

## Data sheet

# Flow controller (PN 16, 25, 40)

## AFQ / VFQ 2(1) - return and flow mounting

### Description



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

Further on two valve versions are available:

- VFQ 2 with metallic sealing cone
- VFQ 21 with soft sealing cone (on special request)

#### Main data:

- DN 15-250
- $k_{vs}$  4,0-400 m<sup>3</sup>/h
- Flow range: 0,1-250 m<sup>3</sup>/h
- PN 16, 25, 40
- Flow restrictor  $\Delta p_b$ : 0,2 bar or 0,5 bar
- Temperature:
  - Circulation water / glycolic water up to 30 %: 2 ... 140 / 150 / 200 °C
- Connections:
  - Flange

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

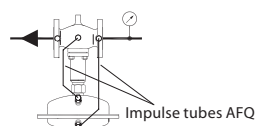
### Ordering

#### Example 1:

Flow controller; DN 15;  $k_{vs}$  4,0; PN 16; metallic sealing; flow restrictor  $\Delta p_b$  0,2 bar;  $t_{max}$  150 °C; flange;

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

Products will be delivered separately.



### VFQ 2 Valves (metallic sealing cone)

| Picture | DN<br>(mm) | $k_{vs}$<br>(m <sup>3</sup> /h) | $t_{max}$<br>(°C) |                   | Connections               | Code No.        |                 |                 |
|---------|------------|---------------------------------|-------------------|-------------------|---------------------------|-----------------|-----------------|-----------------|
|         |            |                                 |                   |                   |                           | PN 16           | PN 25           | PN 40           |
|         | 15         | 4,0                             | 150               | 200 <sup>1)</sup> | Flanges acc. to EN 1092-1 | <b>065B2654</b> | <b>065B2667</b> | <b>065B2677</b> |
|         | 20         | 6,3                             |                   |                   |                           | <b>065B2655</b> | <b>065B2668</b> | <b>065B2678</b> |
|         | 25         | 8,0                             |                   |                   |                           | <b>065B2656</b> | <b>065B2669</b> | <b>065B2679</b> |
|         | 32         | 16                              |                   |                   |                           | <b>065B2657</b> | <b>065B2670</b> | <b>065B2680</b> |
|         | 40         | 20                              |                   |                   |                           | <b>065B2658</b> | <b>065B2671</b> | <b>065B2681</b> |
|         | 50         | 32                              |                   |                   |                           | <b>065B2659</b> | <b>065B2672</b> | <b>065B2682</b> |
|         | 65         | 50                              |                   |                   |                           | <b>065B2660</b> | <b>065B2673</b> | <b>065B2683</b> |
|         | 80         | 80                              |                   |                   |                           | <b>065B2661</b> | <b>065B2674</b> | <b>065B2684</b> |
|         | 100        | 125                             |                   |                   |                           | <b>065B2662</b> | <b>065B2675</b> | <b>065B2685</b> |
|         | 125        | 160                             |                   |                   |                           | <b>065B2663</b> | <b>065B2676</b> | <b>065B2686</b> |
|         | 150        | 280                             | 140               | -                 |                           | <b>065B2664</b> | -               | <b>065B2687</b> |
|         | 200        | 320                             |                   |                   |                           | <b>065B2758</b> | -               | <b>065B2688</b> |
|         | 250        | 400                             |                   |                   |                           | <b>065B2759</b> | -               | <b>065B2689</b> |

**Note:** other valves available on special request.

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

### AFQ Actuators

| Picture | Flow restrictor $\Delta p_b$<br>(bar) | Max. oper. pressure<br>(PN) | Code No.        |
|---------|---------------------------------------|-----------------------------|-----------------|
|         | 0,2                                   | 25                          | <b>003G1024</b> |
|         | 0,5                                   |                             | <b>003G1025</b> |

**Data sheet**

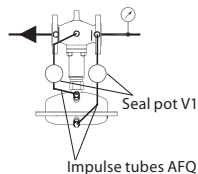
**Flow controller AFQ / VFQ 2(1) (PN 16, 25, 40)**

**Ordering (continuous)**

Example 2:  
Flow controller; DN 15;  $k_{vs}$  4,0; PN 16; metallic sealing; flow restrictor  
 $\Delta p_b$  0,2 bar;  $t_{max}$  200 °C; flange;

- 1x VFQ 2 DN 15 valve  
Code no: **065B2654**
- 1x AFQ actuator  
Code no: **003G1024**
- 2x AFQ DN 15 impulse tubes  
Code no: **003G1391**
- 2x Seal pot V1  
Code no: **003G1392**

Products will be delivered separately.



