Data sheet

Automatic balancing valves ABV

ABV DN15-40

ABV DN50

ABV DN65-100

ABV-I DN15-50

ABV-M DN15-50

Description / Application

ABV balancing valves are used for dynamic hydronic balance in heating and cooling systems. Dynamic balancing means: permanent balancing from 0 to 100 % load by controlling the pressure in systems with variable flow. At partial loads, when the flow is decreased by the control valve, pressure limitation is still performed and consequently performing dynamic balancing. By using ABV you avoid using complex and time consuming commissioning methods. Dynamic balancing of the system in all loads helps you to save energy and improves climate comfort and control.

Flow limitation
By using combination of pressure controller ABV and settable terminal's unit valve, flow limitation is established.

Flow limitation for each terminal unit prevents underflows on distant units and overflows on others thus allows efficient pumping.

Lower noise emission
Differential pressure limitation provides the pressure over the control valve not to increase at partial loads thus noise emission will be lower. (This is the reason why DIN 18380 requires control of differential pressure by partial load.)

No balancing method needed
Flow limitation is achieved by adjusting each hydronic loop separately without influencing others, which consequently results in one time adjusting process No special balancing method

Description / Application (*continuous*)

ABV balancing valves are designed to guarantee high quality of the automatic balancing by:
- a pressure released cone,
- an adapted membrane for every valve dimension which provide constant quality performance for all sizes,
- spring with linear characteristic that makes setting required Δp easy.

A 90° angle between all service features (shut-off, draining, setting, measuring) allows an easy access under any installing condition.

All the above-mentioned features and functions are realized in small build-in dimensions so it is easy to install ABV even in very limited space.

ABV valves are performing pressure control not only at design conditions (100 % load) but also at all partial loads (thus fulfilling the requirements of DIN 18380 norms). By controlling pressure at a partial load one can prevent noise problems on thermostatic radiator valves which often occur in unbalanced systems.

ABV valves (DN 15-40) are packaged in styropore (EPS) which can be used for insulation at temperatures up to 80 °C. An insulation cap is available as an accessory for insulation at higher temperatures (up to 120 °C).

ABV valves in dimensions DN 15-40 are supplied with an internal or external thread while DN 50 is supplied with external thread only. If an external thread is chosen, a threaded or weld nipple can be supplied as an accessory. Dimensions DN 65-100 are supplied as flanged valves.

ABV balancing valves have integrated service functions such as shut-off and draining.

ABV-PV can be equipped with nipple for flow measuring. In that case measuring nipples need to be ordered separately and mounted on the valve as follows:
- on top of drain cock (DN 15-50),
- on the flange connection before the valve is filled with water (DN 65-100).

ABV-PV valves are to be mounted in return pipe, in combination with partner valves mounted in flow pipe. As a partner valve ABV-M/I/BD are recommended for dimensions DN 15 to DN 50 and MSV-F2 for dimensions DN 65 to DN 100.

There are two basic configurations when using ABV partner valves (ABV-BD, ABV-I, ABV-M, MSV-F2):

- partner valve **outside the control loop** (Fig. 1). Recommended configuration: it results in best performance since whole controlled pressure range is available to the riser. Flow limitation is done on each terminal unit in the riser (for example, RA-N with presetting on radiator, etc).

  DN 15 to DN 50: ABV-M or ABV-BD
  DN 65 to DN 100: MPV by connecting impulse tube to down-flow measuring nipple.

- partner valve **inside control loop** (Fig. 2). Offers flow limitation on the riser however part of the controlled pressure range is used by pressure drop on partner valve (Δp_i). It is recommended when flow limitation on each terminal units is not possible.

  DN 15 to DN 50: ABV-I or ABV-BD.
  DN 65 to DN 100: MPV by connecting impulse tube to up-flow measuring nipple.

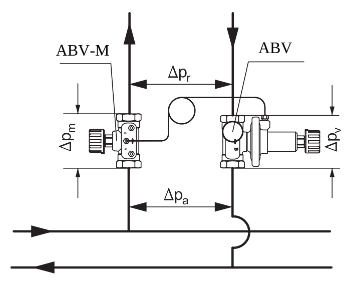


Fig. 1 Setting of ASV-PV = Δp_{riser}

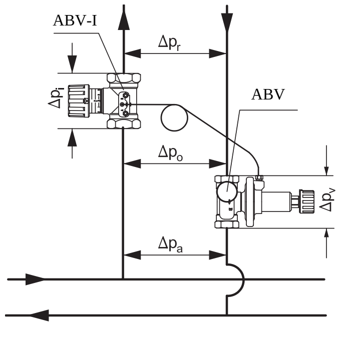


Fig. 2 Setting of ASV-PV = $\Delta p_{riser} + \Delta p_i$

ABV-BD can be used outside or inside control loop by choice of which measuring nipple is open. To be used outside control loop, **blue** measuring nipple needs to be open. In this position, flow verification can be done (**default** position). To be used inside control loop, red measuring nipple needs to be open. In this position, flow verification & flow verification can be done.

Description / Application
(*continuous*)

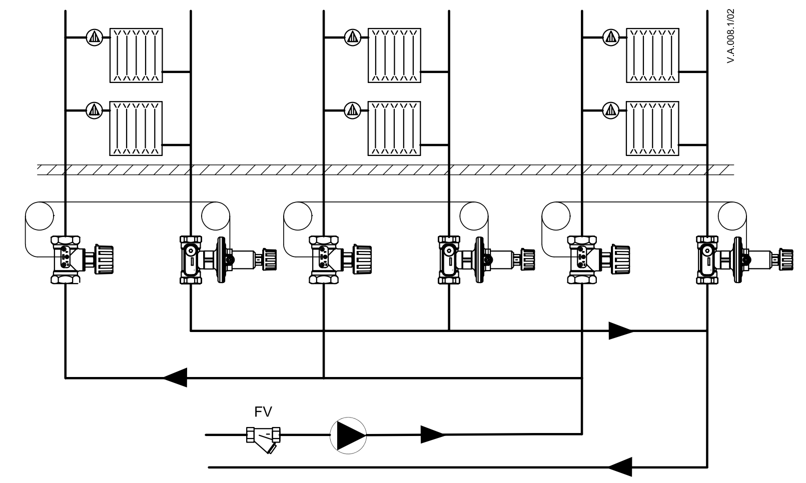


Fig. 3 ASV in riser / typical heating application (general example)

ABV valves are to be used in radiator heating systems to control the differential pressure in risers. To limit the flow for every radiator, the thermostatic radiator valve with pre-setting facilities (feature) is used together with a constant pressure provided by the ABV, thus providing balanced heat distribution.

Alternatively the flow in the riser can be limited by using setting function of the ABV-I. Controlling differential pressure over the riser means also that the valve authority over the thermostatic radiator valves is high – which allows an accurate and stable temperature control and saves energy.

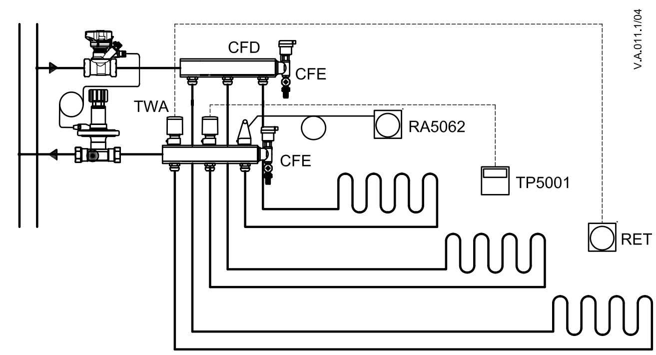


Fig. 4 ASV in manifold for floor heating system

ABV valves are to be used in floor heating systems. To limit the flow for every loop valves with an integrated flow limiting or presetting function should be used together with a constant pressure provided by an ABV-PV valve. Alternatively the flow for the whole manifold can be limited by using the setting function of the ABV-I or ABV-BD.

