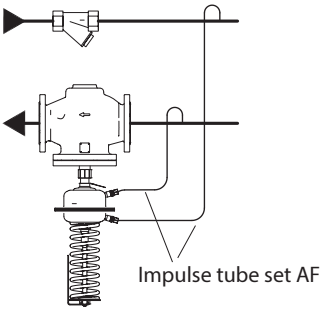
Example 1:
Differential pressure controller, return mounting, DN 65, k_{VS} 60, PN 16, metallic sealing, setting range 1.5-4 bar, T_{max} 150 °C, flange

– 1× VFG 22 DN 65 valve
Code no: **065B5500**

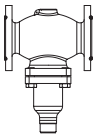
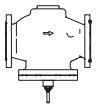
– 1× AFP 2 actuator
Code no: **003G5606**

– 2× Impulse tube set AF
Code no: **003G1391**

Products will be delivered separately.



VFG 21 / VFG 221 Valve (soft sealing cone)

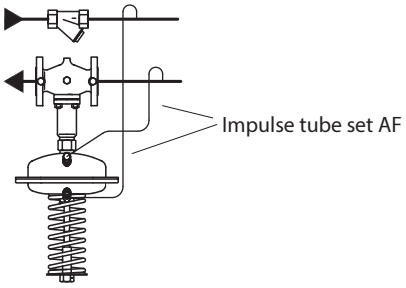
Picture	DN (mm)	k_{vs} (m^3/h)	Connections	$T_{max.}$ (°C)	Code No.		
					PN16	PN25	PN40
	15 [1]	4.0	Flanges acc. to EN 1092-1	150 °C	**065B2502**	-	-
	20 [1]	6.3			**065B2503**	-	-
	25 [1]	8.0			**065B2504**	-	-
	32 [1]	16			**065B2505**	-	-
	40 [1]	20			**065B2506**	-	-
	50 [1]	32			**065B2507**	-	-
	65	60			**065B5521**	**065B5528**	**065B5535**
	80	80			**065B5522**	**065B5529**	**065B5536**
	100	160			**065B5523**	**065B5530**	**065B5537**
	125	250			**065B5524**	**065B5531**	**065B5538**
	150	380			**065B5525**	**065B5532**	**065B5539**
	200	650			**065B5526**	**065B5533**	**065B5540**
	250	800			**065B5527**	**065B5534**	**065B5541**

[1] VFG 21 valves require ordering of 003G1780 adapter for a combination with AFP 2 pressure actuators

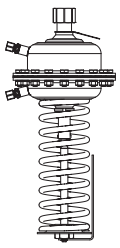
Example 2:
Differential pressure controller; return mounting; DN 15; k_{VS} 4.0; PN 16; metallic sealing; setting range 0.5 - 1.5 bar; T_{max} 150 °C; flange;

– 1× VFG 2 DN 15 valve
Code no: **065B2388**
– 1× AFP actuator
Code no: **003G5608**
– 2× Impulse tube set AF
Code no: **003G1391**
– 1× Adapter VFG 2 - AFx 2
Code no: **003G1780**

Products will be delivered separately.



AFP 2 Actuator

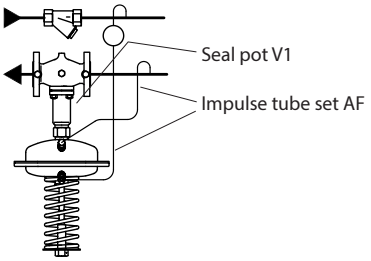
Picture	Setting range (bar)	Possible combinations with DN	Actuator size (cm^2)	Spring colour	Code No.	
					PN16	PN40
	1.5-5	15-125	80	red	**003G5604**	**003G5614**
	1-3	15-125	80	yellow	**003G5605**	**003G5615**
	1.5-4	15-250	160	black [1]	**003G5606**	**003G5616**
	1-2.5	15-250	160	red	**003G5607**	**003G5617**
	0.5-1.5	15-125	160	yellow	**003G5608**	**003G5618**
	0.4-1.5	15-250	320	red	**003G5609**	**003G5619**
	0.1-1	15-125	160	blue	**003G5612**	**003G5622**
	0.1-1	15-250	320	orange	**003G5610**	**003G5620**
	0.1-0.35	15-250	640	yellow	**003G5611**	**003G5621**

[1] Combination with AMEi6 not possible

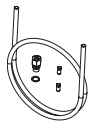
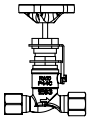
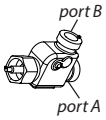
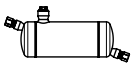
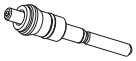
Example 3:
Differential pressure controller; return mounting; DN 15; k_{VS} 4.0; PN 25; metallic sealing; setting range 0.5 - 1.5 bar; T_{max} 200 °C; flange;

– 1× VFG 2 DN 15 valve
Code no: **065B2401**
– 1× AFP actuator
Code no: **003G5618**
– 2× Impulse tube set AF
Code no: **003G1391**
– 1× Seal pot V1
Code no: **003G1392**
– 1× Adapter VFG 2 - AFx 2
Code no: **003G1780**

Products will be delivered separately.

