Data sheet

Flow controller (PN 25)
AVQ - return and flow mounting

Description

AVQ 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.

Main data:
- DN 15-50
- k_{VS} 1.6-25 m³/h
- Flow range 0.03-15 m³/h
- PN 25
- Flow restrictor Δp: 0.2 bar
- Temperature:
  - Circulation water / glycolic water up to 30%: 2 … 150 °C
- Connections:
  - Ext. thread (weld-on, thread and flange tailpieces)
  - Flange

Ordering

Example:
Flow controller; DN 15; k_{VS} 1.6; PN 25; flow restrictor Δp 0.2 bar; T_{max} 150 °C; ext. thread

- *1× AVQ DN 15 controller*
  *Code No: **003H6722***

Option:
- *1× Weld-on tailpieces*
  *Code No: **003H6908***

The controller will be delivered completely assembled, inclusive impulse tube between valve and actuator.

AVQ Controller

Picture	DN (mm)	k_{VS} (m3/h)	Connection		Code No.
	15	1.6	Cylindr. ext. thread acc. to ISO 228/1	G ¾ A	003H6722
		2.5			003H6723
		4.0			003H6724
	20	6.3		G 1 A	003H6725
	25	8.0		G 1¼ A	003H6726
	32	12.5		G 1¾ A	003H6727
	40	16		G 2 A	003H6728
	50	20		G 2½ A	003H6729
	32	12.5	Flanges PN 25, acc. to EN 1092-2		003H6730
	40	20			003H6731
	50	25			003H6732

Ordering (continuous)

Accessories

Picture	Type designation	DN	Connection		Code No.
	Weld-on tailpieces	15	–		**003H6908**
		20			**003H6909**
		25			**003H6910**
		32			**003H6911**
		40			**003H6912**
		50			**003H6913**
	External thread tailpieces	15	Conical ext. thread acc. to EN 10226-1	R ½	**003H6902**
		20		R ¾	**003H6903**
		25		R 1	**003H6904**
		32		R 1¼	**003H6905**
		40		R 1½	**065B2004**
		50		R 2	**065B2005**
	Flange tailpieces	15	Flanges PN 25, acc. to EN 1092-2		**003H6915**
		20			**003H6916**
		25			**003H6917**

Service kits

Picture	Type designation	DN	k_{vs} (m³/h)	Code No.
	Valve insert	15	1.6	**003H6863**
			2.5	**003H6864**
			4.0	**003H6865**
		20	6.3	**003H6866**
		25	8.0	**003H6867**
		32 / 40 / 50	12.5 / 16 / 20 / 25	**003H6868**

Picture	Type designation	Fixed setting (bar)	Code No.
	Actuator	0.2	**003H6841**

Technical data

Valve

Nominal diameter			DN	15			20	25	32	40	50
k_{vs} value				1.6	2.5	4.0	6.3	8.0	12.5	16/20 [4]	20/25 [4]
Range of max. flow setting	Δp_b [1] = 0.2 bar	from	m³/h	0.03	0.07	0.07	0.16	0.2	0.4	0.8	0.8
		to		0.86	1.4	2.2	3.0	3.5	8.0	10	12
		or to [3]		0.9	1.6	2.4	3.5	4.5	10	12	15
Cavitation factor z				≥ 0.6				≥ 0.55		≥ 0.5	
Leakage acc. to standard IEC 534			% of k_{vs}	≤ 0.02					≤ 0.05		
Nominal pressure			PN	25							
Min. differential pressure			bar	see remark [2]							
Max. differential pressure				20					16		
Medium				Circulation water / glycolic water up to 30%							
Medium pH				Min. 7, max. 10							
Medium temperature			°C	2 … 150							
Connections	valve			External thread					External thread and flange		
	tailpieces			Weld-on and external thread							
				Flange					-		
Materials											
Valve body	thread			Red bronze CuSn5ZnPb (Rg5)					Ductile iron EN-GJS-400-18-LT (GGG 40.3)		
	flange			-							
Valve seat				Stainless steel, mat. No. 1.4571							
Valve cone				Dezincing free brass CuZn36Pb2As							
Sealing				EPDM							
Pressure relieve system				Piston							

