



# Pressure flow controllers

**AFPA 2 / VFG 2(1) / VFG 22(1)**

Differential pressure relief controller

## Description

The controller is a self-acting differential pressure relief controller primarily for use in district heating systems. The controller is normally closed and opens on rising differential pressure.

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

Further on two valve versions are available:

- VFG 2 / VFG 22 with metallic sealing cone
- VFG 21 / VFG 221 with soft sealing cone

Together with Danfoss intelligent electrical actuator AMEi 6 intelligent optimization functions are available:

- iNET-intelligent network balancing

### Main data:

- DN 15-250
- $k_{VS}$  4.0-800 m<sup>3</sup>/h
- PN 16, 25, 40
- Setting range: 0.1-0.4 bar / 0.2-0.8 bar / 0.3(0.4)-1.5 bar / 0.5(1)-3 bar / 1.5-6 bar
- Temperature:
  - Circulation water / glycolic water up to 30 %: 2 ... 150° (200°C)
- Connections:
  - Flange

## Features & benefits

- Automatic Differential Pressure Protection:
  - Provides essential system protection as a self-acting controller that is normally closed and opens on rising differential pressure, ensuring stable flow conditions, particularly in bypass or shunt connections.
- Intelligent Network Optimization:
  - Integrates with the Danfoss AMEi 6 intelligent electrical actuator to enable the iNET function, allowing for remote and intelligent network balancing to enhance overall system efficiency and control.
- Versatile and Robust Design:
  - Offers wide application flexibility with a broad range of sizes (DN 15-250), pressure ratings (PN 16-40), multiple differential pressure settings, and options for both metallic and soft sealing cones to suit various district heating system requirements.



[virtus.danfoss.com](https://virtus.danfoss.com)

## Ordering

### Product code numbers

#### VFG 2 / VFG 22 Valve (metal sealing cone)

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

<sup>1)</sup> At temperatures above 150°C only with seal pots (see Accessories)

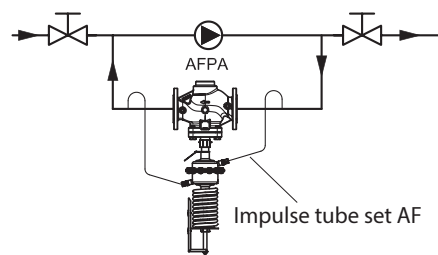
<sup>2)</sup> VFG 2 valves require ordering of 003G1782 adapter for a combination with AFPA 2 pressure actuators

#### Example 1:

Differential pressure controller, return mounting, DN 65, k<sub>vs</sub> 60 m<sup>3</sup>/h, PN 16, metallic sealing, setting range 1-3 bar, T<sub>max</sub> 150 °C, flange;

- 1× VFG 22 DN 65 valve  
Code no: **065B5500**
- 1× AFPA 2 actuator  
Code no: **003G5691**
- 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 <sup>3</sup> /h)	Connections	T <sub>max.</sub> (°C)	Code No.		
					PN16	PN25	PN40
	15 <sup>1)</sup>	4.0	Flanges acc. to EN 1092-1	150 °C	<b>065B2502</b>	-	-
	20 <sup>1)</sup>	6.3			<b>065B2503</b>	-	-
	25 <sup>1)</sup>	8.0			<b>065B2504</b>	-	-
	32 <sup>1)</sup>	16			<b>065B2505</b>	-	-
	40 <sup>1)</sup>	20			<b>065B2506</b>	-	-
	50 <sup>1)</sup>	32			<b>065B2507</b>	-	-
	65	60			<b>065B5521</b>	<b>065B5528</b>	<b>065B5535</b>
	80	80			<b>065B5522</b>	<b>065B5529</b>	<b>065B5536</b>
	100	160			<b>065B5523</b>	<b>065B5530</b>	<b>065B5537</b>
	125	250			<b>065B5524</b>	<b>065B5531</b>	<b>065B5538</b>
	150	380			<b>065B5525</b>	<b>065B5532</b>	<b>065B5539</b>
	200	650			<b>065B5526</b>	<b>065B5533</b>	<b>065B5540</b>
	250	800			<b>065B5527</b>	<b>065B5534</b>	<b>065B5541</b>