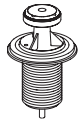
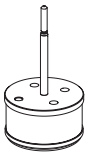
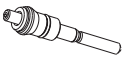
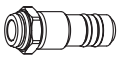


Accessories code numbers

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	For impulse tube Ø10 connections to controller	G ¼	**003G1468**
	Shut off valve	For impulse tube Ø10	-	**003G1401**
	Static throttle valve			**065B2909**
	Combination piece KF3	For combination with pressure actuators. Electrical actuator connected on side (port B) only for ON/OFF function.	G 1¼ / 2x G 1¼	**003G1441**
	Combination piece KF2	For combination with thermostat - side connection to port B	-	**003G1440**
	Seal pot V1	Capacity 1 liter; with compression fittings for imp. tube Ø10	-	**003G1392**
	Seal pot V2	Capacity 3 liter; with compression fittings for imp. tube Ø10 , for actuator size 640 cm²	-	**003G1403**
	Adapter	For combination of new Virtus pressure actuators AFx 2, with old generation of valves VFx 2	-	**003G1780**
	AMEi 6 **iSET** el. actuator 230 V	Intelligent Δp actuator with **iSET** function		**082G4300**
	AMEi 6 **iSET** el. actuator 24 V			**082G4301**
	AMEi 6 **iNET** el. actuator 230 V	Intelligent Δp actuator with **iNET** function		**082G4302**
	AMEi 6 **iNET** el. actuator 24 V			**082G4303**

Spare parts code numbers

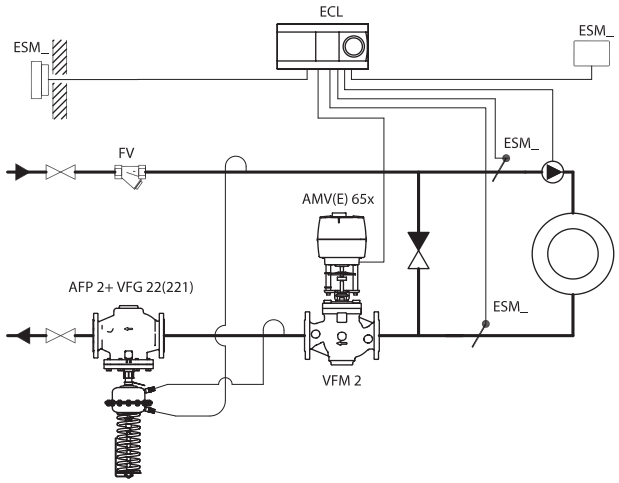
Service kits

Picture	Type designation	DN (mm)	k_{vs} (m^3/h)	PN	for VFG 2 / VFG 22	for VFG 21 / VFG 221
	Valve insert	15	4.0	16/25/40	**065B2796**	**065B2790**
		20	6.3		**065B2797**	**065B2791**
		25	8.0		**065B2798**	**065B2792**
		32	16			
		40	20		**065B2799**	**065B2793**
		50	32			
	Pressure control insert VFG/Q 22	65	60		**003G1800**	**003G1807**
		80	80		**003G1801**	**003G1808**
		100	160		**003G1802**	**003G1809**
		125	250		**003G1803**	**003G1810**
		150	380		**On demand**	**On demand**
		200	650		**On demand**	**On demand**
		250	800		**On demand**	**On demand**
	Adapter (sealing cone) VFG 2 - AFP 2	15-250	-		**003G1780**	
	Pressure stuffing box VFG/Q 22(1)	65-125	-		**003G1730**	
		150-200	-		**003G1731**	
		250	-		**003G1732**	

