Self-operated Pressure Regulators
Pilot-operated by the process medium

Type 2333 Pressure Reducing Valve with pilot valve
Type 2335 Excess Pressure Valve with pilot valve

Application

Pressure regulators for set points from **2** to **28 bar** · Valve nominal sizes **DN 125** to **400** · Nominal pressure **PN 16** to **40** · Suitable for liquids, gases, and vapors up to **350 °C**

Type 2333: the valve closes when the **downstream** pressure rises

Type 2335: the valve opens when the **upstream** pressure rises

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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 Δp_{min} specified in Table 1.

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

Special features

- Low-maintenance proportional regulators requiring no auxiliary energy
- High dynamic response and small system deviation, i.e. excellent control accuracy
- Convenient set point adjustment at the pilot valve
- Single-seated globe valve with flanged end connections
- Regulator delivered as ready-to-install unit

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 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 compensation chamber 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.

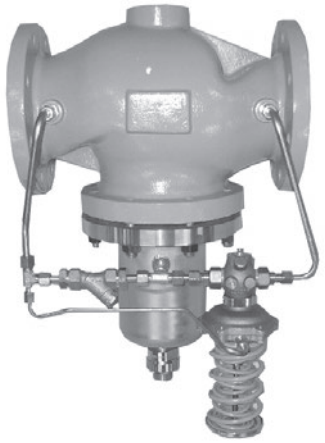


Fig. 1: *Type 2335 Excess Pressure Valve (DN 150) with Type 44-7 Pilot Valve (modified)*

Special versions

– With flow divider for noise reduction (not for liquids)
– Lower min. required differential pressure Δp
– Larger nominal sizes
– With internal parts made of FPM (FKM), e.g. for use with mineral oils
– Version for flammable gases
– Version free of non-ferrous metal
– Version for deionized water
– 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 K_{VS} coefficient

Principle of operation (see Fig. 2)

The medium flows through the globe valve in the direction indicated by the arrow. The position of the plug determines the flow rate across the area released between plug (3) and valve 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 force of set point 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 starts to close. 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 restriction (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.

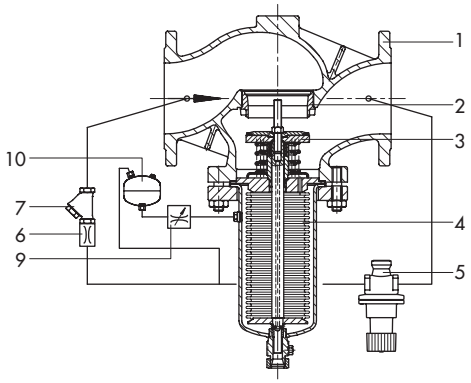
In the **Type 2335 Excess Pressure Valve**, the rising upstream pressure p_1 causes the main valve to open. Together with the pilot valve, the Venturi nozzle (8) (the fixed restriction (6) and needle valve (9) in the version for steam) create the control pressure p_S.

When the pilot valve is closed, the valve is fully balanced. The control pressure p_S between the pilot valve and Venturi nozzle acting on the outside of the balancing bellows (4) or balancing diaphragm (4) and the upstream pressure p_1 balance each other out ($p_S = p_1$). The set point spring below the valve plug closes the valve.

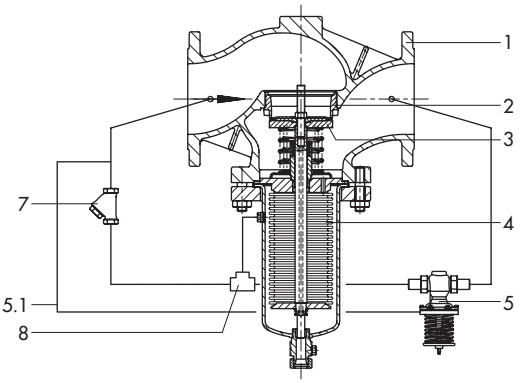
When the pilot valve opens, the control pressure p_S falls, causing the differential pressure at the balancing bellows or balancing diaphragm to increase. The force acting on the plug surface opposes the force of the springs and the valve opens.

