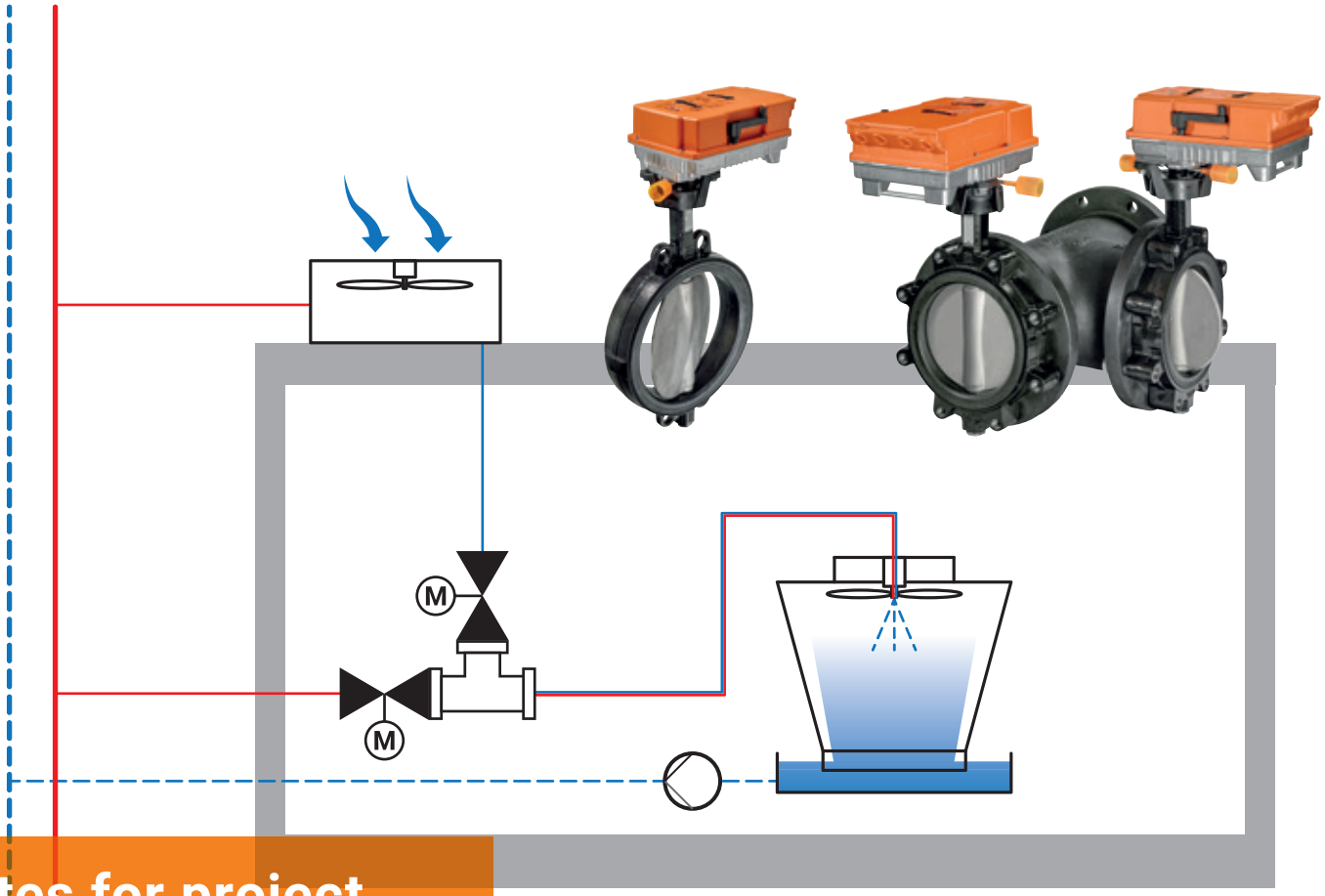



# Notes for project planning

## Butterfly valves for open/close, changeover and control applications

Edition 2022-08/A

BELIMO

# Table of contents

# Table of contents



BELIMO

# Introduction

## Open/close and changeover applications

Energy savings and the reduction of leakages will become even more important in the future. The generation outputs of boilers or chilling systems are divided up into different performance level categories. Depending on the load, the generators will then be switched on or off. The generators will be blocked in order to minimise performance loss. The leakage rate shall be kept as low as possible. The pressure drop should be minor when the valve is open completely. These are prerequisites for minimising the electrical power of the pumps and thus for lowering operating costs.

## Typical applications

### Boiler sequential control

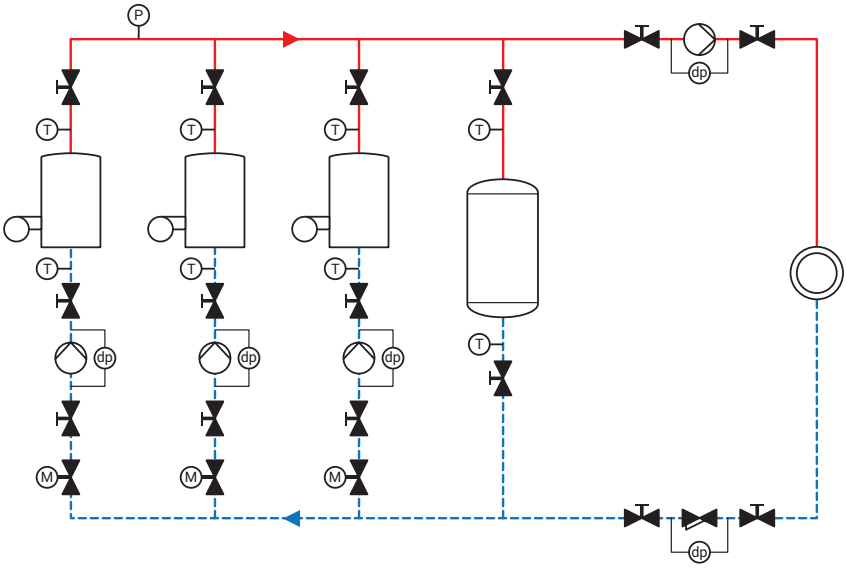



Illustration example
Examples described in detail are listed in the application brochures on heat generation, chillers and cooling towers. Further information: www.belimo.com.

### Shutting off the chiller and bypassing the closed cooling tower

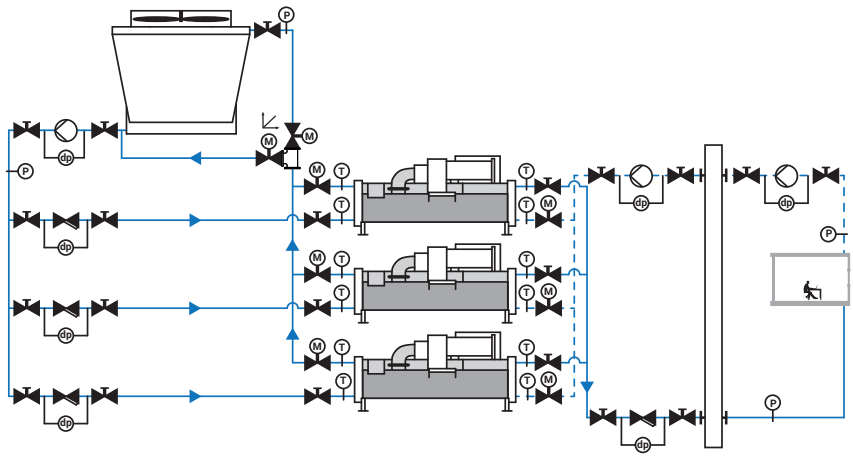



Illustration example
Examples described in detail are listed in the application brochures on heat generation, chillers and cooling towers. Further information: www.belimo.com.

## Control applications and parametrisation

An opening angle of 60% is recommended as standard for control applications, no matter what the parametrised characteristic curve is. Belimo butterfly valves exhibit an equal-percentage characteristic curve in accordance with VDI 2176 for opening angles between 0% and 60%.
For butterfly valves with PR..BAC actuator, the flow characteristic can be parametrised to equal-percentage or linear via the Belimo Assistant App (NFC). Thanks to the parametrisable linear characteristic curve, 3-way control butterfly valves have a constant mixing characteristic curve, which is perfect for control applications.