ABV-PV valves can control the differential pressure in several ranges if different pressure is needed. Due to its small dimensions the ABV automatic balancing valves are easy to install in a wall mounted box for floor heating manifolds.

Description / Application
(*continuous*)

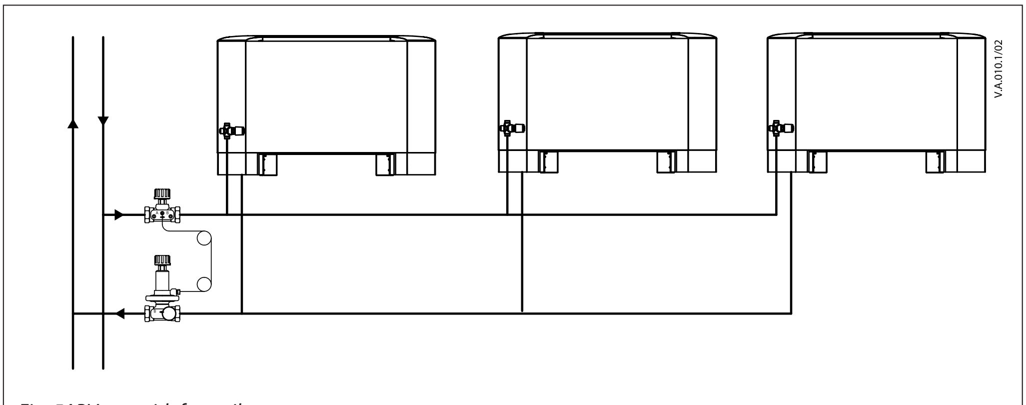


Fig. 5ABV with fan coil

The ABV valves are to be used in systems with fan coils, induction devices and air-heaters to secure an automatic hydronic balance by the means of differential pressure control in branches or at every coil. Constant differential pressure in combination with pre-set control valves i.e. ABV-I or ABV-BD limits the flow.

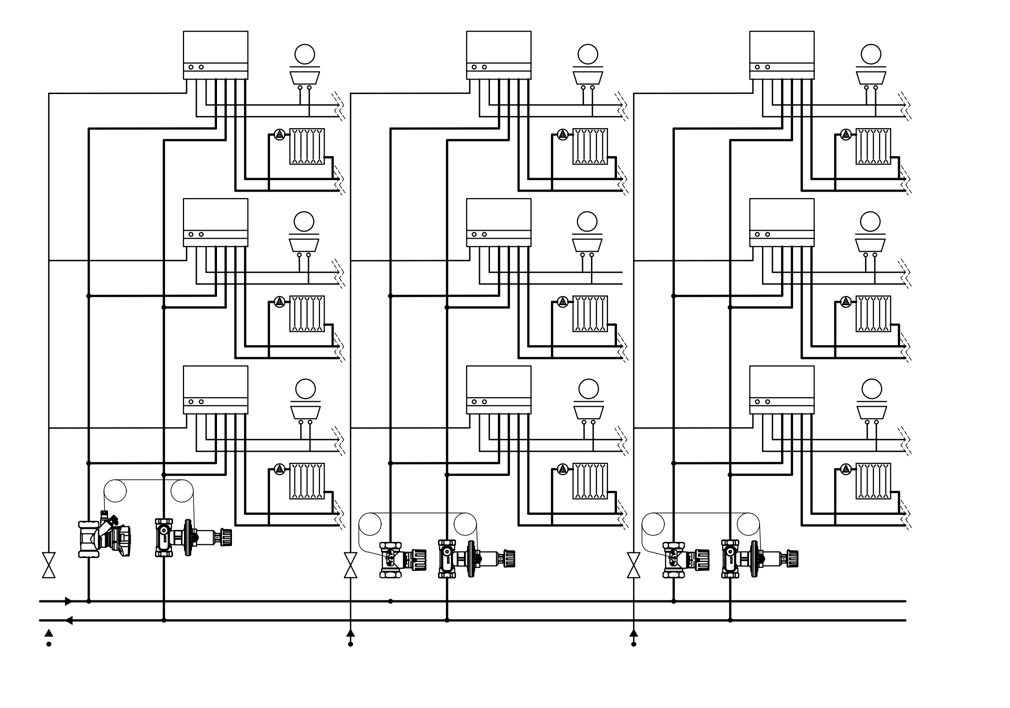


Fig. 6 Flat station

ABV automatic balancing valves can be used also in other applications. For example ABV can be used to prevent noise problems at the thermostatic radiator valves in small systems by controlling the differential pressure. ABV can be used in every application you need a small differential pressure controller, for example like small floor manifolds or flat stations. In buildings equipped with flat stations ABV valves can be used to provide secure automatic balance by the means of differential pressure control in risers/ zones.

In flat stations, pressure conditions change when sanitary water heating is taking place in comaparison to the situation when only heating is needed.
By using ABV-PV valves the differential pressure is controlled also in those conditions.

Constant differential pressure in combination with pre-set control valves i.e. ABV-I or ABV-BD limits the flow.

Sizing

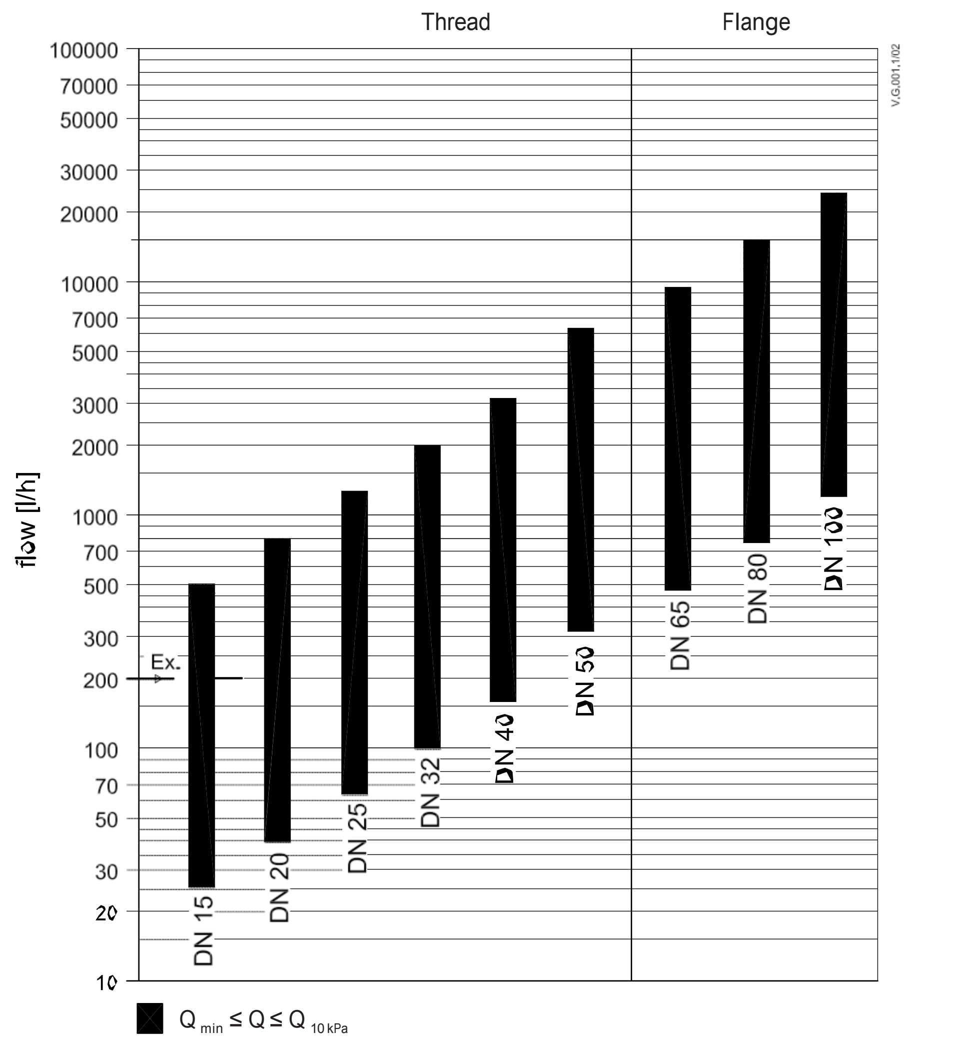


Fig. 7 Column diagram for sizing ABV valves at Δp_v = 10 kPa. For different Δp_v values use diagram A and B in Appendix.

