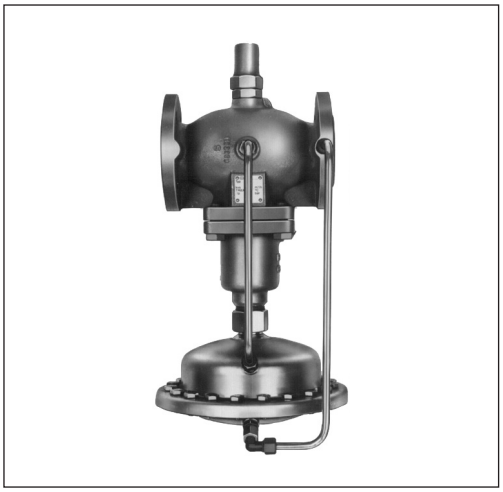
ENGINEERING
**TOMORROW**

**Data sheet**

# Flow controller (PN 16, 25, 40)

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

### Description



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

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)

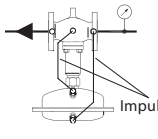
**Main data:**
- DN 15-250
- $k_{VS}$ 4,0-400 m³/h
- Flow range: 0,1-250 m³/h
- PN 16, 25, 40
- Flow restrictor $\Delta p_b$: 0,2 bar or 0,5 bar
- Temperature:
  – Circulation water / glycolic water up to 30 %: 2 … 150/200 °C
- Connections:
  – Flange

### Ordering

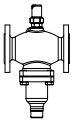
*Example 1:*
*Flow controller; DN 15; $k_{VS}$ 4,0; PN 16; metallic sealing; flow restrictor $\Delta p_b$ 0,2 bar; $T_{max}$ 150 °C; flange;*

– *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 separatly.*




**VFQ 2** Valves (metallic sealing cone)

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

***Note:*** *other valves available on special request.*
*[1] at temperatures above 150 °C only with seal pots (see Accessories)*

**AFQ** Actuators

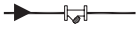
| Picture | Flow restrictor $\Delta p_b$ (bar) | Max. oper. pressure (PN) | Code No. |
|---|---|---|---|
|  | 0,2 | 25 | **003G1024** |
| | 0,5 | | **003G1025** |

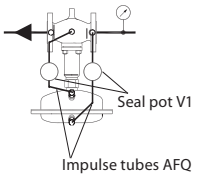
## Ordering *(continuous)*

*Example 2:*
*Flow controller; DN 15; $k_{VS}$ 4,0; PN 25; metallic sealing; flow restrictor $\Delta p_b$ 0,2 bar; $T_{max}$ 200 °C; flange;*

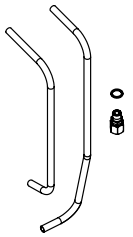
- *1× VFQ 2 DN 15 valve*
  *Code no:* ***065B2667***
- *1× AFQ actuator*
  *Code no:* ***003G1024***
- *2× AFQ DN 15 impulse tubes*
  *Code no:* ***003G1391***
- *2× Seal pot V1*
  *Code no:* ***003G1392***

*Products will be delivered separatly.*



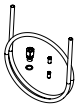
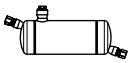



## Accessories

| Picture | Type designation | For controller | DN (mm) | PN | Code No. |
|---|---|---|---|---|---|
|  | Impulse tubes [1] (Stainless steel) | AFQ | 15 | 16, 25, 40 | **003G1338** |
| | | | 20 | | |
| | | | 25 | | **003G1340** |
| | | | 32 | | |
| | | | 40 | | **003G1342** |
| | | | 50 | | **003G1343** |
| | | | 65 | | **003G1344** |
| | | | 80 | | |
| | | | 100 | | **003G1346** |
| | | | 125 | | **003G1347** |
| | | | 150 | | **003G1348** |
| | | | 200 | 16 | **003G1414** |
| | | | | 40 | **003G1349** |
| | | | 250 | 16 | **003G1350** |
| | | | | 40 | **003G1404** |

*[1] With combination piece KF2 or KF3 use 2× **003G1391** at PN 16 and T<150 °C. Otherwise impulse tubes on special request.*