## Typical applications

### Chiller start-up circuit

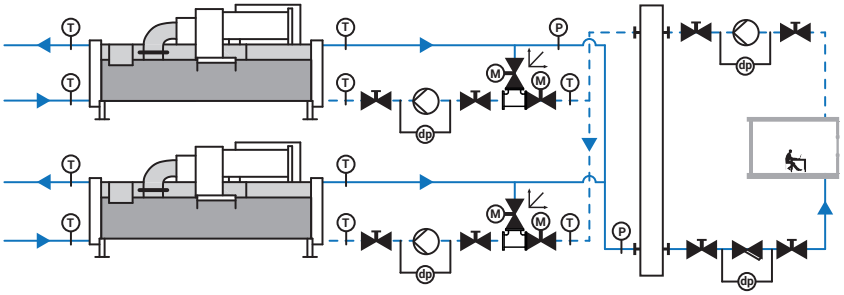


Illustration example
Examples described in detail are listed in the application brochures on heat generation, chillers and cooling towers. Further information: www.belimo.com.

### Bypassing chiller with 2-way control valve

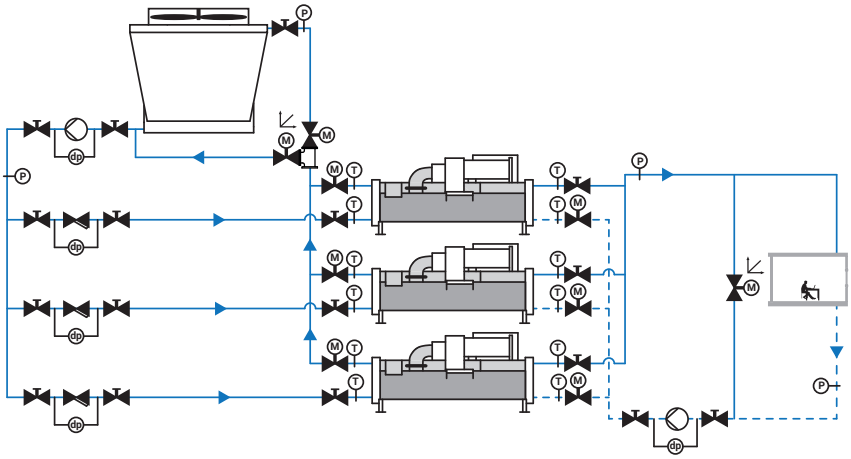


Illustration example
Examples described in detail are listed in the application brochures on heat generation, chillers and cooling towers. Further information: www.belimo.com.

## Butterfly valve and actuator product range

24 V and 230 V rotary actuators with different functionalities, auxiliary switches, and with or without fail-safe in a variety of torque classes ranging from 20 to 3500 Nm are available for the motorisation of the BELIMO wafer and lug-type butterfly valves (DN 25...700) for indoor and outdoor applications: SR..A-5, SRF..A-5, SR..P-5, GR..A-5, DR..A-5, DR..A-7, PR.. and SY..
The butterfly valves can also be manually operated with a lever or worm gear, although worm gears are recommended only for indoor applications.

**Wafer-type butterfly valve with lever**

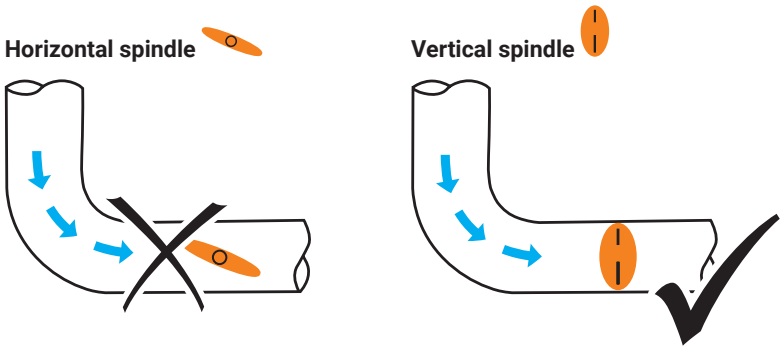
**Lug-type butterfly valve with worm gear**

**Wafer-type butterfly valve with SR..A-5 actuator**

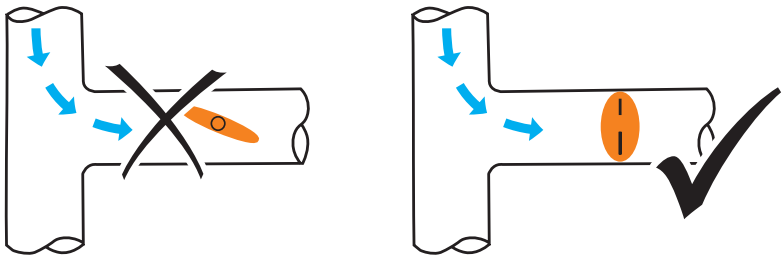
**Wafer-type butterfly valve with PR.. actuator**

# Installation and operation

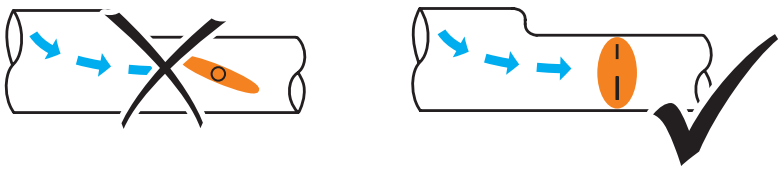
**Butterfly valve after a bend**



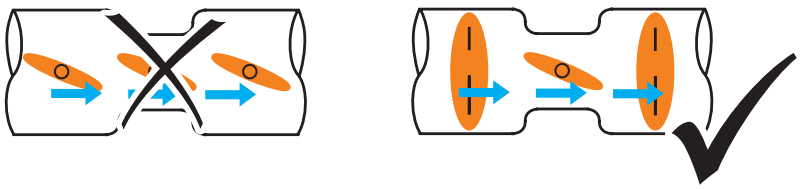

**Butterfly valve after a T-piece**



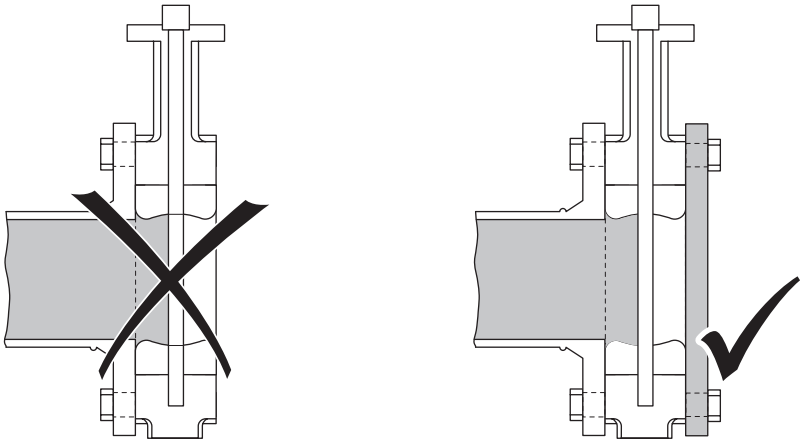
**Butterfly valve after a pipe reduction**



**Multiple butterfly valves for control application**



## Butterfly valve as end-of-line service



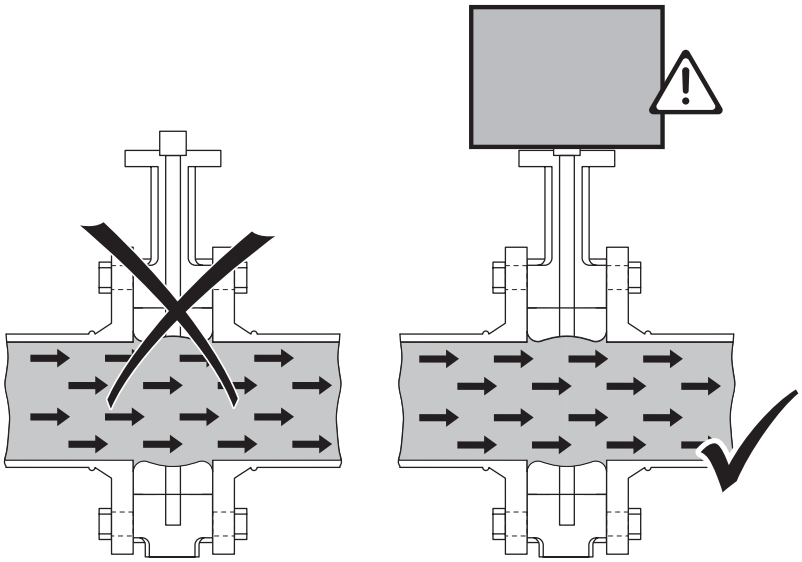
To ensure that the leakage rate of D6..N(L) and D6..W(L) butterfly valves used as end-of-line service is maintained, a contact pressure on the sealing sleeve by a flange is required on both sides. Installation as end-of-line service without a flange providing contact pressure on both sides is not permissible and leads to a defect in the butterfly valve. Furthermore, a closed flange (blanking flange) must be used with D6..W(L).

