

# Pilot-operated Universal Regulators

Pressure, differential pressure, flow rate, temperature <sup>1)</sup> or combined regulators, optionally with additional electric actuator



## Type 2334

### Application

Pilot-operated pressure, differential pressure, flow rate, temperature <sup>1)</sup> or combined regulators, optionally with additional electric actuator · Main valve in nominal sizes **DN 65 to 400** · Nominal pressure **PN 16 to 40** · Flange end connections · For heating and cooling plants · Suitable for **liquids** from **5 to 150 °C**, **non-flammable gases** up to **80 °C**

The universal regulators consist of a large globe valve acting as the main valve and a maximum of three smaller pilot valves connected in parallel in a bypass line.

The pressure drop across the regulator is used to operate the valve, whereby a Venturi nozzle in the bypass line amplifies the pressure drop as the flow rate increases. The pilot valves open depending on the controlled variable used to operate them. As a result, a flow rate arises in the bypass line over the Venturi nozzle, which is used to control the main valve (open or close it). This allows the controlled variable (pressure, differential pressure, flow rate or temperature) to be controlled. Electric signals from an electric actuator can also be used to operate the valve and take influencing on the control loop, too.

### Special features

- Single-seated globe valve with flanged end connections
- Suitable for district heating plants in accordance with DIN 4747-1 (requirements stipulated by AGFW (German District Heating Association) concerning components in house substations)
- Wide control range and high useable rangeability at low pressure loss
- Pilot-operated by the medium, with a maximum of three pilot valves
- Excellent stability and control accuracy even when the pressures fluctuate considerably
- Smooth opening and closing of the main valve
- Wide set point range and convenient set point adjustment at the pilot valve
- Numerous control functions and the possibility to combine several functions

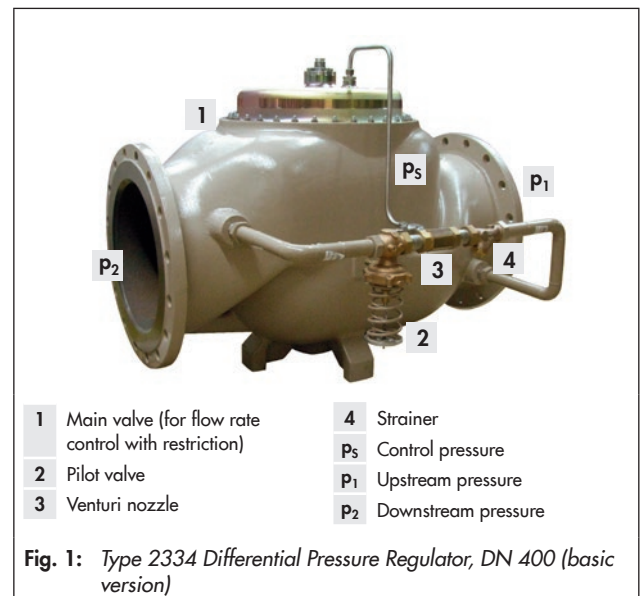
### Versions

**Type 2423** Valve (with integrated restriction to adjust the maximum flow rate) or **Type 2422** Valve (without restriction) · Pilot valve depending on the application

**DN 65 to 100:** with balancing bellows and external Type 2420 Actuator (closing)

**DN 125 to 250:** with balancing diaphragm and internal closing spring, also available with balancing bellows · Optionally with Type 2420 Actuator (closing)

<sup>1)</sup> Temperature regulator on request



**DN 300 and 400:** Type 2422 with balancing diaphragm and internal closing spring · Optionally with external orifice plate

**Basic version** · Main valve **DN 65 to 250** and bypass line (DN 15) with strainer, Venturi nozzle and pilot valve as ready-to-install unit

Main valve **DN 300 or 400** and bypass line (DN 25) with strainer, Venturi nozzle and pilot valve as ready-to-install unit  
Strainer, Venturi nozzle and pilot valve depending on application

**Version with bypass line (DN 25/40)** · With very high useable rangeability, especially for use in district heating plants · Main valve **DN 65 to 400** · Bypass line (DN 25/40) with strainer, Venturi nozzle and pilot valve · Strainer, Venturi nozzle and pilot valve depending on application (installation on site)

### Special versions

**DN 65 to 250:** Reduced  $K_{VS}$  coefficient · For high temperatures ANSI and JIS versions · With flow divider for noise reduction (only valves balanced by a bellows) · Oil-resistant version Free of non-ferrous metals · Pilot valves connected in parallel (instead of in series) · Free of graphite for deionized water With external orifice plate · With downstream attenuation plate for noise reduction

### Type 2334 · Flow and differential pressure regulators (DN 125 to 250) for installation in the return flow pipe

The regulator consists of a **Type 2423** Globe Valve (1), acting as the main valve, with adjustable restriction (1.1) and operating diaphragm (5) as well as bypass line with strainer (10), Venturi nozzle (11) and a pilot valve for flow rate control (7) and a pilot valve for differential pressure control (8).

The pilot valves are used to regulate the flow rate and differential pressure to their adjusted set points. The associated pilot valve closes when either the flow rate or differential pressure exceed their set point, causing the main valve to close as well.