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

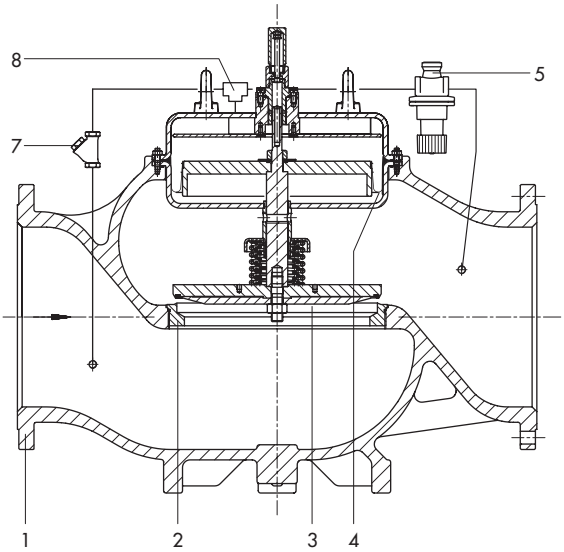
The regulator version for steam is only available with valves balanced by a bellows. This version has a compensation chamber (10) already fitted in the control line. The needle valve (9) is open and lead-sealed. Before start-up, fill the compensation chamber with water at the top filler opening.



Type 2333 Pressure Reducing Valve (DN 125 to 250), Type 2422 Valve **balanced by a bellows** · Version with compensation chamber for steam



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



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

1 Valve body
2 Valve seat
3 Plug with plug stem and set point spring
4 Balancing bellows or diaphragm
5 Pilot valve
5.1 Set point pressure line
6 Fixed restriction or needle valve (version for steam only)
7 Strainer
8 Venturi nozzle (for gases and liquids)
9 Needle valve (version for steam only)
10 Compensation chamber
p_S Control pressure
p_1 Upstream pressure
p_2 Downstream pressure

Fig. 2: *Functional diagrams*

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

Type 2422 Valve · **Balanced by a bellows** · Suitable for liquids, gases, and vapors

Valve size	**DN 125**	**DN 150**	**DN 200**	**DN 250**
Nominal pressure	PN 16 to 40			
Standard K_{VS} coefficients				
K_{VS} coefficient	200	360	520	620
K_{VS}I (with flow divider St I)	150	270	400	500
K_{VS}III (with flow divider St III)	100	180	260	310
Minimum differential pressure Δp_{min}				
Version for water	1.0 bar		0.7 bar	
Version for steam	1.9 bar	2.0 bar	1.3 bar	
Max. permissible differential pressure Δp_{max}	16 bar	12 bar	10 bar	
Reduced K_{VS} coefficients (only for valves balanced by a bellows)				
K_{VS} coefficient	80	125	360	
K_{VS}I (with flow divider St I)	60	95	270	
K_{VS}III (with flow divider St III)	40	60	180	
Minimum differential pressure Δp_{min}				
Version for water/air	0.2 bar [1]		1.0 bar	
Version for steam	–	–	1.9 bar	2.0 bar
Max. permissible differential pressure Δp_{max}	20 bar	16 bar	12 bar	
x_{FZ} value	0.35	0.3		
Leakage class according to IEC 60534-4	≤0.05 % of K_{VS} coefficient [2]			
Max. permissible temperature (depending on the pilot valve)	**Type 44-2/44-7**: 150 °C · **Type 44-0 B/44-1 B/44-6 B**: 200 °C · **Type 2405/2406:** 150 °C **Type 41-23/41-73**: 150 °C			
Set point ranges in bar, continuously adjustable at the pilot valve	**Type 44-2**: 2 to 4.2, 2.4 to 6.3, 6 to 10.5 · **Type 44-7**: 2 to 4.4, 2.4 to 6.6, 6 to 11 **Type 44-0 B/44-1 B/44-6 B**: 2 to 6, 4 to 10, 8 to 20 · **Type 2405/2406**: 2 to 5, 4.5 to 10 **Type 41-23/41-73**: 2 to 5, 4.5 to 10, 8 to 16, 10 to 22, 20 to 28			
Compliance	CE · EAC			

[1] Version with Type 2420 Diaphragm Actuator, 640 cm² (Type 2334, see T 3210).