## Regular actuation

Generally speaking, butterfly valves must run through a full cycle at least once per month in order to reduce the breakaway torque and avoid having the valve become stuck in the sealing!

## Important in case of butterfly valves - D6..W(L)

The butterfly valves D6..W and D6..WL shall not be operated without an actuator or worm gear. In the absence of an actuator or worm gear, the butterfly valve might close and cause damage (hydraulic shock).



# Project planning

## Design

The data, information and limit values on the data sheets and installation instructions must be observed and complied with.

## Pipeline clearances

The minimum clearances between the pipelines and the walls and ceilings required for project planning depend not only on the valve dimensions but also on the selected actuator and can be found in the data sheets of the valves and actuators.

# Open/close butterfly valves


## General information

The open/close and changeover butterfly valves can be used in accordance with the following values:

- The maximum flow velocity of 4 m/s may not be exceeded in the valve
- The butterfly valve is to be selected according to the principle "Nominal pipe diameter = Nominal valve diameter" to keep the pressure drop as low as possible

## Open/close butterfly valves in manual operation

| Open/close butterfly valves DN 25...700 | DN [mm] | ζ zeta value | Manual operation | |
|---|---|---|---|---|
| | | | Lever | Worm gear [1] |
| D625N(L) | 25 | 0.25 | ZD6N-H100 | ZD6N-S100 |
| D632N(L) | 32 | 0.55 | ZD6N-H100 | ZD6N-S100 |
| D640N(L) | 40 | 0.97 | ZD6N-H100 | ZD6N-S100 |
| D650N(L) | 50 | 1.00 | ZD6N-H100 | ZD6N-S100 |
| D665N(L) | 65 | 0.99 | ZD6N-H100 | ZD6N-S100 |
| D680N(L) | 80 | 0.97 | ZD6N-H100 | ZD6N-S100 |
| D6100N(L) | 100 | 0.59 | ZD6N-H100 | ZD6N-S100 |
| D6125N(L) | 125 | 0.50 | ZD6N-H150 | ZD6N-S150 |
| D6150N(L) | 150 | 0.41 | ZD6N-H150 | ZD6N-S150 |
| D6200W(L) | 200 | 0.53 | | ZD6N-S150 |
| D6250W(L) | 250 | 0.35 | | ZD6N-S150 |
| D6300W(L) | 300 | 0.40 | | ZD6N-S150 |
| D6350N(L) | 350 | 0.23 | | ZD6N-S350 |
| D6400N(L) | 400 | 0.20 | | ZD6N-S400 |
| D6450N(L) | 450 | 0.19 | | ZD6N-S450 |
| D6500N(L) | 500 | 0.17 | | ZD6N-S500 |
| D6600N(L) | 600 | 0.15 | | ZD6N-S600 |
| D6700N(L) | 700 | 0.21 | | ZD6N-S700 |

[1] Worm gears are not suitable for outdoor applications.

## Closing and max. differential pressure

| Open/close butterfly valves DN 25...300 | DN [mm] | Actuators SR.. $\Delta p_s$ [kPa] | SR.. $\Delta p_{max}$ [kPa] | GR.. $\Delta p_s$ [kPa] | GR.. $\Delta p_{max}$ [kPa] | DR.. $\Delta p_s$ [kPa] | DR.. $\Delta p_{max}$ [kPa] | PR.. $\Delta p_s$ [kPa] | PR.. $\Delta p_{max}$ [kPa] |
|---|---|---|---|---|---|---|---|---|---|
| D625N(L) | 25 | 1200 | 300 | 1200 | 300 | | | | |
| D632N(L) | 32 | 1200 | 300 | 1200 | 300 | | | | |
| D640N(L) | 40 | 1200 | 300 | 1200 | 300 | | | | |
| D650N(L) | 50 | 1200 | 300 | 1200 | 300 | | | | |
| D665N(L) | 65 | 1200 | 300 | 1200 | 300 | | | | |
| D680N(L) | 80 | | | 1200 | 300 | 1200 | 300 | | |
| D6100N(L) | 100 | | | | | 1200 | 300 | 1200 [1] | 300 |
| D6125N(L) | 125 | | | | | 1200 | 300 | 1200 [2] | 300 |
| D6150N(L) | 150 | | | | | | | 1200 [2] | 300 |
| D6200W(L) | 200 | | | | | | | 1400 [2] | 300 |
| D6250W(L) | 250 | | | | | | | 1400 [2] | 300 |
| D6300W(L) | 300 | | | | | | | 1400 [2] | 300 |

[1] ZPR03 linkage
[2] ZPR01 linkage

| Open/close butterfly valves DN 350...700 | DN [mm] | Actuators SY6 $\Delta p_s$ [kPa] | SY6 $\Delta p_{max}$ [kPa] | SY7 $\Delta p_s$ [kPa] | SY7 $\Delta p_{max}$ [kPa] | SY8 $\Delta p_s$ [kPa] | SY8 $\Delta p_{max}$ [kPa] | SY9 $\Delta p_s$ [kPa] | SY9 $\Delta p_{max}$ [kPa] | SY10 $\Delta p_s$ [kPa] | SY10 $\Delta p_{max}$ [kPa] | SY12 $\Delta p_s$ [kPa] | SY12 $\Delta p_{max}$ [kPa] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D6350N(L) | 350 | 600 | 300 | 1200 [3] | 300 | | | | | | | | |
| D6400N(L) | 400 | 600 [4] | 300 | 1200 [5] | 300 | | | | | | | | |
| D6450N(L) | 450 | | | 600 [6] | 300 | 1200 [6] | 300 | | | | | | |
| D6500N(L) | 500 | | | | | 600 [6] | 300 | 1200 [7] | 300 | | | | |
| D6600N(L) | 600 | | | | | | | | | 600 [8] | 300 | 1000 [8] | 300 |
| D6700N(L) | 700 | | | | | | | | | | | 200 [9] | 200 |

[3] ZSY-703 linkage
[4] ZSY-401 linkage
[5] ZSY-701 linkage
[6] ZSY-702 linkage
[7] ZSY-901 linkage
[8] ZSY-902 linkage

## Flow rate with differential pressure 0.01...3 kPa

| | | | Differential pressure $\Delta p_{v100}$ | | | | |
|---|---|---|---|---|---|---|---|
| | | | 0.01 [kPa] | 0.1 [kPa] | 1 [kPa] | 2 [kPa] | 3 [kPa] |
| Open/close butterfly valves DN 25...700 | DN [mm] | $k_{vmax}$ [$m^3/h$] | Flow rate $V'_{100}$ [$m^3/h$] | | | | |
| D625N(L) | 25 | 50 | 0.5 | 1.6 | 5 | 7 | |
| D632N(L) | 32 | 55 | 0.6 | 1.7 | 5.5 | 7.8 | 9.5 |
| D640N(L) | 40 | 65 | 0.7 | 2.0 | 6.5 | 9.2 | 11.3 |
| D650N(L) | 50 | 100 | 1.0 | 3.2 | 10 | 14.1 | 17.3 |
| D665N(L) | 65 | 170 | 1.7 | 5.4 | 17 | 24 | 29 |
| D680N(L) | 80 | 260 | 2.6 | 8.2 | 26 | 37 | 45 |
| D6100N(L) | 100 | 520 | 5.2 | 16.4 | 52 | 74 | 90 |
| D6125N(L) | 125 | 880 | 8.8 | 28 | 88 | 124 | 152 |
| D6150N(L) | 150 | 1400 | 14 | 44 | 140 | 198 | 242 |
| D6200W(L) | 200 | 2200 | 22 | 70 | 220 | 311 | 381 |
| D6250W(L) | 250 | 4200 | 42 | 133 | 420 | 594 | 727 |
| D6300W(L) | 300 | 5700 | 57 | 180 | 570 | 806 | 987 |
| D6350N(L) | 350 | 10300 | 103 | 326 | 1030 | 1457 | |
| D6400N(L) | 400 | 14200 | 142 | 449 | 1420 | 2008 | |
| D6450N(L) | 450 | 18800 | 188 | 595 | 1880 | | |
| D6500N(L) | 500 | 24100 | 241 | 762 | 2410 | | |
| D6600N(L) | 600 | 37300 | 373 | 1180 | 3730 | | |
| D6700N(L) | 700 | 42800 | 428 | 1353 | 4280 | | |

## Formula $\Delta p_{v100}$

$$\Delta p_{v100} = \left(\frac{V'_{100}}{k_{vmax}}\right)^2 \cdot 100$$

$\Delta p_{v100}$ : [kPa]
$V'_{100}$ : [$m^3/h$]
$k_{vmax}$ : [$m^3/h$]

