

# 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

ANSI version

#### Application

Pressure regulators for set points from **30 to 400 psi (2 to 28 bar)** · Valves in **NPS 6, 8, 10, 12, and 16 (DN 150, 200, 250, 300 and 400)** · Pressure rating **Class 125 to 300** · Suitable for liquids, gases, and vapors up to **+660 °F (350 °C)**

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

**Type 2335:** the 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 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

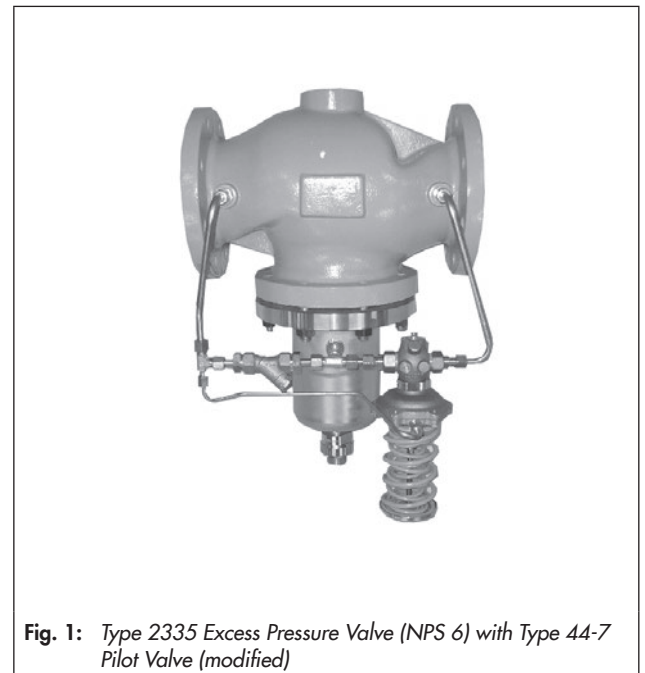
- Type 2422 Valve (modified), balanced by a bellows or a diaphragm, with soft-seated plug and internal closing spring
- Each regulator comes with one pilot valve with a strainer and a fixed restriction or Venturi nozzle
- Valve body made of cast iron A126B, cast steel A216 WCC or stainless steel A351 CF8M.
- 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 (NPS 6) with Type 44-7 Pilot Valve (modified)

#### Special versions

- With flow divider for noise reduction (not for liquids)
- Lower minimum required differential pressure  $\Delta p_{\min}$
- 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 potentiometer or pressure limitation when used in combination with an electric safety pressure limiter
- For higher differential pressures
- Reduced  $C_v$  ( $K_{VS}$ ) 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