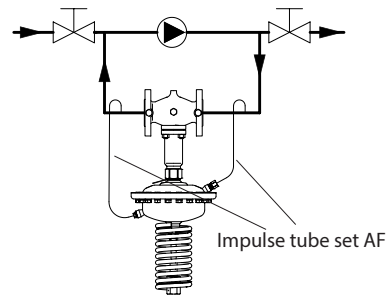
<sup>1)</sup> VFG 21 valves require ordering of 003G1780 adapter for a combination with AFPA 2 pressure actuators

## Example 2:

Differential pressure relief controller; DN 15;  $k_{vs}$  4.0; PN 16; metallic sealing; setting range 0.3 - 1.5 bar; T<sub>max</sub> 150 °C; flange;

- 1x VFG 2 DN 15 valve  
Code no: **065B2388**
- 1x AFPA 2 actuator  
Code no: **003G5692**
- 2x Impulse tube set AF  
Code no: **003G1391**
- 1x Adapter VFG 2 - AF(P)A 2  
Code no: **003G1782**

Products will be delivered separately.



## AFPA 2 Actuator

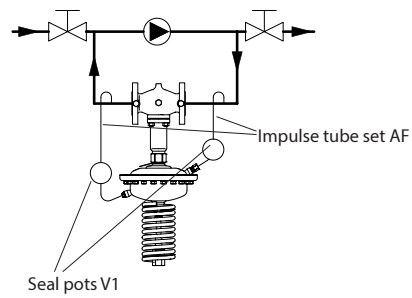
Picture	Setting range (bar)	Possible combinations with DN	Actuator size (cm <sup>2</sup> )	Spring colour	Code No.	
					PN16	PN40
	1.5-6	15-125	80	red	<b>003G5689</b>	<b>003G5696</b>
	0.5-3	15-125	80	yellow	<b>003G5690</b>	<b>003G5697</b>
	1-3	15-250	160	red	<b>003G5691</b>	<b>003G5698</b>
	0.3-1.5	15-125	160	yellow	<b>003G5692</b>	<b>003G5699</b>
	0.4-1.5	15-250	320	red	<b>003G5693</b>	<b>003G5700</b>
	0.2-0.8	15-250	320	yellow	<b>003G5694</b>	<b>003G5701</b>
	0.1-0.4	15-250	640	yellow	<b>003G5695</b>	<b>003G5702</b>

## Example 3:

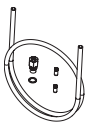
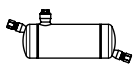

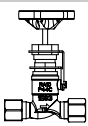

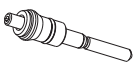
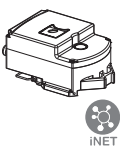
Differential pressure relief controller; DN 15;  $k_{vs}$  4.0; PN 25;  
metallic sealing; setting range 0.3 - 1.5 bar;  $T_{max}$  200 °C; flange;

- 1x VFG 2 DN 15 valve  
Code no: **065B2401**
- 1x AFPA 2 actuator  
Code no: **003G5692**
- 2x Impulse tube set AF  
Code no: **003G1391**
- 2x Seal pot V1  
Code no: **003G1392**
- 1x Adapter VFG 2 - AF(P)A 2  
Code no: **003G1782**

Products will be delivered separately.



## Accessories code numbers

Picture	Type designation	Description	Connections	Code No.
	Impulse tube set AF	- 1x Copper tube $\varnothing 10 \times 1 \times 1500$ mm - 1x compression fitting for imp. tube connection to pipe (G 1/4) - 2x socket	-	<b>003G1391</b>
	Seal pot V1 <sup>1)</sup>	Capacity 1 liter; with compression fittings for imp. tube $\varnothing 10$	-	<b>003G1392</b>
	Seal pot V2 <sup>1)</sup>	Capacity 3 liter; with compression fittings for imp. tube $\varnothing 10$ , for actuator size 640 cm <sup>2</sup>		<b>003G1403</b>
	Compression fitting <sup>2)</sup>	For impulse tube $\varnothing 10$ connections to controller	G 1/4	<b>003G1468</b>
	Shut off valve	For impulse tube $\varnothing 10$	-	<b>003G1401</b>
	Static throttle valve			<b>065B2909</b>
	Adapter	For combination of new Virtus pressure actuators AFx 2, with old generation of valves VFx 2	-	<b>003G1782</b> <sup>3)</sup>
	AMEi 6 <b>iNET</b> el. actuator 230 V	Intelligent $\Delta p$ actuator with <b>iNET</b> function	-	<b>082G4302</b>
	AMEi 6 <b>iNET</b> el. actuator 24 V			<b>082G4303</b>

