

# Self-operated Pressure Regulators

Pilot-operated by the medium



## Pressure Reducing Valve Type 2333 with pilot valve

## Excess Pressure Valve Type 2335 with pilot valve

### Application

Pressure regulators for set points from **1 bar** to **28 bar** · Valve sizes **DN 125** to **DN 400** · Nominal pressures **PN 16** to **PN 40** · Suitable for liquids, gases and vapors up to **350 °C**

**Type 2333:** valve closes when the downstream pressure rises  
**Type 2335:** valve opens when the upstream pressure rises

The differential pressure across the regulator is used as auxiliary energy to operate the valve. To open the regulator, this pressure must be at least as high as the minimum differential pressure  $\Delta p_{\min}$  specified in Table 1.

The attached pilot valve (either a pressure reducing valve or an excess pressure valve) determines the regulator's function.

### Special features

- Low-maintenance proportional regulators requiring no auxiliary energy
- Particularly favorable control properties, while the offset remains small
- Easy set point adjustment on the pilot valve
- Single-seated globe valve with flanged body
- Regulators delivered ready-to-install

### Versions

- Type 2422 Valve (modified), balanced by a bellows or a diaphragm, with soft-seated plug and internal closing spring
- Each regulator comes with one pilot valve (PV) with a strainer and a fixed restrictor or Venturi nozzle
- Valve body made of either cast iron, spheroidal graphite iron, cast steel or CrNiMo steel
- Valves balanced by a diaphragm preferable for use with water and non-flammable gases
- Version for steam (valves balanced by a bellows) with equalizing tank and needle valve

**Type 2333** · Pressure reducing valve for liquids, vapors, and gases. Used to control the downstream pressure  $p_2$  to the set point adjusted at the pilot valve.

Equipped with a pilot valve suitable for the process medium.

**Type 2335** · Excess pressure valve (Fig. 1) for liquids, vapors and gases. Used to control the upstream pressure  $p_1$  to the set point adjusted at the pilot valve.

Equipped with a pilot valve suitable for the process medium.

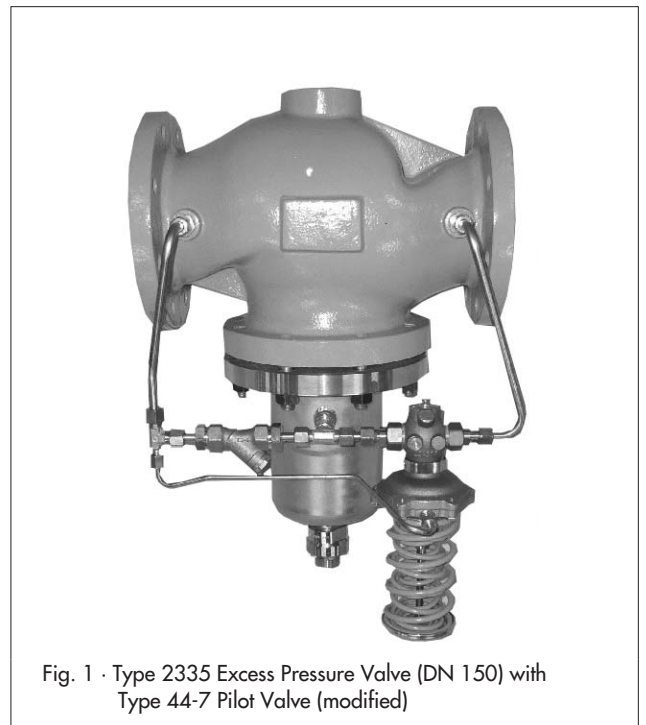


Fig. 1 · Type 2335 Excess Pressure Valve (DN 150) with Type 44-7 Pilot Valve (modified)

### Special versions

- With flow divider for noise reduction (not for liquids)
- Lower minimum required differential pressure  $\Delta p$
- Larger nominal sizes
- Version resistant to mineral oil
- Version for flammable gases
- Version free of non-ferrous metal
- Version for deionized water
- Version for oxygen
- Additionally with solenoid valve for either emergency operation over a remote control unit or pressure limitation when used in combination with an electric safety pressure limiter
- For higher differential pressures
- Reduced  $Kvs$

**Principle of operation** (see Fig. 2)

The medium flows through the globe valve as indicated by the arrow. The position of the valve plug determines the flow rate across the area released between the plug (3) and seat (2). The travel position of the pilot valve (5) determines the pressure conditions across the valve.