## Flow rate with differential pressure 4...8 kPa

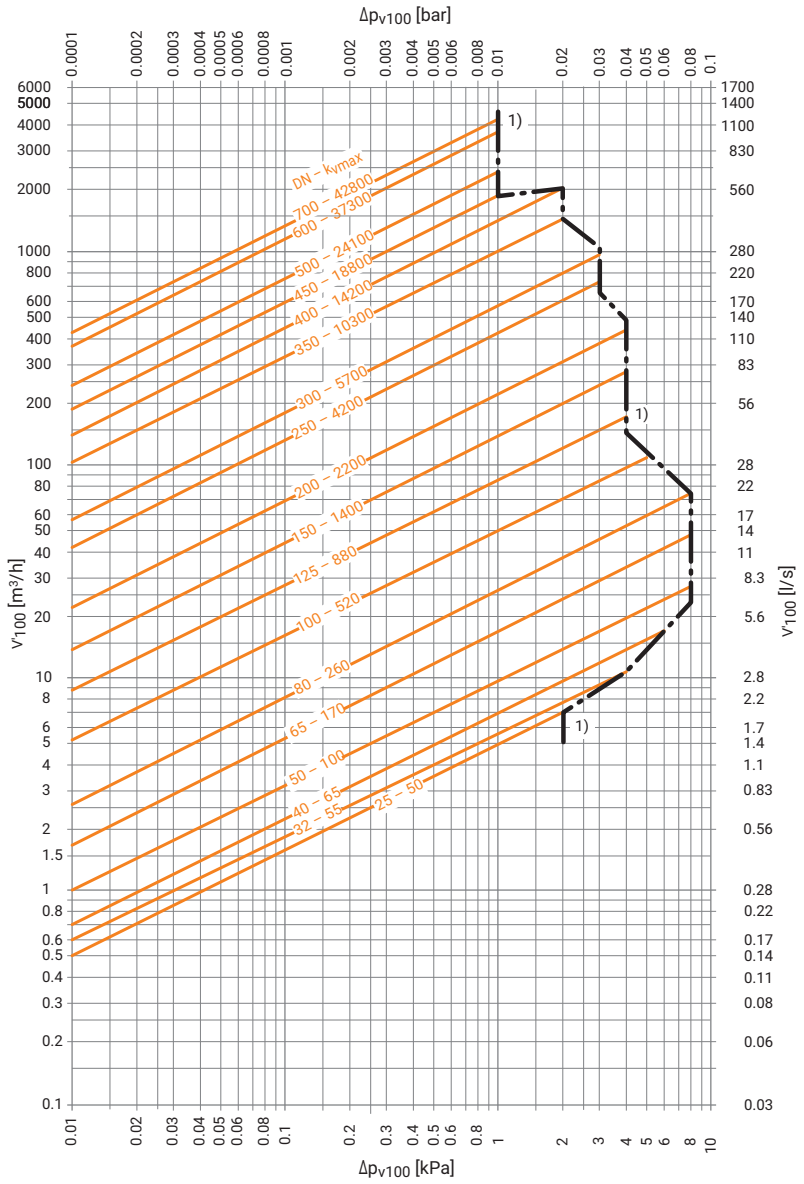
| | | | Differential pressure $\Delta p_{v100}$ | | | | |
|---|---|---|---|---|---|---|---|
| | | | 4 [kPa] | 5 [kPa] | 6 [kPa] | 7 [kPa] | 8 [kPa] |
| Open/close butterfly valves DN 25...700 | DN [mm] | $k_{vmax}$ [$m^3/h$] | Flow rate $V'_{100}$ [$m^3/h$] | | | | |
| D625N(L) | 25 | 50 | | | | | |
| D632N(L) | 32 | 55 | 11 | | | | |
| D640N(L) | 40 | 65 | 13 | 14.5 | 16 | 17.2 | |
| D650N(L) | 50 | 100 | 20 | 22 | 24 | 26 | 28 |
| D665N(L) | 65 | 170 | 34 | 38 | 42 | 45 | 48 |
| D680N(L) | 80 | 260 | 52 | 58 | 64 | 69 | 74 |
| D6100N(L) | 100 | 520 | 104 | 116 | | | |
| D6125N(L) | 125 | 880 | 176 | | | | |
| D6150N(L) | 150 | 1400 | 280 | | | | |
| D6200W(L) | 200 | 2200 | 440 | | | | |
| D6250W(L) | 250 | 4200 | | | | | |
| D6300W(L) | 300 | 5700 | | | | | |
| D6350N(L) | 350 | 10300 | | | | | |
| D6400N(L) | 400 | 14200 | | | | | |
| D6450N(L) | 450 | 18800 | | | | | |
| D6500N(L) | 500 | 24100 | | | | | |
| D6600N(L) | 600 | 37300 | | | | | |
| D6700N(L) | 700 | 42800 | | | | | |

## Formula $\Delta p_{v100}$

$$\Delta p_{v100} = \left(\frac{V'_{100}}{k_{vmax}}\right)^2 \cdot 100$$

$\Delta p_{v100}$ : [kPa]
$V'_{100}$ : [$m^3/h$]
$k_{vmax}$ : [$m^3/h$]

## Pressure drop $\Delta p_{v100}$ with valve completely open




[1] The maximum flow velocity in the butterfly valves is 4 m/s.

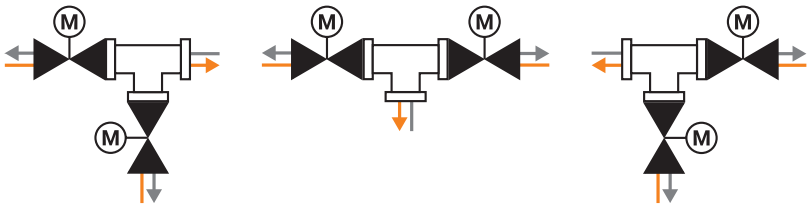
**$\Delta p_{v100}$** Differential pressure with valve completely open

**$\Delta p_{v100}$** ▬ • ▬

**$V'_{100}$** Nominal flow rate with $\Delta p_{v100}$

**$k_{vmax}$** $k_v$ value of the butterfly valve with 100% opening angle

# Changeover butterfly valves




## Flow rate with differential pressure 1...6 kPa

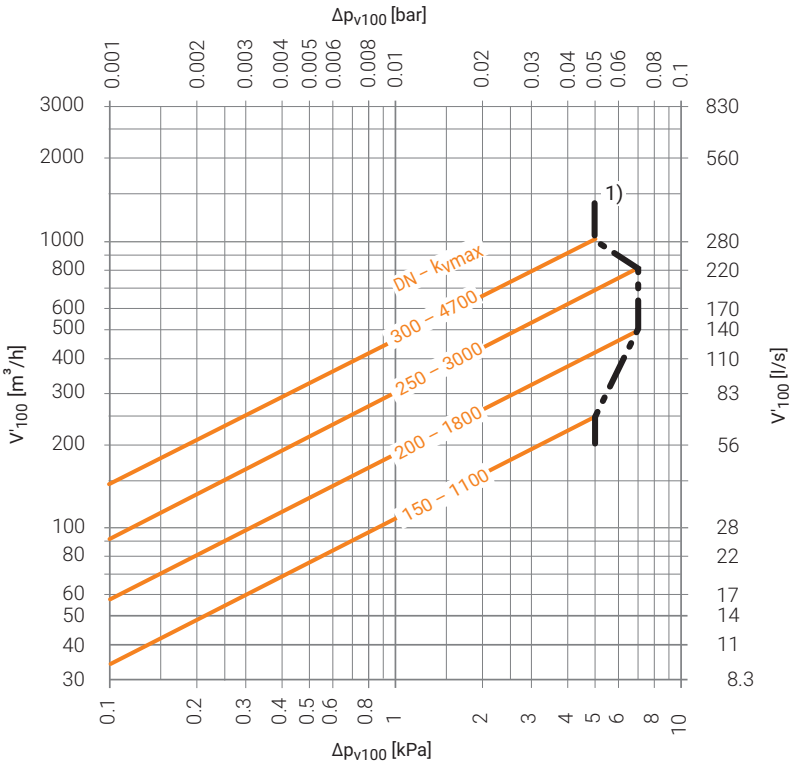
| | | | Differential pressure $\Delta p_{v100}$ | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 1 [kPa] | 2 [kPa] | 3 [kPa] | 4 [kPa] | 5 [kPa] | 6 [kPa] |
| Changeover butterfly valves DN 150...300 | DN [mm] | $k_{vmax}$ [$m^3/h$] | Flow rate $V'_{100}$ [$m^3/h$] | | | | | |
| D7150NL/BAC | **150** | 1100 | 110 | 156 | 190 | 220 | 250 | |
| D7200WL/BAC | **200** | 1800 | 180 | 255 | 300 | 340 | 380 | 440 |
| D7250WL/BAC | **250** | 3000 | 300 | 424 | 500 | 600 | 650 | 700 |
| D7300WL/BAC | **300** | 4700 | 470 | 665 | 760 | 890 | 1000 | |

## Formula $\Delta p_{v100}$

$$\Delta p_{v100} = \left(\frac{V'_{100}}{k_{vmax}}\right)^2 \cdot 100$$

$\Delta p_{v100}$ : [kPa]
$V'_{100}$ : [$m^3/h$]
$k_{vmax}$ : [$m^3/h$]

## Pressure drop $\Delta p_{v100}$ with valve completely open




[1] The maximum flow velocity in the butterfly valves is 4 m/s.