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

<sup>2)</sup> Consist of a nipple, compression ring and nut

<sup>3)</sup> To be available end of Q1 2026

## Spare parts code numbers

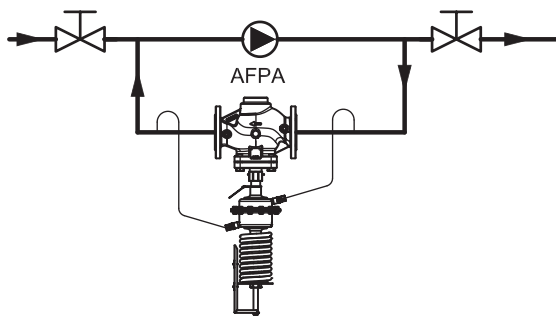
### Service kits

Picture	Type designation	DN (mm)	$k_{vs}$ (m <sup>3</sup> /h)	PN	for VFG 2 / VFG 22	for VFG 21 / VFG 221
	Valve insert	15	4.0	16/25/40	<b>065B2796</b>	<b>065B2790</b>
		20	6.3		<b>065B2797</b>	<b>065B2791</b>
		25	8.0		<b>065B2798</b>	<b>065B2792</b>
		32	16			
		40	20		<b>065B2799</b>	<b>065B2793</b>
		50	32			
	Pressure control insert VFG 22(1)	65	60		<b>003G1800</b>	<b>003G1807</b>
		80	80		<b>003G1801</b>	<b>003G1808</b>
		100	160		<b>003G1802</b>	<b>003G1809</b>
		125	250		<b>003G1803</b>	<b>003G1810</b>
		150	380		<b>On demand</b>	<b>On demand</b>
		200	650		<b>On demand</b>	<b>On demand</b>
		250	800		<b>On demand</b>	<b>On demand</b>
	Adapter VFG 2 - AFPA 2	15-250	-		<b>003G1782 <sup>1)</sup></b>	
	Pressure stuffing box VFG 22(1)	65-125	-	<b>003G1730</b>		
		150-200	-	<b>003G1731</b>		
		250	-	<b>003G1732</b>		