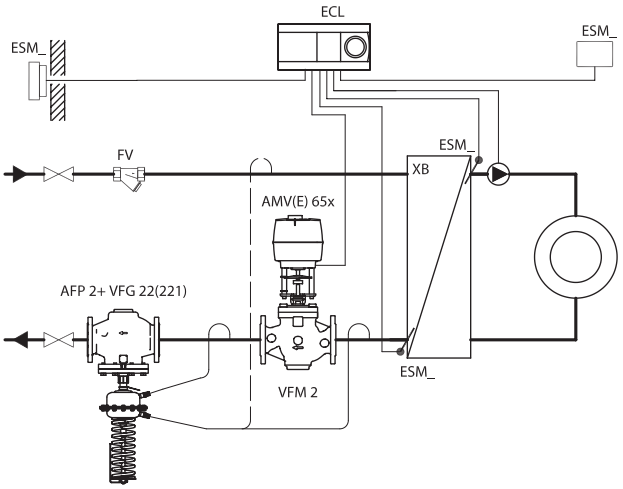
Overview

Application examples

Return mounting

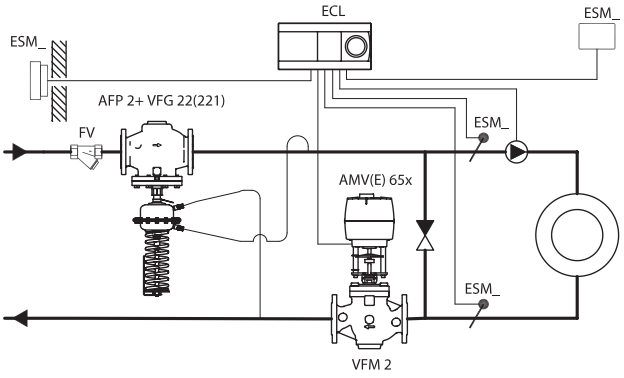


Direct-connected heating system

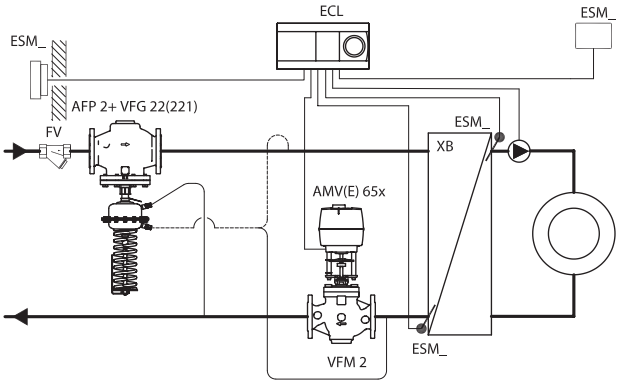


Indirectly connected heating system

Flow mounting



Direct-connected heating system



Indirectly connected heating system

Product details

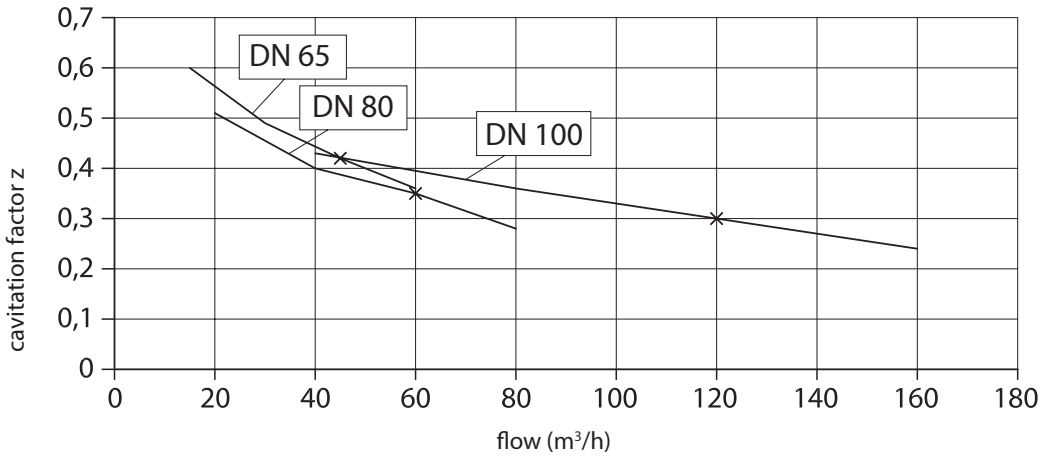
General data

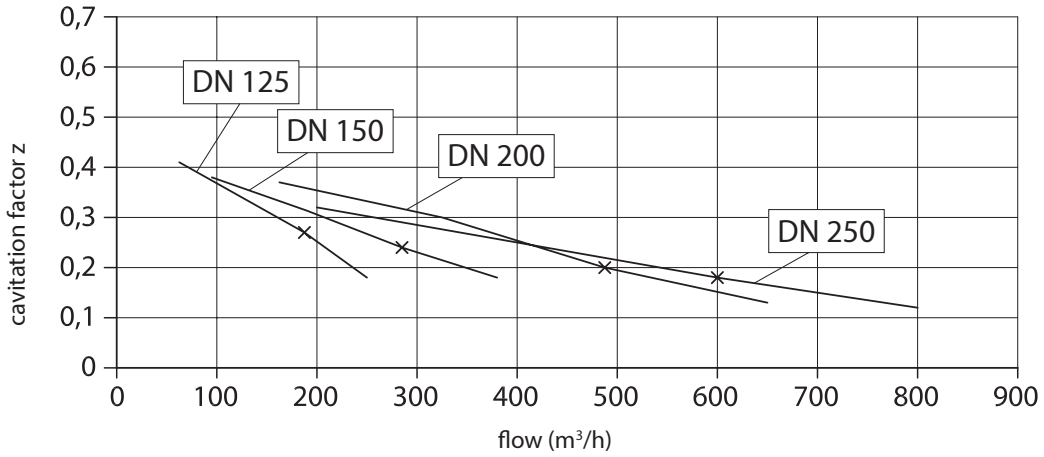
VFG 2 / VFG 22(1) Valve

Nominal diameter		**DN**	**15**	**20**	**25**	**32**	**40**	**50**	**65**	**80**	**100**	**125**	**150**	**200**	**250**
k_{VS} value of Δp controller		m^3/h	4.0	6.3	8.0	16	20	32	60	80	160	250	380	650	800
Leakage acc. to standard IEC 534 (% of k_{vs})	VFG 2 / VFG 22		≤ 0.03										≤ 0.05		
	VFG 21 / VFG 221		≤ 0.01												
Nominal pressure		PN	16, 25, 40												
Max. differential pressure	PN 16	bar	16						16		15	15	12	10	10
	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	VFG 2 / VFG 22	°C	2 ... 200 / 2 ... 150						2 … 150						
	VFG 21 / VFG 221		2 ... 150												
Connections			Flange												
Materials															
Valve body	PN16		Grey cast iron EN-GJL-250 (GG-25)												
	PN25		Ductile iron EN-GJS-400 (GGG-40.3)												
	PN40		Cast steel GP240GH (GS-C 25)												
Valve seat			Stainless steel, mat. No. 14021												
Valve cone			Stainless steel, mat. No. 14404						Stainless steel, mat. No. 1.4021						
Sealing	VFG 2		Metal												
	VFG 22														
	VFG 21		EPDM												
	VFG 221														

AFP 2 Actuator

Actuator size	**cm^2**	**80**		**160**				**320**		**640**
Max. operating pressure	bar	16, 40								
Diff. pressure setting ranges and spring colours	bar	1.5-5	1-3	1.5-4	1-2.5	0.5-1.5	0.1-1	0.4-1.5	0.1-1	0.1-0.35
		red	yellow	black	red	yellow	blue	red	orange	yellow
For valve DN		15-125		15-250		15-125		15-250		15-250