The forces created by the upstream pressure  $p_1$  acting on the plug surface and by the control pressure  $p_s$  and the positioning spring (3) are compared.

In the **Type 2333 Pressure Reducing Valve**, a rise in downstream pressure  $p_2$  causes the pilot valve to close. The control pressure  $p_s$  increases, and the plug of the main valve closes. When the pilot valve is closed ( $p_s = p_1$ ), the pressure reducing valve (main valve) is also completely closed.

Together with the pilot valve, the fixed restrictor (6) or the Venturi nozzle (8) create the control pressure  $p_s$ .

If the downstream pressure  $p_2$  falls again below the set point, the pilot valve opens. The control pressure  $p_s$  falls as a result. The force resulting from the upstream pressure  $p_1$  acting on the plug surface causes the valve to open.

In the **Type 2335 Excess Pressure Valve**, a rise in upstream pressure  $p_1$  causes the pilot valve and the main valve to open.

Together with the pilot valve, the Venturi nozzle (8) (fixed restrictor (6) and needle valve (9) for the steam version) create the control pressure  $p_s$ .

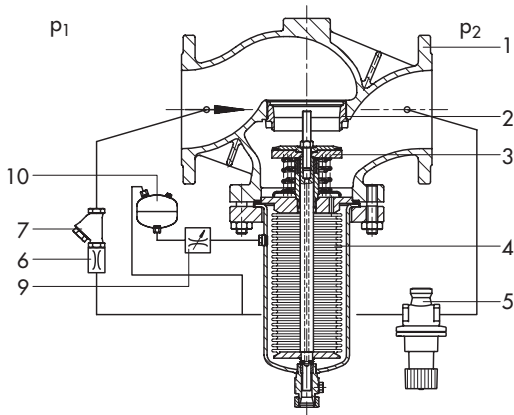
If the pilot valve remains closed, the valve is fully balanced. The upstream pressure  $p_1$  counterbalances the control pressure  $p_s$  ( $p_s = p_1$ ) acting on the outside of the balancing bellows (4) (or on the balancing diaphragm in the case of valves balanced by a diaphragm) between the pilot valve and the Venturi nozzle. The spring located below the plug closes the valve.

By opening the pilot valve, the control pressure  $p_s$  and the differential pressure across the balancing bellows or diaphragm increases as a result. The force acting on the plug surface opposes the force of the positioning spring and opens the valve.

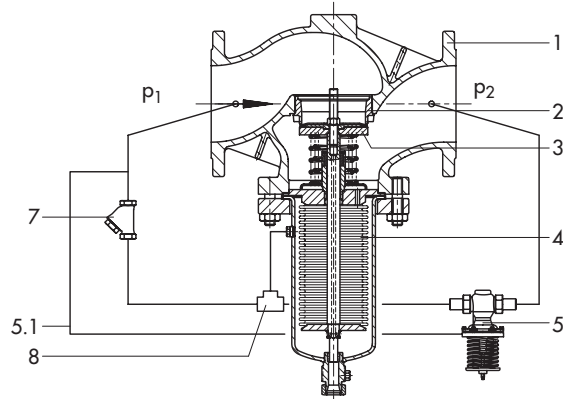
To ensure proper functioning, the minimum differential pressure  $\Delta p_{min}$  listed in Table 1 must be available as specified depending on the field of application.

The regulator version for **steam** is only available with valves balanced by a bellows. This version has an equalizing tank (10) already fitted in the control line. The needle valve (9) is open and lead-sealed.