**Accessories**

| Picture | Type designation                   | For controller | DN<br>(mm) | PN         | Code No.        |
|---------|------------------------------------|----------------|------------|------------|-----------------|
|         | Impulse tubes<br>(Stainless steel) | AFQ            | 15         | 16, 25, 40 | <b>003G1338</b> |
|         |                                    |                | 20         |            |                 |
|         |                                    |                | 25         |            | <b>003G1340</b> |
|         |                                    |                | 32         |            |                 |
|         |                                    |                | 40         |            | <b>003G1342</b> |
|         |                                    |                | 50         |            | <b>003G1343</b> |
|         |                                    |                | 65         |            |                 |
|         |                                    |                | 80         |            | <b>003G1344</b> |
|         |                                    |                | 100        |            | <b>003G1346</b> |
|         |                                    |                | 125        |            | <b>003G1347</b> |
|         |                                    |                | 150        |            | <b>003G1348</b> |
|         |                                    |                | 200        | 16         | <b>003G1414</b> |
|         |                                    |                |            | 40         | <b>003G1349</b> |
|         |                                    |                | 250        | 16         | <b>003G1415</b> |
|         |                                    |                |            | 40         | <b>003G1404</b> |

**Accessories**

| Picture | Type designation                  | Description                                                                                                                      | Ordering number      |    | Code No.        |
|---------|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------|----------------------|----|-----------------|
|         | Impulse tube set AF               | - 1x Copper tube<br>Ø10 x 1 x 1500 mm<br>- 1 x compression fitting for imp.<br>tube connection to pipe (G 1 1/4)<br>- 2 x socket | DN 15-50             | 2x | <b>003G1391</b> |
|         |                                   |                                                                                                                                  | DN 200, 250          | 3x |                 |
|         | Seal pot V1 <sup>1)</sup>         | Capacity 1 liter; with compression fittings for imp. tube Ø10                                                                    | AFQ                  | 2x | <b>003G1392</b> |
|         | Compression fitting <sup>2)</sup> | For impulse tube Ø10 connections to controller                                                                                   | G 1/4                |    | <b>003G1468</b> |
|         | Combination piece KF3             | For combination with pressure and electrical actuators                                                                           | G 1 1/4 / 2x G 1 1/4 |    | <b>003G1397</b> |
|         | Combination piece KF2             | For combination with thermostat                                                                                                  |                      |    | <b>003G1398</b> |
|         | Shut off valve                    | For impulse tube Ø10                                                                                                             | -                    |    | <b>003G1401</b> |
|         | Throttle valve                    |                                                                                                                                  |                      |    | <b>065B2909</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

**Service kits**

| Picture                                                                             | Type designation                  | For valve | DN<br>(mm) | k <sub>vs</sub><br>(m³/h) | Code No. |
|-------------------------------------------------------------------------------------|-----------------------------------|-----------|------------|---------------------------|----------|
|  | Valve insert                      | VFQ 2     | 15         | 4.0                       | 065B2796 |
|                                                                                     |                                   |           | 20         | 6.3                       | 065B2797 |
|                                                                                     |                                   |           | 25         | 8                         | 065B2798 |
|                                                                                     |                                   |           | 32         | 16                        |          |
|                                                                                     |                                   |           | 40         | 20                        | 065B2799 |
|                                                                                     |                                   |           | 50         | 32                        |          |
|                                                                                     |                                   |           | 65         | 50                        | 065B2800 |
|                                                                                     |                                   |           | 80         | 80                        |          |
|                                                                                     |                                   |           | 100        | 125                       | 065B2801 |
|                                                                                     |                                   |           | 125        | 160                       |          |
|                                                                                     |                                   |           | 150        | 280                       | 065B2964 |
|                                                                                     | 250                               | 400       | 065B2965   |                           |          |
|  | Stuffing cone (with EPDM O-rings) |           |            |                           | 003G1464 |