The medium flows through the main valve in the direction indicated by the arrow. The areas released by the plug (3) and the restriction determine the flow rate and differential pressure. The forces are compared arising, on the one side, from the upstream pressure  $p_1$  acting on the plug surface and, on the other side, the control pressure  $p_s$  acting on the operating diaphragm as well as from the set point springs (6).

The control pressure  $p_s$  is generated by the Venturi nozzle (11) depending on how far the pilot valves are open. If the medium is at a standstill in the bypass line, the control pressure  $p_s$  is equal to the upstream pressure  $p_1$ . The main valve is closed by the force of the set point springs.

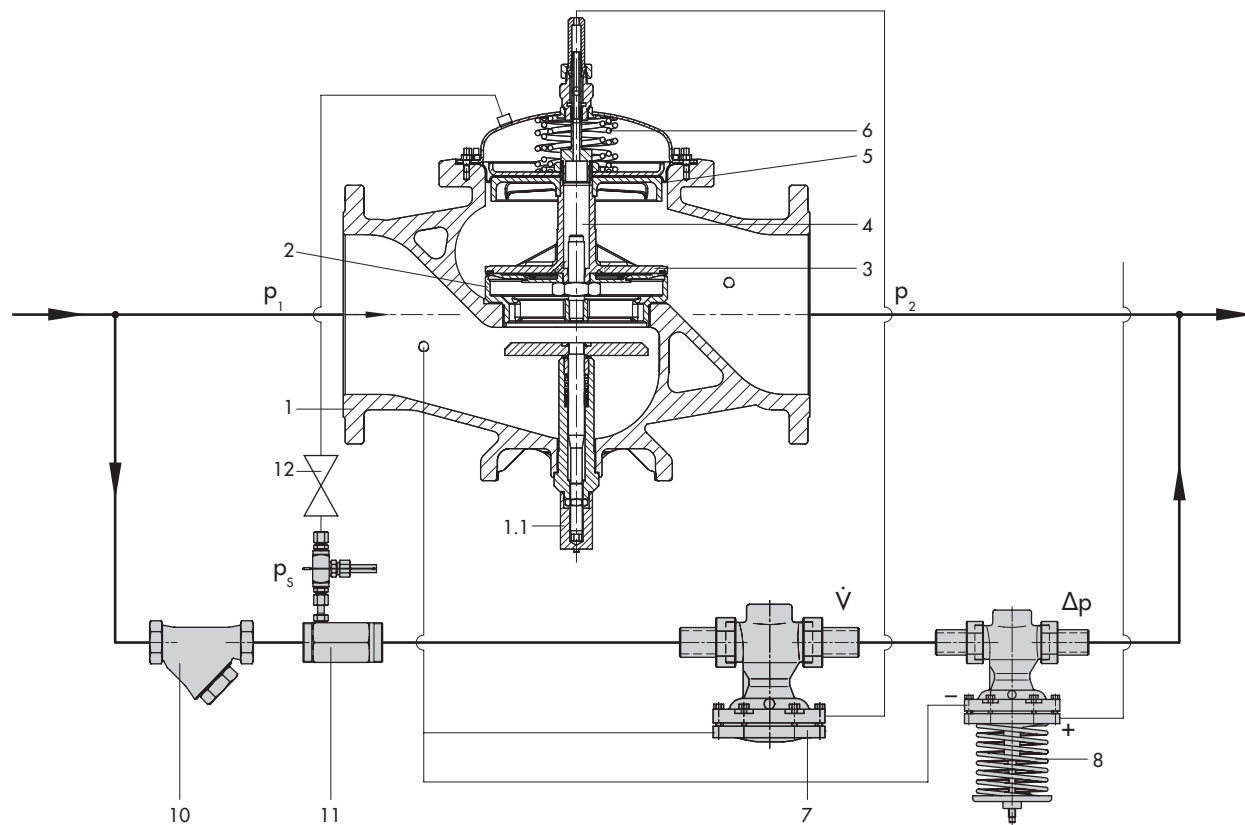
When the differential pressure falls below the set point, the pilot valve responsible for differential pressure control opens and the control pressure  $p_s$  drops. The plug (3) opens until the adjusted set point is reached.

When the flow rate or differential pressure rises above the set point, their associated pilot valve closes. This results in a rise in control pressure  $p_s$  across the Venturi nozzle (11), which causes the plug stem (4) together with the plug (3) to move in the closing direction until a new state of equilibrium is reached. When the flow rate or differential pressure starts to drop, the described procedure is reversed. The pilot valve opens further, causing the control pressure  $p_s$  to drop. The valve plug in the main valve opens until the set point is reached.

The largest signal (either flow rate or differential pressure) determines how much medium flows through the bypass line and how high the resulting control pressure  $p_s$  is.

The higher the control pressure  $p_s$ , the smaller the area released between the seat and plug in the main valve. When the control pressure  $p_s$  is at its maximum and equals  $p_1$ , the pilot valve responsible for the differential pressure and the main valve are closed.