<sup>1)</sup> To be available end of Q1 2026

## Overview

### Application examples



Pressure control for a pump in bypass

## Product details

### General data

#### VFG 2 / VFG 22(1) Valve

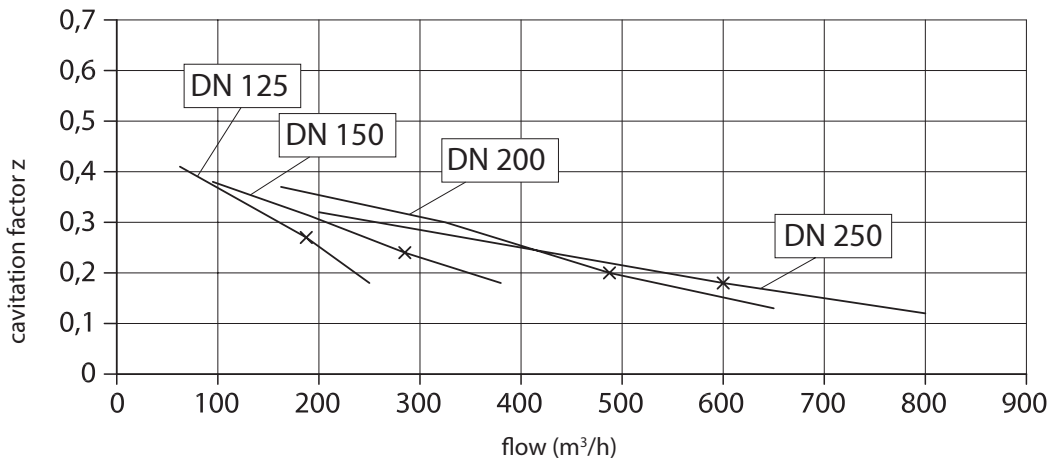
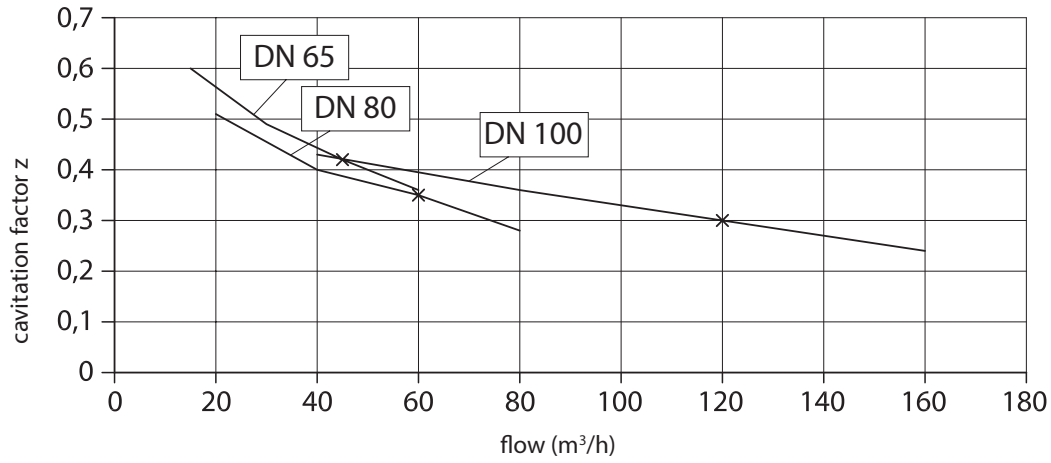
Nominal diameter		DN	15	20	25	32	40	50	65	80	100	125	150	200	250	
k <sub>v5</sub> value of Δp controller		m <sup>3</sup> /h	4.0	6.3	8.0	16	20	32	60	80	160	250	380	650	800	
Cavitation factor z			0.6	0.6	0.6	0.55	0.55	0.5	0.42	0.35	0.3	0.27	0.23	0.2	0.18	
Leakage acc. to standard IEC 534 (% of k <sub>v5</sub> )	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								15	12	10			
	PN 25, 40		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 ... 150 / 2 ... 200 <sup>1)</sup>						2 ... 150							
	VFG 21 / VFG 221		2 ... 150													
Connections			Flange													
<b>Materials</b>																
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. 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															

<sup>1)</sup> At temperatures above 150 °C only with seal pots (see Accessories)

#### AFPA 2 Actuator

Actuator size	cm <sup>2</sup>	80		160		320		640
Max. operating pressure	bar	16, 40						
Diff. Pressure setting ranges and spring colours	bar	red	yellow	red	yellow	red	yellow	yellow
		1.5-6	0.5-3	1-3	0.3-1.5	0.4-1.5	0.2-0.8	0.1-0.4
For valve DN		15-125		15-250	15-125	15-250		
<b>Materials</b>								
Actuator housing		Steel, mat. No. 10345, zinc plated						
Control diaphragm		EPDM						

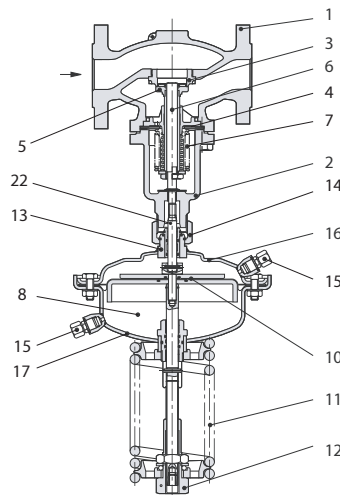
<sup>1)</sup> Combination with AMEi 6 not possible