## Accessories

| Picture | Type designation | Description | Ordering number | | Code No. |
|---|---|---|---|---|---|
|  | Impulse tube set AF | – 1× Copper tube Ø10 × 1 × 1500 mm<br>– 1 × compression fitting for imp. tube connection to pipe (G ¼)<br>– 2 × socket | DN 15-150 | 2× | **003G1391** |
| | | | DN 200, 250 | 3× | |
|  | Seal pot V1 [1] | Capacity 1 liter; with compression fittings for imp. tube Ø10 | AFQ | 2× | **003G1392** |
|  | Compression fitting [2] | For impulse tube Ø10 connections to controller | G ¼ | | **003G1468** |
|  | Combination piece KF3 | For combination with pressure and electrical actuators | G 1¼ / 2× G 1¼ | | **003G1397** |
| | Combination piece KF2 | For combination with thermostat | | | **003G1398** |
|  | Shut off valve | For impulse tube Ø10 | – | | **003G1401** |
|  | Throttle valve | | | | **065B2909** |

*[1] Seal pot has to be used on impulse tubes always when $T_{max} \geq 150$ °C*
*[2] Consist of a nipple, compression ring and nut*

## Service kits

| Picture | Type designation | For valve | DN (mm) | $k_{VS}$ ($m^3/h$) | 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** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $k_{VS}$ value of Δp regulator | | | | 4,0 | 6,3 | 8,0 | 16 | 20 | 32 | 50 | 80 | 125 | 160 | 280 | 320 | 400 |
| Range of max. flow setting | $\Delta p_b$ [1] = 0,2 bar | from | | 0,1 | 0,2 | 0,2 | 0,4 | 0,6 | 0,8 | 3 | 4 | 6 | 8 | 12 | 15 | 18 |
| | | to | $m^3/h$ | 2 | 3 | 4 | 7 | 11 | 16 | 28 | 40 | 63 | 80 | 125 | 150 | 180 |
| | $\Delta p_b$ [1] = 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 $k_{VS}$) | | VFQ 2 | | ≤0,03 | | | | | | | | | | ≤0,05 | | |
| | | VFQ 21 | | ≤0,01 | | | | | | | | | | | | |
| Nominal pressure | | | PN | 16, 25, 40 | | | | | | | | | | | | |
| Min. differential pressure for max flow [2] | $\Delta p_b$ [1] = 0,2 | | bar | 0,5 | 0,4 | 0,5 | 0,4 | 0,5 | | | | | | 0,4 | | |
| | $\Delta p_b$ [1] = 0,5 | | | 0,8 | 0,7 | 0,8 | 0,7 | 0,8 | | | | | | 0,7 | | |
| Max. differential pressure | PN 16 | | | 16 | | | | | | | | 15 | | 12 | 10 | |
| | PN 25, 40 | | | 20 | | | | | | | | | | | | |
| Media | | | | Circulation water / glycolic water up to 30 % | | | | | | | | | | | | |
| Media pH | | | | Min. 7, max. 10 | | | | | | | | | | | | |
| Media temperature | VFQ 2 | | °C | 2 … 150 / 2 … 200 [2] | | | | | | | | | | 2 … 150 | | |
| | 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) | | |

[1] *$\Delta p_b$ – differential pressure over flow restrictor*

[2] *For flows smaller than $Q_{max}$ ->* $\Delta p_{min} = \left(\frac{Q}{k_{VS}}\right)^2 + \Delta p_b$

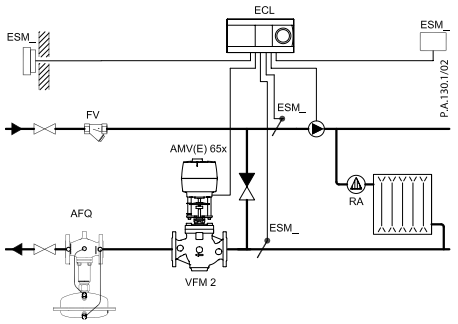
[3] *at temperatures above 150 °C only with seal pots (see Accessories)*

### Actuator

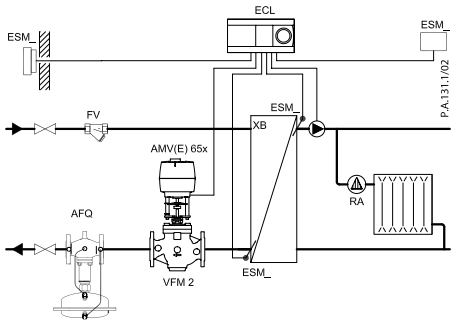
| **Type** | | **AFQ** |
|---|---|---|
| Actuator size | $cm^2$ | 250 |
| Max. operational pressure | PN | 25 |
| Flow restrictor diff. press. $\Delta p_b$ | bar | 0,2 / 0,5 |
| **Materials** | | |
| Actuator housing | | Stainless steel, mat. No.1.0338, zinc plated and yellow chromate |
| Control diaphragm | | EPDM (Rolling; fibre enforced) |