**Type 2334** · Flow and differential pressure regulator · Balanced by a diaphragm



- |     |   |   |                                       |    |                |
|-----|---|---|---------------------------------------|----|----------------|
| 1   | Type 2423 (main valve) with balancing diaphragm and internal closing spring | 4 | Plug stem                             | 10 | Strainer       |
| 1.1 | Restriction   | 5 | Operating diaphragm                   | 11 | Venturi nozzle |
| 2   | Valve seat  | 6 | Set point springs                     | 12 | Needle valve   |
| 3   | Plug  | 7 | Pilot valve for flow rate             |    |                |
|     |   | 8 | Pilot valve for differential pressure |    |                |

**Fig. 2:** Functional diagram (main valve balanced by a diaphragm)

## Type 2334 · Differential pressure regulators (DN 65 to 100) for installation in the return flow pipe

The regulator consists of a **Type 2422** Globe Valve (1), acting as the main valve, with balancing bellows (5) and external **Type 2420** Actuator (7) as well as the bypass line with strainer (10), Venturi nozzle (11) and a pilot valve for differential pressure control (8).

The pilot valve is used to regulate the differential pressure to the adjusted set point. The main valve closes when the differential pressure exceeds the set point.

The medium flows through the main valve in the direction indicated by the arrow. The position of the plug (3) determines the flow rate across the area released between plug and valve seat (2). In the fully balanced valve, the pressure upstream of the plug is transferred through a hole in the plug stem (4) and acts on the outside of the balancing bellows. The pressure on the other side of the plug acts on the inside of the bellows. As a result, the forces created by the pressure that act on the plug are eliminated.

The upstream pressure  $p_1$  acts on the plug in the main valve and on the top of the operating diaphragm of the actuator. The control pressure  $p_s$  created by the Venturi nozzle acts on the diaphragm from below. As a result, the forces created by the upstream pressure  $p_1$  acting on the top of the diaphragm and the control pressure  $p_s$  and set point springs (6) acting on the dia-

phragm from below are compared.

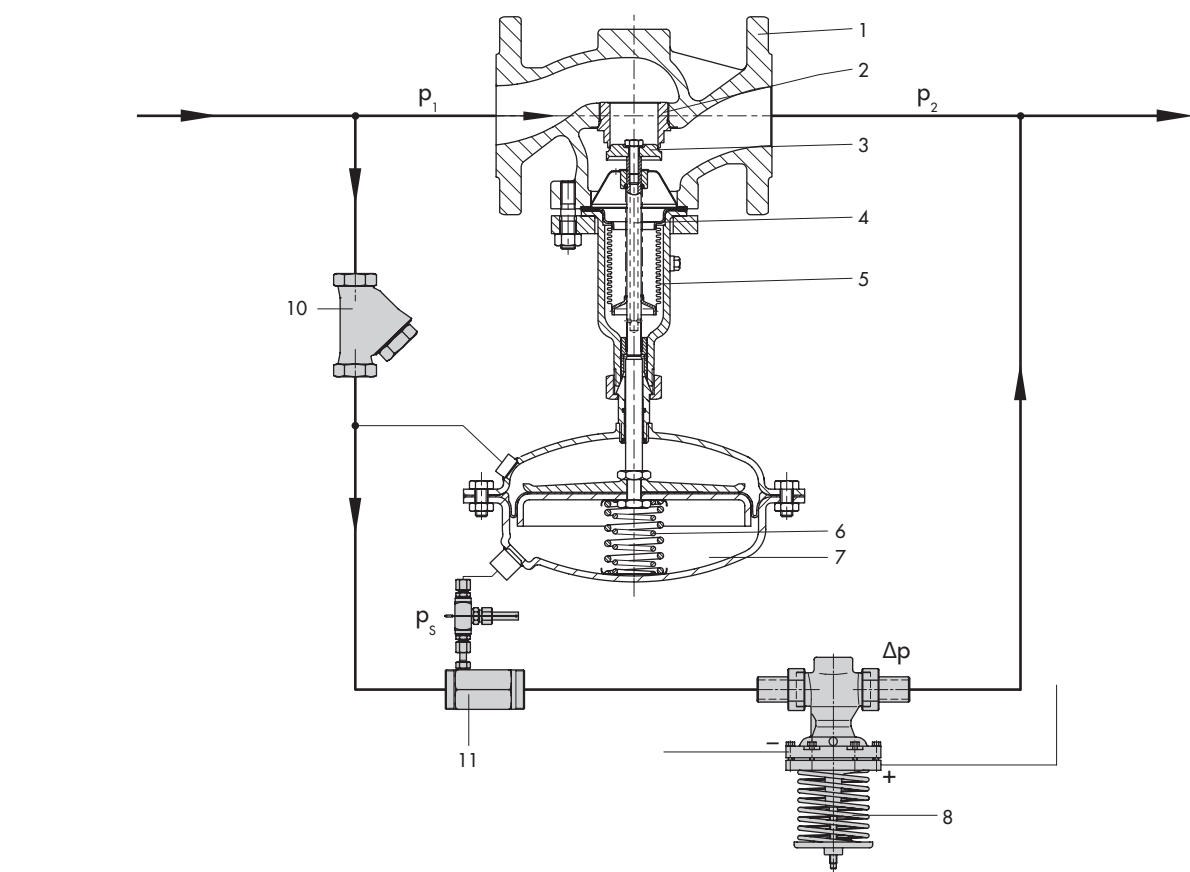
The control pressure  $p_s$  is determined by the Venturi nozzle depending on how far the pilot valve is open. If the medium is at a standstill in the bypass line, the control pressure  $p_s$  is equal to the upstream pressure  $p_1$ . The main valve is closed by the force of the set point springs.