**$\Delta p_{v100}$** Differential pressure with valve completely open

**$\Delta p_{v100}$** ▬ · ▬

**$V'_{100}$** Nominal flow rate with $\Delta p_{v100}$

**$k_{vmax}$** $k_v$ value of the butterfly valve with 100% opening angle

# 2-way control butterfly valves


## General information

Butterfly valves can be used in control mode when the following values are complied with:

- To ensure a valve attains good control characteristics thus a long service life for the control element, it needs to be correctly designed with the correct valve authority
- The maximum flow velocity of 4 m/s may not be exceeded in the control butterfly valve
- The maximum differential pressure during flow through the control butterfly valve is 300 kPa (3 bar)
- The butterfly valve ensures a rangeability of at least Sv = 30 (with reference to $k_{vs}$ with 60% opening angle)

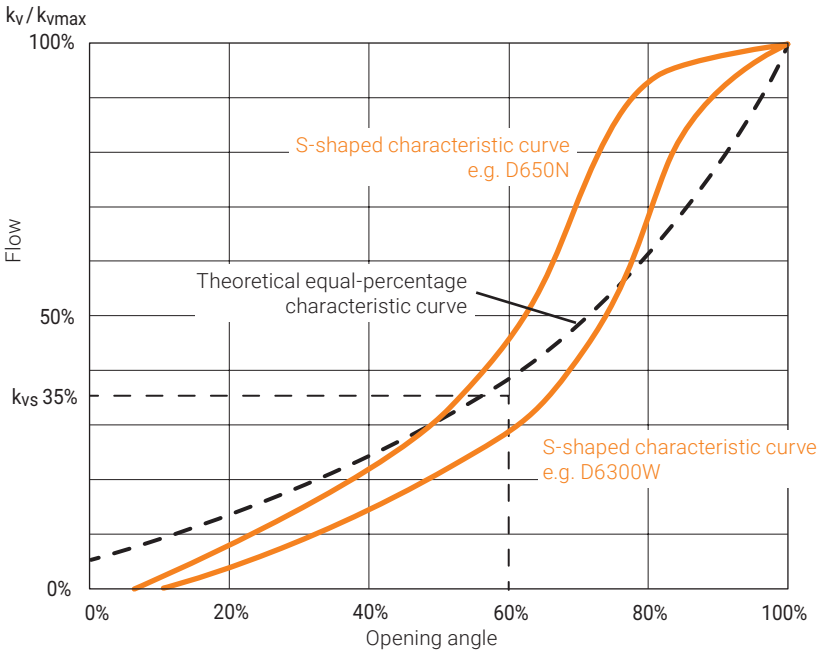
## Technical data for control mode

| | |
|---|---|
| Differential pressure $\Delta p_{v0}$: | ≤300 kPa with valve cone opening (may not be exceeded) |
| Differential pressure $\Delta p_{v60}$: | The values listed in the differential pressure table must be complied with |
| Rangeability: | >30 (with 60% opening angle) |

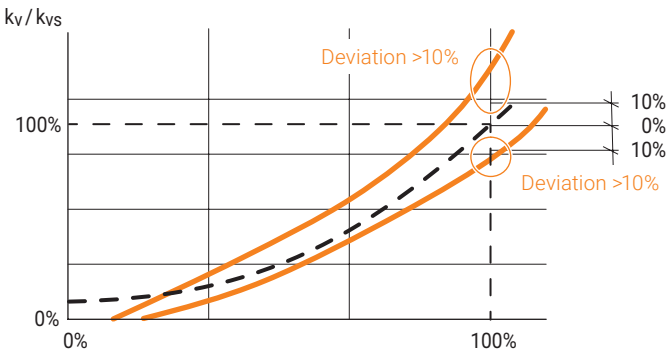
## Opening angle limitation

The S-shaped characteristic curve of the butterfly valve (BFV) does not correspond to the equal-percentage characteristic curve pursuant to VDI 2176. It is only in the angle of rotation range between 0% and 60% that one can however speak of an approximately equal-percentage characteristic curve. With an opening angle of 60%, the $k_{vs}$ corresponds to approx. 35% of the $k_{vmax}$ value with 100% opening angle.

## S-shaped characteristic curve



## Scaled characteristic curve range




## Definition $k_{vmax}$ and $k_{vs}$

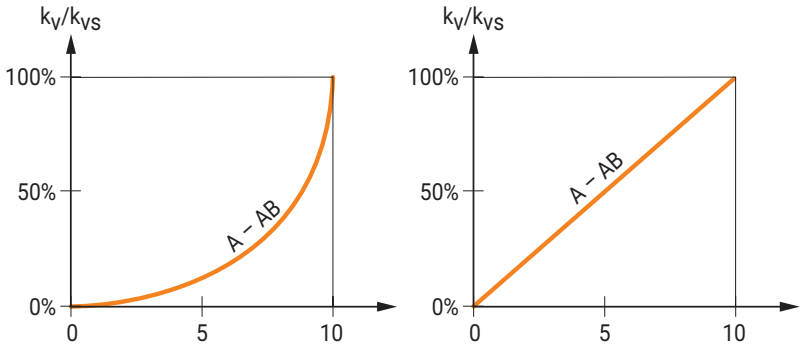
The term $k_v$ value is used to designate the flow factor or flow coefficient (catalogue value). The $k_v$ value corresponds to the volumetric flow of water through a valve (in $m^3$/h or l/min) with a differential pressure of 100 kPa (1 bar), a water temperature of 5...40°C and at a fixed opening angle.
In this connection, the $k_{vmax}$ is the $k_v$ value of the butterfly valve for the 100% opening angle (completely open) and $k_{vs}$ is the $k_v$ value for the 60% opening angle.

## Opening angle parametrisation

An opening angle of 60% is recommended as standard for control applications, no matter what the parametrised characteristic curve is. Depending on the desired $k_v$ value, the opening angle for motorising with the PR..BAC actuator can be set with a smartphone by the BELIMO Assistant App via Near Field Communication (NFC). In case of motorising with the SR, GR and DR actuators, the desired angle of rotation range for MF and MP types can be set via PC-Tool MFT-P, as from Version 3.3 (does not apply to SY actuators).

## Parametrisation of the flow characteristic

For butterfly valves with PR..BAC actuator, the flow characteristic can be parametrised to equal percentage or linear via the Belimo Assistant App (NFC).



## Closing and max. differential pressure

| 2-way control butterfly valves DN 25...300 | DN [mm] | Actuators SR.. $\Delta p_s$ [kPa] | SR.. $\Delta p_{max}$ [kPa] | GR.. $\Delta p_s$ [kPa] | GR.. $\Delta p_{max}$ [kPa] | DR.. $\Delta p_s$ [kPa] | DR.. $\Delta p_{max}$ [kPa] | PR.. $\Delta p_s$ [kPa] | PR.. $\Delta p_{max}$ [kPa] |
|---|---|---|---|---|---|---|---|---|---|
| D625N(L) | 25 | 1200 | 300 | 1200 | 300 | | | | |
| D632N(L) | 32 | 1200 | 300 | 1200 | 300 | | | | |
| D640N(L) | 40 | 1200 | 300 | 1200 | 300 | | | | |
| D650N(L) | 50 | 1200 | 300 | 1200 | 300 | | | | |
| D665N(L) | 65 | 1200 | 300 | 1200 | 300 | | | | |
| D680N(L) | 80 | | | 1200 | 300 | 1200 | 300 | | |
| D6100N(L) | 100 | | | | | 1200 | 300 | 1200 [1] | 300 |
| D6125N(L) | 125 | | | | | 1200 | 300 | 1200 [2] | 300 |
| D6150N(L) | 150 | | | | | | | 1200 [2] | 300 |
| D6200W(L) | 200 | | | | | | | 1400 [2] | 300 |
| D6250W(L) | 250 | | | | | | | 1400 [2] | 300 |
| D6300W(L) | 300 | | | | | | | 1400 [2] | 300 |