## Application principles

*– Return mounting*

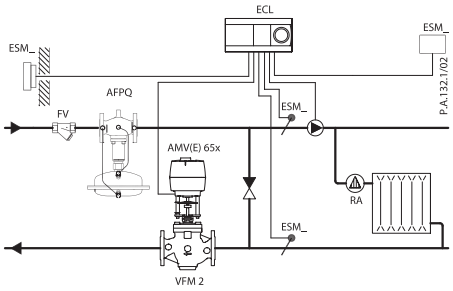



*Direct-connected heating system*

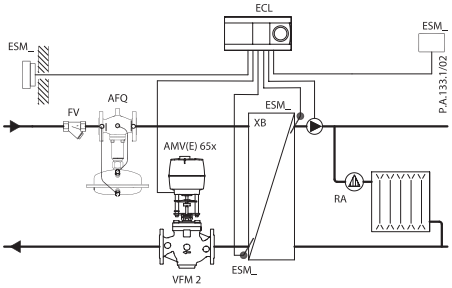



*Indirectly connected heating system*

*– Flow mounting*




*Direct-connected heating system*




*Indirectly connected heating system*

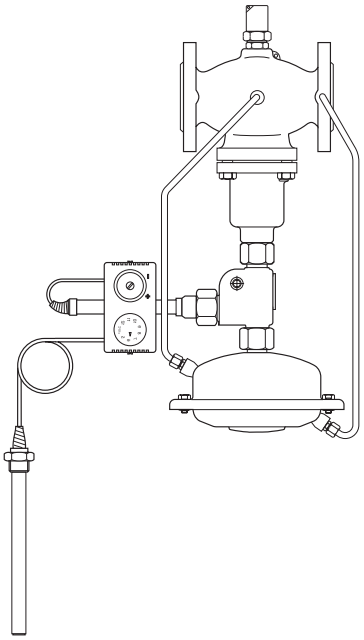
## Combinations

*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;*

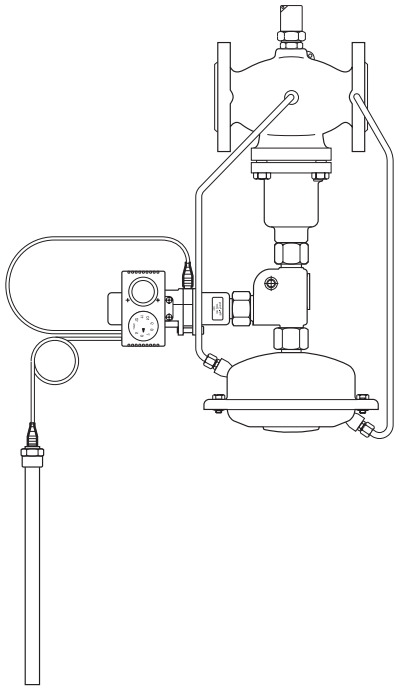
- *1× VFQ 2 DN 15 valve*
  *Code no:* ***065B2654***
- *1× AFQ actuator*
  *Code no:* ***003G1038***
- *2× Impulse tube set AF*
  *Code no:* ***003G1391***
- *1× AFT06 thermostat*
  *Code no:* ***065-4390***
- *1× Combination piece KF2*
  *Code no:* ***003G1398***