## Technical data

## Valve

| Nominal diameter                                         |                                         |                                   | DN                                            | 15  | 20  | 25   | 32   | 40  | 50  | 65   | 80  | 100  | 125 | 150                              | 200 | 250 |
|----------------------------------------------------------|-----------------------------------------|-----------------------------------|-----------------------------------------------|-----|-----|------|------|-----|-----|------|-----|------|-----|----------------------------------|-----|-----|
| k <sub>vs</sub> value                                    |                                         |                                   | m³/h                                          | 4,0 | 6,3 | 8,0  | 16   | 20  | 32  | 50   | 80  | 125  | 160 | 280                              | 320 | 400 |
| Range of max. flow setting                               | Δp <sub>b</sub> <sup>1)</sup> = 0,2 bar | from                              |                                               | 0,1 | 0,2 | 0,2  | 0,4  | 0,6 | 0,8 | 3    | 4   | 6    | 8   | 12                               | 15  | 18  |
|                                                          |                                         | to                                |                                               | 2   | 3   | 4    | 7    | 11  | 16  | 28   | 40  | 63   | 80  | 125                              | 150 | 180 |
|                                                          | Δp <sub>b</sub> <sup>1)</sup> = 0,5 bar | from                              |                                               | 0,2 | 0,3 | 0,3  | 0,5  | 0,8 | 1,2 | 4    | 6   | 9    | 12  | 18                               | 22  | 25  |
|                                                          |                                         | to                                |                                               | 3   | 4.5 | 6    | 10   | 16  | 24  | 40   | 58  | 90   | 120 | 180                              | 220 | 250 |
| Cavitation factor z                                      |                                         |                                   | 0,6                                           | 0,6 | 0,6 | 0,55 | 0,55 | 0,5 | 0,5 | 0,45 | 0,4 | 0,35 | 0,3 | 0,2                              | 0,2 |     |
| Leakage acc. to standard IEC 534 (% of k <sub>vs</sub> ) |                                         | VFQ 2                             | ≤0,03                                         |     |     |      |      |     |     |      |     |      |     | ≤0,05                            |     |     |
|                                                          |                                         | VFQ 21                            | ≤0,01                                         |     |     |      |      |     |     |      |     |      |     |                                  |     |     |
| Nominal pressure                                         |                                         | PN                                | 16, 25, 40                                    |     |     |      |      |     |     |      |     |      |     |                                  |     |     |
| Min. differential pressure                               |                                         | bar                               | see remark <sup>2)</sup>                      |     |     |      |      |     |     |      |     |      |     |                                  |     |     |
| Max. differential pressure                               | PN 16                                   |                                   | 16                                            |     |     |      |      |     |     |      |     |      | 15  | 12                               | 10  |     |
|                                                          | PN 25, 40                               |                                   | 20                                            |     |     |      |      |     |     |      |     |      |     |                                  |     |     |
| Medium                                                   |                                         |                                   | Circulation water / glycolic water up to 30 % |     |     |      |      |     |     |      |     |      |     |                                  |     |     |
| Medium pH                                                |                                         |                                   | Min. 7, max. 10                               |     |     |      |      |     |     |      |     |      |     |                                  |     |     |
| Medium temperature                                       | VFQ 2                                   | °C                                | 2 ... 150 / 2 ... 200 <sup>3)</sup>           |     |     |      |      |     |     |      |     |      |     | 2 ... 140                        |     |     |
|                                                          | VFQ 21                                  |                                   | 2 ... 150                                     |     |     |      |      |     |     |      |     |      |     |                                  |     |     |
| Connections                                              |                                         |                                   | Flange                                        |     |     |      |      |     |     |      |     |      |     |                                  |     |     |
| Materials                                                |                                         |                                   |                                               |     |     |      |      |     |     |      |     |      |     |                                  |     |     |
| Valve body                                               | PN 16                                   | Grey cast iron EN-GJL-250 (GG-25) |                                               |     |     |      |      |     |     |      |     |      |     |                                  |     |     |
|                                                          | PN 25                                   | Ductile iron EN-GJS-400(GGG-40.3) |                                               |     |     |      |      |     |     |      |     |      |     |                                  |     |     |
|                                                          | PN 40                                   | Cast steel GP240GH (GS-C 25)      |                                               |     |     |      |      |     |     |      |     |      |     |                                  |     |     |
| Valve seat                                               |                                         |                                   | Stainless steel, mat. No. 1.4021              |     |     |      |      |     |     |      |     |      |     | Stainless steel, mat. No. 1.4313 |     |     |
| Valve cone                                               |                                         |                                   | Stainless steel, mat. No. 1.4404              |     |     |      |      |     |     |      |     |      |     | Stainless steel, mat. No. 1.4021 |     |     |
| Sealing                                                  | VFQ 2                                   |                                   | Metal                                         |     |     |      |      |     |     |      |     |      |     |                                  |     |     |
|                                                          | VFQ 21                                  |                                   | EPDM                                          |     |     |      |      |     |     |      |     |      |     |                                  |     |     |
| Pressure relieve system                                  |                                         |                                   | Bellows (Stainless steel, mat. No. 1.4571)    |     |     |      |      |     |     |      |     |      |     | Diaphragm (EPDM)                 |     |     |