When the differential pressure falls below the set point, the pilot valve responsible for differential pressure control opens and the control pressure  $p_s$  drops. If the force resulting from the difference between the upstream pressure  $p_1$  and the control pressure  $p_s$  is greater than the force of the set point springs, the plug of the main valve opens until the adjusted set point is reached.

When the differential pressure rises above the set point, the pilot valve closes. This results in a rise in control pressure  $p_s$  across the Venturi nozzle until it is the same as  $p_1$ . The plug stem along with the plug starts to move in the closing direction until a new state of equilibrium is reached.

When the differential pressure starts to drop, the described procedure is reversed. The pilot valve opens further, causing the control pressure  $p_s$  to drop. The valve plug in the main valve opens, opposing the force of the positioning springs, until the set point is reached.

**Type 2334 · Flow and differential pressure regulator · Balanced by a bellows**



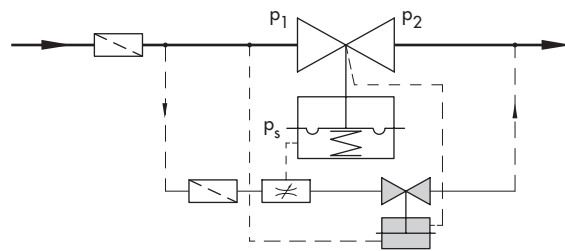
- |  |                     |   |                   |
|--|---------------------|---|-------------------|
| 1 Type 2423 as main valve<br>(balanced by a bellows) | 3 Plug              | 6 Set point springs                     | 10 Strainer       |
| 2 Valve seat   | 4 Plug stem         | 7 Type 2420 Actuator (closing)          | 11 Venturi nozzle |
|  | 5 Balancing bellows | 8 Pilot valve for differential pressure |                   |

**Fig. 3:** Functional diagram (main valve balanced by a bellows)

## Versions of Type 2334 Regulator

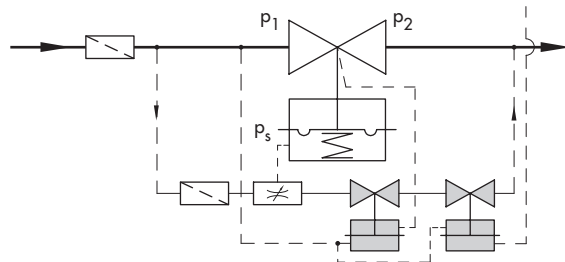
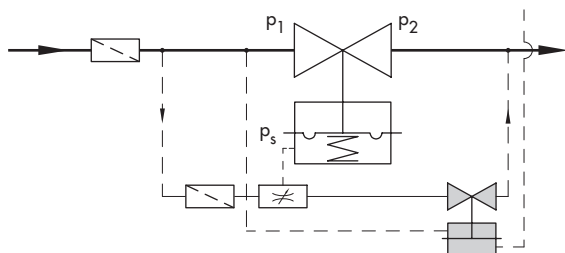
The **Type 2334 Universal Regulators** consist of a Type 2422 or Type 2423 Globe Valve (acting as the main valve) and a bypass line with a strainer, Venturi nozzle and a maximum of three special pilot valves (regulators).

The following schematic diagrams show the principle setup of a Type 2334 Universal Regulator and its possible functions.



### Flow regulator

Type 2423 Main Valve (modified) · Type 45-1 Pilot Valve (modified) · Installation in flow pipe or return flow pipe

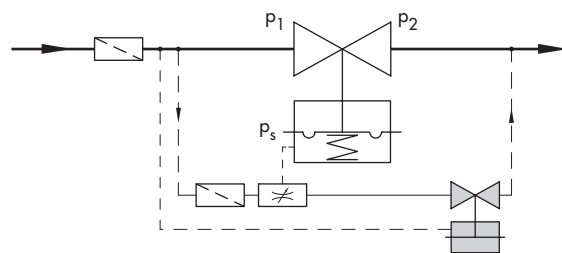
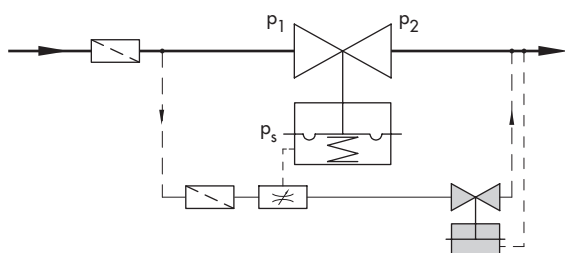