*Products will be delievered separatelly.*

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



*AFT06 / KF2 / AFQ / VFQ 2*
*– Flow and temperature controller*



*STFW / KF2 / AFQ / VFQ 2*
*– Flow and safety temperature controller*

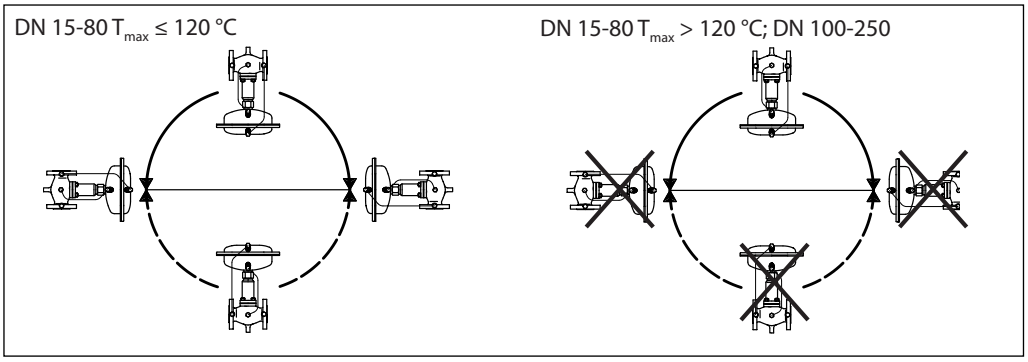
**Installation positions**

DN 15-80 $T_{max}$ ≤ 120 °C

The controllers can be installed in any position.

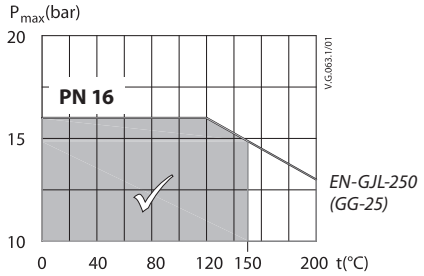
DN 15-80 $T_{max}$ > 120 °C; DN 100-250

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

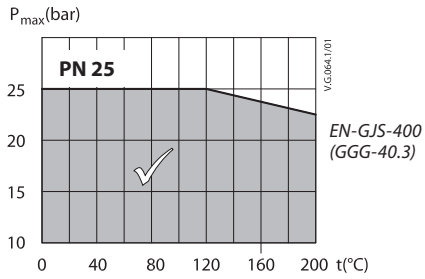



**Pressure temperature diagram**

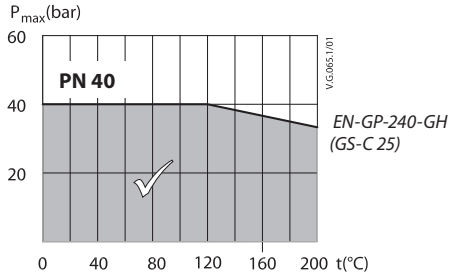
*Working area is below P-T line and it ends at Tmax for each valve*




*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 1092-2)*




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

## Sizing

– *Directly connected heating system*

**Example 1**
Motorised control valve (MCV) for mixing circuit in direct-connected heating system requires differential pressure of 0,3 bar (30 kPa) and flow less than 600 l/h.

*Given data:*

$Q_{max}$ = 0,6 m³/h (600 l/h)
$\Delta p_{min}$ = 0,9 bar (90 kPa)
$\Delta p_{circuit}$ [1)] = 0,1 bar (10 kPa)
$\Delta p_{MCV}$ = 0,3 bar (30 kPa) selected
$\Delta p_b$ [2)] = 0,2 bar (20 kPa)

*Remark:*
[1)] *$\Delta p_{circuit}$ corresponds to the required pump pressure in the heating circuit and is not to be considered when sizing the AFQ.*
[2)] *$\Delta p_b$ is differential pressure over flow restrictor.*

The total (available) pressure loss across the controller is:
$\Delta p_{AFQ,A} = \Delta p_{min} - \Delta p_{MCV} = 0{,}9 - 0{,}3$
$\Delta p_{AFQ,A}$ = 0,6 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 m³/h

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

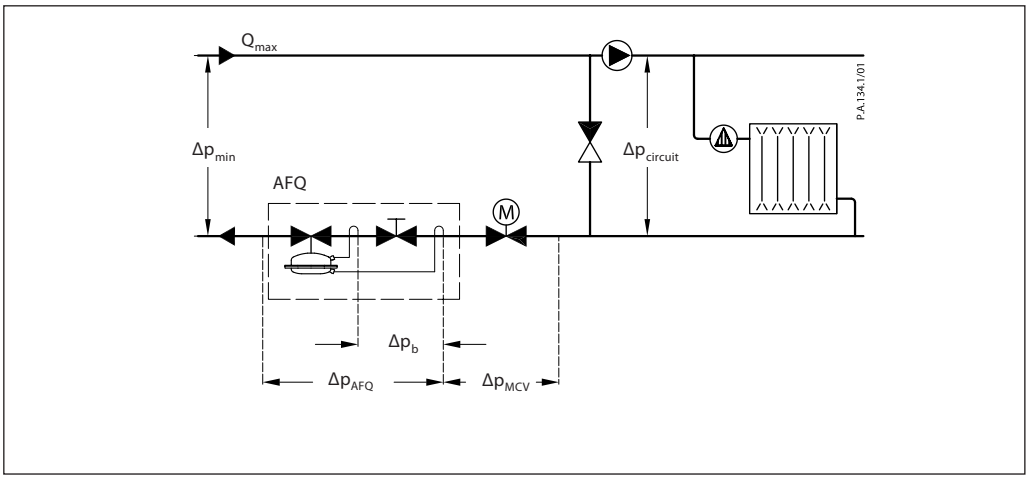
$$\Delta p_{AFQ,MIN} = \left(\frac{Q_{max}}{k_{VS}}\right)^2 + \Delta p_b = \left(\frac{0{,}6}{4}\right)^2 + 0{,}2$$