We recommend to size the diameter of ABV-P/PV valves by using Fig 7. Maximum flow rates are based on 10 kPa differential pressure over the valve which allows effcient pumping and saves energy.

After ABV-P/PV valves have been sized the same dimension of partner valve ABV-BD / ABV-I / ABV-M / MSV-F2 valve should be selected.

Example:

<u>Given</u>:
Pipe flow 200 l/h, pipes DN 15

<u>Solution</u>:
Horizontal line intersects the column for the valve DN 15 which can therefore be selected as required size.

For detailed sizing see examples on pages 12 and 13. For different Δp_v (differential pressure over the valve) see diagrams in Appendix A.

Connection between valves size and pipe size
K_v values per particular dimension were designed to cover flow range according to VDI 2073 with water velocity of up 0.8 m/s, at differential pressure of 10 kPa over the valve. As long as the water velocity in the pipe is between 0.3 and 0.8 m/s dimension of the valve should be equal to pipe dimension.

This rule is derived out of the fact that K_v values per particular dimension were designed to cover flow range according to VDI 2073 at differential pressure of 10 kPa over the valve.

Technical data

Type		ABV-I/M/P/PV		ABV-BD
Nominal diameter	DN	15-40	50-100	15-50
Max. pressure	bar	16 (PN 16)		20
Test pressure		25		30
Differential pressure over the valve	kPa	10-150 [1]	10-250 [2]	10-250
Temperature	°C	–20 … 120	–10 … 120	–20 … 120
Material of parts in contact with water				
Valve body		Brass	Grey cast iron EN-GJL-250 (GG 25)	DZR brass
Cone (ABV-P/PV)		DZR brass	Stainless steel	
Ball		-		Brass / chromium plated
Membrane / O-rings		EPDM		
Spring		Stainless steel		-

[1] *Please note that the maximum admissible differential pressure across the valve 150 kPa should also not be exceeded at partial load.*
[2] *Please note that the maximum admissible differential pressure across the valve 250 kPa should also not be exceeded at partial load.*

Design

1. Shut-off knob
2. Shut-off spindle
3. O-ring
4. Reference spring
5. Impulse tube connection
6. Diaphragm element
7. Control diaphragm
8. Pressure-relieved valve cone
9. Valve body
10. Seat

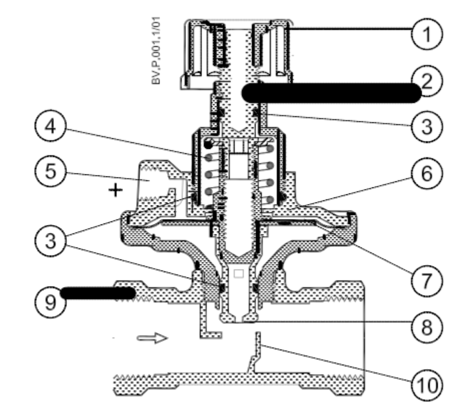
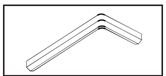


Fig. 8 ABV-P

The ABV-P is designed to maintain constant differential pressure across a riser. Via an internal connection and together with the reference spring, pressure in the return pipe acts on the underside of the control diaphragm (7) while via an impulse tube (5), pressure in the flow pipe acts on the top of the diaphragm. In this way the balancing valve maintains a fixed differential pressure of 10 kPa.

1. Shut-off knob
2. Differential pressure setting spindle
3. O-ring
4. Reference spring
5. Impulse tube connection
6. Diaphragm element
7. Control diaphragm
8. Pressure-relieved valve cone
9. Valve body
10. Seat

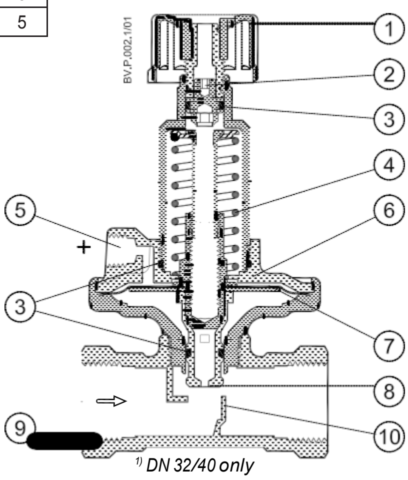
n (turns)	5-25 (kPa)	20-40 (kPa)	35-75 (kPa) [1]
0	25	40	75
1	24	39	73
2	23	38	71
3	22	37	69
4	21	36	67
5	20	35	65
6	19	34	63
7	18	33	61
8	17	32	59
9	16	31	57
10	15	30	55
11	14	29	53
12	13	28	51
13	12	27	49
14	11	26	47
15	10	25	45
16	9	24	43
17	8	23	41
18	7	22	39
19	6	21	37
20	5	20	35



DN	15	2.5
	20	3
	25	4
	32	5
	40	5

Factory presetting

Δp setting range (kPa)	kPa
5-25	10
20-40	30
35-75	60



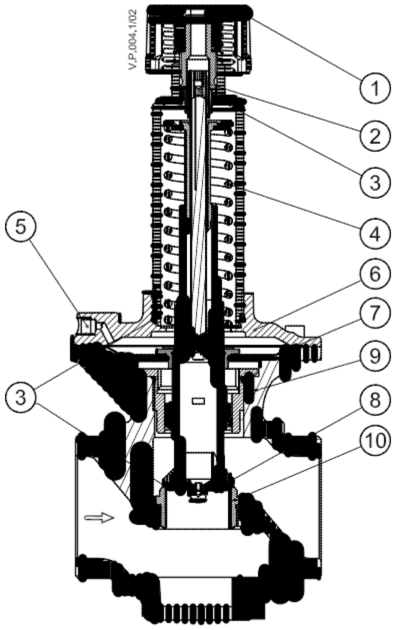
[1] *DN 32/40 only*

Fig. 9 ABV-PV (DN 15-40)

Design *(continuous)*

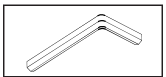
1. Shut-off knob
2. Differential pressure setting spindle
3. O-ring
4. Reference spring
5. Impulse tube connection
6. Diaphragm element
7. Control diaphragm
8. Pressure-relieved valve cone
9. Valve body
10. Seat

n (turns)	5-25 (kPa)	20-40 (kPa)	35-75 (kPa)	60-100 (kPa)
0	25	40	75	100
1	24	39	73	98
2	23	38	71	96
3	22	37	69	94
4	21	36	67	92
5	20	35	65	90
6	19	34	63	88
7	18	33	61	86
8	17	32	59	84
9	16	31	57	82
10	15	30	55	80
11	14	29	53	78
12	13	28	51	76
13	12	27	49	74
14	11	26	47	72
15	10	25	45	70
16	9	24	43	68
17	8	23	41	66
18	7	22	39	64
19	6	21	37	62
20	5	20	35	60



Factory presetting

Δp setting range (kPa)	kPa
5-25	10
20-40	30
35-75	60
60-100	80



DN	50	5

Fig. 10 ABV-PV (DN 50)

ABV-PV is designed to maintain a constant set differential pressure. Via an internal connection and together with the reference spring (4), pressure in the return pipe acts on the underside of the control diaphragm (7) while via an impulse tube (5), pressure in the flow pipe acts on the top of the diaphragm. In this way the balancing valve maintains adjusted differential pressure.