### Differential pressure regulator

Type 2422 Main Valve (modified) · Type 45-2 Pilot Valve for installation in flow pipe or Type 45-4 Pilot Valve for installation in return flow pipe (control lines drawn for installation in return flow pipe)

### Flow and differential pressure regulator

Type 2423 Main Valve (modified) · Type 45-1 and Type 45-2 Pilot Valve for installation in flow pipe or Type 45-1 and Type 45-4 Pilot Valve for installation in return flow pipe (control lines drawn for installation in return flow pipe)

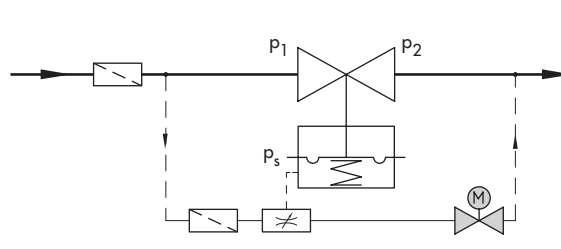
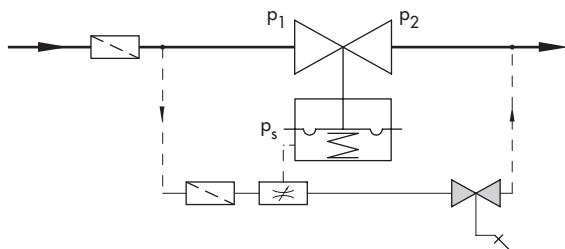


### Pressure reducing valve

Type 2422 Main Valve (modified) · Pilot valve on request

### Excess pressure valve

Type 2422 Main Valve (modified) · Pilot valve on request



### Temperature regulator

Type 2422 Main Valve (modified) · Pilot valve on request

### Regulator with additional electric actuator, controlled by a binary signal

Type 2422 Main Valve (modified) · Pilot valve on request

Fig. 4: Various versions of Type 2334

## Type 2422 or Type 2423 Valve as main valve

Balanced valve · Functioning as a closing valve or opening valve · Type 2423 with integrated restriction to adjust the flow rate set point

**Table 1: Technical data**

Type 2422 and Type 2423 Valves										
Nominal size	DN 65	DN 80	DN 100	DN 125	DN 150	DN 200	DN 250	DN 300	DN 400	
Nominal pressure	PN 16 to 40									
Leakage class according to IEC 60534-4	≤ 0.05 % of $K_{VS}$ coefficient									
Max. permissible temperature	150 °C									
Set point ranges in bar, continuously adjustable at the pilot valve	Depending on the pilot valve									
<b>Type ... Pilot Valve</b>	Depending on the application									
Type 2334 · Basic version	DN 15							DN 25		
Type 2334 · Version with bypass	DN 25				DN 40					
Type 2334 · With Type 2420 Actuator	320 cm <sup>2</sup> actuator area				640 cm <sup>2</sup> actuator area				-	

**Table 2: Permissible differential pressures  $\Delta p$**

Type 2422 Valve · Balanced by a bellows							
Nominal size	DN 65	DN 80	DN 100	DN 125	DN 150	DN 200	DN 250
Min. differential pressure $\Delta p_{min}$ in bar with Type 2420 Actuator <sup>1)</sup>	0.4 with 320 cm <sup>2</sup> 0.2 with 640 cm <sup>2</sup>			-			
Min. differential pressure $\Delta p_{min}$ in bar	-			1.0 <sup>1)</sup> · 1.1 <sup>2)</sup>	1.0 <sup>1)</sup> · 0.7 <sup>3)</sup>	0.7 <sup>1)</sup> · 0.4 <sup>3)</sup>	
Min. differential pressure $\Delta p_{min}$ in bar <sup>5)</sup>	-			1.9	2.0	1.4	
Max. perm. differential pressure $\Delta p_{max}$ in bar	20		16		12	10	

Type 2422 Valve · Balanced by a bellows with reduced $K_{VS}$ coefficient							
Nominal size	DN 65	DN 80	DN 100	DN 125	DN 150	DN 200	DN 250
Min. differential pressure $\Delta p_{min}$ in bar with Type 2420 Actuator <sup>1)</sup>	0.8 with 320 cm <sup>2</sup> 0.4 with 640 cm <sup>2</sup>			0.5 with 640 cm <sup>2</sup>		-	
Min. differential pressure $\Delta p_{min}$ in bar	-			-		1.0 <sup>1)</sup> · 0.7 <sup>3)</sup>	
Min. differential pressure $\Delta p_{min}$ in bar <sup>5)</sup>	-			-		2.0	
Max. perm. differential pressure $\Delta p_{max}$ in bar	20			16		12	

Type 2422 Valve · Balanced by a diaphragm						
Nominal size	DN 125	DN 150	DN 200	DN 250	DN 300	DN 400
Min. differential pressure $\Delta p_{min}$ in bar	0.8 <sup>1)</sup> · 1.0 <sup>2)</sup>	0.8 <sup>1)</sup> · 0.5 <sup>3)</sup>	0.4 <sup>1)</sup> · 0.2 <sup>3)</sup>		0.5 <sup>4)</sup> · 0.3 <sup>3)</sup>	
Max. perm. differential pressure $\Delta p_{max}$ in bar	12		10			6

