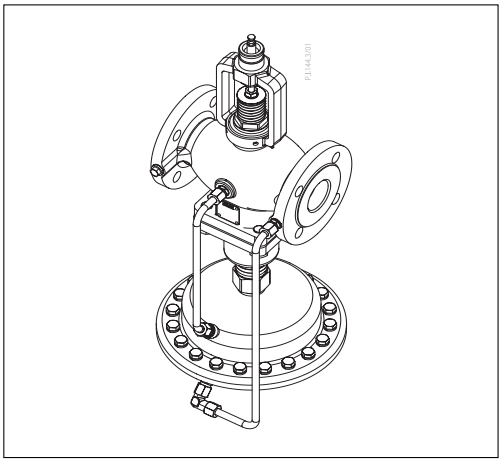
ENGINEERING
**TOMORROW**

**Data sheet**

# Pressure independent control valve with integrated flow limiter **AFQM 6 DN 40, 50** - return and flow mounting

## Description



AFQM 6 is a self-acting flow controller with integrated control valve with full authority, primarily for use in district heating systems. The controller closes when set max. flow is exceeded. In combination with Danfoss electrical actuators AMV(E) can be controlled by ECL electronic controllers.

The AFQM 6 is pressure independent which means that the control characteristic is independent from the available pressure and is not influenced by a low authority.

The controller has a control valve with adjustable flow restrictor, connection neck for electrical actuator and an actuator with one control diaphragm. Control valve AFQM 6 DN40-50 is not pressure relieved.

Controllers are used together with Danfoss electrical actuators:
- AFQM 6 PN 16/25 DN 40-50 [1)]
  - AMV(E) 65x [1]
    without spring return function and with manual operation:
  - AMV(E) 655
    spring return function and manual operation:
  - AMV(E) 658 SD [2)]

Spring return function, without mechanical operation:
- AMV(E) 659 SD [3)]
- AMV(E) 55, 56

[1)] *For AFQM 6 PN 16/25 controllers, produced before March 2015, adapter code 065B3527 need to be separately ordered*

[2)] *not DIN approved*

[3)] *DIN approved ,according to EN 14597*

**Main data:**
- DN 40-50
- $k_{VS}$ 20-32 $m^3/h$
- Flow range 2.2-16 $m^3/h$
- PN 16, 25, 40*
  ** PN 40 on special request*
- Flow restrictor $\Delta p_{MCV}$: 0.2 bar
- Temperature:
  - Circulation water / glycolic water up to 30 %: 2 … 150 °C
- Connections:
  - Flange
- AFQM 6 combined with AMV(E) 659 SD have been DIN approved according to EN 14597.

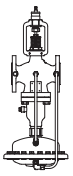
## Ordering

*Example:*
*Flow controller with integrated control valve, DN 50, $k_{VS}$ 32, PN 16, flow restrictor $\Delta p_{MCV}$ 0.2 bar, $T_{max}$ 150 °C, flange*

- *1× AFQM 6 DN 50 controller Code No.:* ***003G1083***

*The controller will be delivered completely assembled, inclusive impulse tubes between valve and actuator. Electrical actuator AMV(E) must be ordered separately.*

**AFQM 6** Controller

| Picture | DN | $k_{VS}$ m³/h | PN | Connection | Code No. $\Delta P_{MCV}$=0.2 bar |
|---|---|---|---|---|---|
|  | 40 | 20 | 16 | Flange EN 1092-1 | **003G1082** |
| | 50 | 32 | | | **003G1083** |
| | 40 | 20 | 25 | | **003G1084** |
| | 50 | 32 | | | **003G1085** |
| | | | | | |

**Service kits**

| | Type designation | For controller | $\Delta p_{MCV}$ (bar) | Code No. |
|---|---|---|---|---|
|  | Actuator | AFQM 6 | 0.2 | **003G1024** |