[2] ≤0.1 % of K_{VS} coefficient with metal-seated plug

Type 2422 Valve · **Balanced by a diaphragm** · Suitable for liquids and gases

Valve size	**DN 125**	**DN 150**	**DN 200**	**DN 250**	**DN 300**	**DN 400**
Nominal pressure	PN 16 to 40					
K_{VS} coefficient	250	380	650 [1]	800 [1]	1250	2000
x_{FZ} value	0.35		0.3 [1]		0.2	
Minimum differential pressure Δp_{min}	0.8 bar		0.4 bar [1]		0.5 bar	0.3 bar
Max. permissible differential pressure Δp_{max}	12 bar		10 bar [1]			6 bar
Leakage class according to IEC 60534-4	≤ 0.01 % of K_{VS} coefficient					
Max. permissible temperature (depending on the pilot valve)	**Type 44-2/44-7**: 150 °C · **Type 44-1 B/Type 44-6 B:** 150 °C · **Type 2405/2406:** 150 °C **Type 41-23/41-73**: 150 °C · Steam pressure regulator as special version on request					
Set point ranges in bar, continuously adjustable at the pilot valve	**Type 44-2**: 2 to 4.2, 2.4 to 6.3, 6 to 10.5 · **Type 44-7**: 2 to 4.4, 2.4 to 6.6, 6 to 1 **Type 44-1 B/44-6 B**: 2 to 6, 4 to 10, 8 to 20 · **Type 2405/2406**: 2 to 5, 4.5 to 10 **Type 41-23/41-73**: 2 to 5, 4.5 to 10, 8 to 16, 10 to 22, 20 to 28					
Compliance	CE · EAC					

[1] Version with reduced K_{VS} coefficient possible. Same technical data as DN 150.

Pilot valves for Type 2333 Pressure Reducing Valve

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), non-flammable gases (80 °C), and 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 Valve

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 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	Nominal pressure	Connection [1]	Material	K_{VS} coefficient	Set point ranges	Medium	Data Sheet
Type 44-2 Pressure Reducing Valve	PN 25	DN 15	Red brass · Spheroidal graphite iron	1	2 to 10.5 bar	Liquids up to 150 °C Non-flammable gases up to 80 °C	T 2623 T 2723
Type 44-7 Excess Pressure Valve					2 to 11 bar		
Type 44-0 B Pressure Reducing Valve	PN 25	G ½, DN 15	Red brass · Spheroidal graphite iron · Stainless steel	1	2 to 20 bar	Steam up to 200 °C	T 2628
Type 44-1 B Pressure Reducing Valve						Liquids and mineral oil up to 150 °C · Non-flammable gases up to 80 °C · Nitrogen up to 150 °C	T 2626
Type 44-6 B Excess Pressure Valve						Liquids and air up to 150 °C Non-flammable gases up to 80 °C · Steam and nitrogen up to 150 °C	
Type 2405 Pressure Reducing Valve	PN 16 to 40	DN 15	Cast iron · Cast steel · Spheroidal graphite iron Stainless steel Forged steel	1	2 to 5 bar	Gases in temperature range –20 to +60 °C	T 2520
Type 2406 Excess Pressure Valve	PN 16 to 40	DN 15	Cast iron · Cast steel · Spheroidal graphite iron Stainless steel Forged steel	1	2 to 5 bar	Gases in temperature range –20 to +60 °C	T 2522
Type 41-23 Pressure Reducing Valve	PN 16 to 40	DN 15	Cast iron · Cast steel · Spheroidal graphite iron Stainless steel Forged steel	1	2 to 28 bar	Gases, liquids, and steam up to 350 °C	T 2512
Type 41-73 Excess Pressure Valve							T 2517

[1] Main valve DN 300/400: all pilot valves with G 1/DN 25 connection, K_{VS} 5 (threaded connection) or K_{VS} 8 (flanged connection).

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

Type 2422 Valve, balanced by a bellows					
Nominal pressure		**PN 16**	**PN 16/25**	**PN 16, 25 and 40**	**PN 16, 25 and 40**
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		1.4006			1.4571
Plug	Standard version	1.4301 with PTFE soft seal [1], max. 220 °C			1.4571 with PTFE soft seal, max. 220 °C
	Version for steam	PTFE soft seal, max. 220 °C · Metal seal, max. 350 °C			
Pressure balancing		Balancing cases made of sheet steel DD11 · Balancing bellows made of 1.4571			
Gasket		Graphite on metal core			
Type 2422 Valve, balanced by a diaphragm					
Nominal pressure		**PN 16**	**PN 16/25**	**PN 16, 25 and 40**	**PN 16/25/40** [2]
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	DN 125 to 250	Red brass [3]			1.4409
	DN 300, 400	Stainless steel 1.4301			
Plug	DN 125 to 250	Red brass [3]			1.4409
	DN 300, 400	Stainless steel 1.4301 with EPDM soft seal [4], max. 150 °C			
Pressure balancing		Balancing cases made of sheet steel DD11 · EPDM balancing diaphragm, max. 150 °C			

1) Optionally with EPDM soft seal, max. 150 °C.
2) DN 125 to 250
3) Optionally 1.4409
4) Optionally with PTFE soft seal, max. 150 °C.