Materials										
Actuator housing		Steel, mat. No. 1.0345, zinc plated								
Control diaphragm		EPDM								

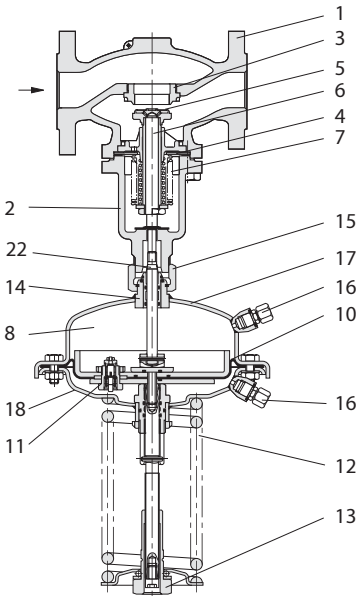

DN 65
DN 80
DN 100
cavitation factor z
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
0
20
40
60
80
100
120
140
160
180
flow (m³/h)


DN 125
DN 150
DN 200
DN 250
cavitation factor z
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
0
100
200
300
400
500
600
700
800
900
flow (m³/h)

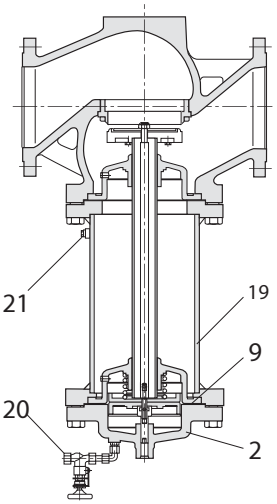
Design

DN15-50

1. Valve body
2. Cover
3. Valve seat
4. Valve insert
5. Pressure relieved valve cone
6. Valve stem
7. Bellows for pressure relief of valve cone
8. Actuator
9. Diaphragm for pressure relief of valve cone
10. Control diaphragm for differential pressure control
11. Excess pressure safety valve
12. Setting spring for diff. pressure control
13. Adjuster for diff. pressure setting, prepared for sealing
14. Stuffing cone
15. Union nut
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
22. Adapter VFG 2 - AFP 2



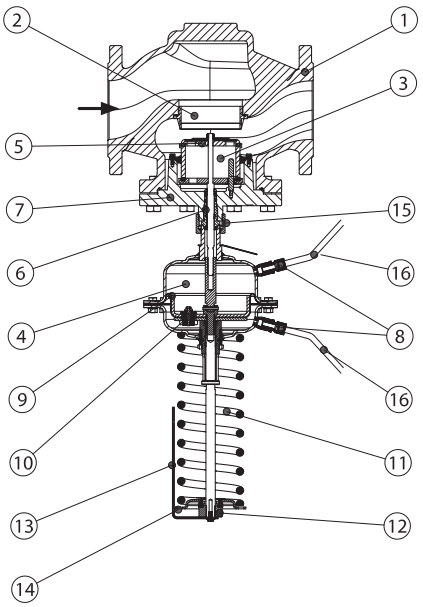
AFP 2 / VFG 2 DN15-50



VFG 2 DN150-250, T_{max} 200 °C

DN65-250

1. Valve body
2. Valve seat
3. Pressure control insert
4. Pressure actuator
5. Pressure control cone
6. Pressure stuffing box
7. Cover
8. Impulse tube connection
9. Diaphragm
10. Diaphragm excess pressure safety valve
11. Differential pressure setting spring
12. Differential pressure setting nut
13. Setting scale
14. Setting indicator
15. Union nut
16. Impulse tube



Function

The differential pressure control is achieved by maintaining a constant differential pressure over the control valve/application.
The differential pressure over the control valve is lead to the pressure actuator diaphragm through the impulse tubes.
The opening/closing of the pressure control cone is performed by changing differential pressure over the diaphragm.