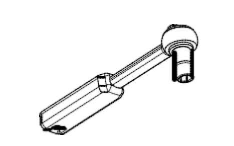
The ABV-PV valves are sold in four different Δp setting ranges. The valves are factory–set to a defined value as described on Factory presseting table on Fig. 9, 10 and 11.

Use the following procedure to set the desired differential presure:
the setting on ABV-PV can be changed by turning the setting spindle (2).
Turning the spindle clockwise increases the setting; turning it counter clockwise reduces the setting.

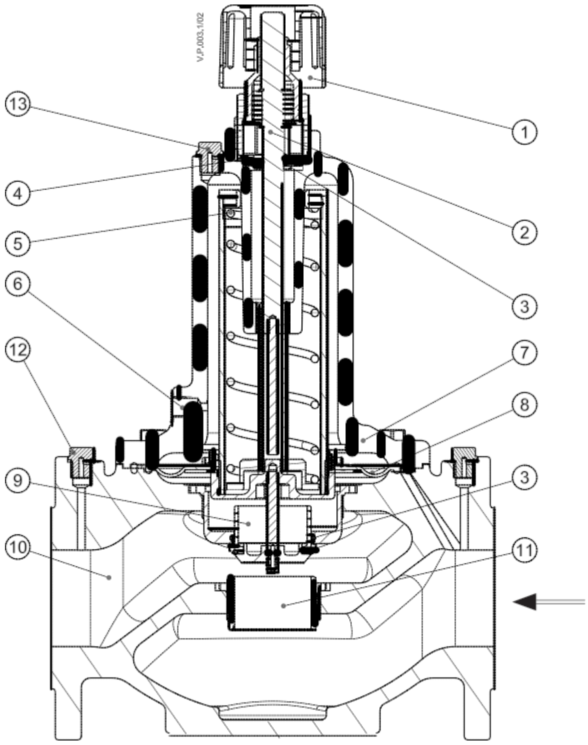
If the setting is not known, turn the spindle fully clockwise. With this the setting on ABV-PV is at maximum value within setting range. Now turn the spindle a number of times (n) as described in Fig. 9, 10 or 11 until the required differential pressure setting is obtained.

Design *(continuous)*

1. Shut-off knob
2. Differential pressure setting spindle
3. O-ring
4. Flat gasket
5. Reference spring
6. Impulse tube connection
7. Diaphragm element
8. Control diaphragm
9. Pressure-relieved valve cone
10. Valve body
11. Seat
12. Measuring holes-plugged
13. Air-vent



DN	65	13
	80	13
	100	13



Factory presetting

Δp setting range (kPa)	kPa
20-40	30
35-75	60
60-100	80

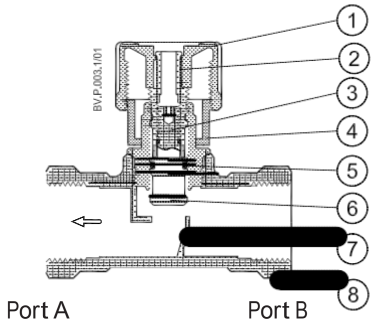
n (turns)	20-40 (kPa)	35-75 (kPa)	60-100 (kPa)
0	40	75	100
1	39	74	99
2	38	73	98
3	37	72	97
4	36	71	96
5	35	70	95
6	34	69	94
7	33	68	93
8	32	67	92
9	31	66	91
10	30	65	90
11	29	64	89
12	28	63	88
13	27	62	87
14	26	61	86
15	25	60	85
16	24	59	84
17	23	58	83
18	22	57	82
19	21	56	81
20	20	55	80

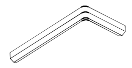
n (turns)	20-40 (kPa)	35-75 (kPa)	60-100 (kPa)
21		54	79
22		53	78
23		52	77
24		51	76
25		50	75
26		49	74
27		48	73
28		47	72
29		46	71
30		45	70
31		44	69
32		43	68
33		42	67
34		41	66
35		40	65
36		39	64
37		38	63
38		37	62
39		36	61
40		35	60

Fig. 11 ABV-PV (DN 65-100)

Design *(continuous)*

1. Shut-off knob
2. Shut-off spindle
3. Setting spindle
4. Scale disc
5. O-rings
6. Valve cone
7. Seat
8. Valve body





DN	15	2.5
	20	3
	25	4
	32/40/50	5

Fig. 12 ABV-I

ABV-I incorporates a double cone able to give maximum stroke limitation, thus achieving flow limitation. It also incorporates shut off function. ABV-I is equipped with the nipples for the flow measurement and a connection for the ABV-P/ ABV-PV impulse tube.

Use the following procedure to limit the flow: turn the valve knob fully counter clockwise to open the valve. The mark on the knob will now be opposite »0« on the scale. Turn the valve knob clockwise to the required setting (e.g. for setting 2.2 the knob must be rotated two full turns and then forward to »2« on the scale. Hold the knob to keep the setting (e.g. 2.2) and using a hexagon socket key turn the spindle fully counter clockwise (until a stop can be felt). Turn the valve knob fully counter clockwise so that the mark on the knob is opposite »0« on the scale.

The valve is now open as many turns from the closed position (2.2) as indicated by the conversion from required flow. To annul the setting, turn the hexagon socket key fully clockwise (until a stop can be felt).

Remember, at the same time the knob must be held on its »0« setting.

To read presetting valve has to be closed.

1. Shut-off knob
2. Shut-off spindle
3. O-rings
4. Valve cone
5. Seat
6. Valve body

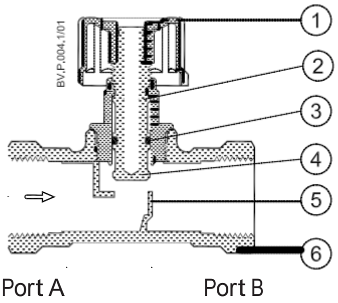
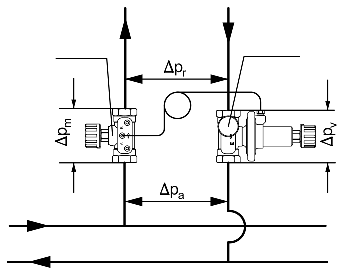


Fig. 13 ABV-M

ABV-M is designed to shut-off the pipe flow. ABV-M has a connection for an impulse tube to ABV-P/ABV-PV. It can be equipped with nipples for flow measuring (which are sold separately as accessories).