## Technical data

**AFQM 6** valve

| Nominal diameter | | DN | 40 | 50 |
|---|---|---|---|---|
| $k_{VS}$ value | | m³/h | 20 | 32 |
| Max. flow setting ($Q_{max}$) | $\Delta p_{MCV}$ [1] = 0.2 bar | m³/h | 11 | 16 |
| Stroke | | mm | 8 | 12 |
| Control valve authority | | % | 100 | |
| Control characteristic | | | Linear [3] | |
| Cavitation factor z | | | 0.55 | 0.5 |
| Leakage acc. to standard IEC 534 | | % of $k_{VS}$ | ≤ 0.01 | |
| Nominal pressure | | PN | 16, 25 | |
| Min. differential pressure | | bar | see remark [2] | |
| Max. differential pressure PN 16 | | bar | 16 | |
| Max. differential pressure PN 25 | | bar | 20 | |
| Medium | | | Circulation water / glycolic water up to 30% | |
| Medium pH | | | Min.7, max.10 | |
| Medium temperature | | °C | 2 … 150 | |
| Connections | | | Flange | |
| **Materials** | | | | |
| Valve body | | PN 16 | Grey cast iron EN-GJL-250 (GG-25) | |
| | | PN 25 | Ductile cast iron EN-GJS-400-18-LT (GGG-40.3) | |
| Valve seat DP, CV | | | Stainless steel mat. No. 1.4021 | |
| Valve cone DP, CV | | | Stainless steel mat. No. 1.4404 | |
| Sealing DP | | | EPDM | |
| Sealing CV | | | Metal | |
| Pressure relieve system | Control valve insert | | - | |
| | Valve insert | | Bellows (Stainless steel mat. No. 1.4571) | |

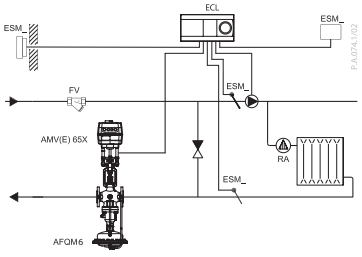
***Note:***
*DP - differential pressure controller, CV - control valve*
[1] *$\Delta p_{MCV}$ - differential pressure over flow restrictor*
[2] *Depends on the flow rate and valve $k_{VS}$; For $Q_{set} = Q_{max}$ -> $\Delta p_{min} \geq 0.5$ bar; For $Q_{set} < Q_{max}$ ->* $\Delta p_{min} = \left(\frac{Q}{k_{VS}}\right)^2 + \Delta p_{MCV}$
[3] *Could be converted by actuator AME 65x to logarithmic*

**AFQM 6** Actuator

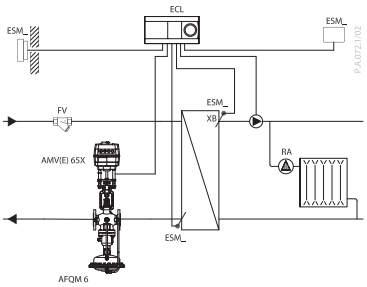
| For valve | DN | 40 | 50 |
|---|---|---|---|
| Actuator size | cm² | 250 | |
| Max. operational pressure | bar | 25 | |
| Flow restrictor diff. pressure $\Delta P_{MCV}$ | bar | 0.2 | |
| **Materials** | | | |
| Housing | | Stainless steel M. No. 1.0338 | |
| Diaphragm | | EPDM (Rolling; fibre enforced) | |
| Impulse tube | | Stainless steel tube Ø10 × 0.8 mm | |

**Application principles**

*- Return mounting*

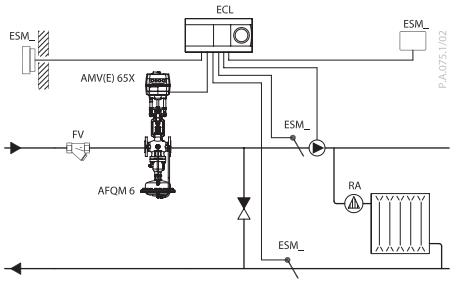



*Direct-connected heating system*

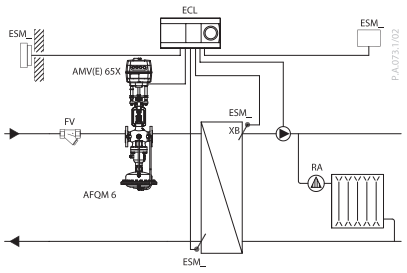



*Indirectly connected heating system*

*- Flow mounting*




*Direct-connected heating system*




*Indirectly connected heating system*

**Installation positions**

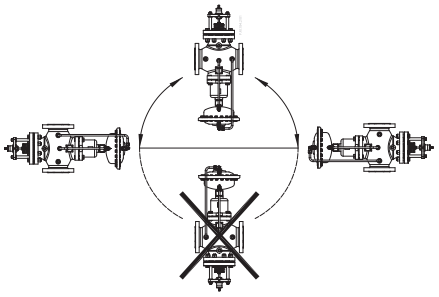
DN 40-50 $T_{max}$ ≤ 120 °C

The controllers can be installed, with connection neck pointing in horizontal direction or upwards.