When differential pressure over the control valve:
a) rises, the pressure control cone takes over the exceeded differential pressure by closing, until set differential pressure over the control valve/application is reached.
b) drops, the pressure control cone compensates the missing differential pressure by opening, until set differential pressure over the control valve/application is reached.

The pressure actuator diaphragm is equipped with excess pressure safety valve to protect diaphragm from the damages caused by 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.

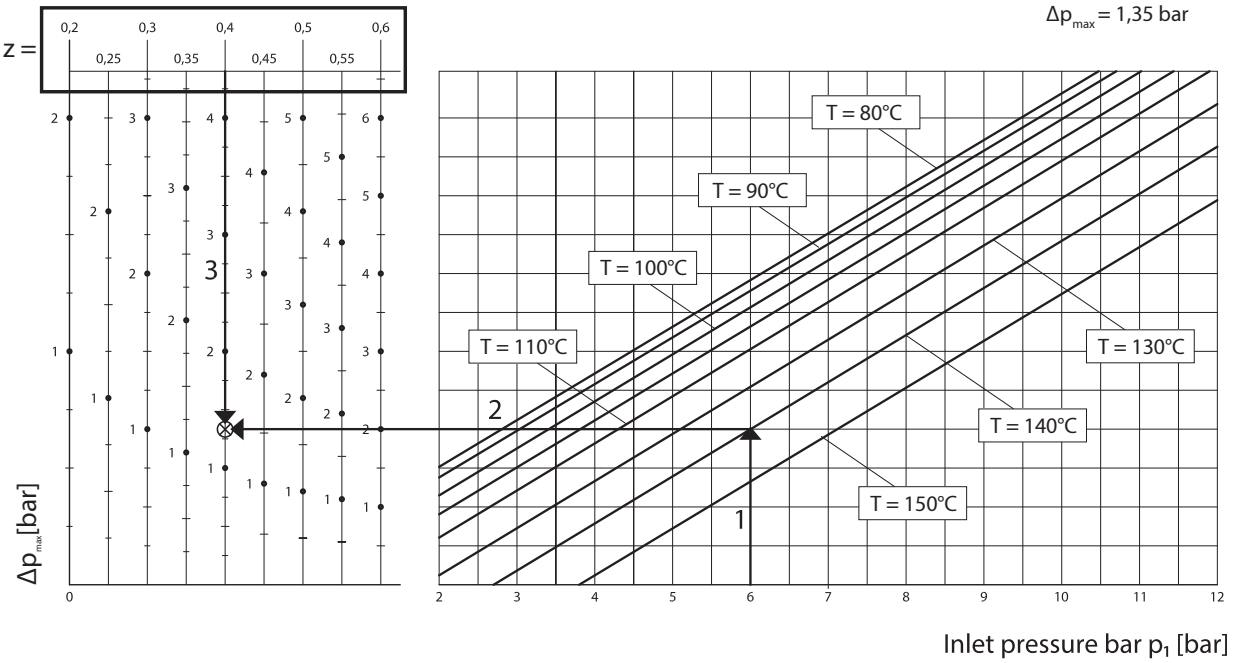
Pressure and temperature data

Operating area

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

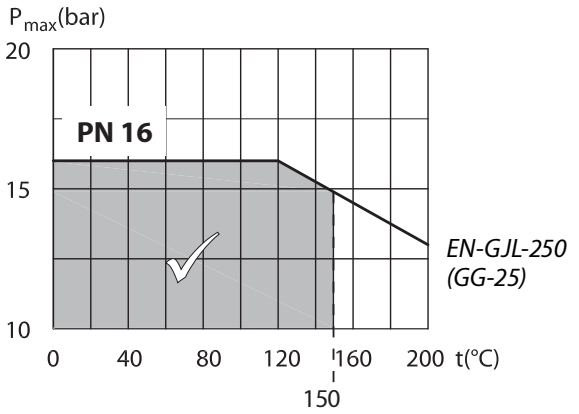
Δp_{max} at z = 0,2 ... 0,6 [bar]

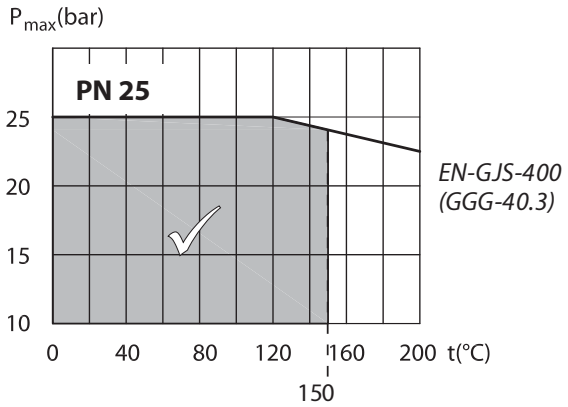
Example ⊗:
p_1 = 6 bar
T = 140°C
z = 0,4
Δp_{max} = 1,35 bar