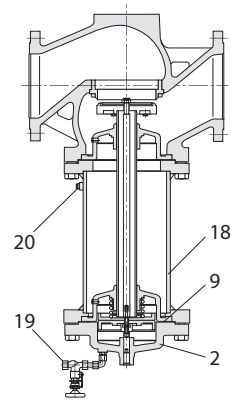
## Design

### 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 pressure control
11. Setting spring for pressure control
12. Adjuster for pressure setting, prepared for sealing
13. Stuffing cone
14. Union nut
15. Compression fitting for impulse tube
16. Upper casing of diaphragm
17. Lower casing of diaphragm
18. Valve body extension
19. Shut off valve for water filling
20. Closing plug
21. Air space bore
22. Adapter VFG 2 - AFPA 2

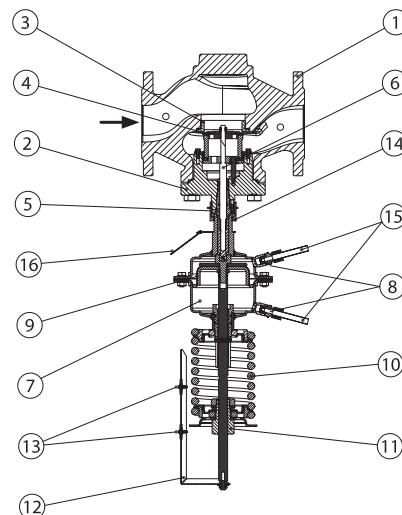


AFPA 2 / VFG 2 DN15-50

VFG 2 DN150-250, T<sub>max</sub> 200 °C

### DN65-250

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



### Function

The pressures in front and behind of the control valve are being transferred through the impulse tubes to the actuator chambers and act on control diaphragm for differential pressure control.

The controller became normally closed after commissioning (stretching the spring). It opens on rising differential pressure and closes on falling differential pressure to maintain constant differential pressure.

### Settings

#### Pressure setting

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

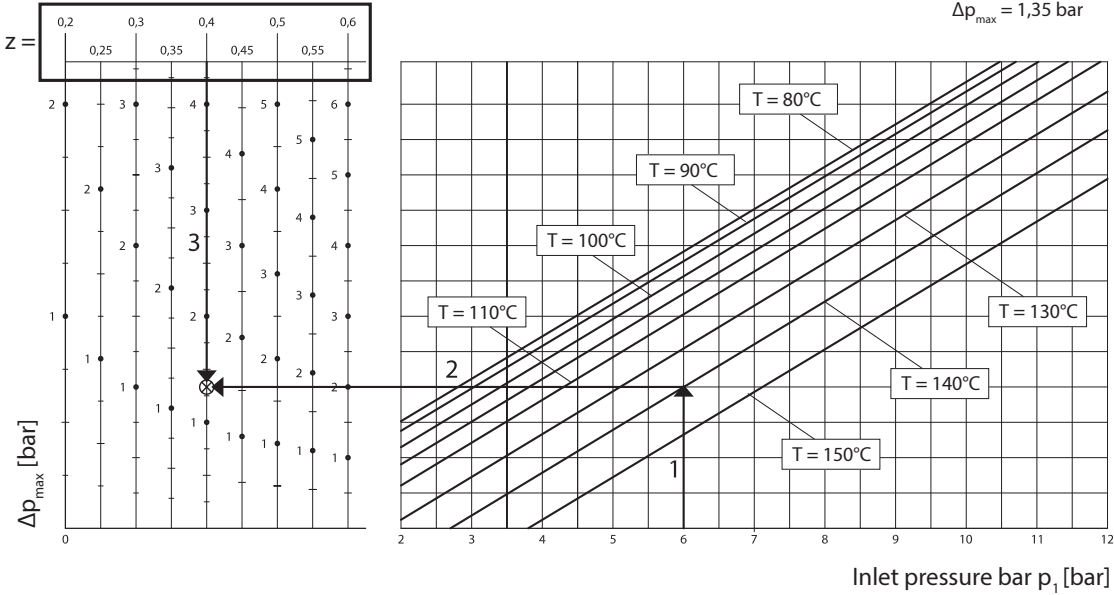
## Pressure and temperature data

### Operating area

Maximum allowed differential pressure over the controller ( $\Delta p_{max}$ ) at different cavitation factors (z)