Sizing-design examples



$\Delta p_a = \Delta p_m + \Delta p_r + \Delta p_v$

Δp_v Pressure drop across ABV-P/PV
Δp_m Pressure drop across ABV-M valve
Δp_r Necessary pressure for the riser
Δp_a Available pressure for the riser

Fig. 14

1. Example

Given:
Radiator system with thermostatic radiator valves with pre-setting function.
Desired flow for the riser (Q):........................1,500 l/h
Minimal available pressure
for that riser (Δp_a).. 70 kPa
Estimated pressure drop over the riser
at the desired flow (Δp_r) .... 20 kPa

Wanted:
- Valve type
- Valve size

Since radiator valves has pre-setting function ABV-M is selected.
Since desired pressure drop over the riser is 20 kPa ABV-PV is selected.
ABV-PV should control 20 kPa pressure over the riser that means that 50 kPa out of 70 will be disposed over two valves.

$\Delta p_v + \Delta p_m = \Delta p_a - \Delta p_r = 70 - 20 = 50$ kPa

We presume that dimension DN 25 is the right dimension for this example (please mind that both valves should be of the same dimension).
As ABV-M DN 25 is to be fully open pressure drop is calculated by following equation:

$$\Delta p_m = \left(\frac{Q}{Kv}\right)^2 = \left(\frac{1.5}{4.0}\right)^2 = 0.14\text{bar} = 14\text{ kPa}$$

or by reading from diagram in **Appendix A, fig. E** as follows:
Draw horizontal line from 1.5 m^3/h (~1,500 l/h) trough the line that depicts dimension DN 25.
From the intersection draw vertical line to read that pressure drop is 14 kPa.
Pressure drop over ABV-PV valve is therefore:

$\Delta p_v = (\Delta p_a - \Delta p_r) - \Delta p_m = 50$ kPa-14 kPa $= 36$ kPa

as can be read from diagram in **Appendix A, Fig. A**.

2. Example

Correcting the flow with the differential pressure setting.

Given:
Measured flow for the riser Q_1.....................1,500 l/h
ABV-PV valve's setting Δp_r................................ 20 kPa

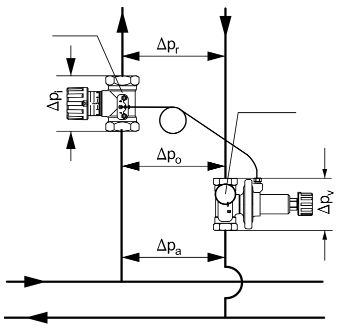
Wanted:
New valves' setting to increase the flow for 10%, Q_2 = 1650 l/h.

Setting on the ABV-PV valve:
When needed setting of the control pressure can be adjusted to particular value (ABV-PV from 5 to 25 kPa or 20 to 40 kPa).
With increasing/decreasing the setting it is possible to adjust flow trough the riser, terminal or similar. (100 % increase of control pressure will increase the flow for 41 %)

$$p_2 = p_1 \times \left(\frac{Q_2}{Q_1}\right)^2 = 0.20 \times \left(\frac{1650}{1500}\right)^2 = 24\text{kPa}$$

If we increase the setting to 24 kPa flow will be increased to 10 % to 1,650 l/h.

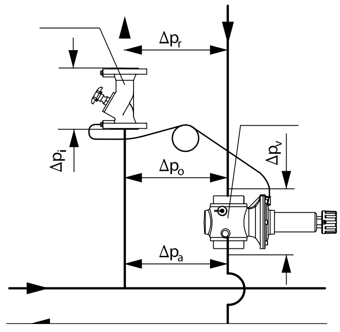
Sizing-design examples
(continuous)



$\Delta p_a = \Delta p_i + \Delta p_r + \Delta p_v$

Δp_v Pressure drop across ABV-PV valve
Δp_i Pressure drop across ABV-I valve
Δp_o Pressure drop in the riser including ABV-I
Δp_a Available pressure for the riser
Δp_r Pressure drop in the riser excluding ABV-I

Fig. 15



$\Delta p_a = \Delta p_i + \Delta p_r + \Delta p_v$

Δp_v Pressure drop across ABV-PV valve
Δp_i Pressure drop across MSV-F2
Δp_o Pressure drop across the riser including MSV-F2
Δp_a Pressure drop across the riser
Δp_r Pressure drop in the riser excluding MSV-F2

Fig. 16

3. Example
Limiting the flow with ABV-I valve

Given:
Desired flow for the branch (Q): .... 880 l/h
ABV-PV and ABV-I (DN 25)
Setting on the ABV-PV valve (Δp_o) .... 10 kPa
Estimated pressure drop over the riser at desired flow (Δp_r) .... 4 kPa

Required:
Setting of the ABV-I valve to achieve desired flow

Solution:
When needed setting of the ABV-I can be adjusted to perform flow limitation function. ABV-I namely is inside the control loop of the pressure controller therefore adjusting ABV-I would result in adjusting flow limitation. (General rule is that 100 % increase of kv value will increase the flow for 100%)

$$k_v = \frac{Q}{\sqrt{\Delta p_v}} = \frac{0.880}{\sqrt{0.06}} = 3.6 m^3/h$$

The result can be read as well from diagram in **Appendix A, Fig. D**.

At desired flow pressure drop over the entire branch is 4 kPa. Without using ABV-I flow trough the branch at fully open control valve will be 58 % higher thus causing overflow (4 kPa allow 880 l/h, while 10 kPa allow 1390 l/h). With adjusting the ABV-I DN 25 on value 90 % k_v value (3.6 m^3/h) we will limit the flow to 880 l/h as desired.
This value is obtained by following calculation:

$\Delta p_i = \Delta p_o - \Delta p_r = 10 - 4 = 6$ kPa.

4. Example
Flat station application

Given:
No. of flat stations connected to one riser 5
Heating power of each station .... 15 kW
Sanitary water heating on each station .... 35 kW
Simultaneous factor (source TU Dresden) 0.407
Desired flow for branch (Q): .... 6,400 l/h
Minimal available pressure for that riser (Δp_a) .... 80 kPa
Estimated pressure drop over the riser at the desired flow (Δp_o) .... 50 kPa

Wanted:
- Valve type
- Valve size.

For maximum flow calculation in the riser, simultaneous factor is used since sanitary water consumption is temporary occurrence and is not used simultaneous in all apartments-flats. Since water flow through heat exchanger while heating sanitary water is not controlled, maximum flow needs to be limited as well.

Since desired pressure drop over the riser is 50 kPa ABV-PV with range between 0.35 and 0.75 bar (35 and 75 kPa) is selected.

Since 80 kPa is available for the riser, Δp_v shall be 30 kPa.

$\Delta p_v = \Delta p_a - \Delta p_o = 80 - 50 = 30$ kPa

$$k_v = \frac{Q}{\sqrt{\Delta p_v}} = \frac{6.4}{\sqrt{0.3}} = 11.7 m^3/h$$

For 6.400 l/h DN 50 size valve is selected as calculated above or by reading from diagram in **Appendix A, fig. B**. If needed, to limit the flow through the riser the valve ABV-I or MSV-F2 to be used.

Measurement of flow and differential pressure

ABV-BD (needle type) and ABV-I (rectus type) are equipped with two measuring nipples so that the differential pressure across the valve can be measured using measuring equipment or any other measuring device. Using the pressure drop graph for ABV-BD (Appendix A, fig C) or ABV-I (Appendix A, fig D), the actual differential pressure across a valve can be converted to actual flow.

For rectus type measuring nipples: when the measuring equipment quick couplings are connected, the measuring nipples can be opened by giving them a half-turn counter clockwise with an 8 mm open-ended spanner. After measurement, the nipples must be closed again by turning them back clockwise and disconnecting the quick-couplings.

Note: *When measuring sized flow, all radiator valves must be fully open (nominal flow).*

Measurement of differential pressure (Δp_r) across riser.
Fit a measuring connector (Forex code no. **003L8143**) on the ABV-P/PV balancing valve drain cock (DN 15-50) or threaded connection closer to the terminal unit (TU). Measurements must be taken between the measuring nipple at ABV-BD/ABV-I/ABV-M/MSV-F2 valve port B and the measuring connector on the ABV-P/PV.