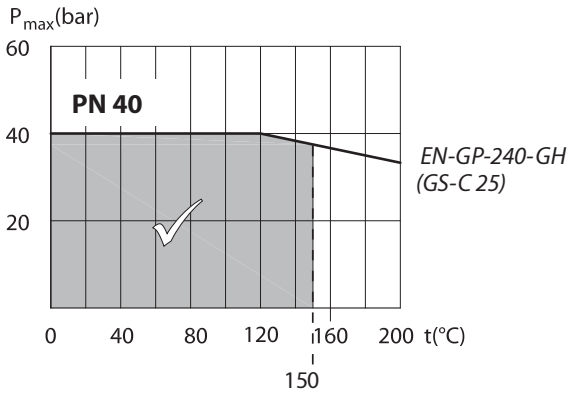
Pressure temperature diagram

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

Example 1:

The application demands a maximal flow of 25 m^3/h and has a motorized control valve (MCV) that needs a control of a pressure drop 0.4 bar. The minimal differential pressure available over MCV and AFP is 0.7 bar.

Given data:

Q_{max} = 25 m^3/h
Δp_{min} = 0.7 bar
Δp_{MCV} = 0.4 bar

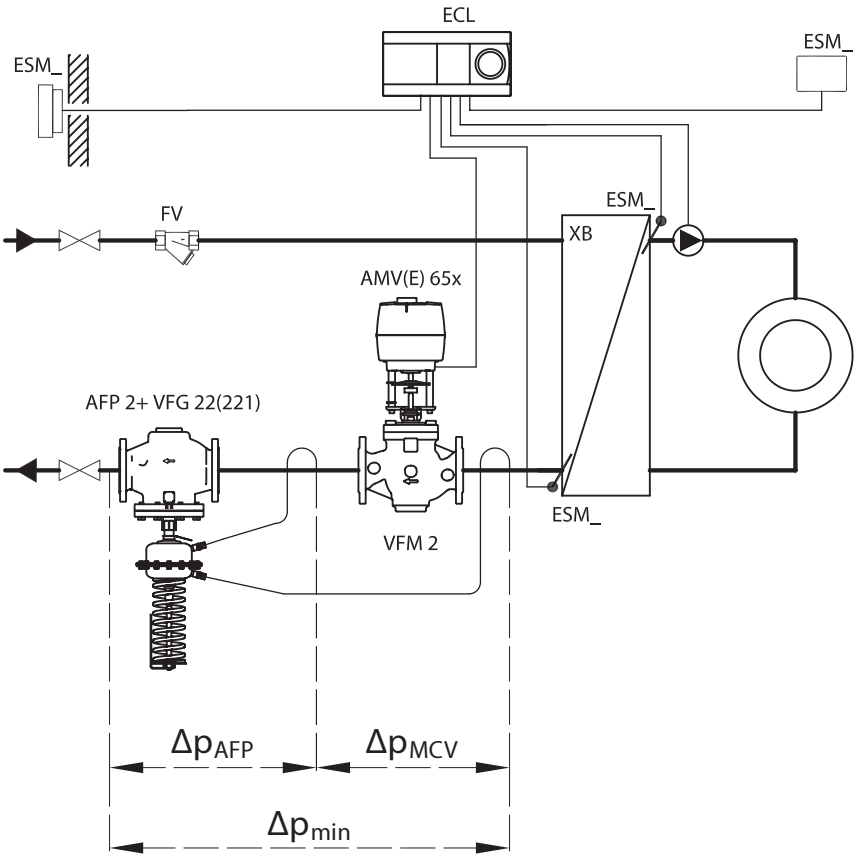
The total pressure across the controller is:
$\Delta p_{AFP} = \Delta p_{min} - \Delta p_{MCV} = 0.7 - 0.4 = 0.3$ (30 kPa)

Calculate the k_v value:

$$k_v = \frac{Q_{max}}{\sqrt{\Delta p_{AFP}}} = \frac{25}{\sqrt{0.3}} = 45.6 m^3/h$$

The first bigger k_{VS} to 45.6 m^3/h is 60 m^3/h and gives VFG DN 65.
The available setting range to control 0.4 bar is 0.1-0.7 bar and is available for DN 65.

Solution:
AFP 2 0.1-0.7
VFG 22 (221) DN 65 k_{VS} 60



Directly connected heating system

Example 2:
Motorised control valve (MCV) for mixing circuit in direct-connected heating system requires differential pressure of 0.3 bar (30 kPa).