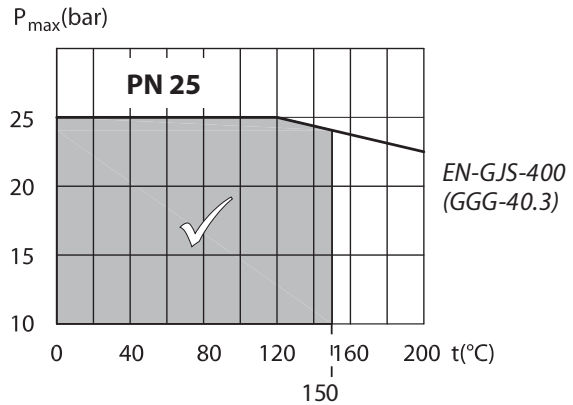
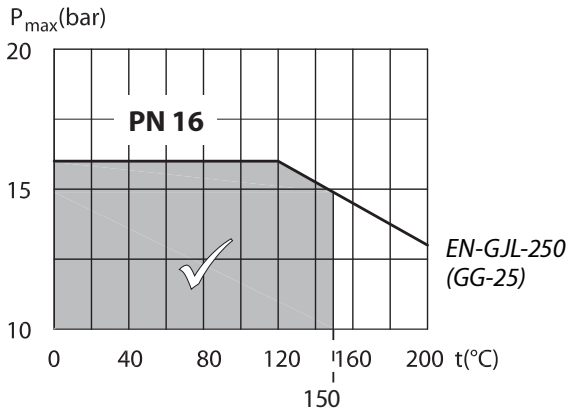
$\Delta p_{max}$  at z = 0,2 ... 0,6 [bar]

Example ⊗:  
 $p_1 = 6$  bar  
 $T = 140^\circ\text{C}$   
 $z = 0,4$   
 $\Delta p_{max} = 1,35$  bar

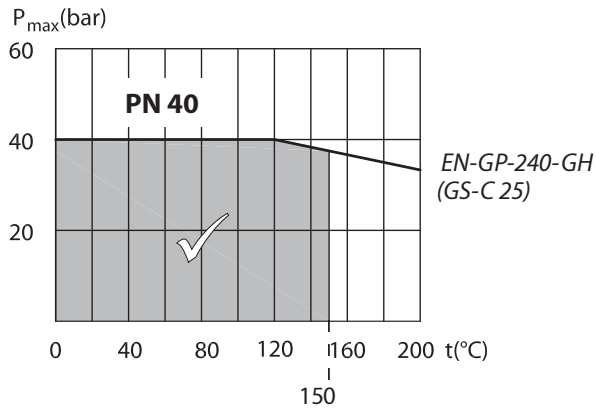


### Pressure temperature diagram

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:

The application demands a maximal flow of 60 m<sup>3</sup>/h. The minimal differential pressure available over controller is 1.3 bar. Demanded opening setting pressure is 2 bar.

Given data:

$$Q_{max} = 60 \text{ m}^3/\text{h}$$

$$\Delta p_{AFPA} = 1.3 \text{ bar}$$

Calculate the  $k_v$  value:

$$k_v = \frac{Q_{max}}{\sqrt{\Delta p_{AFPA}}} = \frac{60}{\sqrt{1.3}} = 52.6 \text{ m}^3/\text{h}$$

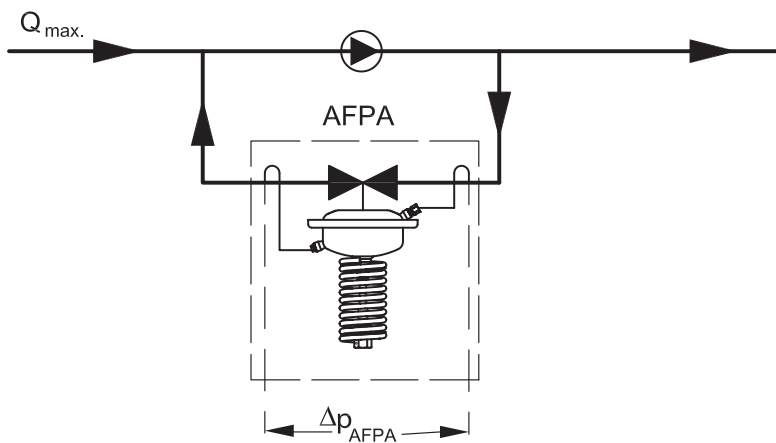
The first bigger  $k_{vs}$  to 52.6 m<sup>3</sup>/h is 60 m<sup>3</sup>/h and gives VFG 22 DN 65.