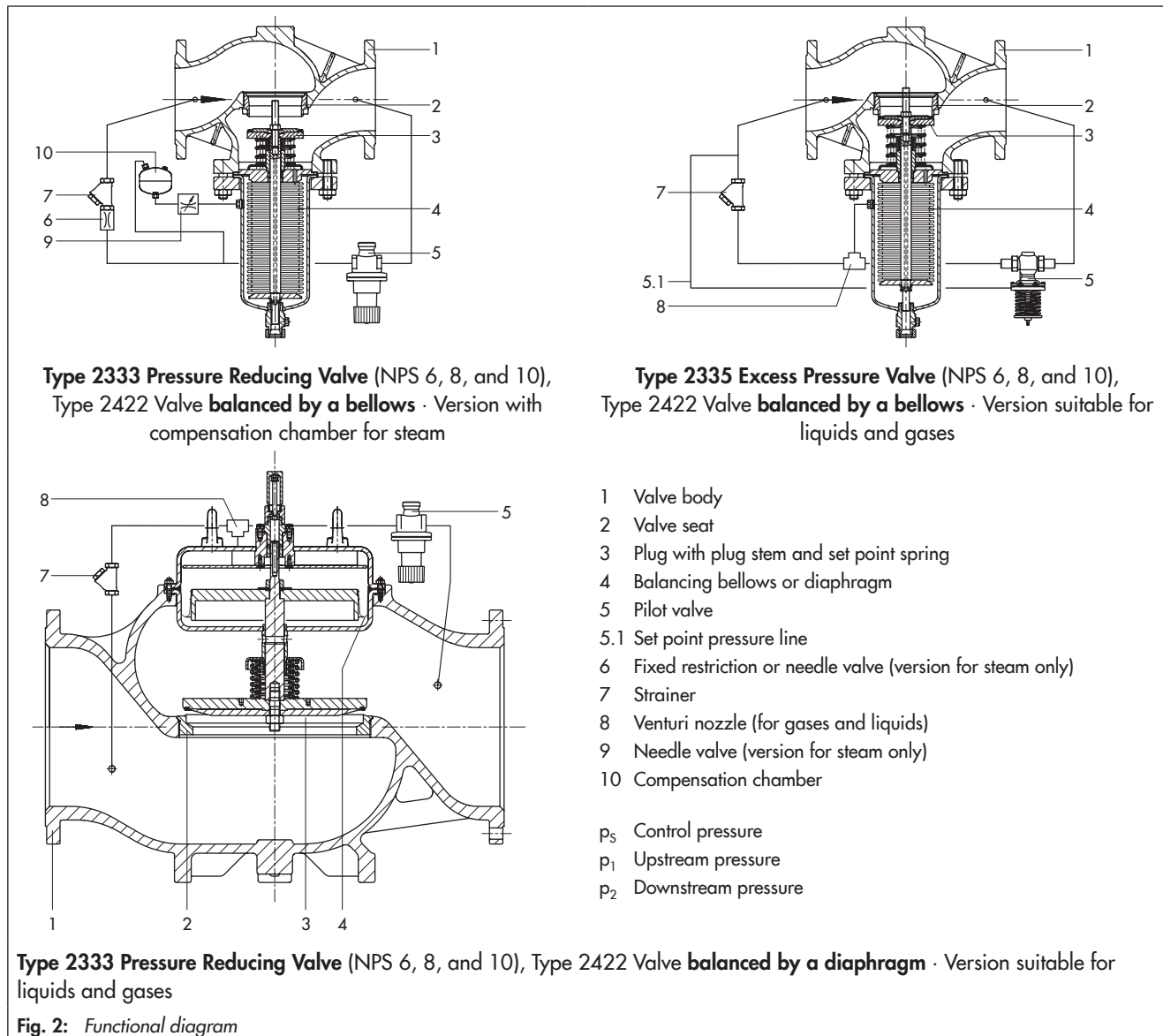
pressure  $p_1$  causes the main valve to open. Together with the pilot valve, the Venturi nozzle (8) (the fixed restriction (6) and needle valve (9) in the version for steam) create the control pressure  $p_s$ .

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  $\Delta p_{\min}$  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.



**Table 1: Technical data · All pressures in bar (gauge)**Type 2422 Valve · **Balanced by a bellows** · Suitable for liquids, gases, and vapors

Valve size		NPS 6 · DN 150	NPS 8 · DN 200	NPS 10 · DN 250
Pressure rating		Class 125 to 300		
<b>Flow coefficients (normal)</b>				
Flow coefficient	$C_V$	420	600	720
	$K_{VS}$	360	520	620
Flow coefficient with flow divider St I	$C_V$	310	460	590
	$K_{VS}$	270	400	500
Flow coefficient with flow divider St III	$C_V$	210	300	355
	$K_{VS}$	180	260	310
Minimum differential pressure $\Delta p_{min}$				
Version for water		15 psi · 1.0 bar	10 psi · 0.7 bar	
Version for steam		305 psi · 2.0 bar	19 psi · 1.3 bar	
Max. permissible differential pressure $\Delta p_{max}$		230 psi · 16 bar	175 psi · 12 bar	
<b>Reduced flow coefficients (only for valves balanced by a bellows)</b>				
Flow coefficient	$C_V$	145	420	420
	$K_{VS}$	125	360	360
Flow coefficient with flow divider St I	$C_V$	110	315	315
	$K_{VS}$	95	270	270
Flow coefficient with flow divider St III	$C_V$	70	210	210
	$K_{VS}$	60	180	180
Minimum differential pressure $\Delta p_{min}$				
Version for water/air		3 psi · 0.2 bar <sup>1)</sup>	3 psi · 1.0 bar	
Version for steam		–	28.5 psi · 1.9 bar	30 psi · 2.0 bar
Max. permissible differential pressure $\Delta p_{max}$		233 psi · 16 bar	175 psi · 12 bar	
$x_{FZ}$ value		0.3		
Leakage class according to ANSI/FCI 70-2		≤0.05 % of $C_V$ ( $K_{VS}$ ) coefficient <sup>2)</sup>		
Max. permissible temperature (depending on the pilot valve)		<b>Type 44-2/44-7:</b> 300 °F (150 °C) · <b>Type 44-0 B/44-1 B/44-6 B:</b> max. 390 °F (200 °C) <b>Type 2405/2406:</b> max. 300 °F (150 °C) · <b>Type 41-23/41-73:</b> 660 °F (350 °C)		
Set point ranges, continuously adjustable at the pilot valve	psi	<b>Type 44-2:</b> 30 to 63, 36 to 94, 90 to 150 · <b>Type 44-7:</b> 30 to 66, 36 to 100, 90 to 165 <b>Type 44-0 B/44-1 B/44-6 B:</b> 30 to 90, 60 to 150, 120 to 290 · <b>Type 2405/2406:</b> 30 to 75, 65 to 145 · <b>Type 41-23/41-73:</b> 30 to 75, 65 to 145, 115 to 230, 145 to 290, 290 to 400		
	bar	<b>Type 44-2:</b> 2 to 4.2, 2.4 to 6.3, 6 to 10.5 · <b>Type 44-7:</b> 2 to 4.4, 2.4 to 6.6, 6 to 11 <b>Type 44-0 B/44-1 B/44-6 B:</b> 2 to 6, 4 to 10, 8 to 20 · <b>Type 2405/2406:</b> 2 to 5, 4.5 to 10 · <b>Type 41-23/41-73:</b> 2 to 5, 4.5 to 10, 8 to 16, 10 to 22, 20 to 28		
Compliance		<b>CE · EAC</b>		