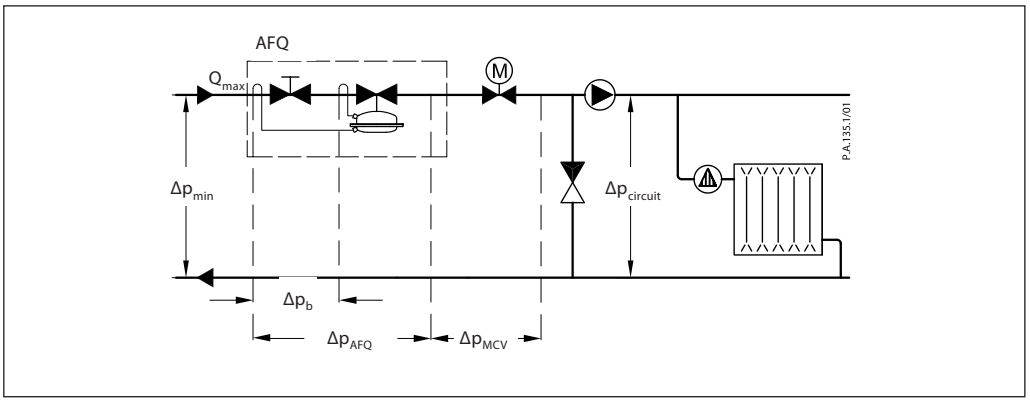
$\Delta p_{AFQ,MIN}$ = 0,22 bar (22 kPa)

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

0,6 bar > 0,22 bar

*Solution:*
The example selects AFQ DN 15; $k_{VS}$ value 4,0; flow setting range 0,1-2,0 m³/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:*

$Q_{max}$ = 1,9 m³/h (1900 l/h)
$\Delta p_{min}$ = 1,1 bar (110 kPa)
$\Delta p_{exchanger}$ = 0,1 bar (10 kPa)
$\Delta p_{MCV}$ = 0,3 bar (30 kPa) selected
$\Delta p_b$ [1)] = 0,2 bar (20 kPa)

*Remark:*
[1)] *$\Delta p_b$ is differential pressure over flow restrictor*

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

$\Delta p_{AFQ,A} = \Delta p_{min} - \Delta p_{exchanger} - \Delta p_{MCV}$
$= 1{,}1 - 0{,}1 - 0{,}3$
$\Delta p_{AFQ,A}$ = 0,7 bar (70 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 m³/h

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

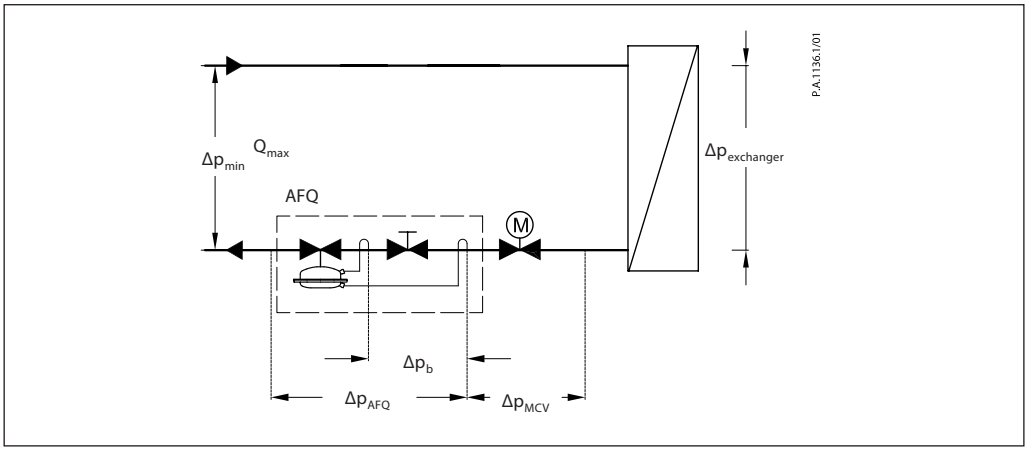
$$\Delta p_{AFQ,MIN} = \left(\frac{Q_{max}}{k_{VS}}\right)^2 + \Delta p_b = \left(\frac{1{,}9}{4{,}0}\right)^2 + 0{,}2$$