[1] Δp_b - 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 $Q_{set} < Q_{max}$ -> $\Delta p_{min} = \left(\dfrac{Q}{k_{vs}} \right)^2 + \Delta p_b$

[3]   Higher max flow are achieved at higher differential pressures over AVQ controller. In general at $\Delta p > 1\text{-}1.5$ bar
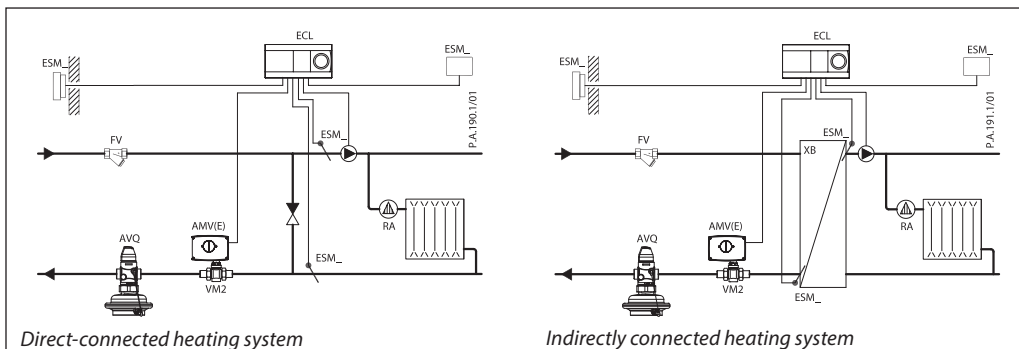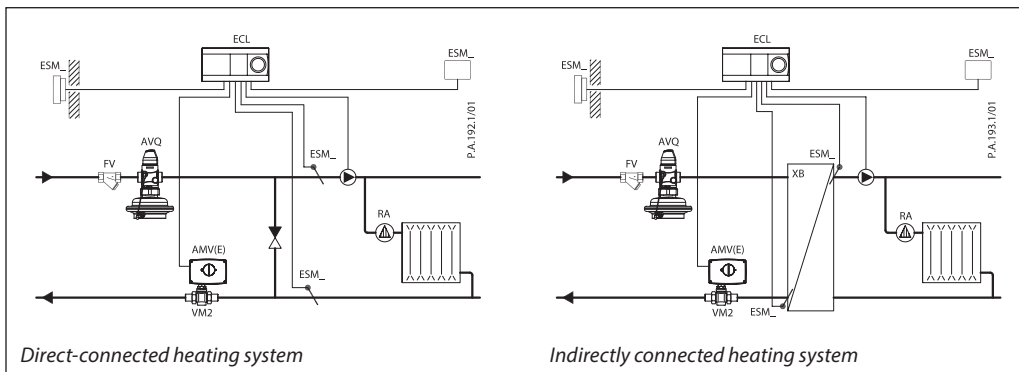[4]   Flange valve body

Technical data *(continuous)*

Actuator

Type		AVQ
Actuator size	cm²	54
Nominal pressure	PN	25
Flow restrictor diff. pressure	bar	0.2
Materials		
Actuator housing	Upper casing of diaphragm	Stainless steel, mat. No.1.4301
	Lower casing of diaphragm	Dezincing free brass CuZn36Pb2As
Diaphragm		EPDM
Impulse tube		Copper tube Ø 6 × 1 mm

Application principles

- Return mounting

Direct-connected heating system   *Indirectly connected heating system*

- Flow mounting

Direct-connected heating system   *Indirectly connected heating system*
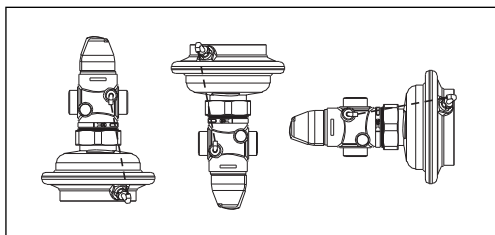
Installation positions

Up to medium temperature of 100°C the controllers can be installed in any position.