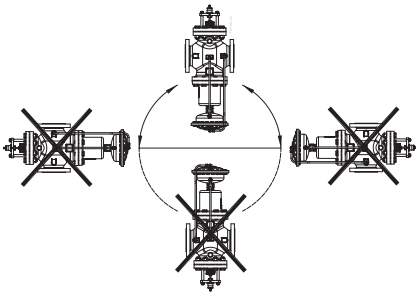
DN 40-50 $T_{max}$ > 120 °C

The controllers can be installed, with connection neck pointing upwards.

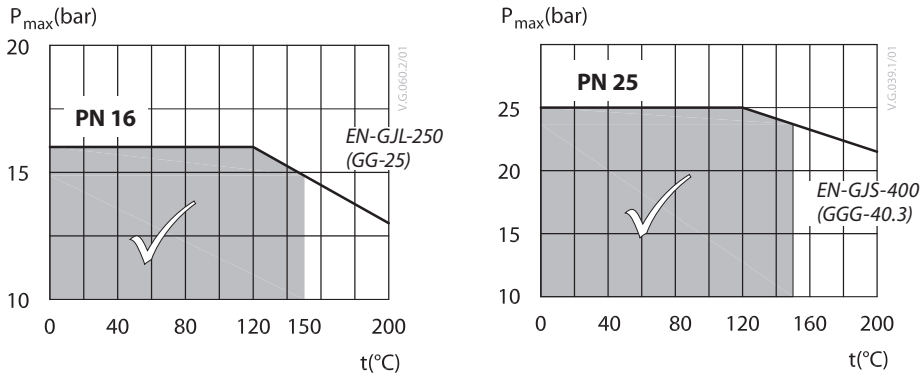
DN 40-50 $T_{max}$ ≤ 120 °C



DN 40-50 $T_{max}$ > 120 °C



## Pressure temperature diagram

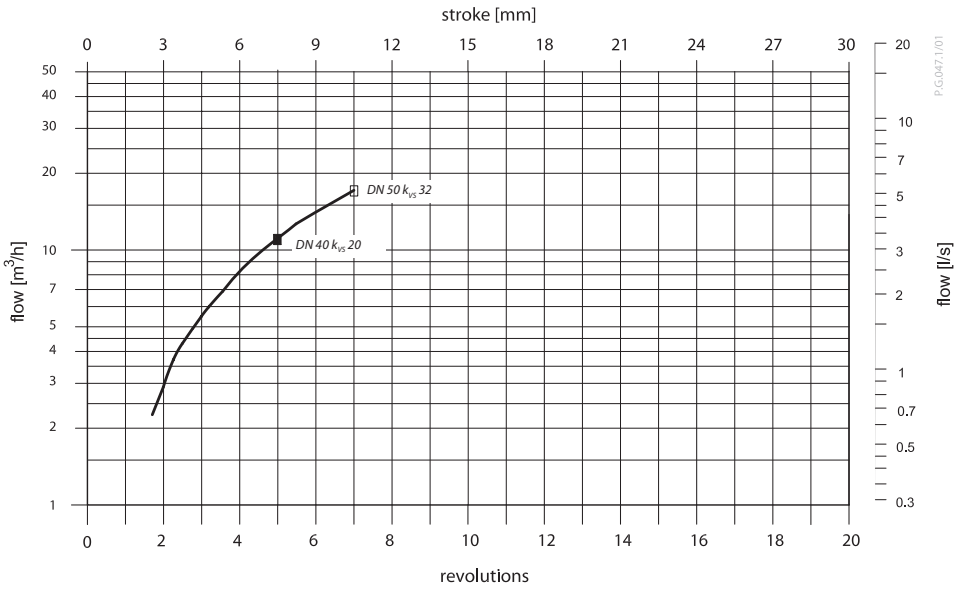



*Maximum allowed operating pressure as a function of medium temperature (according to EN 1092-2)*

## Flow diagram

*Sizing and setting diagram*

Relation between actual flow and number of revolutions on flow restictor. Values given are approximate.