[1] ZPR03 linkage
[2] ZPR01 linkage

| 2-way control butterfly valves DN 350...700 | DN [mm] | Actuators SY6 $\Delta p_s$ [kPa] | SY6 $\Delta p_{max}$ [kPa] | SY7 $\Delta p_s$ [kPa] | SY7 $\Delta p_{max}$ [kPa] | SY8 $\Delta p_s$ [kPa] | SY8 $\Delta p_{max}$ [kPa] | SY9 $\Delta p_s$ [kPa] | SY9 $\Delta p_{max}$ [kPa] | SY10 $\Delta p_s$ [kPa] | SY10 $\Delta p_{max}$ [kPa] | SY12 $\Delta p_s$ [kPa] | SY12 $\Delta p_{max}$ [kPa] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D6350N(L) | 350 | 600 | 300 | 1200 [3] | 300 | | | | | | | | |
| D6400N(L) | 400 | 600 [4] | 300 | 1200 [5] | 300 | | | | | | | | |
| D6450N(L) | 450 | | | 600 [6] | 300 | 1200 [6] | 300 | | | | | | |
| D6500N(L) | 500 | | | | | 600 [6] | 300 | 1200 [7] | 300 | | | | |
| D6600N(L) | 600 | | | | | | | | | 600 [8] | 300 | 1000 [8] | 300 |
| D6700N(L) | 700 | | | | | | | | | | | 200 [9] | 200 |

[3] ZSY-703 linkage
[4] ZSY-401 linkage
[5] ZSY-701 linkage
[6] ZSY-702 linkage
[7] ZSY-901 linkage
[8] ZSY-902 linkage

## Flow rate with differential pressure 5...40 kPa

| | | | Differential pressure $\Delta p_{v60}$ | | | | |
|---|---|---|---|---|---|---|---|
| | | | 5 [kPa] | 10 [kPa] | 20 [kPa] | 30 [kPa] | 40 [kPa] |
| 2-way control butterfly valves DN 25...700 | DN [mm] | $K_{vs}$ [$m^3/h$] | Flow rate $V'_{60}$ [$m^3/h$] | | | | |
| D625N(L) | 25 | 24 | 5.4 | 7.6 | | | |
| D632N(L) | 32 | 25 | 5.6 | 7.9 | 11.2 | | |
| D640N(L) | 40 | 27 | 6.0 | 8.5 | 12.1 | 14.8 | 17.1 |
| D650N(L) | 50 | 30 | 6.7 | 9.5 | 13.4 | 16.4 | 19 |
| D665N(L) | 65 | 50 | 11.2 | 15.8 | 22 | 27 | 32 |
| D680N(L) | 80 | 75 | 16.8 | 24 | 34 | 41 | 47 |
| D6100N(L) | 100 | 150 | 34 | 47 | 67 | 82 | 95 |
| D6125N(L) | 125 | 260 | 58 | 82 | 116 | 142 | 164 |
| D6150N(L) | 150 | 400 | 89 | 126 | 179 | 219 | 253 |
| D6200W(L) | 200 | 820 | 183 | 259 | 367 | 449 | |
| D6250W(L) | 250 | 1300 | 291 | 411 | 581 | 712 | |
| D6300W(L) | 300 | 1740 | 389 | 550 | 778 | 953 | |
| D6350N(L) | 350 | 3010 | 673 | 952 | 1346 | | |
| D6400N(L) | 400 | 4140 | 926 | 1309 | 1851 | | |
| D6450N(L) | 450 | 5490 | 1228 | 1736 | | | |
| D6500N(L) | 500 | 7060 | 1579 | 2233 | | | |
| D6600N(L) | 600 | 10900 | 2437 | 3447 | | | |
| D6700N(L) | 700 | 11760 | 2630 | 3719 | | | |

## Formula $\Delta p_{v60}$

$$\Delta p_{v60} = \left( \frac{V'_{60}}{k_{vs}} \right)^2 \cdot 100$$

$\Delta p_{v60}$ : [kPa]
$V'_{60}$ : [$m^3/h$]
$k_{vs}$ : [$m^3/h$]

## Flow rate with differential pressure 50...90 kPa

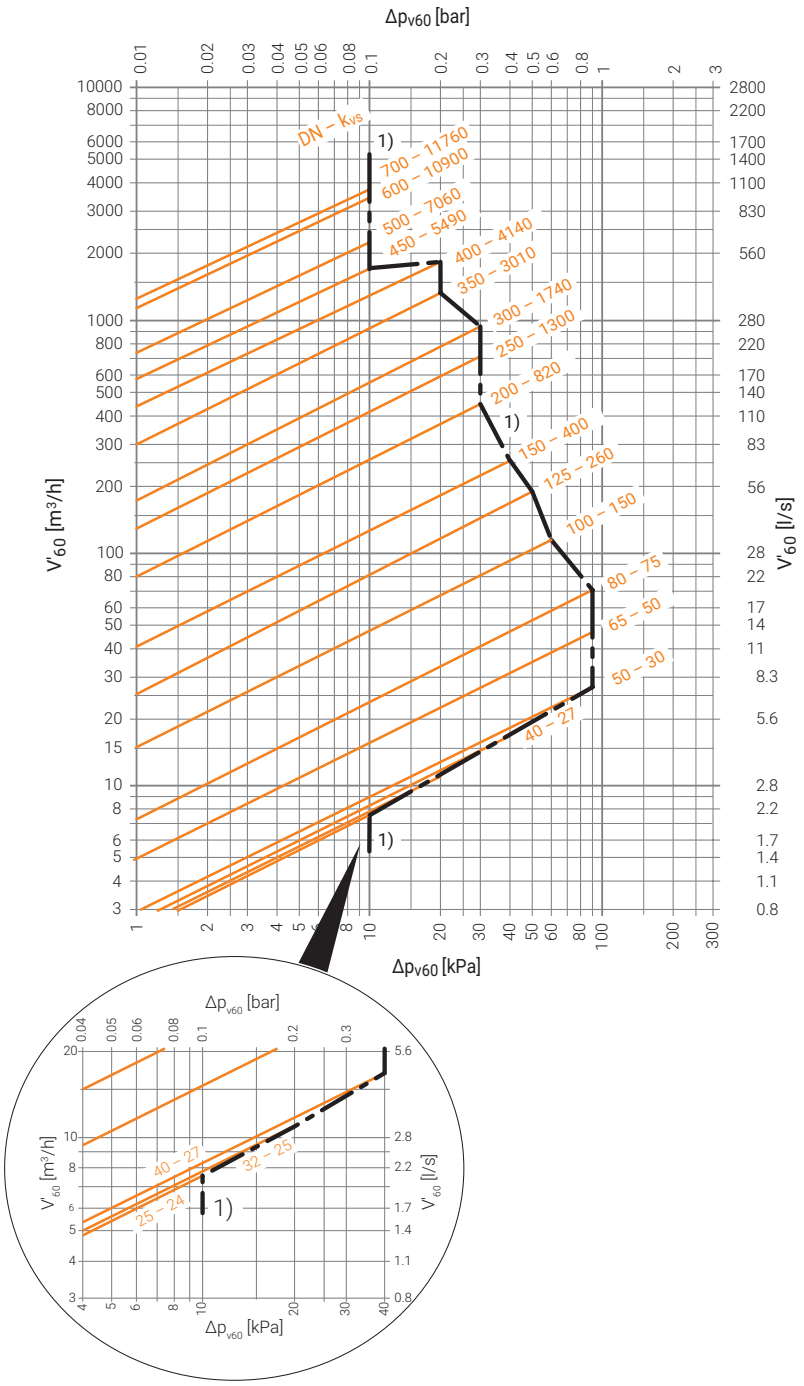
| | | | Differential pressure $\Delta p_{v60}$ | | | | |
|---|---|---|---|---|---|---|---|
| | | | 50 [kPa] | 60 [kPa] | 70 [kPa] | 80 [kPa] | 90 [kPa] |
| 2-way control butterfly valves DN 25...700 | DN [mm] | $k_{vs}$ [$m^3/h$] | Flow rate $V'_{60}$ [$m^3/h$] | | | | |
| D625N(L) | 25 | 24 | | | | | |
| D632N(L) | 32 | 25 | | | | | |
| D640N(L) | 40 | 27 | | | | | |
| D650N(L) | 50 | 30 | 21 | 23 | 25 | 27 | 28 |
| D665N(L) | 65 | 50 | 35 | 39 | 42 | 45 | 47 |
| D680N(L) | 80 | 75 | 53 | 58 | 63 | 67 | 71 |
| D6100N(L) | 100 | 150 | 106 | 116 | | | |
| D6125N(L) | 125 | 260 | 184 | | | | |
| D6150N(L) | 150 | 400 | | | | | |
| D6200W(L) | 200 | 820 | | | | | |
| D6250W(L) | 250 | 1300 | | | | | |
| D6300W(L) | 300 | 1740 | | | | | |
| D6350N(L) | 350 | 3010 | | | | | |
| D6400N(L) | 400 | 4140 | | | | | |
| D6450N(L) | 450 | 5490 | | | | | |
| D6500N(L) | 500 | 7060 | | | | | |
| D6600N(L) | 600 | 10900 | | | | | |
| D6700N(L) | 700 | 11760 | | | | | |