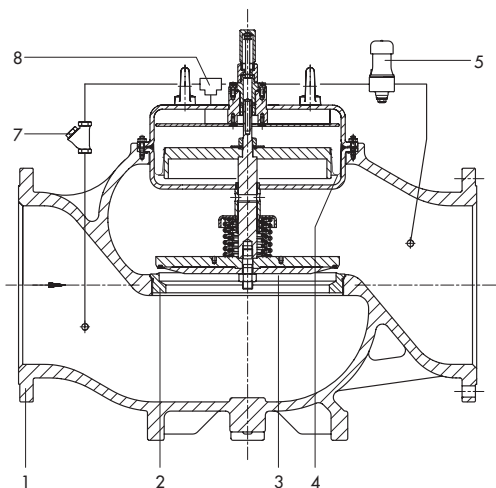
Prior to start-up, the equalizing tank must be filled with water until it flows over the top of the filler neck.



**Type 2333 Pressure Reducing Valve** (DN 125 to DN 250),  
Type 2422 Valve balanced by a bellows · Suitable for vapors



**Type 2335 Excess Pressure Valve** (DN 125 to DN 250),  
Type 2422 Valve balanced by a bellows · Suitable for liquids and gases



**Type 2333 Pressure Reducing Valve** (DN 125 to DN 400),  
Type 2422 Valve balanced by a diaphragm · Suitable for liquids and gases

- 1 Valve body
- 2 Valve seat
- 3 Plug with plug stem and positioning spring
- 4 Balancing bellows or balancing diaphragm
- 5 Pilot valve (PV)
- 5.1 Set point pressure line
- 6 Fixed restrictor or needle valve (only with version for steam)
- 7 Strainer
- 8 Venturi nozzle (for gases and liquids)
- 9 Needle valve (only with version for steam)
- 10 Equalizing tank

- $p_s$  Control pressure
- $p_1$  Upstream pressure
- $p_2$  Downstream pressure

Fig. 2 · Sectional views

**Table 1 · Technical data** · All pressures in bar (gauge)

<b>Type 2422 Valve · Balanced by a bellows · Suitable for liquids, gases and vapors</b>				
Nominal size	DN 125	DN 150	DN 200	DN 250
Nominal pressure	PN 16 to 40			
<b>K<sub>VS</sub> coefficients (normal)</b>				
K <sub>VS</sub> value	200	360	520	620
K <sub>VS</sub> I value (with flow divider St I)	150	270	400	500
K <sub>VS</sub> III value (with flow divider St III)	100	180	260	310
Minimum differential pressure Δp <sub>min</sub>				
Version for water	0.8	0.9		0.6
Version for steam	1.2	1.0		0.8
Max. permissible differential pressure Δp <sub>max</sub>	16	12		10
<b>K<sub>VS</sub> coefficients (reduced)</b>				
K <sub>VS</sub> value	80	125	360	360
K <sub>VS</sub> I value (with flow divider St I)	60	95	270	270
K <sub>VS</sub> III value (with flow divider St III)	40	60	180	180
Minimum differential pressure Δp <sub>min</sub>				
Version for water	0.5 <sup>1)</sup>	0.5 <sup>1)</sup>	0.9	0.9
Version for steam	–	–	1.0	1.0
Max. permissible differential pressure Δp <sub>max</sub>	20	16	12	12
z value	0.35	0.3	0.3	0.3
Leakage class acc. to IEC 60534-4	≤ 0.05 % of the K <sub>VS</sub> coefficient <sup>2)</sup>			
Max. permissible temperature depending on pilot valve	<b>Type 50 ES:</b> 50 °C · <b>Type 44-2/44-7:</b> 150 °C · <b>Type 44-0 B/44-1 B/44-6 B:</b> 200 °C <b>Type 2405/2406:</b> 150 °C · <b>Type 41-23/41-73:</b> 350 °C			
Set point ranges in bar continuously adjustable at the pilot valve	<b>Type 50 ES:</b> 1 to 4; 2.5 to 6; 4 to 10 · <b>Type 44-2:</b> 1 to 4; 2 to 4.2; 2.4 to 6.3; 6 to 10.5 · <b>Type 44-7:</b> 1 to 4, 2 to 4.4, 2.4 to 6.6, 6 to 11 · <b>Type 44-0 B/44-1 B/44-6 B:</b> 1 to 4, 2 to 6, 4 to 10, 8 to 20 · <b>Type 2405/2406:</b> 0.8 to 2.5, 2 to 5, 4.5 to 10 <b>Type 41-23/41-73:</b> 0.8 to 2.5, 2 to 5, 4.5 to 10, 8 to 16, 10 to 22, 20 to 28			