**1 = 360°**

*Flow can be adjusted by turning flow restrictor screw counter-clockwise as shown in this diagram, flow should not be limited to less than 20% of maximum valve capacity.*

*Water flow shown at differential pressure across flow restrictor **0.2 bar** (20 kPa) and across the controller from 0.5 bar (50 kPa) to max. diff. pressure.*

## Sizing

- *Directly connected heating system*

**Example 1**
Motorised control valve (MCV) for mixing circuit in direct-connected heating systems requires differential pressure of 0.2 bar (20 kPa) and flow less than 8000 l/h.

*Given data:*
$Q_{max}$ = 8.0 m³/h (8000 l/h)
$\Delta p_{min}$ = 0.8 bar (80 kPa)
$\Delta p_{circuit}$ [1)] = 0.1 bar (10 kPa)
$\Delta p_{MCV}$ = 0.2 bar (20 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 AFQM.*

The total (available) pressure loss across the controller is:
$\Delta p_{AFQM,A} = \Delta p_{min}$
$\Delta p_{AFQM,A}$ = 0.8 bar (80 kPa)

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

Select controller from flow diagram, page 4, with the smallest possible $k_{VS}$ value considering available flow ranges.

$k_{VS}$ = 20 m³/h

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

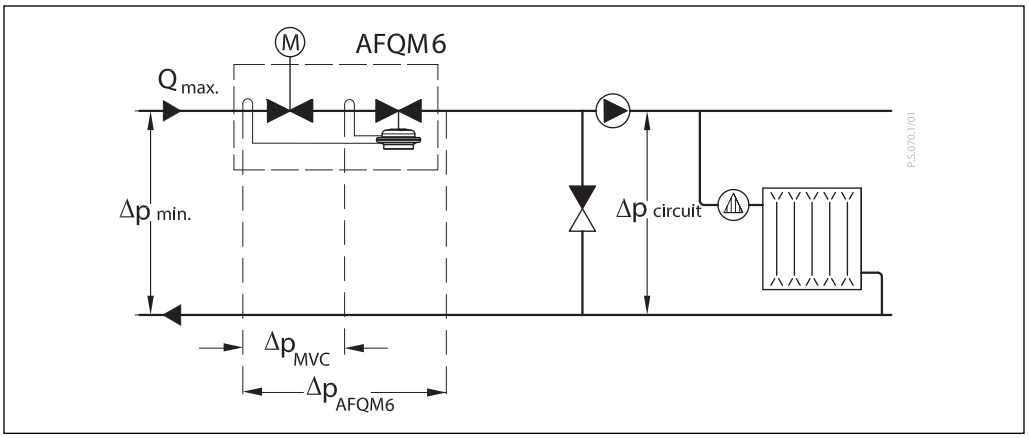
$$\Delta p_{AFQM,MIN} = \left(\frac{Q_{max}}{k_{VS}}\right)^2 + \Delta p_{MCV} = \left(\frac{8.0}{20}\right)^2 + 0.2$$