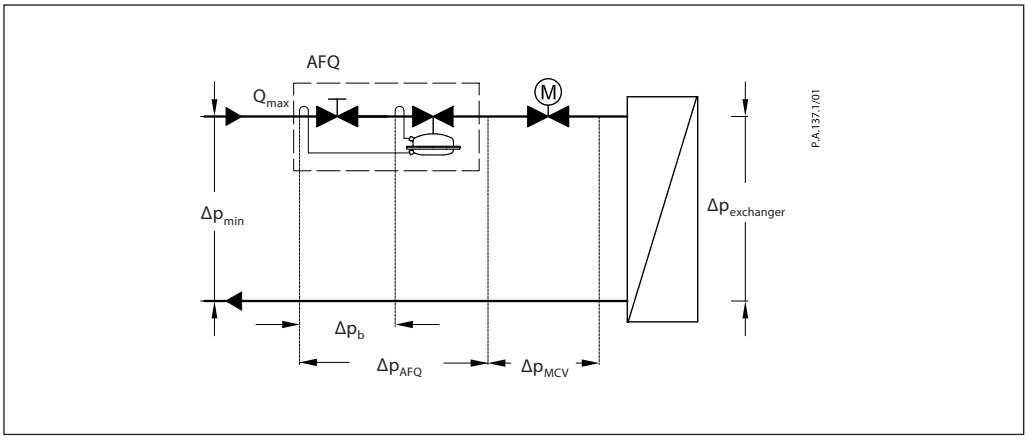
$\Delta p_{AFQ,MIN}$ = 0,43 bar (43 kPa)

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

0,7 bar > 0,43 bar

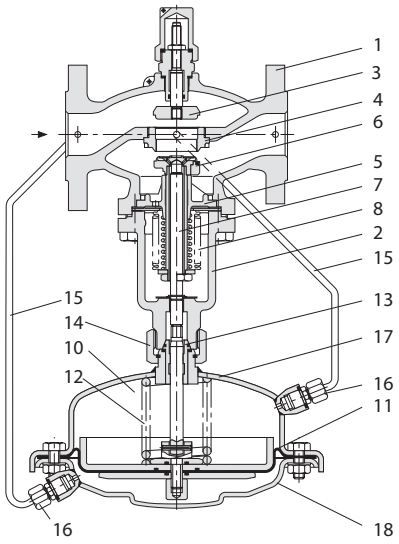
*Solution:*
The example selects AFQ; DN 15; $k_{VS}$ value 4,0; flow setting range 0,1-2,0 m³/h.



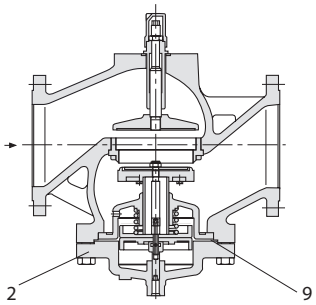



## Design

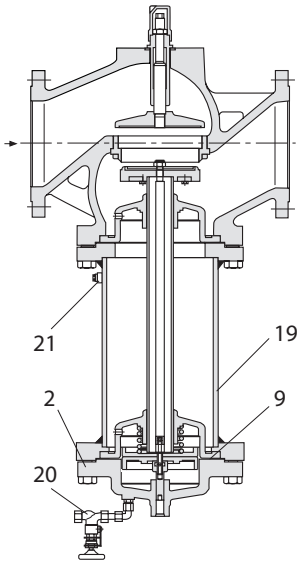
1. Valve body
2. Cover
3. Adjustable flow restrictor
4. Valve seat
5. Valve insert
6. Pressure relieved valve cone
7. Valve stem
8. Bellows for pressure relief of valve cone
9. Diaphragm for pressure relief of valve cone
10. Actuator
11. Control diaphragm for flow control
12. Built-in spring for flow 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, $T_{max}$ 150 °C*




*VFQ 2 DN 150-250, $T_{max}$ 200 °C*

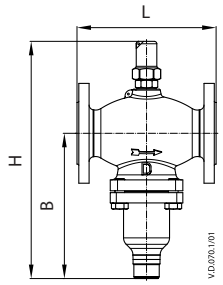
## Function

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.