For higher temperatures the controllers have to be installed in horizontal pipes only, with a pressure actuator oriented downwards.
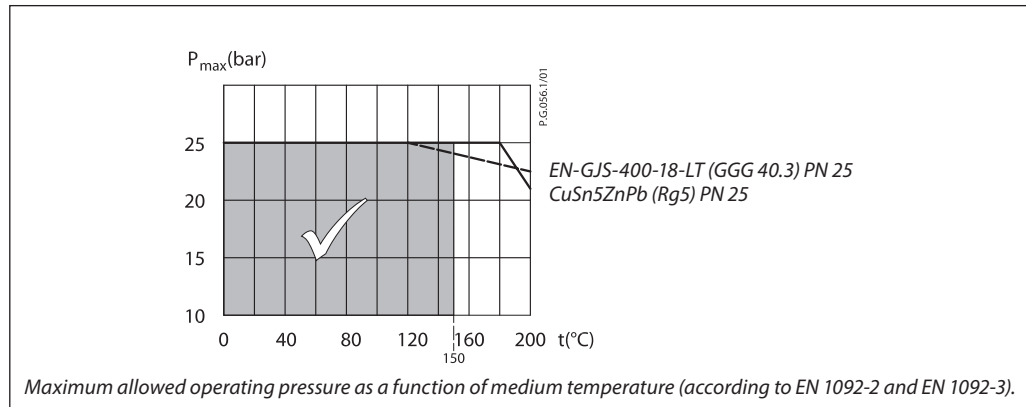
Electrical actuator
Note!
Installation positions for electrical actuators AMV(E) have to be observed as well. Please see relevant Data Sheet.
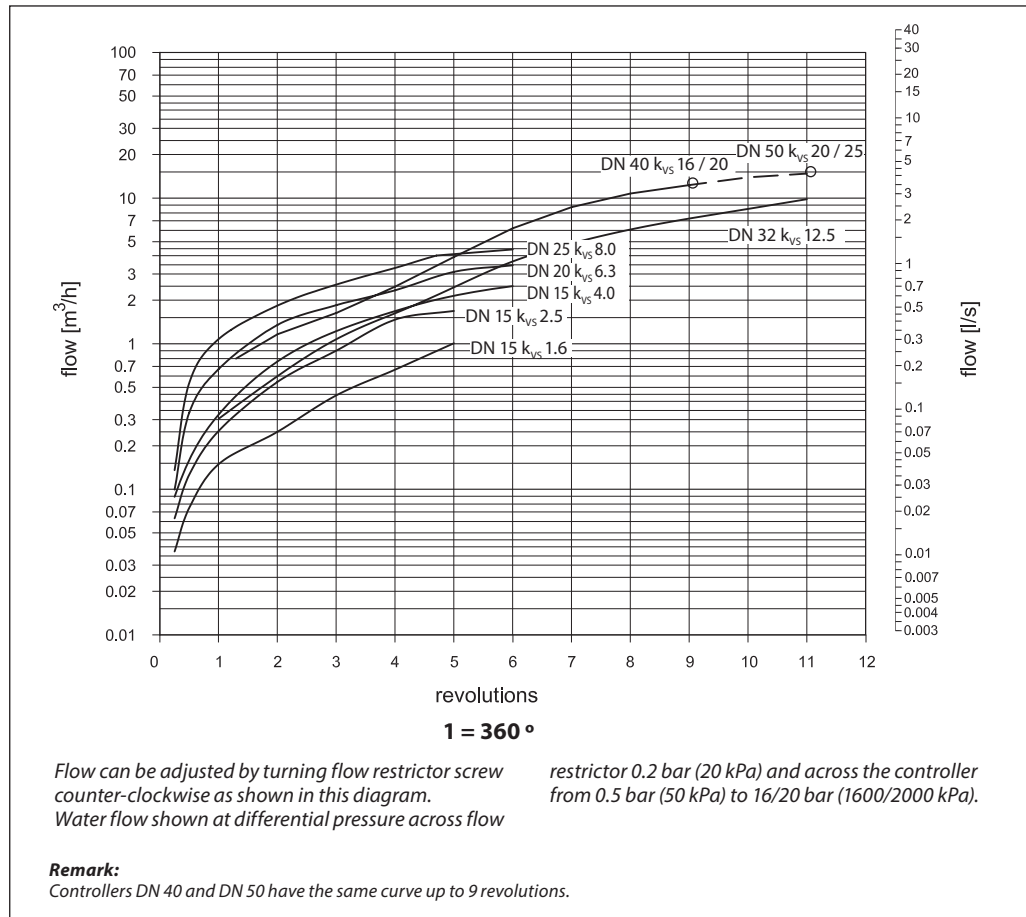
Danfoss
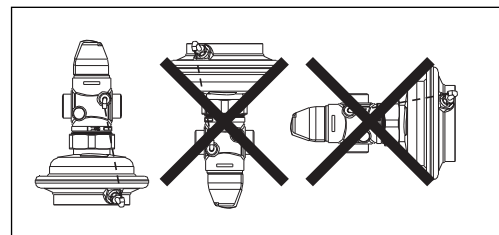
Pressure temperature diagram

