Data sheet

Differential pressure controller (PN 16, 25, 40)
AFP(-9) / VFG 2(1) – return and flow mounting, adjustable setting

Description

The controller is a self-acting differential pressure controller primarily for use in district heating systems. The controller closes on rising differential pressure.

Ordering

Example 1:
Differential pressure controller; return mounting: DN 15; \(k_{VS} 4.0\); PN 16; metallic sealing; setting range 0.15-1.5 bar; \(T_{max} 150\) °C; Flange;

- 1× VFG 2 DN 15 valve
  - Code no: 065B2388
- 1× AFP actuator
  - Code no: 003G1016
- 2× Impulse tube set AF
  - Code no: 003G1391

Products will be delivered separately.

Main data:
- DN 15-250
- \(k_{VS} 4.0-400 \text{ m}^3/\text{h}\)
- PN 16, 25, 40
- Setting range:
  - AFP: 0.05-0.35 bar / 0.1-0.7 bar / 0.15-1.5 bar
  - AFP-9: 0.5-3 bar / 1-6 bar
- Temperature: Circulation water / glycolic water up to 30 %:
  - 2 … 150 / 200 °C
- Connections:
  - Flange

Further on two valve versions are available:
- VFG 2 with metallic sealing cone
- VFG 21 with soft sealing cone

Main data:

<table>
<thead>
<tr>
<th>Picture</th>
<th>DN (mm)</th>
<th>(k_{VS} ) (m³/h)</th>
<th>Connections</th>
<th>( T_{max} ) (°C)</th>
<th>Code No.</th>
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\(^1\) at temperatures above 150 °C only with seal pots (see Accessories)
### Ordering (continuous)

**Example 2:**
Differential pressure controller; return mounting; DN 15; \(k_{vs} = 4.0\); PN 25; metallic sealing; setting range 0.15-1.5 bar; \(T_{\text{max}} = 200^\circ\text{C}\); flange;

- 1x VFG 2 DN 15 valve
  Code no: 065B2401
- 1x AFP actuator
  Code no: 003G1016
- 2x Impulse tube set AF
  Code no: 003G1391
- 1x Seal pot V1
  Code no: 003G1392

Products will be delivered separately.

**Example 3:**
Differential pressure; flow mounting; DN 15; \(k_{vs} = 4.0\); PN 25; metallic sealing; setting range 0.15-1.5 bar; \(T_{\text{max}} = 200^\circ\text{C}\); flange;

- 1x VFG 2 DN 15 valve
  Code no: 065B2401
- 1x AFP actuator
  Code no: 000G1016
- 2x Impulse tube set AF
  Code no: 003G1391
- 1x Seal pot V1
  Code no: 003G1392

Products will be delivered separately.

### VFG 21 Valves (soft sealing cone)

<table>
<thead>
<tr>
<th>Picture</th>
<th>DN (mm)</th>
<th>(k_{vs}) (m³/h)</th>
<th>Connections</th>
<th>(T_{\text{max}}) (°C)</th>
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### Note:
- other valves available on special request.
- Actuator does not have excess pressure safety valve

### AFP / AFP-9 Actuators

<table>
<thead>
<tr>
<th>Picture</th>
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<th>(\Delta p) setting range (bar)</th>
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<td><img src="image2.png" alt="Picture" /></td>
<td>AFP-9&lt;sup&gt;1&lt;/sup&gt;</td>
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<sup>1</sup> actuator does not have excess pressure safety valve