<sup>1)</sup> Version with Type 2420 Diaphragm Actuator, 100 in<sup>2</sup> (640 cm<sup>2</sup>) (Type 2334, see T 3210).<sup>2)</sup> ≤0.1 % of  $C_V$  ( $K_{VS}$ ) coefficient with metal-seated plugType 2422 Valve · **Balanced by a diaphragm** · Suitable for liquids and gases

Valve size		NPS 6 · DN 150	NPS 8 · DN 200	NPS 10 · DN 250	NPS 12 · DN 300	NPS 16 · DN 400
Pressure rating		Class 125 to 300			Class 150 and 300	
Flow coefficient	$C_V$	445	760 <sup>1)</sup>	930 <sup>1)</sup>	1440	2300
	$K_{VS}$	380	650 <sup>1)</sup>	800 <sup>1)</sup>	1250	2000
$x_{FZ}$ value		0.35	0.3 <sup>1)</sup>		0.2	
Minimum differential pressure $\Delta p_{min}$		12 psi · 0.8 bar	6 psi <sup>1)</sup> · 0.4 bar <sup>1)</sup>		7 psi · 0.5 bar	4.5 psi · 0.3 bar
Max. perm. differential pressure $\Delta p_{max}$		175 psi · 12 bar	150 psi <sup>1)</sup> · 10 bar <sup>1)</sup>			90 psi · 6 bar
Leakage class acc. to ANSI/FCI 70-2		≤0.01 % of $C_V$ ( $K_{VS}$ ) coefficient				
Max. permissible temperature (depending on the pilot valve)		<b>Type 44-2/44-7:</b> 300 °F (150 °C) · <b>Type 44-0 B/44-1 B/44-6 B:</b> max. 390 °F (200 °C) <b>Type 2405/2406:</b> max. 300 °F (150 °C) · <b>Type 41-23/41-73:</b> 660 °F (350 °C) · Steam pressure regulator as special version on request				
Set point ranges, continuously adjustable at the pilot valve	psi	<b>Type 44-2:</b> 30 to 63, 36 to 94, 90 to 150 · <b>Type 44-7:</b> 30 to 66, 36 to 100, 90 to 165 <b>Type 44-0 B/44-1 B/44-6 B:</b> 30 to 90, 60 to 150, 120 to 290 · <b>Type 2405/2406:</b> 30 to 75, 65 to 145 · <b>Type 41-23/41-73:</b> 30 to 75, 65 to 145, 115 to 230, 145 to 290, 290 to 400				
	bar	<b>Type 44-2:</b> 2 to 4.2, 2.4 to 6.3, 6 to 10.5 · <b>Type 44-7:</b> 2 to 4.4, 2.4 to 6.6, 6 to 11 <b>Type 44-0 B/44-1 B/44-6 B:</b> 2 to 6, 4 to 10, 8 to 20 · <b>Type 2405/2406:</b> 2 to 5, 4.5 to 10 <b>Type 41-23/41-73:</b> 2 to 5, 4.5 to 10, 8 to 16, 10 to 22, 20 to 28				
Compliance		<b>CE · EAC</b>				

<sup>1)</sup> Version with reduced  $C_V$  coefficient possible. Same technical data as NPS 6.