P_{max}(bar)

P.G.056.1/01

25

20

15

10

0　40　80　120　160　200　t(°C)
　　　　　　　　　150

EN-GJS-400-18-LT (GGG 40.3) PN 25
CuSn5ZnPb (Rg5) PN 25

Maximum allowed operating pressure as a function of medium temperature (according to EN 1092-2 and EN 1092-3).

Flow diagram

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

flow [m³/h]

flow [l/s]

DN 50 k_{VS} 20 / 25
DN 40 k_{VS} 16 / 20
DN 32 k_{VS} 12.5
DN 25 k_{VS} 8.0
DN 20 k_{VS} 6.3
DN 15 k_{VS} 4.0
DN 15 k_{VS} 2.5
DN 15 k_{VS} 1.6

revolutions

1 = 360 °

Flow can be adjusted by turning flow restrictor screw counter-clockwise as shown in this diagram. 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 16/20 bar (1600/2000 kPa).

Remark:
Controllers DN 40 and DN 50 have the same curve up to 9 revolutions.

Note:
For max flow setting on the controller diagrams from Instructions should be used.

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)
Δp_{min} = 0.9 bar (90 kPa)
$\Delta p_{circuit}$ [1] = 0.1 bar (10 kPa)
Δp_{MCV} = 0.3 bar (30 kPa) selected
Δp_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 AVQ.
[2] Δp_b is differential pressure over flow restrictor.

The total (available) pressure loss across the controller is:
$\Delta p_{AVQ,A} = \Delta p_{min} - \Delta p_{MCV} = 0.9 - 0.3$
$\Delta p_{AVQ,A}$ = 0.6 bar (60 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} = 1.6 m³/h

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

$$\Delta p_{AVQ,MIN} = \left(\frac{Q_{max}}{k_{VS}}\right)^2 + \Delta p_b = \left(\frac{0{,}6}{1{,}6}\right)^2 + 0{,}2$$

$\Delta p_{AVQ,MIN}$ = 0.34 bar (34 kPa)