Given data:

Q_{max} = 2.2 m^3/h (1200 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

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

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

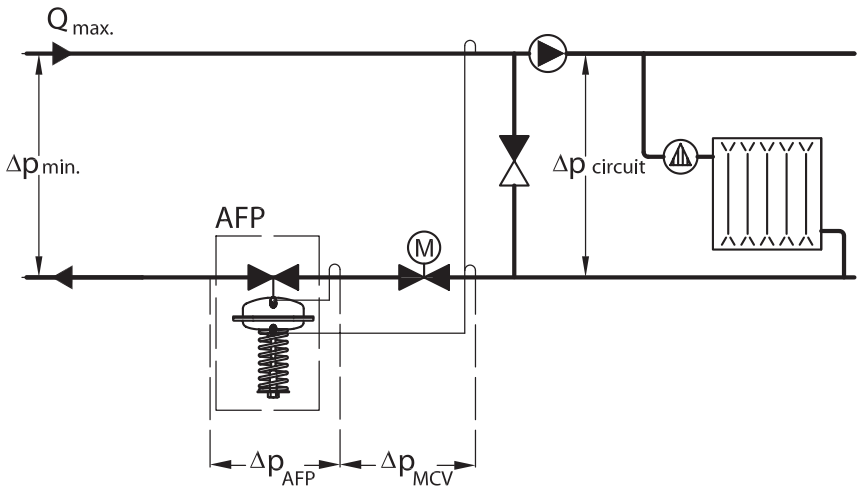
The total pressure loss across the controller is:
$\Delta p_{AFP} = \Delta p_{min} - \Delta p_{MCV} = 0.7 - 0.3$
Δp_{AFP} = 0.4 bar (40 kPa)

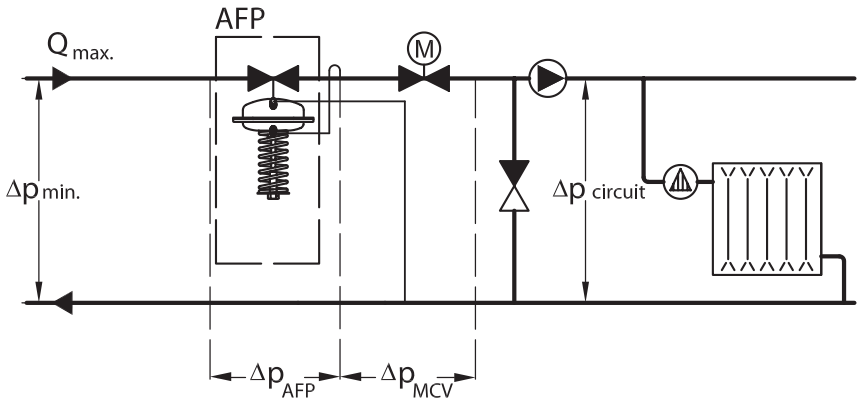
Possible pipe pressure losses in tubes, shut-off fittings, heatmeters, etc. are not included.

k_v value is calculated according to formula:

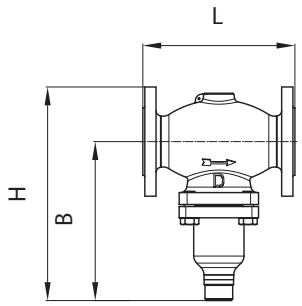
$$k_v = \frac{Q_{max}}{\sqrt{\Delta p_{AFP}}} = \frac{2.2}{\sqrt{0.4}} = 3.5 m^3/h$$

Solution:
The example selects AFP 2 DN 15, k_{VS} value 4.0, with differential pressure setting range 0.1 - 1.0 bar.

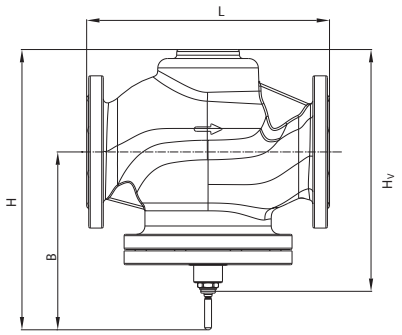




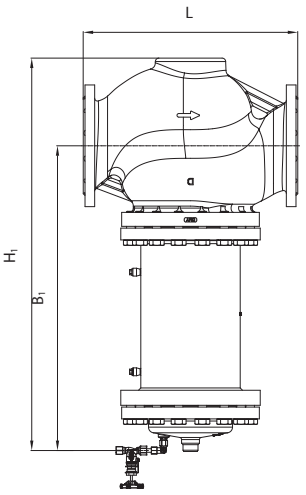
Dimensions



VFG 2 DN15-50



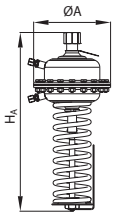
VFG 22(1) DN65-250



VFG DN150-250
with valve body extension up to 200 °C

VFG 2(1), VFG 22(1) Valves

DN	L	B	H	H_V	B1	H1	Weight		
							PN 16	PN 25	PN 40
15	130	213	267	-			7.5	7.5	7.5
20	150	213	267	-			8.5	8.5	8.5
25	160	239	304	-			10	10	10
32	180	239	304	-			12	12	12
40	200	241	323	-			15	15	15
50	230	241	323	-			18	18	18
65	290	245	370	285	-		24	24	27
80	310	240	365	290	-		29	29	32
100	350	275	425	350	-		47	48	53
125	400	270	435	370	-		60	60	68
150	480	330	520	460	-		105	106	121
200	600	365	610	550	-		204	206	235
250	730	420	680	620	-		343	350	404
150 extension	480	-	-	-	620	799	154	-	179
200 extension	600	-	-	-	852	1089	301	-	336
250 extension	730	-	-	-	1199	1459	469	-	505