Installation

ABV-P, ABV-PV must be installed in the return pipe with flow in the direction of the arrow on thevalve body. Partner valves (ABV-M/I/BD, MSV--F2 must be installed in the flow pipe, with flow in the direction of the arrow on the valve body. The impulse tube must be installed between partner valve and ABV-P/PV.
The impulse tube must be flushed through before installation. ABV-PV and ABV-I/BD must in addition be installed as determined by installation conditions.

Pressure testing

Max. test pressure .... 25 bar

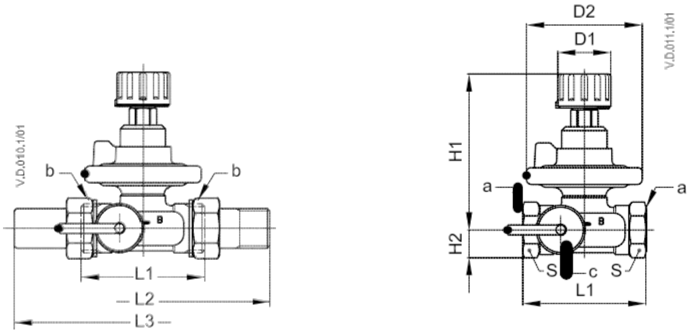
When pressure testing the system you must secure that both sides of the membrane have the same static pressure to prevent damage of the pressure controller. That means the impulse tube must be connected and any needle valves must be open.

If ABV-P/PV DN 15-50 is installed in combination with ABV-M both valves must be open or closed (both valves must be in the same position!). If ABV-P/PV DN 15-50 is installed in combination with ABV-I /ABV-BD both valves must be open. During this operation (closing or opening the valves) please make sure that there is never lower pressure on upper side of the membrane to prevent damaging it .

Starting

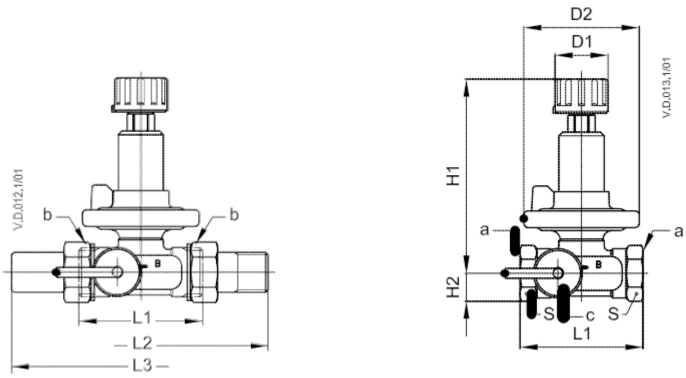
During system start – opening the shut-off on ABV-PV and partner valve-please secure that there is the same static pressure on both sides or higher pressure on upper side of the membrane. If filling is done by opening ABV-PV and partner valve, please make sure there is a pressure on the upper side of the membrane by opening partner valve first before ABV-PV is opened.

Dimensions



ABV-P

DN	L1	L2	L3	H1	H2	D1	D2	S	a	b	c
	mm								ISO 7/1	ISO 228/1	
15	65	120	139	82	15	28	61	27	Rp ½	G ¾ A	
20	75	136	159	103	18	35	76	32	Rp ¾	G 1 A	
25	85	155	169	132	23	45	98	41	Rp 1	G 1¼ A	G ¾ A
32	95	172	179	165	29	55	122	50	Rp 1¼	G 1½ A	
40	100	206	184	170	31	55	122	55	Rp 1½	G 1¾ A	



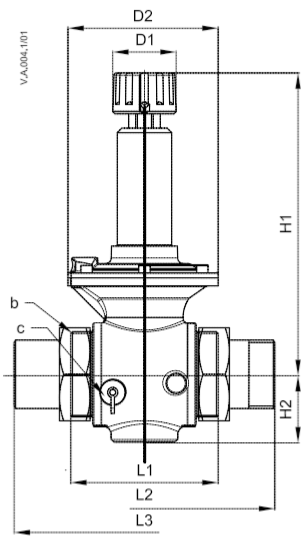
ABV-PV

DN	L1	L2	L3	H1	H2	D1	D2	S	a	b	c
	mm								ISO 7/1	ISO 228/1	
15	65	120	139	102	15	28	61	27	Rp ½	G ¾ A	
20	75	136	159	128	18	35	76	32	Rp ¾	G 1 A	
25	85	155	169	163	23	45	98	41	Rp 1	G 1¼ A	
32	95	172	179	204 245 [1)]	29	55	122	50	Rp 1¼	G 1½ A	G ¾ A
40	100	206	184	209 250 [1)]	31	55	122	55	Rp 1½	G 1¾ A	

[1)] *35-75 kPa setting range*

Fig. 17

Dimensions
(continuous)



ABV-PV

<table>
<tr><th rowspan="2">DN</th><th>Δp setting range</th><th>L1</th><th>L2</th><th>L3</th><th>H1</th><th>H2</th><th>D1</th><th>D2</th><th>b</th><th>c</th></tr>
<tr><td>kPa</td><td colspan="7">mm</td><td colspan="2">ISO 228/1</td></tr>
<tr><td rowspan="4">50</td><td>5-25</td><td rowspan="4">130</td><td rowspan="4">244</td><td rowspan="4">234</td><td rowspan="2">232</td><td rowspan="4">61</td><td rowspan="4">55</td><td rowspan="4">133</td><td rowspan="4">G 2 1/2</td><td rowspan="4">G 3/4 A</td></tr>
<tr><td>20-40</td></tr>
<tr><td>35-75</td><td rowspan="2">273</td></tr>
<tr><td>60-10</td></tr>
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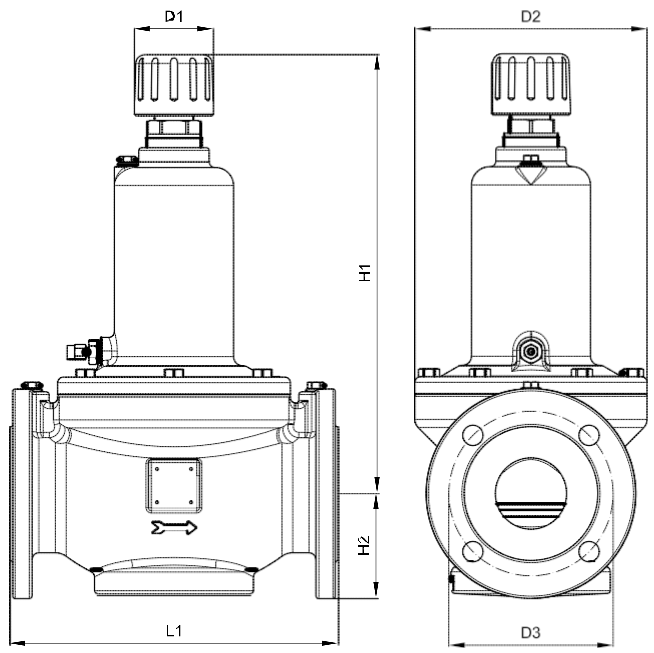
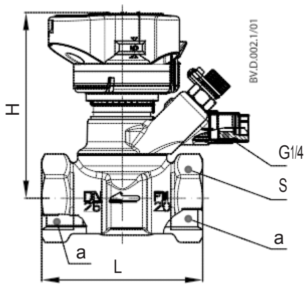