<sup>1)</sup> Δp<sub>b</sub> - differential pressure over flow restrictor

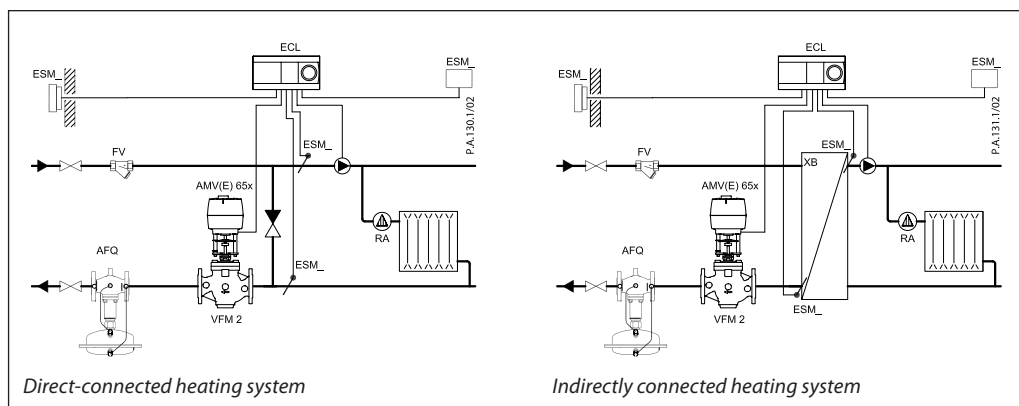
<sup>2)</sup> Depends on the flow rate and valve k<sub>VS</sub>; For Q<sub>set</sub> = Q<sub>max</sub> -> Δp<sub>min</sub> ≥ 0,5 bar; For Q<sub>set</sub> < Q<sub>max</sub> -> Δp<sub>min</sub> =  $\left(\frac{Q}{k_{VS}}\right)^2 + \Delta p_b$ 
<sup>3)</sup> at temperatures above 150 °C only with seal pots (see Accessories)

## Actuator

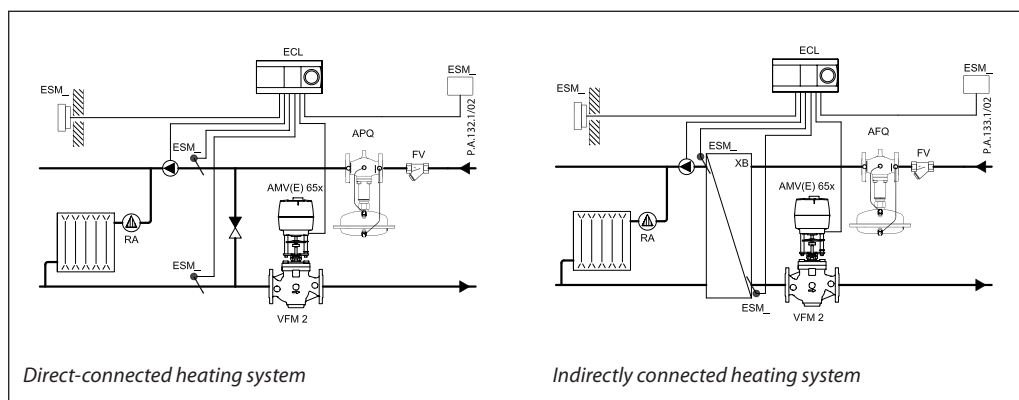
| Type                                         |                 | AFQ                                                                                         |
|----------------------------------------------|-----------------|---------------------------------------------------------------------------------------------|
| Actuator size                                | cm <sup>2</sup> | 250                                                                                         |
| Max. operational pressure                    | PN              | 25                                                                                          |
| Flow restrictor diff. press. Δp <sub>b</sub> | bar             | 0,2 / 0,5                                                                                   |
| <b>Materials</b>                             |                 |                                                                                             |
| Actuator housing                             |                 | Stainless steel, mat. No.1.0338, zinc plated and yellow chromate                            |
| Control diaphragm                            |                 | EPDM (Rolling; fibre enforced)                                                              |
| Impulse tube                                 |                 | Stainless steel tube Ø10 × 0,8 mm / copper tube Ø10 × 1 mm, threaded fitting G 1/4, ISO 228 |