**Pilot valves for Type 2333 Pressure Reducing Valve**

**Type 44-2** · Suitable for liquids and mineral oil 300 °F (150 °C), non-flammable gases 175 °F (80 °C)

**Type 44-1 B** · Suitable for liquids 300 °F (150 °C), non-flammable gases 175 °F (80 °C), and nitrogen 300 °F (150 °C)

**Type 44-0 B** · Suitable for steam 390 °F (200 °C)

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

**Type 2405** · Suitable for gases -5 to +140 °F (-20 to +60 °C)

**Pilot valves for Type 2335 Excess Pressure Valve**

**Type 44-7** · Suitable for liquids and mineral oil 300 °F (150 °C), non-flammable gases 175 °F (80 °C)

**Type 44-6 B** · Suitable for liquids 300 °F (150 °C), non-flammable gases 175 °F (80 °C), steam 390 °F (200 °C), and nitrogen 300 °F (150 °C)

**Type 41-73** · Suitable for gases, liquids, and steam 660 °F (350 °C)

**Type 2406** · Suitable for gases -5 to +140 °F (-20 to +60 °C)

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

Pilot valve	Nominal pressure	Connection <sup>1)</sup>	Material	K <sub>V5</sub>	Set point ranges	Medium	Data Sheet
<b>Type 44-2 Pressure Reducing Valve</b>	PN 25	DN 15	Red brass · Spheroidal graphite iron	1	30 to 155 psi (2 to 10.5 bar)	Liquids up to 300 °F (150 °C) Non-flammable gases up to 175 °F (80 °C)	T 2623 T 2723
<b>Type 44-7 Excess Pressure Valve</b>					30 to 165 psi (2 to 11 bar)		
<b>Type 44-0 B Pressure Reducing Valve</b>	PN 25	G 1/2, DN 15	Red brass · Spheroidal graphite iron · Stainless steel	1	30 to 290 psi (2 to 20 bar)	Steam up to 390 °F (200 °C)	T 2628
<b>Type 44-1 B Pressure Reducing Valve</b>						Liquids and mineral oil up to 300 °F (150 °C) · Non-flammable gases up to 175 °F (80 °C) · Nitrogen up to 300 °F (150 °C)	T 2626
<b>Type 44-6 B Excess Pressure Valve</b>						Liquids and air up to 300 °F (150 °C) · Non-flammable gases up to 175 °F (80 °C) · Steam and nitrogen up to 300 °F (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	30 to 145 psi (2 to 10 bar)	Gases in temperature range -5 to +140 °F (-20 to +60 °C)	T 2520
<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	30 to 145 psi (2 to 10 bar)	Gases in temperature range -5 to +140 °F (-20 to +60 °C)	T 2522
<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	30 to 400 psi (2 to 28 bar)	Gases, liquids, and steam up to 660 °F (350 °C)	T 2512
<b>Type 41-73 Excess Pressure Valve</b>							T 2517

<sup>1)</sup> Main valve NPS 12/16 (DN 300/400): all pilot valves with G 1/DN 25 connection, C<sub>V</sub> = 6 | K<sub>V5</sub> = 5 (threaded connection) or C<sub>V</sub> = 9.6 | K<sub>V5</sub> = 8 (flanged connection).

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

Type 2422 Valve, balanced by a bellows			
Pressure rating	Class 125	Class 150 · Class 300	Class 150 · Class 300
Body	Cast iron A126B	Cast steel A216 WCC	Stainless steel A351 CF8M
Valve seat	1.4006		1.4571
Plug	Standard version	1.4301 with PTFE soft seal <sup>1)</sup> , max. 430 °F (220 °C)	
	Version for steam	PTFE soft seal, max. 430 °F (220 °C) · Metal seal, max. 660 °F (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			
Pressure rating	Class 125	Class 150 · Class 300	Class 150 · Class 300
Body	Cast iron A126B	Cast steel A216 WCC	Stainless steel A351 CF8M
Valve seat	NPS 6 to 10: red brass <sup>2)</sup> · NPS 12 and 16: 1.4301		1.4571
Plug	Standard	NPS 6 to 10: red brass <sup>2)</sup> · NPS 12 and 16: 1.4301 with EPDM soft seal <sup>3)</sup> , max. 300 °F (150 °C)	
Pressure balancing	Balancing cases made of sheet steel DD11 · EPDM balancing diaphragm, max. 300 °F (150 °C)		

<sup>1)</sup> Optionally with EPDM soft seal, max. 300 °F (150 °C).

<sup>2)</sup> Optionally 1.4409

<sup>3)</sup> Optionally with PTFE soft seal, max. 300 °F (150 °C).