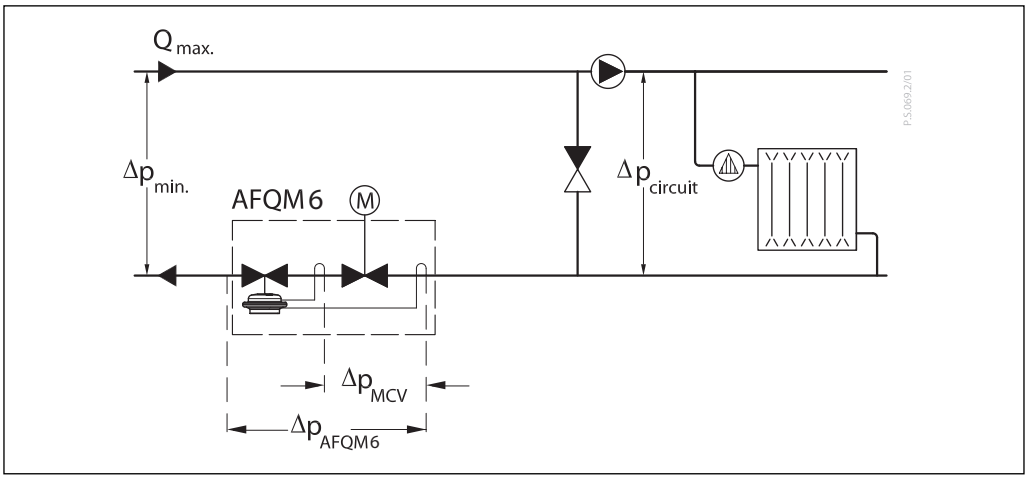
$\Delta p_{AFQM,MIN}$ = 0.36 bar (36 kPa)

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

0.8 bar > 0.36 bar

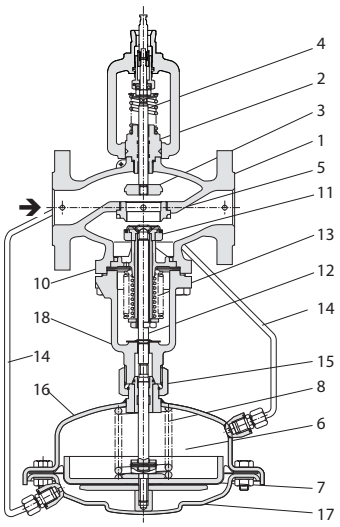
*Solution:*
The example selects AFQM 6 DN 40, $k_{VS}$ value 20, flow setting range 2.2-11 m³/h.



## Design

1. Valve body
2. Control valve insert
3. Adjustable flow restrictor
4. Control valve stem
5. Valve seat
6. Actuator
7. Control diaphragm for flow control
8. Built-in spring for flow rate control
9. Excess pressure safety valve
10. Valve insert
11. Pressure relieved valve cone
12. Valve stem
13. Bellows for pressure relief of valve cone
14. Impulse tube
15. Union nut
16. Upper casing of diaphragm
17. Lower casing of diaphragm
18. Cover




*AFQM 6 DN 40, 50*

## Function

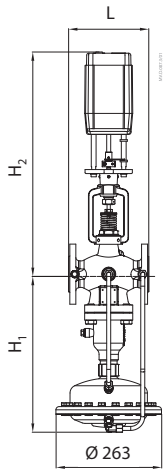
Flow volume causes pressure drop across the adjustable flow restrictor. Resulting pressures are being transferred through the impulse tubes to the actuator chambers and act on control diaphragm for flow control. The flow restrictor diff. pressure is controlled and limited by means of built-in spring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

Additionally the electrical actuator will operate from zero to set max. flow according to the load.

## Settings

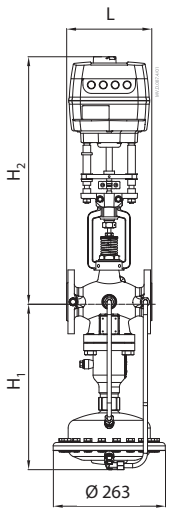
*Flow setting*
Flow setting is being done by the adjustment of the flow restrictor position. The adjustment can be performed on the basis of flow adjustment diagram (see relevant instructions) and/or by the means of heat meter.

## Dimensions




*AMV(E) 55, 56/AFQM 6*

| DN | L | $H_1$ | $H_2$ | Valve weight |
|---|---|---|---|---|
| | mm | | | (kg) |
| **40** | 200 | 390 | 645 | 17 |
| **50** | 230 | 390 | 645 | 22 |




*AMV(E) 65X/AFQM 6* [1)]

| DN | L | $H_1$ | $H_2$ | Valve weight |
|---|---|---|---|---|
| | mm | | | (kg) |
| **40** | 200 | 390 | 590 | 17 |
| **50** | 230 | 390 | 590 | 22 |

[1)] *For AFQM 6 PN 16/25 and AFQM PN 25/40 controllers, produced before March 2015, adapter code 065B3527 need to be separately ordered*

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