## Application principles

### - Return mounting



### - Flow mounting



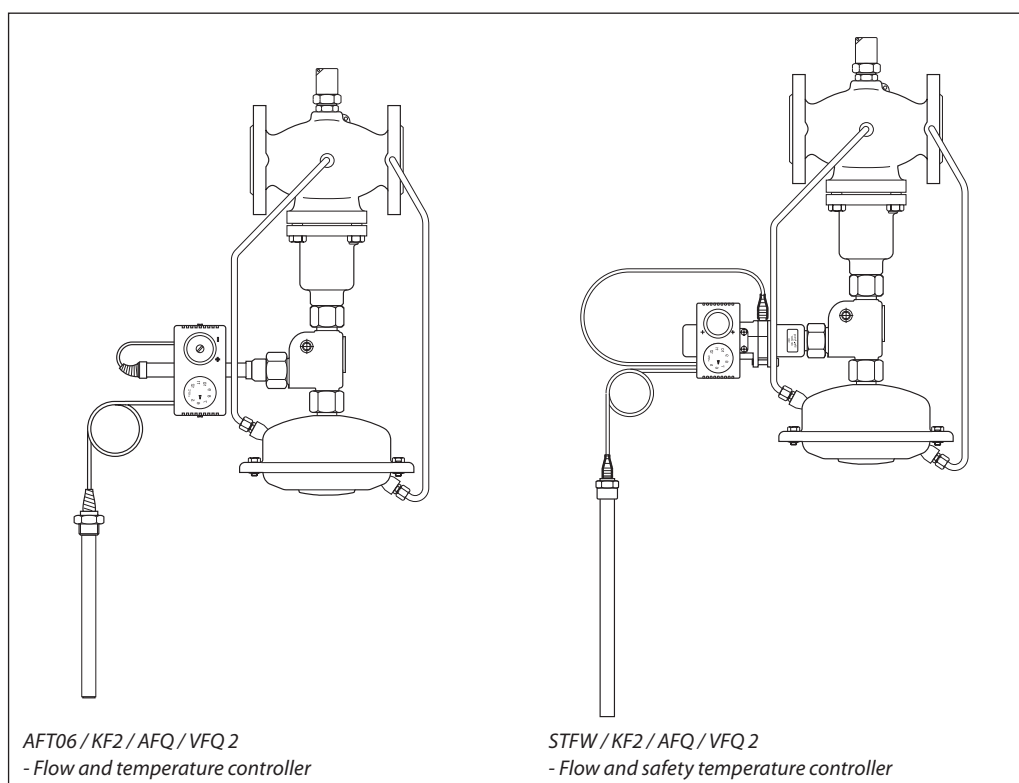
## Combinations

**Example:**  
Flow temperature controller, return mounting; DN 15;  $k_{VS}$  4,0; PN 16; metallic sealing; flow restrictor  $\Delta p_b$  0,2 bar;  $t_{max}$  150 °C; flange;

- 1x VFQ 2 DN 15 valve  
Code no: **065B2654**
- 1x AFQ actuator  
Code no: **003G1038**
- 2x Impulse tube set AF  
Code no: **003G1338**
- 1x AFT06 thermostat  
Code no: **065-4390**
- 1x Combination piece KF2  
Code no: **003G1398**

Products will be delivered separately.

**Note:**  
For AFT06 and STFW thermostats data see relevant data sheets



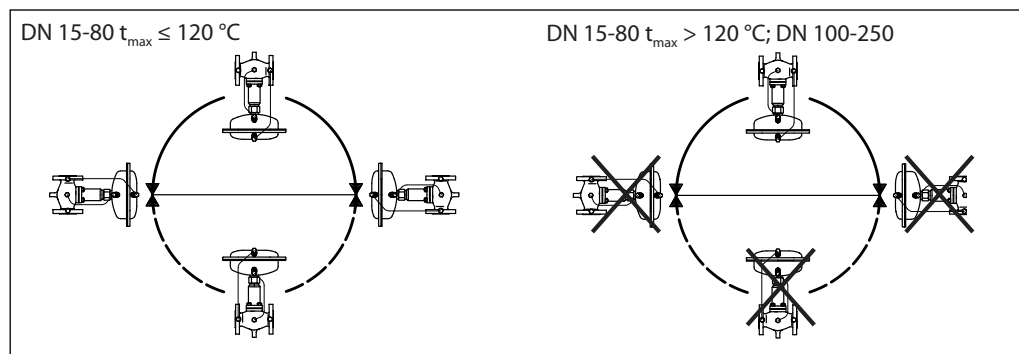
**Installation positions**

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

The controllers can be installed in any position.