The available setting range to control 2 bar is 1-3 bar and is available for DN 65.

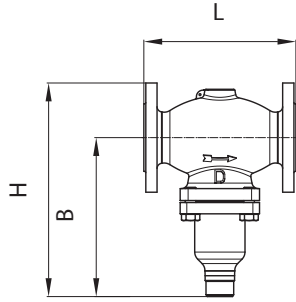
Solution:

AFPA 2 1-3 bar

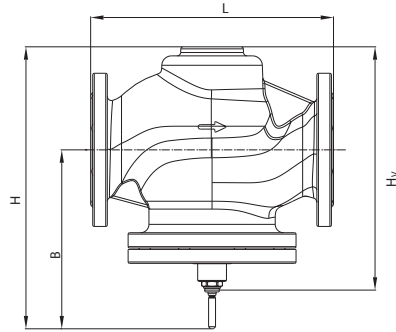
VFG 22 (221) DN 65  $k_{vs}$  60 m<sup>3</sup>/h



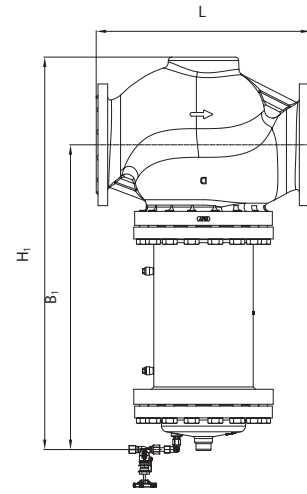
## Dimensions



VFG 2 DN15-50



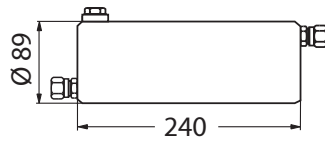
VFG 22(1) DN65-250



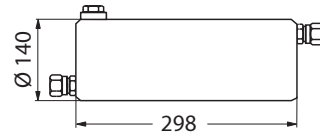
VFG DN150-250  
with valve body extension up to 200 °C

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

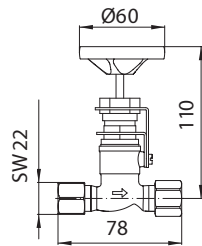
DN	L	B	H	H <sub>v</sub>	B <sub>1</sub>	H <sub>1</sub>	Weight		
							PN 16	PN 25	PN 40
15	130	213	267	-	-	-	7.5	7.5	7.5
20	150	213	267	-	-	-	8.5	8.5	8.5
25	160	239	304	-	-	-	10	10	10
32	180	239	304	-	-	-	12	12	12
40	200	241	323	-	-	-	15	15	15
50	230	241	323	-	-	-	18	18	18
65	290	245	370	285	-	-	24	24	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



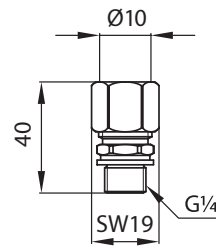
Seal pot V1



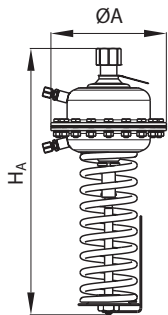
Seal pot V2



Shut off valve



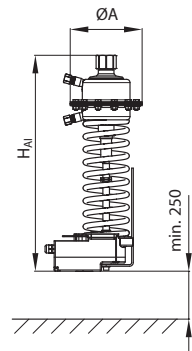
Compression fitting



**AFPA 2 Actuator**

Size	ØA	H <sub>A</sub>	H <sub>AI</sub>	Weight (kg)			
				AFPA 2 PN 16	AFPA 2 PN 16 + AMEi 6	AFPA 2 PN 40	AFPA 2 PN 40 + AMEi 6
cm <sup>2</sup>	mm						
80	175	490	590	9	11.5	16	8.5
160	230	490	590	12.5	15	25	27.5
320	300	490	590	17	19.5	37	39.5
640	300	610	710	40	42.5	58	60.5