## Installation

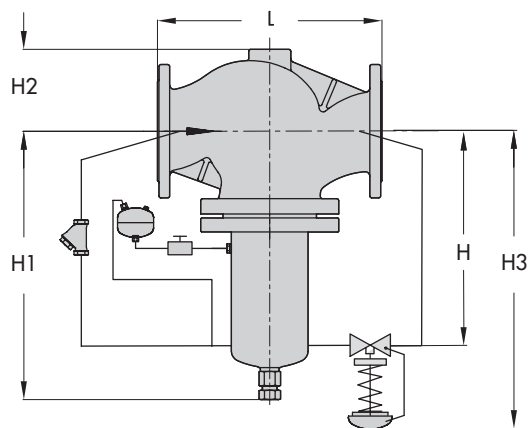
- Installation in horizontal pipelines
- The direction of flow must match the direction indicated by the arrow on the body
- **Valve balanced by a bellows:** valve with actuator suspended downwards
- **Valve balanced by a diaphragm:** balancing diaphragm facing upward
- Install a strainer (e.g. SAMSON Type 2 N or Type 2 NI) upstream of the valve.
- Do not insulate the pilot valve when the medium temperature exceeds 175 °F (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



Valve size	NPS	6	8	10	
Length L	Class 125/150	inch	17.8	21.4	26.5
		mm	451	543	673
	Class 300	inch	18.6	22.4	27.9
		mm	473	568	708
Height H		inch	12.4	15.4	15.4
		mm	315	390	390
Height H1		inch	23.2	28.7	28.7
		mm	590	730	730
Height H2		inch	6.9	10.2	10.2
		mm	175	260	260
Max. height H3 <sup>2)</sup>		inch	≤32.5	≤35	≤35
		mm	≤825	≤890	≤890
Weight <sup>1)</sup> , approx. (Class 125 with Type 41-23 Pilot Valve)	lb	260	570	670	
	kg	118	260	305	

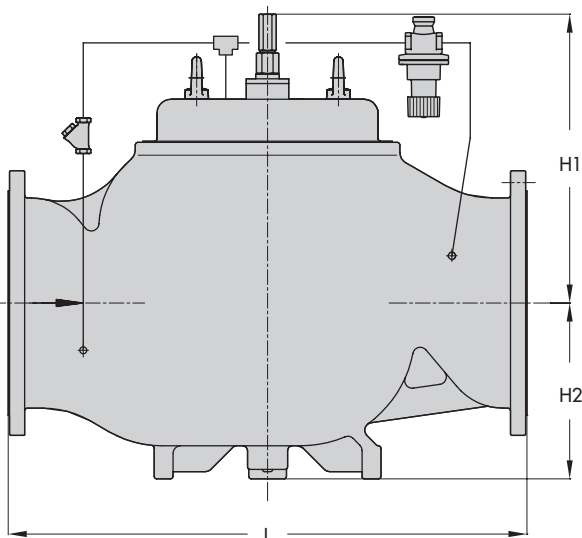
<sup>1)</sup> +10 % for A216 WCC and stainless steel A351 CF8M

### Type 2333 Pressure Reducing Valve/Type 2335 Excess Pressure Valve

NPS 6 to 10 · Version balanced by a bellows, with compensation chamber for steam

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.

### Type 2422 Valve, balanced by a diaphragm



Valve size	NPS	6	8	10	12	16	
Length L	Class 125/150	inch	17.8	21.4	26.5	29	40
		mm	451	543	673	737	1016
	Class 300	inch	18.6	22.4	27.9	30.5	–
		mm	473	568	708	775	–
Height H1, approx.		inch	12.2	14.9	14.9	20	24
		mm	310	380	380	510	610
Height H2, approx.		inch	6.9	10.2	10.2	11.4	15.4
		mm	175	260	260	290	390
Weight <sup>1)</sup> , approx. (Class 125 with Type 41-23 Pilot Valve)	lb	154	463	585	695	1378	
	kg	70	210	220	315	625	

<sup>1)</sup> +10 % for cast steel 1.0619/Class 125 and spheroidal graphite iron EN-GJS-400-18-LT/Class 125

### Type 2333 Pressure Reducing Valve/Type 2335 Excess Pressure Valve

NPS 6 to 16 · Version balanced by a diaphragm

Drawing shows the version with Type 41-23 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

NPS ... (DN ...), valve balanced by a bellows/diaphragm (NPS 6 and larger)

Body material ..., Class ...

With Type ... Pilot Valve, set point range ... psi (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

T 2554 EN

2016-11-24 · English