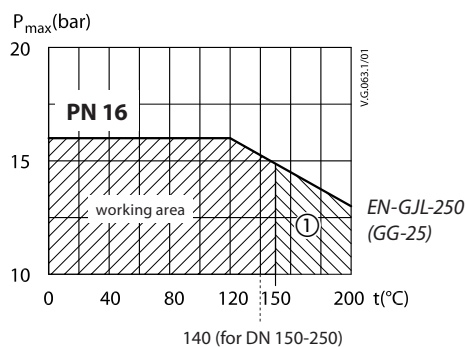
DN 15-80  $t_{\max} > 120^\circ\text{C}$ ; DN 100-250

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

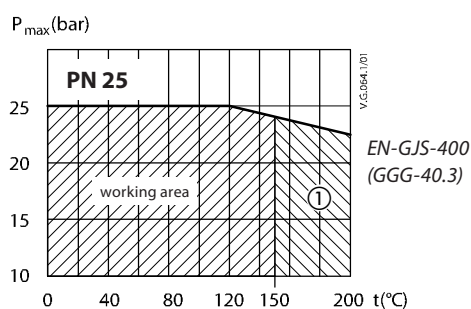


**Pressure temperature diagram**

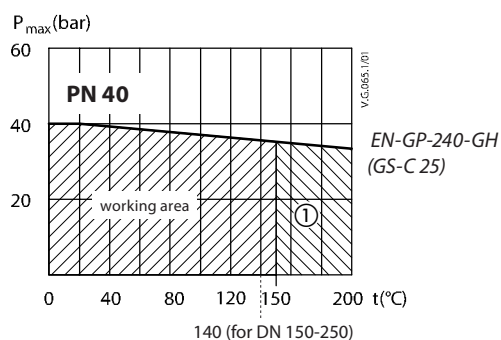
Working area is below P-T line and it ends at  $T_{\max}$  for each valve



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



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



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

**Note:**

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

## Sizing

- Directly connected heating system

### Example 1

Motorised control valve (MCV) for mixing circuit in direct-connected heating system requires differential pressure of 0,3 bar (30 kPa) and flow less than 600 l/h.

Given data:

$$\begin{aligned} Q_{\max} &= 0,6 \text{ m}^3/\text{h} \text{ (600 l/h)} \\ \Delta p_{\min} &= 0,9 \text{ bar (90 kPa)} \\ \Delta p_{\text{circuit}}^{1)} &= 0,1 \text{ bar (10 kPa)} \\ \Delta p_{\text{MCV}} &= 0,3 \text{ bar (30 kPa) selected} \\ \Delta p_b^{2)} &= 0,2 \text{ bar (20 kPa)} \end{aligned}$$

Remark:

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

<sup>2)</sup>  $\Delta p_b$  is differential pressure over flow restrictor.

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

$$\Delta p_{\text{AFQ,A}} = \Delta p_{\min} - \Delta p_{\text{MCV}} = 0,9 - 0,3$$

$$\Delta p_{\text{AFQ,A}} = 0,6 \text{ bar (60 kPa)}$$

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

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

$$k_{VS} = 4,0 \text{ m}^3/\text{h}$$

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

$$\Delta p_{\text{AFQ,MIN}} = \left( \frac{Q_{\max}}{k_{VS}} \right)^2 + \Delta p_b = \left( \frac{0,6}{4} \right)^2 + 0,2$$

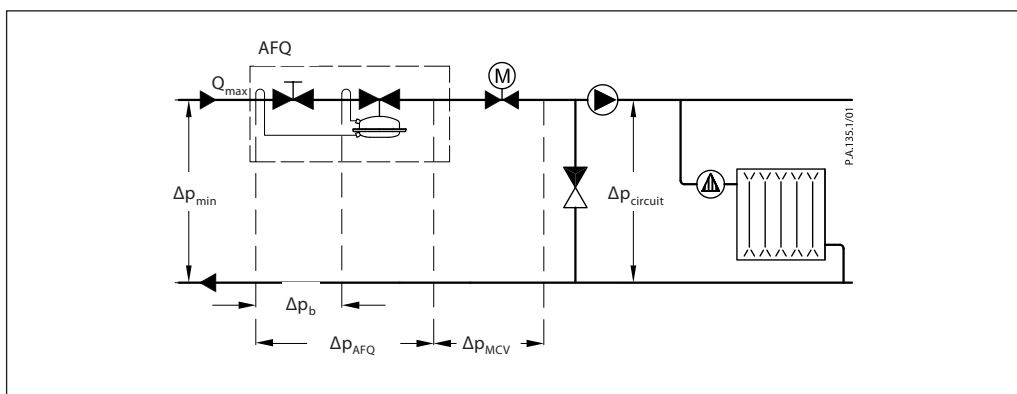
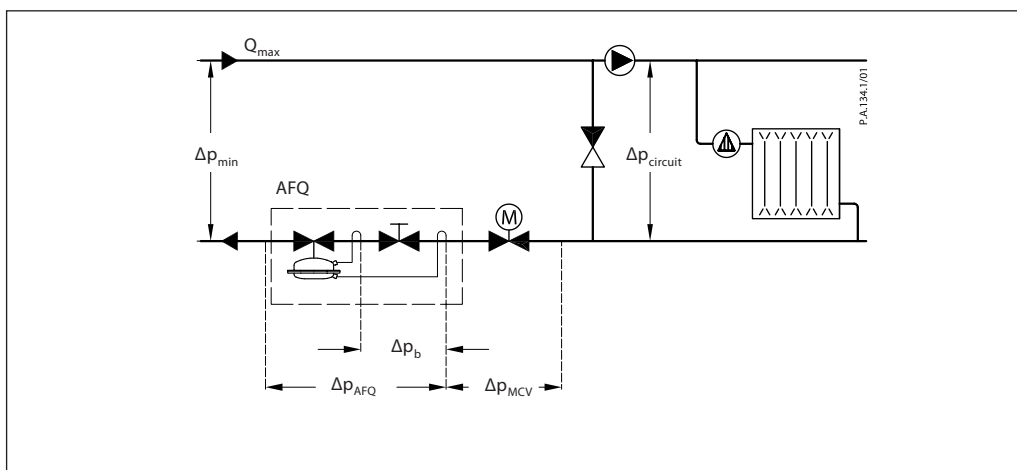
$$\Delta p_{\text{AFQ,MIN}} = 0,22 \text{ bar (22 kPa)}$$