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

0.6 bar > 0.34 bar

Solution:
The example selects AVQ DN 15; k_{VS} value 1.6; flow setting range 0.03-0.9 m³/h.
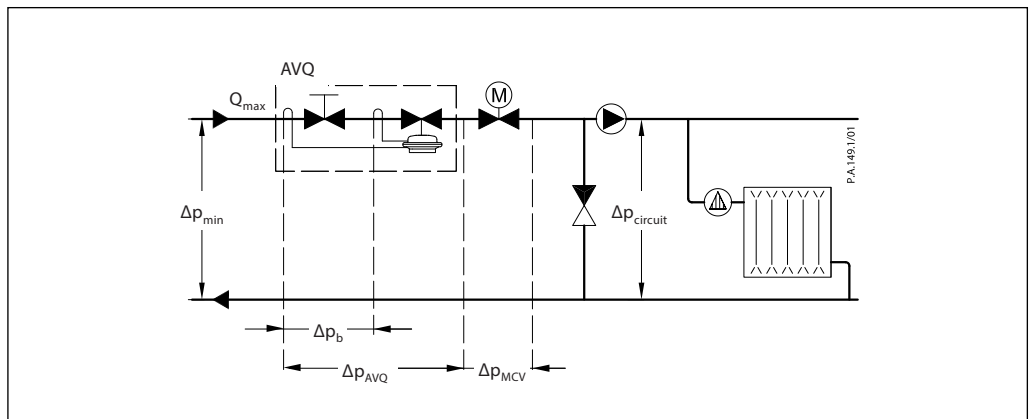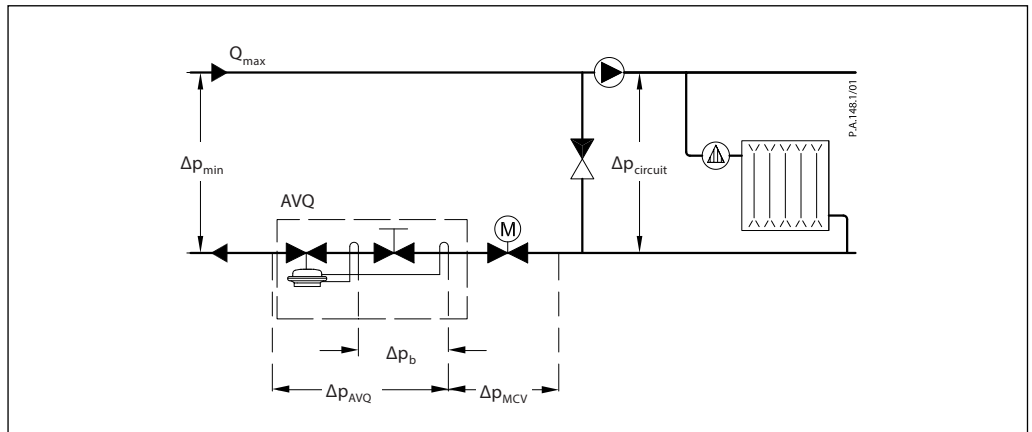
Sizing *(continuous)*

- *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)
Δp_{min} = 1.1 bar (110 kPa)
$\Delta p_{exchanger}$ = 0.1 bar (10 kPa)
Δp_{MCV} = 0.3 bar (30 kPa) selected
Δp_b [1] = 0.2 bar (20 kPa)
Remark:
[1] *Δp_b is differential pressure over flow restrictor*

The total (available) pressure loss across the controller is:
$\Delta p_{AVQ,A}$ = $\Delta p_{min} - \Delta p_{exchanger} - \Delta p_{MCV}$
= 1.1 − 0.1 − 0.3
$\Delta p_{AVQ,A}$ = 0.7 bar (70 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} = 4.0 m³/h