Total installation height of the controller (VFG 22(1) valve + AFPA 2 pressure actuator) is sum of H<sub>V</sub> and H<sub>A</sub> (H<sub>AI</sub>)

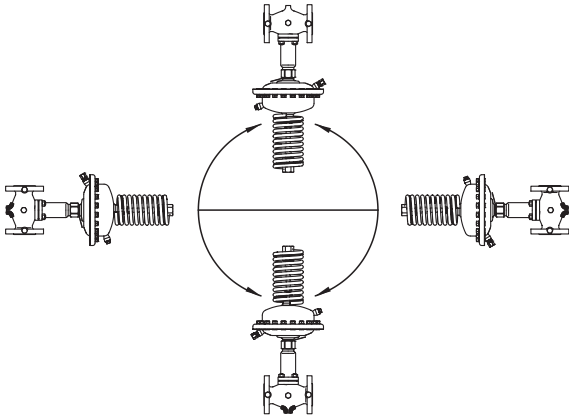


AMEi 6 intelligent actuator with iNET functionality should be ordered separately

## Installation

### VFG 2(1) DN15-50

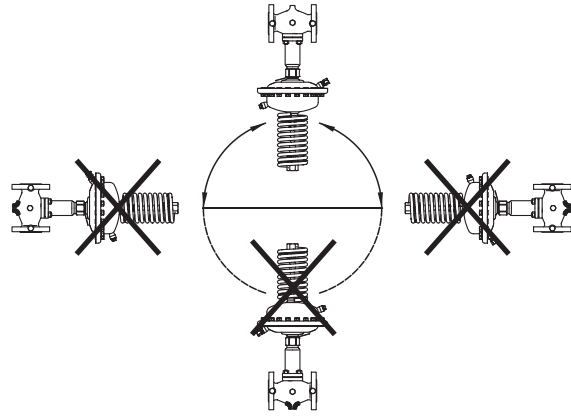
$T_{max} \leq 120\text{ }^{\circ}\text{C}$



The controllers can be installed in any position.

### VFG 2(1) DN15-50

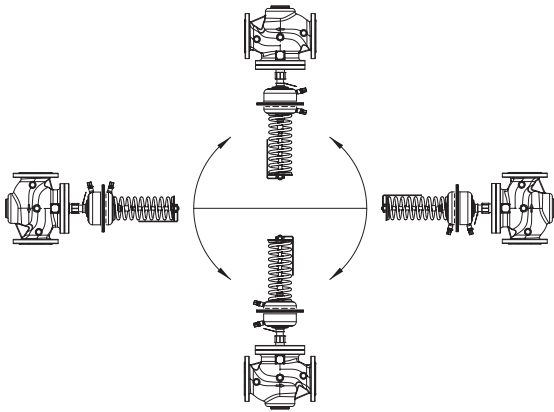
$T_{max} > 120\text{ }^{\circ}\text{C}$



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

### VFG 22(1) DN65-250

2 ... 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	<a href="#">EAC KZ 7100841.13.12.02339</a>	EAC - Eurasian Customs Union	MD
EU Declaration	<a href="#">Danfoss EU</a> <a href="#">230612EN0854103.05</a>	Danfoss	PED, Pressure
Export Control Declaration	<a href="#">Actuators pressure flow and temperature</a>	Danfoss	
EU Declaration	<a href="#">Danfoss EU</a> <a href="#">230530EN0858104.06</a>	Danfoss	PED, Pressure
UA Declaration	<a href="#">Danfoss UA 10.01.23 Heat Control Valves</a>	Danfoss	
Pressure Safety Certificate	<a href="#">CE-0062-PED-H-DAF 002-24-DNK-rev-A</a>	BV - Bureau Veritas	PED, Pressure

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