## Formula $\Delta p_{v60}$

$$\Delta p_{v60} = \left(\frac{V'_{60}}{k_{vs}}\right)^2 \cdot 100$$

$\Delta p_{v60}$ : [kPa]
$V'_{60}$ : [$m^3/h$]
$k_{vs}$ : [$m^3/h$]

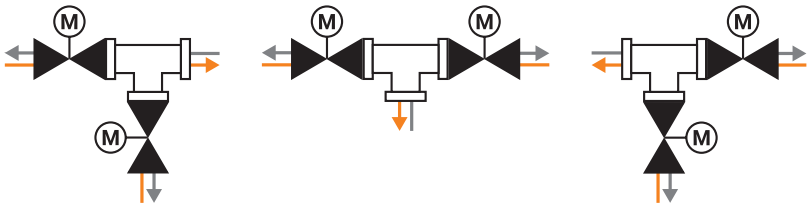
## Pressure drop $\Delta p_{v60}$ with 60% opening angle




[1] The maximum flow velocity in the butterfly valves is 4 m/s.

**$\Delta p_{v60}$** Differential pressure with valve open 60%
**$\Delta p_{v60}$** ——·——
**$V'_{60}$** Nominal flow rate with $\Delta p_{v60}$
**$k_{vs}$** $k_V$ value of the butterfly valve with 60% opening angle

# 3-way control butterfly valves

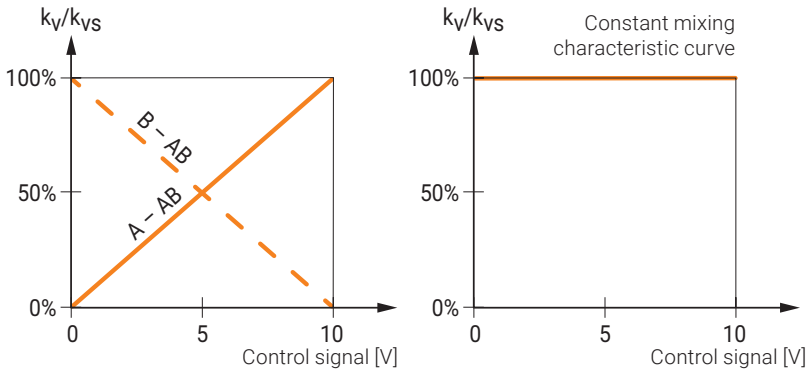


## Opening angle parametrisation

An opening angle of 60% is recommended as standard for control applications, no matter what the parametrised characteristic curve is. Depending on the desired $k_v$ value, the opening angle for motorising with the PR..BAC actuator can be set with a smartphone by the BELIMO Assistant App via Near Field Communication (NFC).

## Constant mixing characteristic curve

For butterfly valves with PR..BAC actuator, the flow characteristic can be parametrised to linear via the Belimo Assistant App (NFC). Thanks to the parametrisable linear characteristic curve, 3-way control butterfly valves have a constant mixing characteristic curve, which is perfect for control applications.




## Flow rate with differential pressure 5...40 kPa

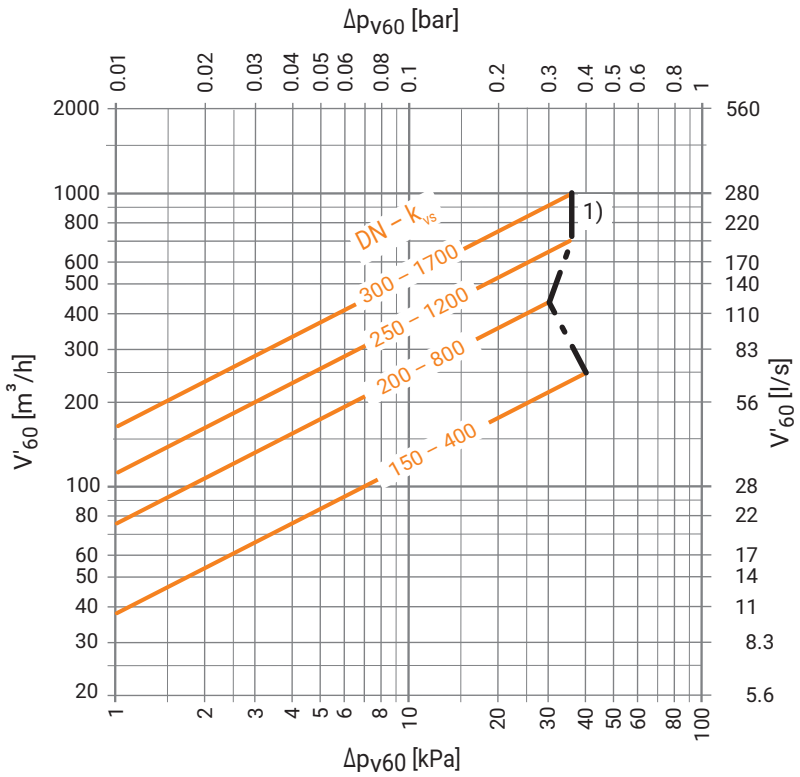
| | | | Differential pressure $\Delta p_{v60}$ | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 5 [kPa] | 10 [kPa] | 15 [kPa] | 20 [kPa] | 25 [kPa] | 30 [kPa] | 35 [kPa] | 40 [kPa] |
| 3-way control butterfly valves DN 150...300 | DN [mm] | $k_{VS}$ [m³/h] | Flow rate V'60 [m³/h] | | | | | | | |
| D7150NL/BAC | 150 | 400 | 90 | 120 | 150 | 175 | 200 | 220 | 235 | 250 |
| D7200WL/BAC | 200 | 800 | 180 | 250 | 300 | 360 | 400 | 440 | | |
| D7250WL/BAC | 250 | 1200 | 260 | 370 | 460 | 530 | 600 | 650 | 700 | |
| D7300WL/BAC | 300 | 1700 | 380 | 530 | 660 | 760 | 850 | 925 | 1000 | |

## Formula $\Delta p_{v60}$

$$\Delta p_{v60} = \left(\frac{V'_{60}}{k_{VS}}\right)^2 \cdot 100$$

$\Delta p_{v60}$ : [kPa]
$V'_{60}$ : [m³/h]
$k_{VS}$ : [m³/h]

## Pressure drop $\Delta p_{v60}$ with 60% opening angle




[1] The maximum flow velocity in the butterfly valves is 4 m/s.

**$\Delta p_{v60}$** Differential pressure with valve open 60%
**$\Delta p_{v60}$** ▬ • ▬
**$V'_{60}$** Nominal flow rate with $\Delta p_{v100}$
**$k_{vs}$** $k_v$ value of the butterfly valve with 60% opening angle