<sup>1)</sup> With Type 2420 Actuator, 640 cm<sup>2</sup>
<sup>2)</sup> ≤ 0.1% of K<sub>VS</sub> coefficient with metal-seated plug

<b>Type 2422 Valve · Balanced by a diaphragm · Suitable for liquids and gases</b>						
Nominal size	DN 125	DN 150	DN 200	DN 250	DN 300	DN 400
Nominal pressure	PN 16 to 40					
K <sub>VS</sub> coefficient	250	380	650 <sup>1)</sup>	800 <sup>1)</sup>	1250	2000
z value	0.35		0.3 <sup>1)</sup>		0.2	
Minimum differential pressure Δp <sub>min</sub>	0.45 bar		0.4 bar <sup>1)</sup>		0.3 bar	
Max. permissible differential pressure Δp <sub>max</sub>	12 bar		10 bar <sup>1)</sup>			6 bar
Leakage class acc. to IEC 60534-4	≤ 0.01 % of the K <sub>VS</sub> coefficient					
Max. permissible temperature depending on pilot valve	<b>Type 50 ES:</b> 50 °C · <b>Type 44-2/44-7:</b> 150 °C · <b>Type 44-1 B/44-6 B:</b> 150 °C · <b>Type 2405/2406:</b> 150 °C · <b>Type 41-23/41-73:</b> 150 °C · Pressure regulator for steam as special version on request					
Set point ranges in bar continuously adjustable at the pilot valve	<b>Type 50 ES:</b> 1 to 4, 2.5 to 6, 4 to 10 · <b>Type 44-2:</b> 1 to 4, 2 to 4.2, 2.4 to 6.3, 6 to 10.5 <b>Type 44-7:</b> 1 to 4, 2 to 4.4, 2.4 to 6.6, 6 to 11 · <b>Type 44-1 B/44-6 B:</b> 1 to 4, 2 to 6, 4 to 10, 8 to 20 · <b>Type 2405/2406:</b> 0.8 to 2.5, 2 to 5, 4.5 to 10 · <b>Type 41-23/41-73:</b> 0.8 to 2.5, 2 to 5, 4.5 to 10, 8 to 16, 10 to 22, 20 to 28					

<sup>1)</sup> Version with reduced K<sub>VS</sub> coefficient possible. In this case, the technical data are same as for version in DN 150.