### Accessories

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<tr>
<th>Picture</th>
<th>Type designation</th>
<th>Description</th>
<th>Connections</th>
<th>Code No.</th>
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<tr>
<td><img src="image3.png" alt="Picture" /></td>
<td>Impulse tube set AF</td>
<td>– 1x Copper tube Ø10 × 1 × 1500 mm&lt;br&gt;– 1x compression fitting for imp. tube connection to pipe (G 1/4)&lt;br&gt;– 2x socket</td>
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<td>003G1391</td>
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<td><img src="image4.png" alt="Picture" /></td>
<td>Seal pot V1&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Capacity 1 liter; with compression fittings for imp. tube Ø10</td>
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<td>Seal pot V2&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Capacity 3 liter; with compression fittings for imp. tube Ø10, for actuator size 630 cm²</td>
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<td><img src="image5.png" alt="Picture" /></td>
<td>Compression fitting&lt;sup&gt;3&lt;/sup&gt;</td>
<td>For impulse tube Ø10 connections to controller</td>
<td>G 1/4</td>
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<td><img src="image6.png" alt="Picture" /></td>
<td>Combination piece KF3&lt;sup&gt;4&lt;/sup&gt;</td>
<td>For combination with pressure actuators, Electrical actuator connected on side (port B) only for ON/OFF function.</td>
<td>G 1/4 / 2x G 1/4</td>
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<td>Combination piece KF2&lt;sup&gt;5&lt;/sup&gt;</td>
<td>For combination with thermostat - side connection to port B</td>
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<td><img src="image7.png" alt="Picture" /></td>
<td>Shut off valve&lt;sup&gt;6&lt;/sup&gt;</td>
<td>For impulse tube Ø10</td>
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<td><img src="image8.png" alt="Picture" /></td>
<td>Throttle valve</td>
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</table>

<sup>1</sup> Seal pot has to be used on impulse tubes always when \(T_{\text{max}} \geq 150^\circ\text{C}\)
<sup>2</sup> Consist of a nipple, compression ring and nut
<sup>3</sup> Port A - for connection of any type of actuator
Data sheet

Differential pressure controller AFP(-9)/VFG 2(1) (PN 16, 25, 40)

Ordering (continuous)

Service kits

<table>
<thead>
<tr>
<th>Picture</th>
<th>Type designation</th>
<th>DN (mm)</th>
<th>k VS (m³/h)</th>
<th>Code No.</th>
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Technical data

Valve

Nominal diameter | DN | 15 | 20 | 25 | 32 | 40 | 50 | 65 | 80 | 100 | 125 | 150 | 200 | 250
---|---|---|---|---|---|---|---|---|---|---|---|---|---|---
k VS value | m³/h | 4.0 | 6.3 | 8.0 | 16 | 20 | 32 | 50 | 80 | 125 | 160 | 280 | 320 | 400
Cavitation factor z | 0.6 | 0.6 | 0.55 | 0.55 | 0.5 | 0.55 | 0.45 | 0.45 | 0.45 | 0.35 | 0.3 | 0.2 | 0.2 | 0.2
Leakage acc. to standard IEC 534 (% of k VS) | VFG 2 | ≤ 0.03 | | | | | | | | | | | | |
| VFG 21 | ≤ 0.01 | | | | | | | | | | | | |
Nominal pressure | PN | 16, 25, 40 | | | | | | | | | | | | |
Max. differential pressure | PN 16 | bar | 16 | | | | | | | | | | |
| PN 25, 40 | 20 | 15 | 12 | 10 |
Media | Circulation water / glycolic water up to 30 % |
Media pH | Min. 7, max. 10 |
Media temperature | VFG 2 | °C | 2 … 150 / 2 … 200 ¹ | | | | | | | | | | |
| VFG 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 | VFG 2 | Metal |
| VFG 21 | EPDM |
Pressure relieve system | Bellows (Stainless steel, mat. No. 1.4571) |
| | Diaphragm (EPDM) |

¹ at temperatures above 150 °C only with seal pots (see Accessories)
² on request

Actuators

Type | AFP-9 ³ | AFP
---|---|---
Actuator size | cm² | 80 | 250 | 630
Max. operating pressure | bar | 25 | 25 | 16
Diff. pressure setting ranges and spring colours | bar | red | yellow | red | yellow | yellow | 0.05-0.35

Materials

Actuator housing | Steel, mat. No. 1.0338, zinc plated |
Control diaphragm | EPDM (Rolling; fibre enforced) |

³ Actuator does not have excess pressure safety valve
Application principles

- Return mounting

- Flow mounting

Combinations

Example
Differential pressure and temperature controller
AFP / AFT06 / VFG 2; DN 15; PN 16;
"k_r 4.6 T_max 150 °C; 0.15-1.5 bar;
range 20 ... 90 °C;
- 1x VFG 2 DN 15 valve
  Code no: 065B2388
- 1x AFP actuator
  Code no: 003G1016
- 1x AFT06 thermostat
  Code no: 065-4391
- 1x Combination piece KF2
  Code no: 003G1398
- 2x Impulse tube set AF
  Code no: 003G1391
Parts will be delivered separately.