Type 2422 Valve · Balanced by a diaphragm with reduced $K_{VS}$ coefficient						
Nominal size	DN 125	DN 150	DN 200	DN 250	DN 300	DN 400
Min. differential pressure $\Delta p_{min}$ in bar	-		0.8 <sup>1)</sup> · 0.5 <sup>3)</sup>		-	
Max. perm. differential pressure $\Delta p_{max}$ in bar	-		12		-	

Type 2423 Valve · Balanced by a bellows							
Nominal size	DN 65	DN 80	DN 100	DN 125	DN 150	DN 200	DN 250
Min. differential pressure $\Delta p_{min}$ in bar with Type 2420 Actuator <sup>1)</sup>	0.6 with 320 cm <sup>2</sup> 0.5 with 640 cm <sup>2</sup>			-			
Min. differential pressure $\Delta p_{min}$ in bar	-			1.2 <sup>1)</sup> · 1.4 <sup>2)</sup>	1.3 <sup>1)</sup> · 0.9 <sup>3)</sup>	1.0 <sup>1)</sup> · 0.7 <sup>3)</sup>	
Max. perm. differential pressure $\Delta p_{max}$ in bar	20		16		12	10	

Type 2423 Valve · Balanced by a diaphragm						
Nominal size	DN 125	DN 150	DN 200	DN 250	DN 300 <sup>6)</sup>	DN 400 <sup>6)</sup>
Min. differential pressure $\Delta p_{min}$ in bar	1.1 <sup>1)</sup> · 1.3 <sup>2)</sup>	1.1 <sup>1)</sup> · 0.8 <sup>3)</sup>	0.6 <sup>1)</sup> · 0.5 <sup>3)</sup>		0.6 <sup>2)</sup> · 0.4 <sup>3)</sup>	0.4 <sup>2)</sup> · 0.3 <sup>3)</sup>
Max. perm. differential pressure $\Delta p_{max}$ in bar	12		10			6

<sup>1)</sup> In basic version (pipeline kit DN 15 for water)

<sup>2)</sup> With bypass DN 25 for water

<sup>3)</sup> With bypass DN 40 for water

<sup>4)</sup> Fixed hook-up (pipeline kit DN 25 for water)

<sup>5)</sup> Version for steam

<sup>6)</sup> Type 2422 Valve with external orifice plate

**Table 3:**  $K_{VS}$  coefficients and  $x_{FZ}$  values

Type 2422 and Type 2423 Valves · Balanced by a bellows							
Nominal size	DN 65	DN 80	DN 100	DN 125	DN 150	DN 200	DN 250
Standard $K_{VS}$ coefficient	50	80	125	200	360	520	620
$x_{FZ}$ value	0.4	0.35				0.3	
Reduced $K_{VS}$ coefficient	20	32	80	80 <sup>2)</sup>	125 <sup>2)</sup>	360	
$x_{FZ}$ value	0.4	0.35				0.3	

Type 2422 and Type 2423 Valves · Balanced by a diaphragm						
Nominal size	DN 125	DN 150	DN 200	DN 250	DN 300 <sup>1)</sup>	DN 400 <sup>1)</sup>
Nominal pressure	PN 16 to 40					
Standard $K_{VS}$ coefficient	250	380	650	800	1250	2000
$x_{FZ}$ value	0.35		0.3		0.2	
Reduced $K_{VS}$ coefficient	–		360		–	–
$x_{FZ}$ value	–		0.3		–	–

<sup>1)</sup> Type 2422 only · <sup>2)</sup> Only with Type 2420 Actuator

**Table 4:** Flow rate set points for water

Type 2423 Valve · Balanced by a bellows							
Nominal size	DN 65	DN 80	DN 100	DN 125	DN 150	DN 200	DN 250
Flow rate set point ranges for water in m <sup>3</sup> /h							
Differential pressure	$\Delta p_{restriction} = 0.2 \text{ bar}$	2 to 28	3.5 to 35	6.5 to 63	11 to 80	18 to 120	20 to 180
	$\Delta p_{restriction} = 0.5 \text{ bar}$	3.5 to 40	6.5 to 55	11 to 90	18 to 120	20 to 180	26 to 260

Type 2423 Valve · Balanced by a diaphragm				
Nominal size	DN 125	DN 150	DN 200	DN 250
Flow rate set point ranges for water in m <sup>3</sup> /h				
Differential pressure	$\Delta p_{restriction} = 0.2 \text{ bar}$	11 to 120	18 to 180	20 to 320
	$\Delta p_{restriction} = 0.5 \text{ bar}$	18 to 180	20 to 260	26 to 450