ABV-PV

DN	L1	H1	H2	D1	D2	D3
	mm					
65	290	385	93	68	205	145
80	310	390	100	68	218	160
100	347	446	112	68	248	180

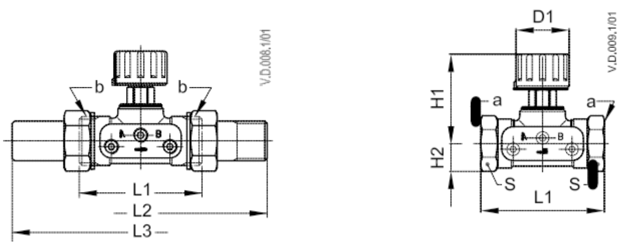
Fig. 18

Dimensions
(continuous)



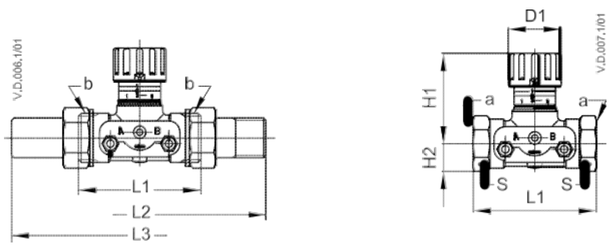
ABV-BD

DN	L	H	S	a
	mm			ISO 228/1
15	65	92	27	G ½
20	75	95	32	G ¾
25	85	98	41	G 1
32	95	121	50	G 1¼
40	100	125	55	G 1½
50	130	129	67	G 2



ABV-M

DN	L1	L2	L3	H1	H2	D1	S	a	b
	mm							ISO 7/1	ISO 228/1
15	65	120	139	48	15	28	27	Rp ½	G ¾ A
20	75	136	159	60	18	35	32	Rp ¾	G 1 A
25	85	155	169	75	23	45	41	Rp 1	G 1¼ A
32	95	172	179	95	29	55	50	Rp 1¼	G 1½ A
40	100	206	184	100	31	55	55	Rp 1½	G 1¾ A
50	130	246	214	106	38	55	67	-	G 2¼ A



ABV-I

DN	L1	L2	L3	H1	H2	D1	S	a	b
	mm							ISO 7/1	ISO 228/1
15	65	120	139	48	15	28	27	Rp ½	G ¾ A
20	75	136	159	60	18	35	32	Rp ¾	G 1 A
25	85	155	169	75	23	45	41	Rp 1	G 1¼ A
32	95	172	179	95	29	55	50	Rp 1¼	G 1½ A
40	100	206	184	100	31	55	55	Rp 1½	G 1¾ A
50	130	246	214	106	38	55	67	-	G 2¼ A