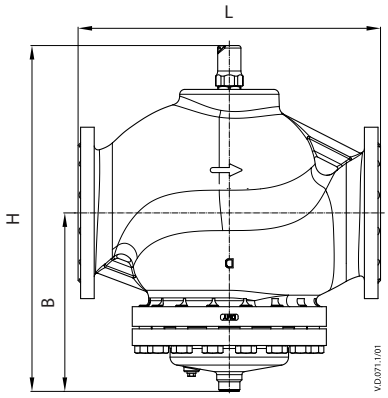
## Settings

*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.

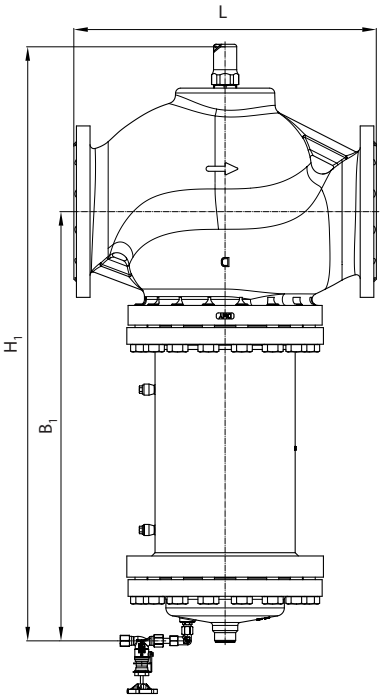
## Dimensions




*VFQ DN 15-125*



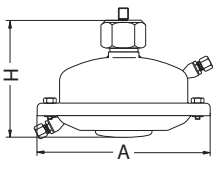

*VFQ DN 150-250*




*VFQ DN 150-250*
*with valve body extension up to 200 °C*

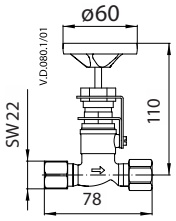
**VFQ 2, VFQ 21** Valves

| DN | | | 15 | 20 | 25 | 32 | 40 | 50 | 65 | 80 | 100 | 125 | 150 | 200 | 250 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L | | mm | 130 | 150 | 160 | 180 | 200 | 230 | 290 | 310 | 350 | 400 | 480 | 600 | 730 |
| B | | mm | 213 | 213 | 239 | 239 | 241 | 241 | 276 | 276 | 381 | 381 | 326 | 354 | 401 |
| H | | mm | 337 | 337 | 374 | 374 | 393 | 393 | 440 | 440 | 575 | 575 | 595 | 686 | 756 |
| Weight | PN 16 / 25 | kg | 8 | 9 | 10,5 | 12,5 | 15,5 | 18,5 | 28,5 | 31 | 61 | 71 | 120 | 193 | 337 |
| | PN 40 | kg | | | | | | | 31 | 34 | 63 | 72 | 147 | 264 | 347 |
| $B_1$ | | mm | | | | | | | | | | | 620 | 852 | 1199 |
| $H_1$ | | mm | | | | | | | | | | | 889 | 1184 | 1555 |
| Weight (valve with body extension) | PN 16 / 25 | kg | | | | | | | | | | | 160 | 314 | 489 |
| | PN 40 | kg | | | | | | | | | | | 187 | 350 | 526 |

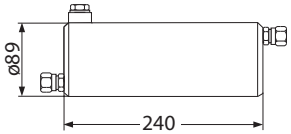



**AFQ** Actuator

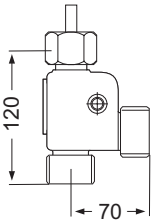
| Size | cm² | 250 |
|---|---|---|
| Ø A | mm | 263 |
| H | mm | 160 |
| Weight | kg | 9 |



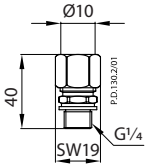

*Shut off valve*




*Seal pot V1*




*Comb. piece KF2, KF3*




*Compression fitting*