**Table 5:** Materials · Material numbers according to DIN EN

Type 2422 and Type 2423 Valves · Balanced by a bellows				
Nominal pressure	PN 16	PN 25	PN 16, 25 and 40	
Valve body	Cast iron EN-GJL-250	Spheroidal graphite iron EN-GJS-400-18-LT <sup>1)</sup>	Cast steel 1.0619	Cast stainless steel 1.4408 <sup>1)</sup>
Seat	DN 65 to 250	1.4006	1.4571	
	DN 300/400	1.4301	1.4571	
Plug	DN 65/80	1.4104 <sup>2)</sup>	1.4301/1.4571 with PTFE seal	
	DN 100	1.4006 <sup>2)</sup>	1.4301/1.4571 with PTFE seal	
	DN 125 to 250	1.4571 with PTFE seal and retaining plate made of 1.4301		
	DN 300/400	1.4301 with EPDM seal and retaining plate made of 1.4301		
Plug stem	1.4301			
Metal bellows	1.4571 · DN 125 and higher: 1.4404			
Bottom section	P265GH			1.4571
Body gasket	Graphite on metal core			

Type 2422 and Type 2423 Valves · Balanced by a diaphragm				
Nominal pressure PN	PN 16	PN 16/25	PN 16, 25 and 40	PN 16, 25 and 40
Valve body	Cast iron EN-GJL-250	Spheroidal graphite iron EN-GJS-400-18-LT	Cast steel 1.0619	Cast stainless steel 1.4408
Valve seat	Red brass <sup>3)</sup>			
Plug (standard version)	Red brass <sup>3)</sup> · EPDM soft seal, max. 150 °C or with PTFE soft seal, max. 150 °C			
Pressure balancing	Balancing cases made of sheet steel DD11 · EPDM balancing diaphragm, max. 150 °C or NBR diaphragm, max. 80 °C			

Type 2420 Actuator		
Diaphragm cases	Sheet steel DD11	1.4301
Diaphragm	EPDM <sup>4)</sup> with fabric reinforcement	
Guide bushing	DU bushing	PTFE
Seals	EPDM/PTFE <sup>4)</sup>	

<sup>1)</sup> DN 65 to 150 only; PN 16/25 on request

<sup>2)</sup> Optionally with soft seal

<sup>3)</sup> Special version: seat and plug made of 1.4409

<sup>4)</sup> Special version for mineral oil: FKM

## Pilot valve

Various SAMSON valves may be used as pilot valves (see regulator versions). The technical data and valve materials are listed in the corresponding data sheet.

## Installation

Install the regulator in such a way that it is still easily accessible after the plant is completed to facilitate maintenance or re-vision work.

The following points must be observed:

- Install the regulators in horizontal pipelines.
- **Main valve DN 65 to 100 (Type 2422/Type 2423):**  
Operating bellows and Type 2420 Actuator installed to face downwards
- **Main valve DN 125 to 250 (balanced by a bellows):**  
Operating bellows installed to face downwards
- **Main valve DN 125 to 400 (balanced by a diaphragm):**  
Balancing diaphragm installed to face upwards
- Make sure the direction of flow corresponds to the arrow on the valve body.

## Typical installation with dimensions

Fig. 5 shows an example of two pilot valves mounted in the bypass line.

The dimensions are intended as guidelines. In particular cases, the overall dimensions vary depending on the installed regulators and the conditions on site.

The minimum distance of the bypass line connections to the main valve depend on the length  $L$  of the main valve, the nominal size  $DN$  of the main line and the direction of flow.

The minimum length of the bypass line  $L + (4 \times DN)$  must be observed.

Minimum distances for regulator (main valve), installed in the flow pipe:

- $1 \times DN$  on the upstream pressure side
- $3 \times DN$  on the downstream pressure side

Installed in the return flow pipe:

- $3 \times DN$  on the upstream pressure side
- $1 \times DN$  on the downstream pressure side

Make sure that the main valve is installed at a distance of at least five times the nominal size ( $DN$ ) away from pipe fittings or instruments that cause flow turbulence (e.g. pipe bends or manifolds).

► EB 3210 for more details.