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

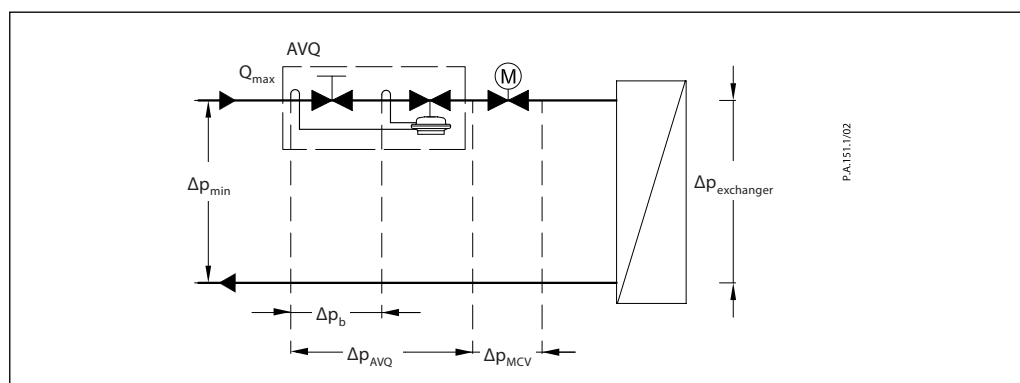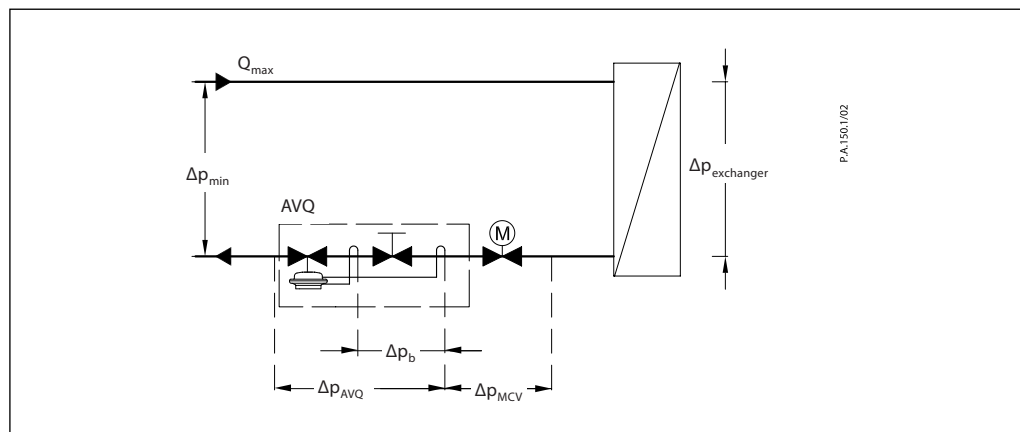$$\Delta p_{AVQ,MIN} = \left(\frac{Q_{max}}{k_{VS}}\right)^2 + \Delta p_b = \left(\frac{1.9}{4.0}\right)^2 + 0.2$$

$\Delta p_{AVQ,MIN}$ = 0.43 bar (43 kPa)

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

0.7 bar > 0.43 bar

Solution:
The example selects AVQ; DN 15; k_{VS} value 4.0; flow setting range 0.07-2.4 m³/h.

Design

1. Cover
2. Adjustable flow restrictor
3. Valve body
4. Valve insert
5. Pressure relieved valve cone
6. Valve stem
7. Built-in spring for flow rate control
8. Control drain
9. Control diaphragm
10. Union nut
11. Upper casing of diaphragm
12. Lower casing of diaphragm
13. Impulse tube
14. Compression fitting for impulse tube
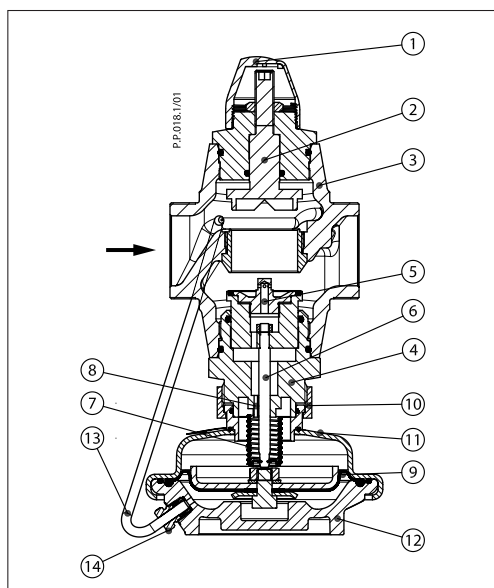
Function

Flow volume causes pressure drop across the adjustable flow restrictor. Resulting pressures are being transferred through the impulse tubes and/or control drain in the actuator stem 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.