### Pilot valves for Type 2333 Pressure Reducing Valves

**Type 50 ES** · Suitable for cold water, mineral oil and non-flammable gases (50 °C)

**Type 44-2** · Suitable for liquids and mineral oil (150 °C), non-flammable gases (80 °C)

**Type 44-1 B** · Suitable for liquids (150 °C) and non-flammable gases (80 °C), nitrogen (150 °C)

**Type 44-0 B** · Suitable for steam (200 °C)

**Type 41-23** · Suitable for gases, liquids and steam (350 °C)

**Type 2405** · Suitable for gases (-20 to +60 °C)

### Pilot valves for Type 2335 Excess Pressure Valves

**Type 44-7** · Suitable for liquids and mineral oil (150 °C), non-flammable gases (80 °C)

**Type 44-6 B** · Suitable for liquids (150 °C), non-flammable gases (80 °C) and steam (200 °C), nitrogen (150 °C)

**Type 41-73** · Suitable for gases, liquids and steam (350 °C)

**Type 2406** · Suitable for gases (-20 to +60 °C)

**Table 2 · Pilot valves · Overview, technical data**

Pilot valve	Nom. pressure	Connection <sup>1)</sup>	Material	K <sub>V5</sub> coefficient	Set point range	Process medium	Data Sheet
<b>Type 50 ES Pressure Reducing Valve</b>	PN 16	G ½	Brass	0.93	1 to 10 bar	Water, liquids and non-flammable gases up to 50 °C	T 2555 EN
<b>Type 44-2 Pressure Reducing Valve</b>	PN 25	DN 15	Red brass · Spheroidal graphite iron	1	1 to 10.5 bar	Liquids up to 150 °C Non-flammable gases up to 80 °C	T 2623 EN T 2723 EN
<b>Type 44-7 Excess Pressure Valve</b>					1 to 11 bar		
<b>Type 44-0 B Pressure Reducing Valve</b>	PN 25	G ½ DN 15	Red brass · Spheroidal graphite iron Stainless steel	1	1 to 20 bar	Steam up to 200 °C	T 2628 EN
<b>Type 44-1 B Pressure Reducing Valve</b>						Liquids and mineral oil up to 150 °C · Non-flammable gases up to 80 °C · Nitrogen up to 150 °C	T 2626 EN
<b>Type 44-6 B Excess Pressure Valve</b>						Liquids and air up to 150 °C · Non-flammable gases up to 80 °C · Steam and nitrogen up to 150 °C	
<b>Type 2405 Pressure Reducing Valve</b>	PN 16 to 40	DN 15	Cast iron · Cast steel · Spheroidal graphite iron Stainless steel Forged steel	1	1 to 5 bar	Gases in the temperature range between -20 to +60 °C	T 2520 EN
<b>Type 2406 Excess Pressure Valve</b>	PN 16 to 40	DN 15	Cast iron · Cast steel · Spheroidal graphite iron Stainless steel Forged steel	1	1 to 5 bar	Gases in the temperature range between -20 to +60 °C	T 2522 EN
<b>Type 41-23 Pressure Reducing Valve</b>	PN 16 to 40	DN 15	Cast iron · Cast steel · Spheroidal graphite iron · Stainless steel · Forged steel	1	0.8 to 28 bar	Gases, liquids and steam up to 350 °C	T 2512 EN
<b>Type 41-73 Excess Pressure Valve</b>							T 2517 EN

<sup>1)</sup> Main valve DN 300/400: All pilot valves with connection G 1/DN 25, K<sub>V5</sub> = 5 (threaded connection) or K<sub>V5</sub> = 8 (flanged connection)

**Table 3 · Materials** · Material numbers according to DIN EN

<b>Type 2422 Valve, balanced by a bellows</b>				
Nominal pressure		PN 16	PN 16/25	PN 16/25/40
Body		Cast iron EN-JL1040	Spheroidal graphite iron EN-JS1049	Cast steel 1.0619 Cast stainless steel 1.4408
Valve seat		1.4006		1.4571
Plug	Standard version	1.4301 with PTFE soft sealing <sup>1)</sup> , max. 220 °C		1.4571 with PTFE soft sealing, max. 220 °C
	Version for steam	PTFE soft sealing, max. 220 °C · Metal seating, max. 350 °C		
Pressure balancing		Balancing cases of sheet steel DD11 · Balancing bellows made of 1.4571		
Gasket		Graphite with metal core		
<b>Type 2422 Valve, balanced by a diaphragm</b>				
Nominal pressure		PN 16	PN 16/25	PN 16/25/40 PN 16/25/40 <sup>2)</sup>
Body		Cast iron EN-JL1040	Spheroidal graphite iron EN-JS1049	Cast steel 1.0619 Cast stainless steel 1.4408
Valve seat		DN 125 to 250: Red brass <sup>3)</sup> · DN 300/400: Stainless steel 1.4301		1.4571
Plug	Standard version	DN 125 to 250: Red brass <sup>3)</sup> · DN 300/400: Stainless steel (1.4301) With EPDM soft sealing <sup>4)</sup> , max. 150 °C		1.4571 with PTFE soft sealing, max. 150 °C
	Pressure balancing	Balancing cases of sheet steel DD11 · EPDM balancing diaphragm, max. 150 °C		