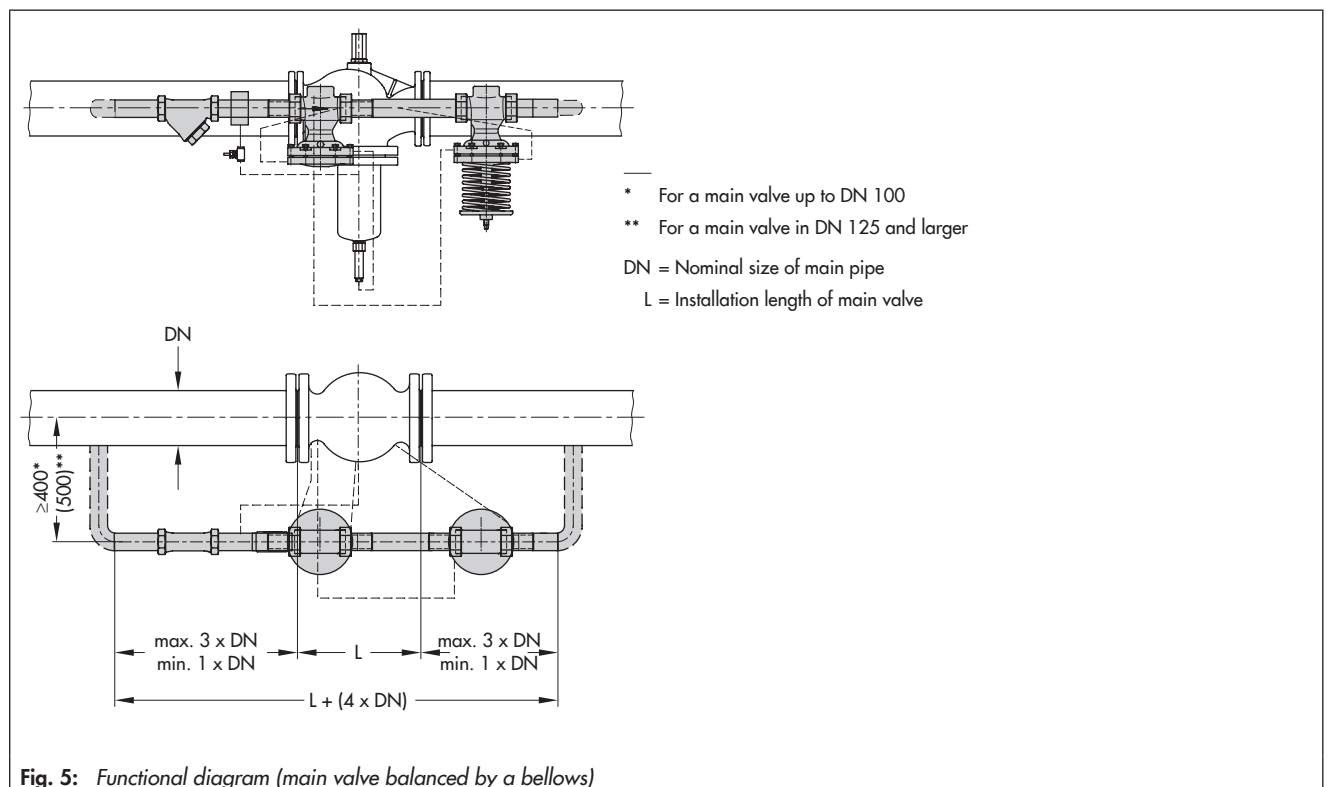


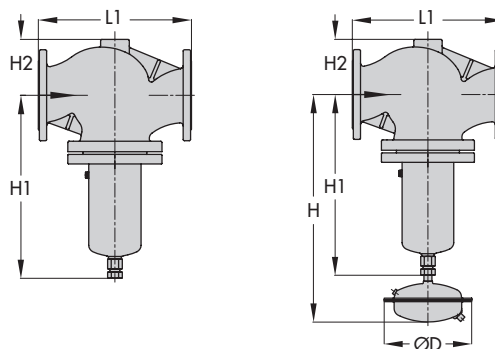
Fig. 5: Functional diagram (main valve balanced by a bellows)

## Dimensions

### Type 2422 · Balanced by a bellows

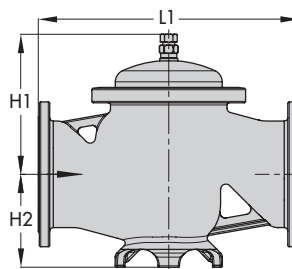
DN	65	80	100	125	150	200	250
L1	290	310	350	400	480	600	730
H1	300	300	355	460	590	730	
H2	100	100	120	145	175	260	
H	465		520	685 <sup>1)</sup>	815 <sup>1)</sup>	925 <sup>1)</sup>	
ØD	285			380			

<sup>1)</sup> Optionally Type 2420 Actuator



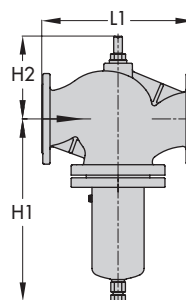
### Type 2422 · Balanced by a diaphragm

DN	125	150	200	250	300	400
L1	400	480	600	730	850	1100
H1	285	310	380	510	610	
H2	145	175	260	290	390	



### Type 2423 · Balanced by a bellows

DN	65	80	100	125	150	200	250
L1	290	310	350	400	480	600	730
H1	300		355	460	590	730	
H2	195		220	265	295	400	



### Type 2423 · Balanced by a diaphragm

DN	125	150	200	250
L1	400	480	600	730
H1	370	395	465	
H2	295	325	400	

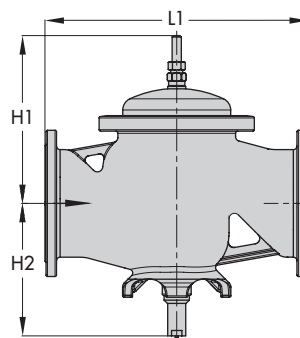


Fig. 6: Dimensions in mm



**Ordering text****Type 2334** Pilot-operated Regulator

Main valve DN ...

Material: Cast iron EN-GJL-250 · Spheroidal graphite iron  
EN-GJS-400-18-LT · Cast steel 1.0619 · Stainless steel  
1.4408 · Cast steel 1.4571

Nominal pressure PN ...

Version functioning as differential pressure regulator/flow  
regulator, etc.

Type ... Pilot Valve, set point range/control range ...

Optionally, special version

Specifications subject to change without notice



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