Note:
For AFT 06 and STFW thermostats
data see relevant data sheets
**Installation position**

- DN 15-80 $T_{\text{max}} \leq 120 \, ^\circ\text{C}$
  - The controllers can be installed in any position.

- DN 15-80 $T_{\text{max}} > 120 \, ^\circ\text{C}$; DN 100-250
  - The controllers can be installed in horizontal pipes only, with a pressure actuator oriented downwards.

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**Pressure temperature diagram**

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

- Maximum allowed operating pressure as a function of media temperature (according to EN 1092-1)
- Maximum allowed operating pressure as a function of media temperature (according to EN 1092-2)
**Example 1**

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

Given data:

- $Q_{\text{max}} = 2.2 \text{ m}^3/\text{h} (1200 \text{ l/h})$
- $\Delta p_{\min} = 0.7 \text{ bar (70 kPa)}$
- $*\Delta p_{\text{circuit}} = 0.1 \text{ bar (10 kPa)}$
- $\Delta p_{\text{MCV}} = 0.3 \text{ bar (30 kPa)}$ selected

*Remark

$\Delta p_{\text{circuit}}$ 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:

$\Delta p_{\text{set value}} = \Delta p_{\text{MCV}} = 0.3 \text{ bar (30 kPa)}$

The total pressure loss across the controller is:

$\Delta p_{\text{AFP}} = \Delta p_{\min} - \Delta p_{\text{MCV}} = 0.7 - 0.3 = 0.4 \text{ bar (40 kPa)}$

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

$k_v$ value is calculated according to formula:

$k_v = \frac{Q_{\text{max}}}{\sqrt{\Delta p_{\text{AFP}}}} = \frac{2.2}{\sqrt{0.4}}$

$k_v = 3.5 \text{ m}^3/\text{h}$

Solution:

The example selects AFP DN 15, $k_v$ value 4.0, with differential pressure setting range 0.15-1.5 bar.
Sizing (continuous)

- Indirectly connected heating system

**Example 2**

Motorised control valve (MCV) for indirectly connected heating system requires differential pressure of 0.5 (50 kPa) bar.

Given data:

- $Q_{\text{max}} = 2.4$ m$^3$/h (1250 l/h)
- $\Delta p_{\text{min}} = 1.0$ bar (100 kPa)
- $\Delta p_{\text{exchanger}} = 0.05$ bar (5 kPa)
- $\Delta p_{\text{MCV}} = 0.4$ bar (40 kPa) selected

The differential pressure set value is:

$\Delta p_{\text{set value}} = \Delta p_{\text{exchanger}} + \Delta p_{\text{MCV}} = 0.05 + 0.4$

$\Delta p_{\text{set value}} = 0.45$ bar (45 kPa)

The total pressure loss across the controller is:

$\Delta p_{\text{AFP}} = \Delta p_{\text{min}} - \Delta p_{\text{exchanger}} - \Delta p_{\text{MCV}} = 1.0 - 0.05 - 0.4$

$\Delta p_{\text{AFP}} = 0.55$ bar (55 kPa)

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

$k_v$ value is calculated according to formula:

$$ k_v = \frac{Q_{\text{max}}}{\sqrt{\Delta p_{\text{AFP}}}} = \frac{2.4}{\sqrt{0.55}} $$

$k_v = 3.2$ m$^3$/h

**Solution:**

The example selects AFP DN 15, $k_v$ value 4.0, with differential pressure setting range 0.15-1.5 bar.
Data sheet Differential pressure controller AFP(-9)/VFG 2(1) (PN 16, 25, 40)

Design
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

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 control. The diff. pressure is controlled by means of setting spring for diff. pressure control. Control valve closes on rising differential pressure and opens on falling differential pressure to maintain constant differential pressure.

Controller is equipped with excess pressure safety valve (not AFP-9), which protects control diaphragm for diff. pressure 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. The adjustment can be done by means of spring for diff. pressure setting and/or pressure indicators.
Data sheet
Differential pressure controller AFP(-9)/VFG 2(1) (PN 16, 25, 40)

Dimensions

**VFG 2, VFG 21 Valves**

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<td>301</td>
<td>469</td>
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<td>336</td>
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**AFP Actuator**

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VD.L1.H1.02 | 9