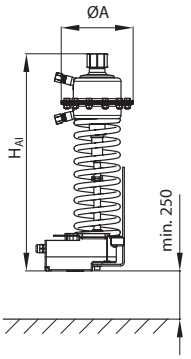


AFPB 2
Actuator

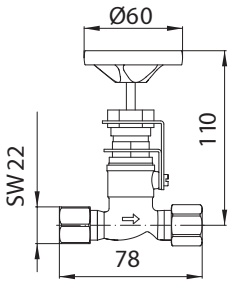
AFP 2 Actuator

Size	ØA	H_A	H_{AI}	Weight (kg)			
cm^2	mm			AFP 2 PN 16	AFP 2 PN 16 + AMEi 6	AFP 2 PN 40	AFP 2 PN 40 + AMEi 6
80	175	490	590	9	11.5	16	18.5
160	230	510	610	11.5	14	23.5	26
320	300	510	610	15	17.5	35.5	38
640	300	630	730	38	40.5	58	60.5

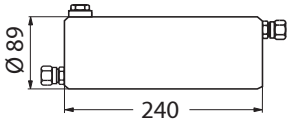
Total installation height of the controller (VFG 22(1) valve + AFP 2 pressure actuator) is sum of H_V and H_A (H_{AI})



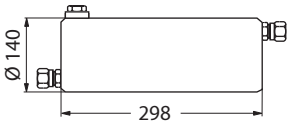
AMEi 6 intelligent actuator with iSET / iNET functionality should be ordered separately



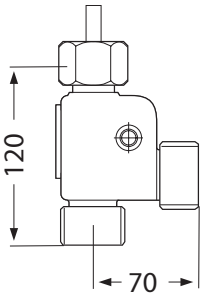
Shut off valve



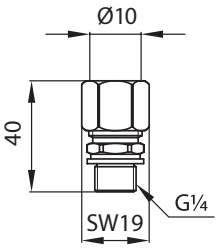
Seal pot V1



Seal pot V2



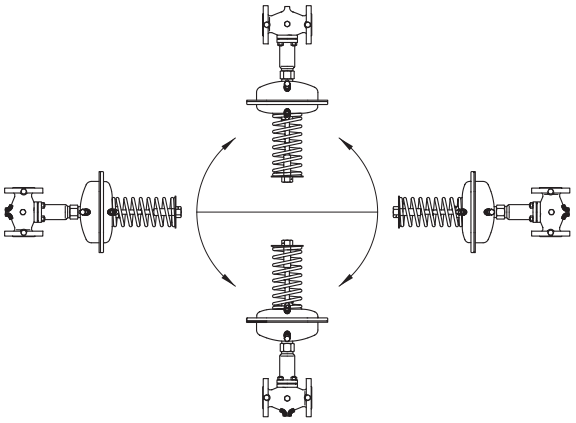
Comb. piece KF2, KF3



Compression fitting

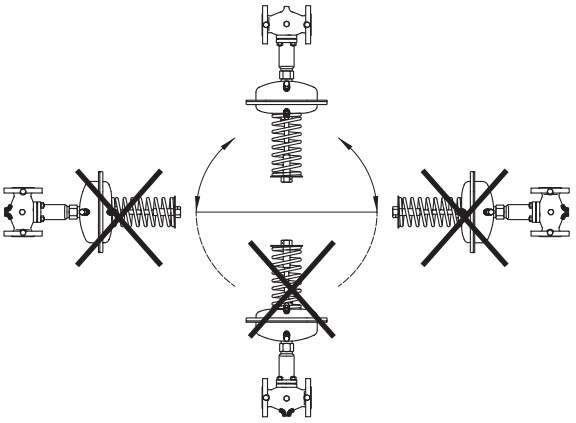
Installation

DN 15-50
$T_{max} \leq 120°C$



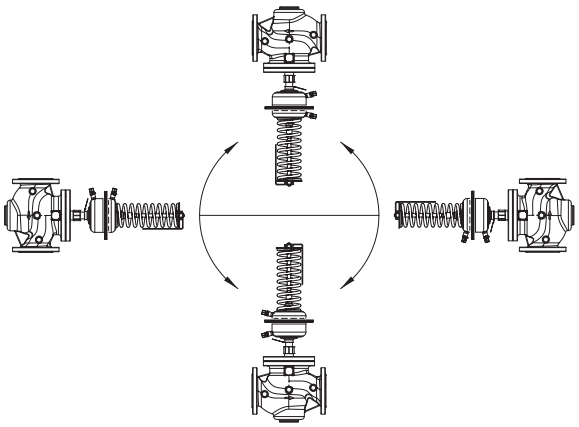
The controllers can be installed in any position.

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	
Pressure Safety Certificate	CE-0062-PED-H-DAF 002-24-DNK-rev-A	BV - Bureau Veritas	PED, Pressure

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