<sup>1)</sup> Optionally with EPDM soft sealing, max. 150 °C

<sup>2)</sup> DN 125 to 250

<sup>3)</sup> Optionally 1.4409

<sup>4)</sup> Optionally with PTFE soft sealing, max. 150 °C

### Installation

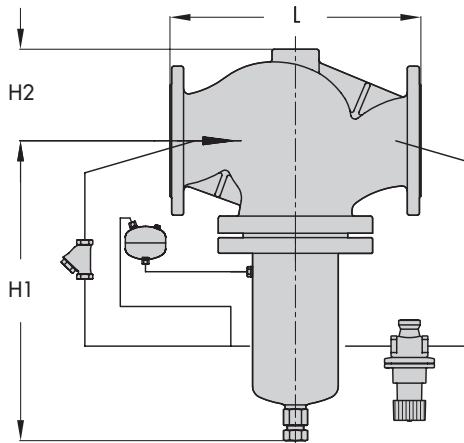
- Installation in horizontal pipelines
- Direction of flow as indicated by the arrow on the valve body
- **Valve balanced by a bellows:** valve with actuator suspended downwards
- **Valve balanced by a diaphragm:** installation with the balancing diaphragm facing upwards
- Install a strainer (for example, a SAMSON Type 2 N/Type 2 NI Strainer) upstream of the valve
- Do not insulate pilot valve when handling hot media



Refer to **Mounting and Operating Instructions EB 2552-1 EN** and **EB 2552-2 EN** for more details.

## Dimensions

### Type 2422 Valve · Balanced by a bellows



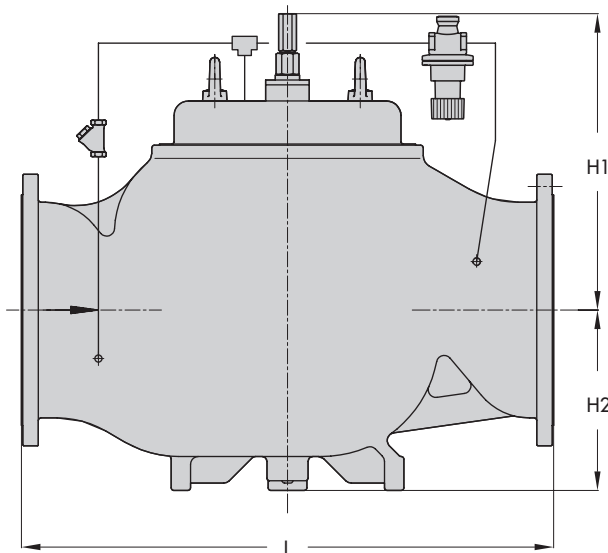
Nominal size DN	125	150	200	250
Length L	400	480	600	730
Height H1	145	175	270	
Height H2	460	590	730	
Weight <sup>1)</sup> (PN 16 with Type 50 ES as PV)	75	118	260	305

<sup>1)</sup> +10% for cast steel 1.0619/PN 25 and spheroidal graphite iron EN-JS1049/PN 25

Drawings show the version with Type 44-0 B Pressure Reducing Valve as pilot valve

Type 2333 Pressure Reducing Valve/Type 2335 Excess Pressure Valve DN 125 and DN 250 · Version balanced by a bellows  
Version with equalizing tank for steam regulation

### Type 2422 Valve · Balanced by a diaphragm



Nominal size DN	125	150	200	250	300	400
Length L	400	480	600	730	850	1100
Height H1	285	310	380		510	610
Height H2	145	175	260		290	390
Weight <sup>1)</sup> (PN 16 with Type 50 ES as PV)	50	70	210	220	315	625

<sup>1)</sup> +10% for cast steel 1.0619/PN 25 and spheroidal graphite iron EN-JS1049/PN 25

Drawings show the version with Type 44-1 B Pressure Reducing Valve as pilot valve

Type 2333 Pressure Reducing Valve/Type 2335 Excess Pressure Valve DN 125 and DN 400 · Version balanced by a diaphragm

Fig. 3 · Dimensions in mm

## Ordering text

Type 2333 Pressure Reducing Valve/  
Type 2335 Excess Pressure Valve

DN ..., balanced by a bellows/diaphragm (DN 125 and higher)

Body material ..., PN ...

With Type ... Pilot Valve, set point range ... bar

Process medium ..., max. medium temperature ...

Optionally, special version ...

Specifications subject to change without notice.



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T 2552 EN

2012-02