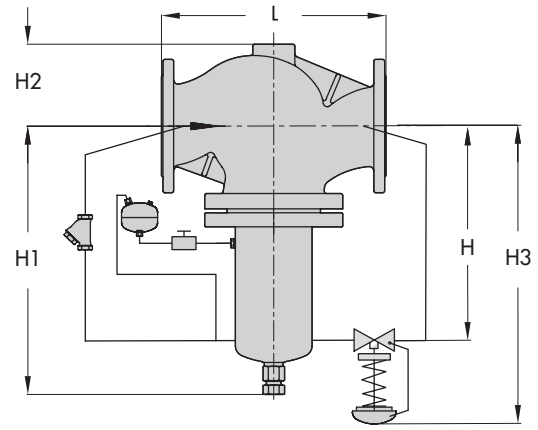
Installation

- Installation in horizontal pipelines
- The direction of flow must match the direction indicated by the arrow on the body
- **Valve balanced by a bellows:** valve with actuator suspended downwards
- **Valve balanced by a diaphragm:** balancing diaphragm facing upward
- Install a strainer (e.g. SAMSON Type 2 N or Type 2 NI) upstream of the valve.
- Do not insulate the pilot valve when the medium temperature exceeds 80 °C.

For further details on installation refer to Mounting and Operating Instructions ▶ EB 2552-1 or ▶ EB 2552-2.

Dimensions

Type 2422 Valve balanced by a bellows



Nominal size	DN	125	150	200	250
Length L	mm	400	480	600	730
Height H	mm	285	315	390	390
Height H1	mm	460	590	730	730
Height H2	mm	145	175	235	260
Max. height H3 [2]	mm	≤725	≤825	≤890	≤890
Weight [1], approx. (PN 16 with Type 41-23 Pilot Valve)	kg	77	120	262	307

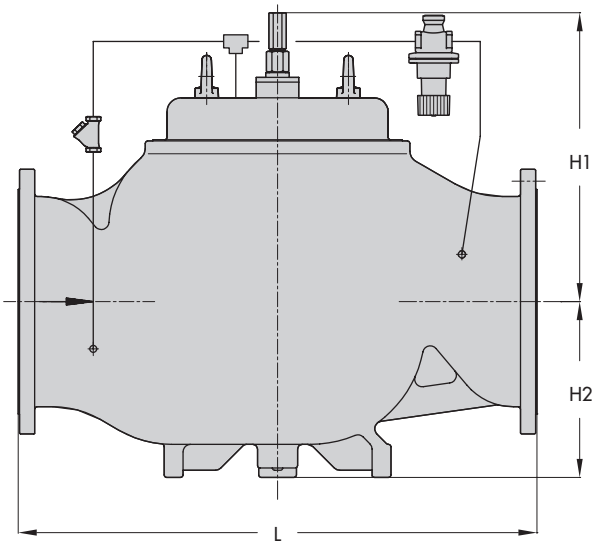
[1] +10 % for cast iron 1.0619/PN 25 and spheroidal graphite iron EN-GJS-400-18-LT/PN 25

[2] Depending on the pilot valve used

Type 2333 Pressure Reducing Valve/**Type 2335** Excess Pressure Valve
DN 125 to 250 · Version balanced by a bellows, with compensation chamber for steam

Drawing shows the version with Type 41-23 Pressure Reducing Valve as the pilot valve. The dimensions apply to an excess pressure valve accordingly.

Type 2422 Valve, balanced by a diaphragm



Nominal size	DN	125	150	200	250	300	400
Length L	mm	400	480	600	730	850	1110
Height H1	mm	285	310	380	380	510	610
Height H2	mm	145	175	260	260	290	390
Weight [1], approx. (PN 16 with Type 44-1 B Pilot Valve)	kg	52	72	212	307	317	627

[1] +10 % for cast iron 1.0619/PN 25 and spheroidal graphite iron EN-GJS-400-18-LT/PN 25

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

Drawing shows the version with Type 44-1 B Pressure Reducing Valve as the pilot valve. The dimensions apply to an excess pressure valve accordingly.

Fig. 3: *Dimensions in mm*

Ordering text

Type 2333 Pressure Reducing Valve/Type 2335 Excess Pressure Valve

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

Body material ..., PN …

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

Medium ..., max. medium temperature

Optionally, special version

Specifications subject to change without notice

SAMSON AG · MESS- UND REGELTECHNIK
Weismüllerstraße 3 · 60314 Frankfurt am Main, Germany
Phone: +49 69 4009-0 · Fax: +49 69 4009-1507
samson@samson.de · www.samson.de