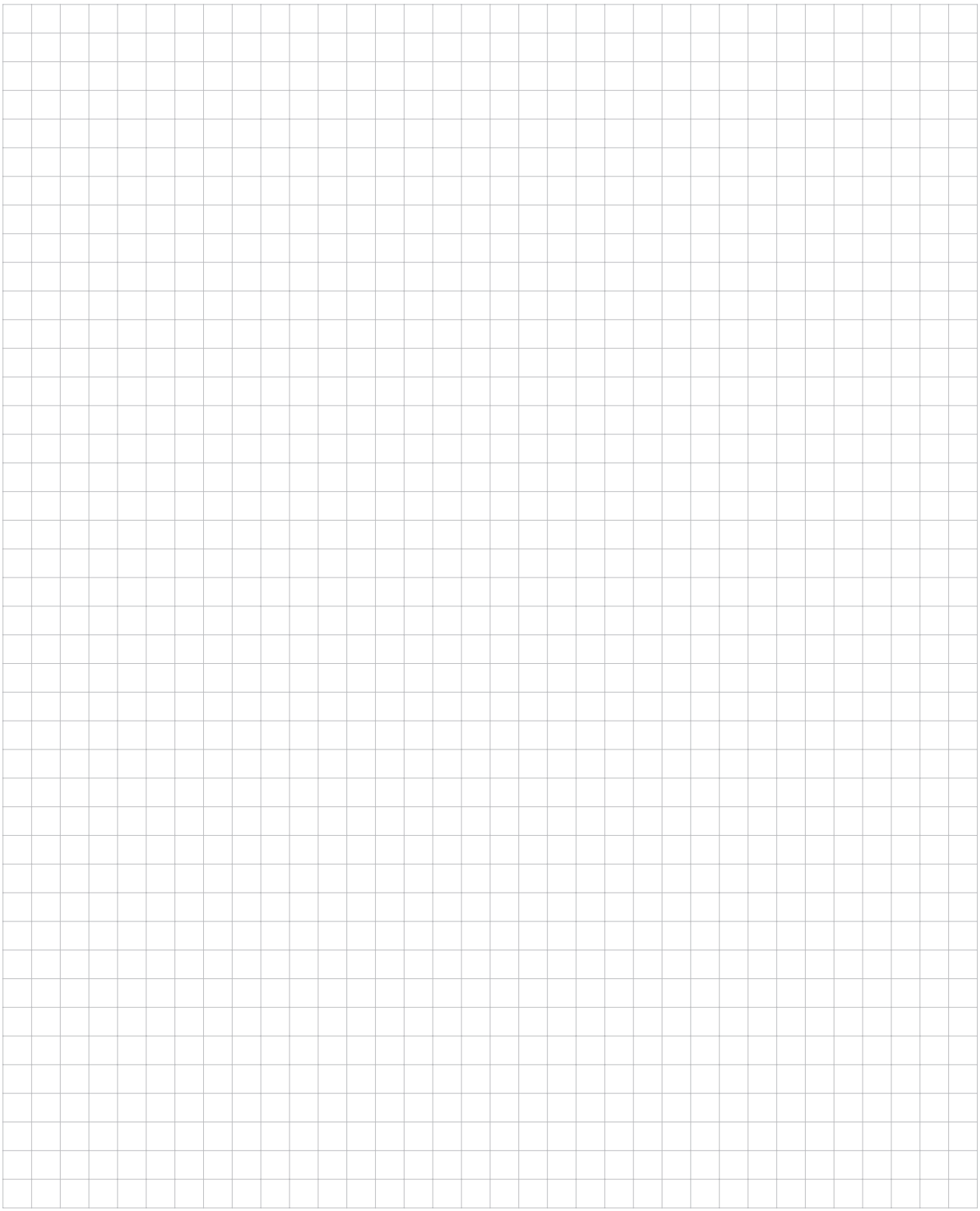
# Definitions

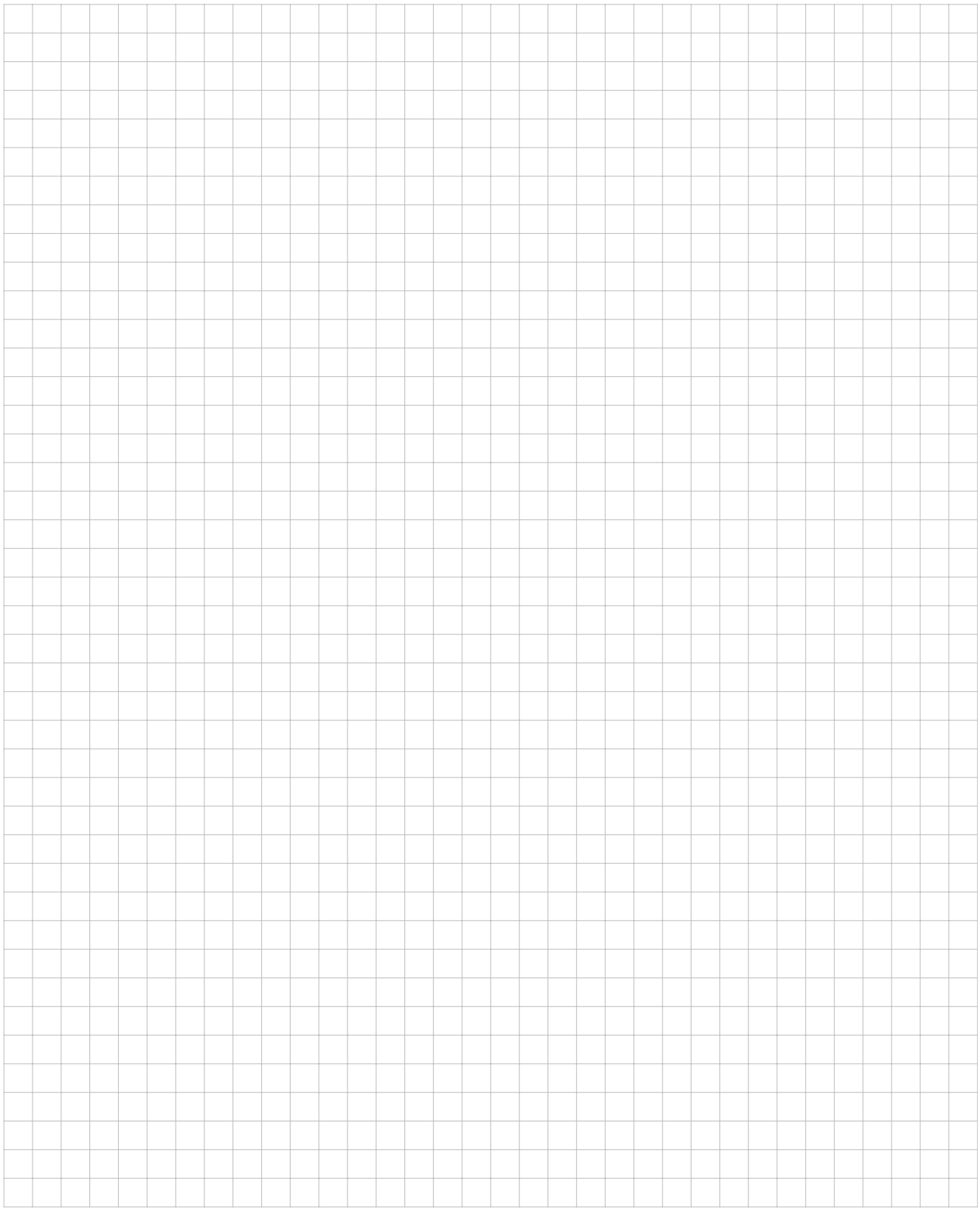
## Formula symbol

| | |
|---|---|
| **$k_v$** | Flow rate factor or flow coefficient (catalogue value). The $k_v$ value corresponds to the volumetric flow of water through a valve (in $m^3/h$ or l/min) with a differential pressure of 100 kPa (1 bar), a water temperature of 5...40°C and at a fixed opening angle |
| **$k_{vmax}$** | $k_v$ value of the butterfly valve with 100% opening angle |
| **$k_{vs}$** | $k_v$ value of the butterfly valve with 60% opening angle |
| **$\Delta p_s$** | Closing pressure at which the actuator can still seal the butterfly valve tightly allowing for the appropriate leakage rate |
| **$\Delta p_{v100}$** | Maximum permissible differential pressure in compliance with the flow velocity of 4 m/s with butterfly valve completely open (100%). |
| **$\Delta p_{v60}$** | Maximum permissible differential pressure in compliance with the flow velocity of 4 m/s at 60% butterfly valve opening angle |
| **$\Delta p_{v0}$** | Differential pressure at closing element opening |
| **$V'_{100}$** | Nominal flow rate at $\Delta p_{v100}$ |
| **$V'_{60}$** | Nominal flow rate at $\Delta p_{v60}$ |
| **ζ value** | Zeta ζ is the coefficient for the pressure drop through the fully opened butterfly valve (100%) |

## Further documentation

- Data sheets butterfly valves and actuators
- Installation instructions butterfly valves and actuators
- General notes for project planning
- Application brochure for chillers and cooling towers
- Application brochure for heat generation





# All inclusive.

Belimo as a global market leader develops innovative solutions for the controlling of heating, ventilation and air-conditioning systems. Damper actuators, control valves, sensors and meters represent our core business.

Always focusing on customer value, we deliver more than only products. We offer you the complete product range for the regulation and control of HVAC systems from a single source. At the same time, we rely on tested Swiss quality with a five-year warranty. Our worldwide representatives in over 80 countries guarantee short delivery times and comprehensive support through the entire product life. Belimo does indeed include everything.

The "small" Belimo devices have a big impact on comfort, energy efficiency, safety, installation and maintenance.

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- On site around the globe
- Complete product range
- Tested quality
- Short delivery times
- Comprehensive support

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