Fig. 19

Appendix A-*Sizing diagram*

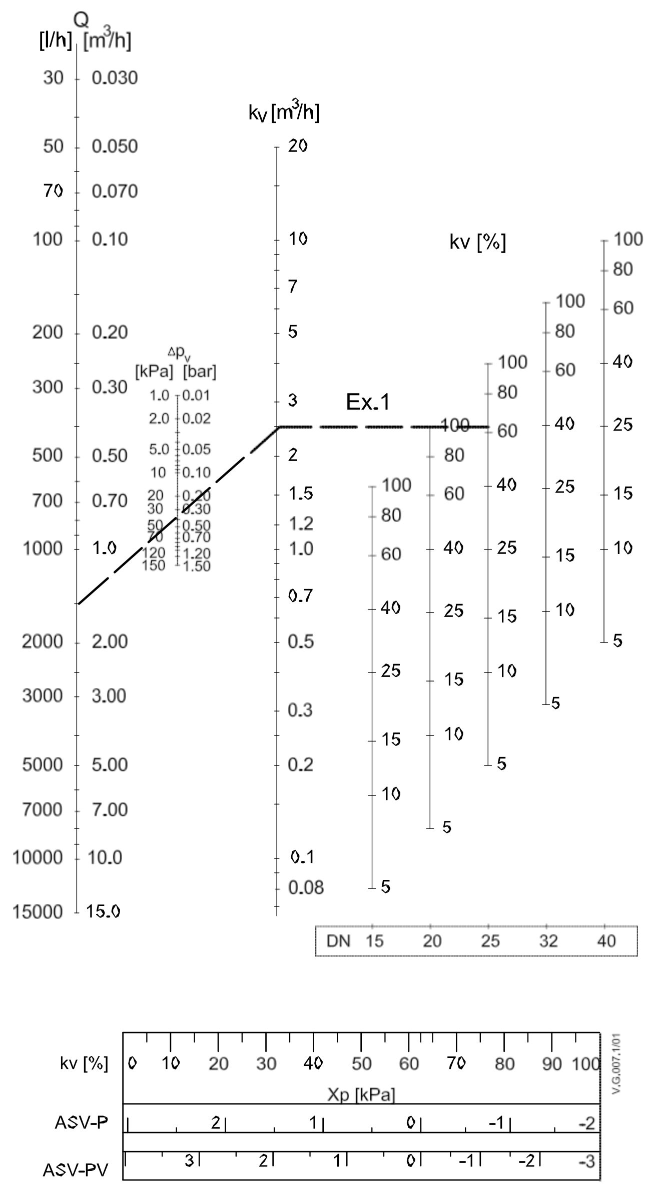


Fig. A - Sizing diagram ABV-P/PV DN 15-40

Appendix A-*Sizing diagram*

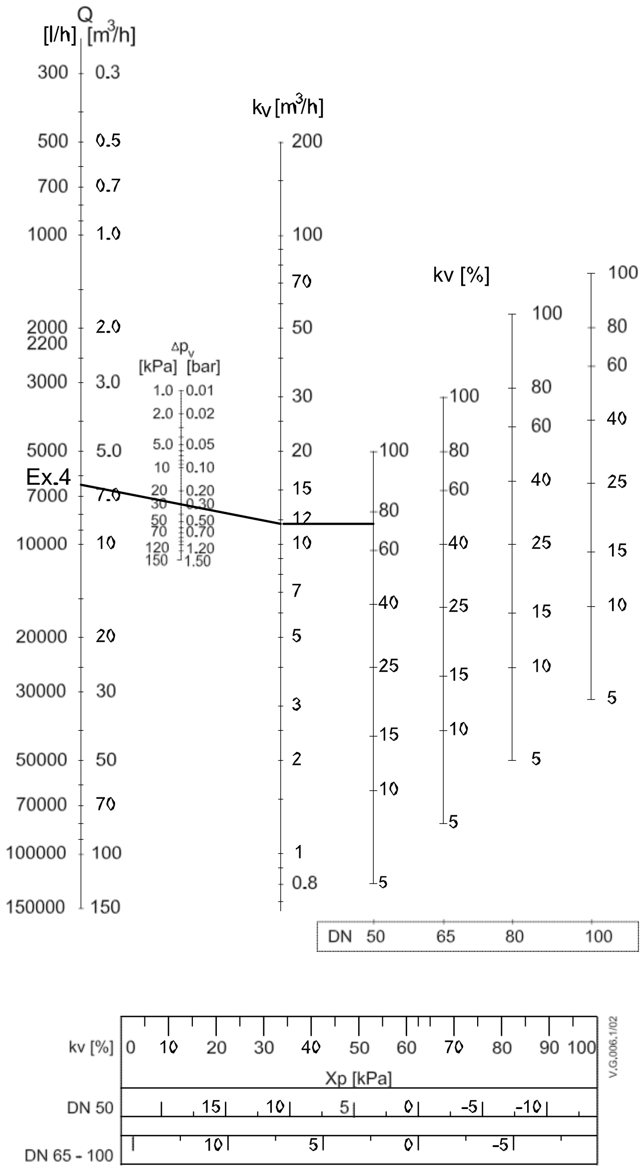


Fig. B - Sizing diagram ABV-PV DN 50-100

Appendix A-*Sizing diagram*

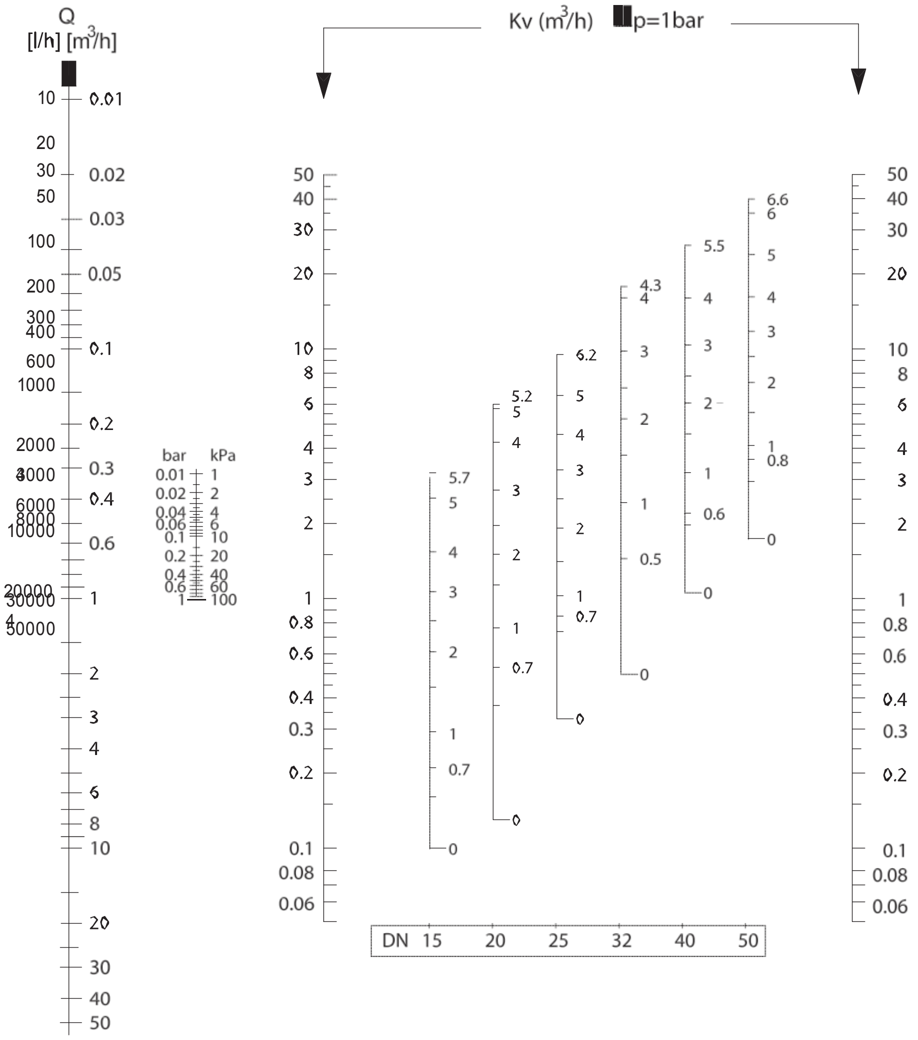


***Fig.C** - Sizing diagram ABV-BD DN 15-50*

Appendix A

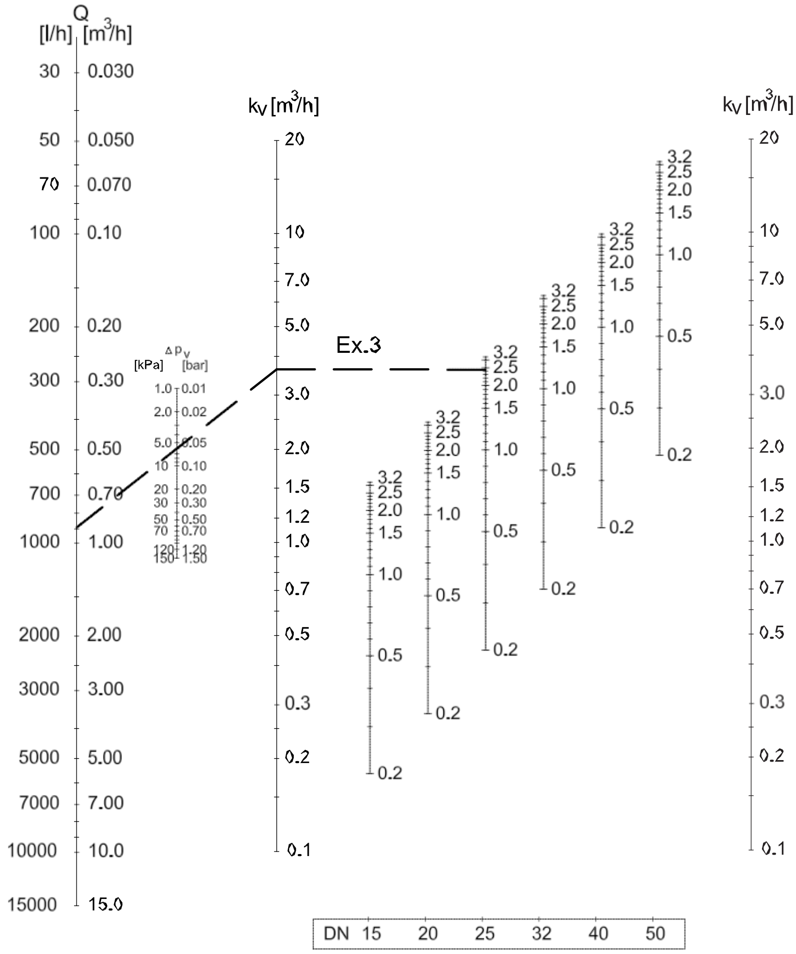


Fig. D Sizing diagram ABV-I, DN 15-50

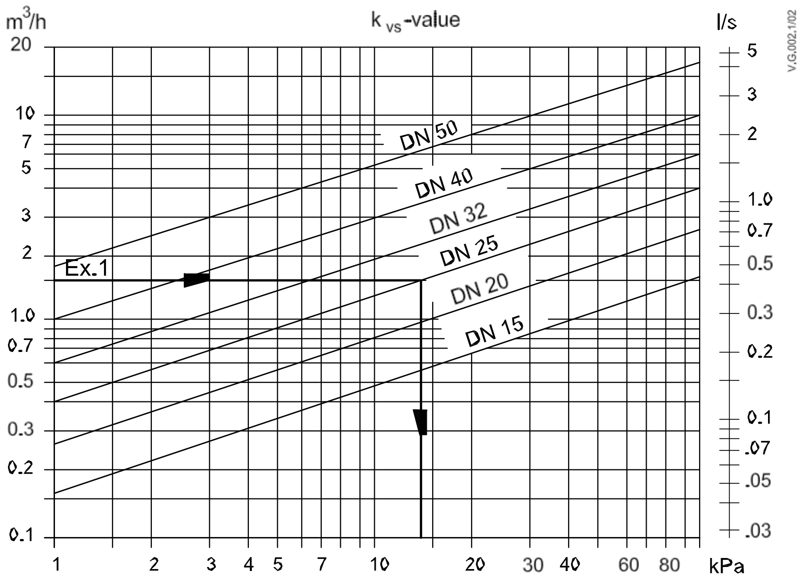


Fig. E -Pressure drop over ABV-M valves, DN 15-50