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.
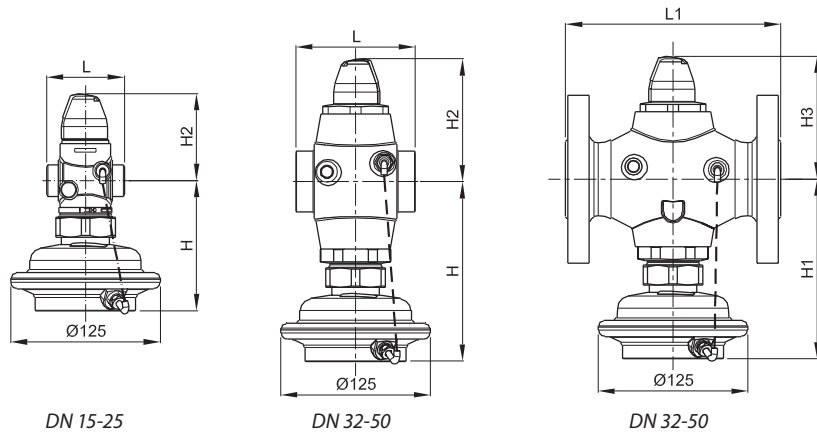
Data sheet   **AVQ (PN 25)**

Dimensions
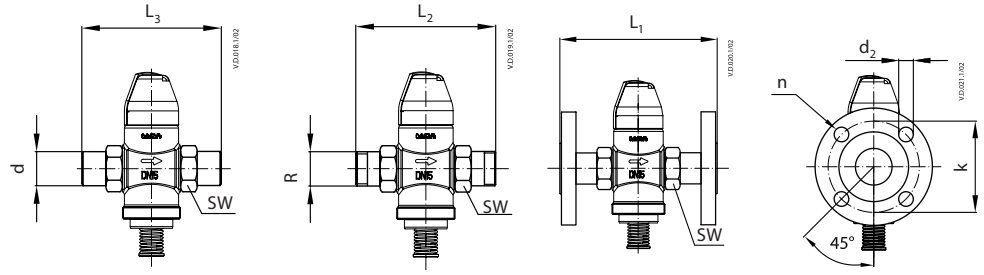
DN	R [1]	SW	d	L$_1$ [2]	L$_2$	L$_3$	k	d$_2$	n
					mm				
15	½	32 (G ¾A)	21	130	120	139	65	14	4
20	¾	41 (G 1A)	26	150	131	154	75	14	4
25	1	50 (G 1¼A)	33	160	145	159	85	14	4
32	1¼	63 (G 1¾A)	42	-	177	184	100	18	4
40	1 ½	70 (G 2A)	47	-	200	204	110	18	4
50	2	82 (G 2½A)	60	-	244	234	125	18	4

[1] *Conical ext. thread acc. to EN 10226-1*
[2] *Flanges PN 25, acc. to EN 1092-2*

DN 15-25   *DN 32-50*   *DN 32-50*

DN		15	20	25	32	40	50
L		65	70	75	100	110	130
L1		-	-	-	180	200	230
H		109	109	109	150	150	150
H1	mm	-	-	-	150	150	150
H2		73	73	76	103	103	103
H3		-	-	-	103	103	103
Weight (thread)		2.7	2.7	2.9	5.3	5.5	6.1
Weight (flange)	kg	-	-	-	9.8	11.4	13.5

Note: *other flange dimensions-see table for tailpieces.*