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

$$0,6 \text{ bar} > 0,22 \text{ bar}$$

Solution:

The example selects AFQ DN 15;  $k_{VS}$  value 4,0; flow setting range 0,1-2,0 m<sup>3</sup>/h.



**Sizing (continuous)**

- Indirectly connected heating system

**Example 2**

Motorised control valve (MCV) for indirectly connected heating system requires differential pressure of 0,3 (30 kPa) bar and flow less than 1900 l/h.

Given data:

$$\begin{aligned} Q_{\max} &= 1,9 \text{ m}^3/\text{h} \text{ (1900 l/h)} \\ \Delta p_{\min} &= 1,1 \text{ bar (110 kPa)} \\ \Delta p_{\text{exchanger}} &= 0,1 \text{ bar (10 kPa)} \\ \Delta p_{\text{MCV}} &= 0,3 \text{ bar (30 kPa) selected} \\ \Delta p_b^{1)} &= 0,2 \text{ bar (20 kPa)} \end{aligned}$$

Remark:

<sup>1)</sup>  $\Delta p_b$  is differential pressure over flow restrictor

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

$$\begin{aligned} \Delta p_{\text{AFQ,A}} &= \Delta p_{\min} - \Delta p_{\text{exchanger}} - \Delta p_{\text{MCV}} \\ &= 1,1 - 0,1 - 0,3 \\ \Delta p_{\text{AFQ,A}} &= 0,7 \text{ bar (70 kPa)} \end{aligned}$$

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

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

$$k_{VS} = 4,0 \text{ m}^3/\text{h}$$

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

$$\Delta p_{\text{AFQ,MIN}} = \left( \frac{Q_{\max}}{k_{VS}} \right)^2 + \Delta p_b = \left( \frac{1,9}{4,0} \right)^2 + 0,2$$

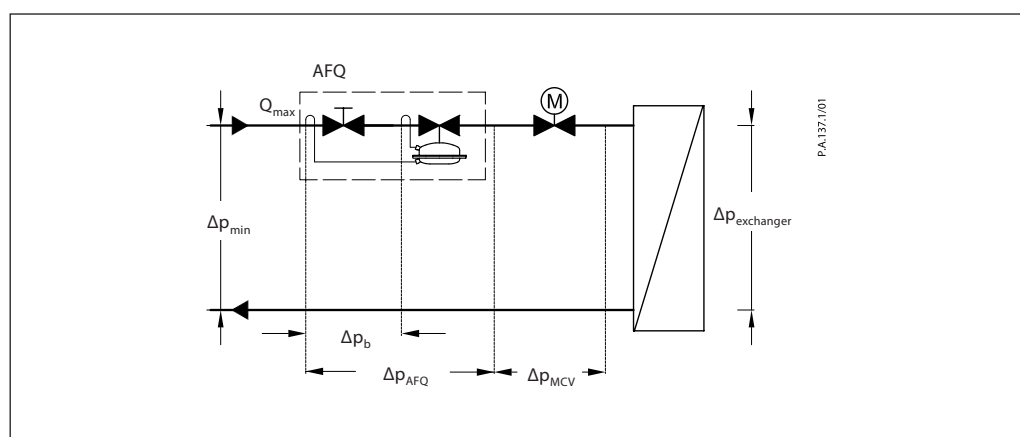
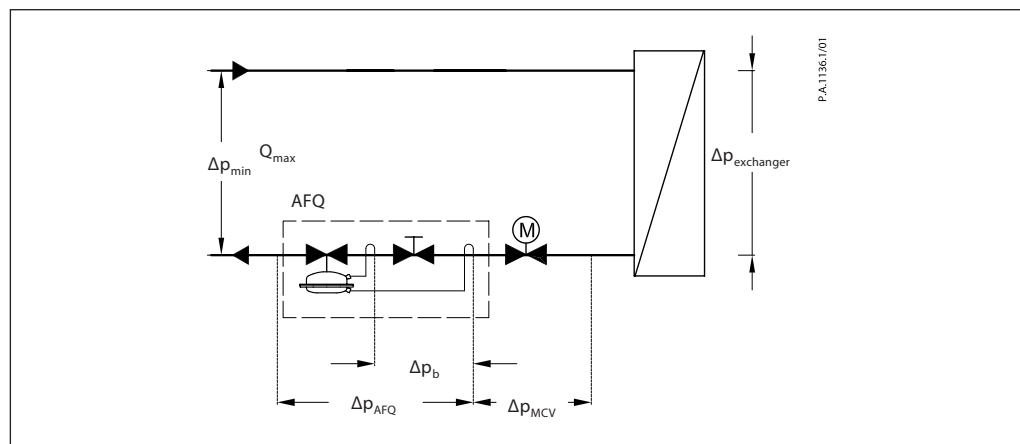
$$\Delta p_{\text{AFQ,MIN}} = 0,43 \text{ bar (43 kPa)}$$

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

$$0,7 \text{ bar} > 0,43 \text{ bar}$$

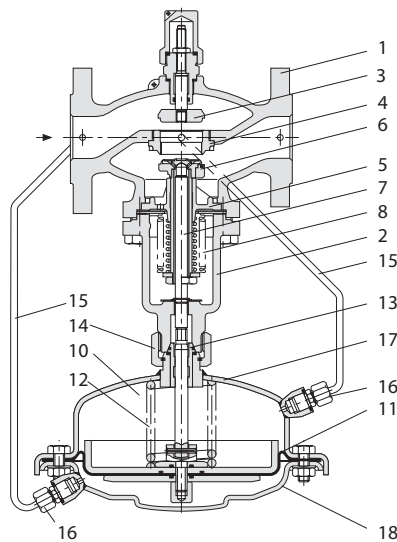
**Solution:**

The example selects AFQ; DN 15;  $k_{VS}$  value 4,0; flow setting range 0,1-2,0 m<sup>3</sup>/h.

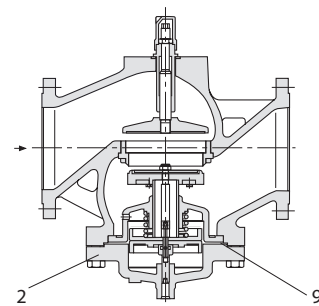


## Design

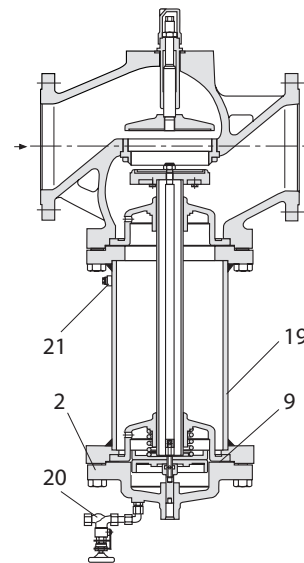
1. Valve body
2. Cover
3. Adjustable flow restrictor
4. Valve seat
5. Valve insert
6. Pressure relieved valve cone
7. Valve stem
8. Bellows for pressure relief of valve cone
9. Diaphragm for pressure relief of valve cone
10. Actuator
11. Control diaphragm for flow control
12. Built-in spring for flow control
13. Stuffing cone
14. Union nut
15. Impulse tube
16. Compression fitting for impulse tube
17. Upper casing of diaphragm
18. Lower casing of diaphragm
19. Valve body extension
20. Shut off valve for water filling
21. Closing plug



AFQ / VFQ 2 DN 15 - 125



VFQ 2(1) DN 150-250,  $t_{max}$  140 °C



VFQ 2 DN 150-250,  $t_{max}$  200 °C

## Function

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

## Settings

### Flow setting

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

Dimensions

