

## T 2554 EN

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

Self-operated Pressure Regulators · ANSI version



#### Application

Pressure regulators for set points from **30 to 400 psi (2 to 28 bar)** · Valves in **NPS 2½ to 16 (DN 65 to 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

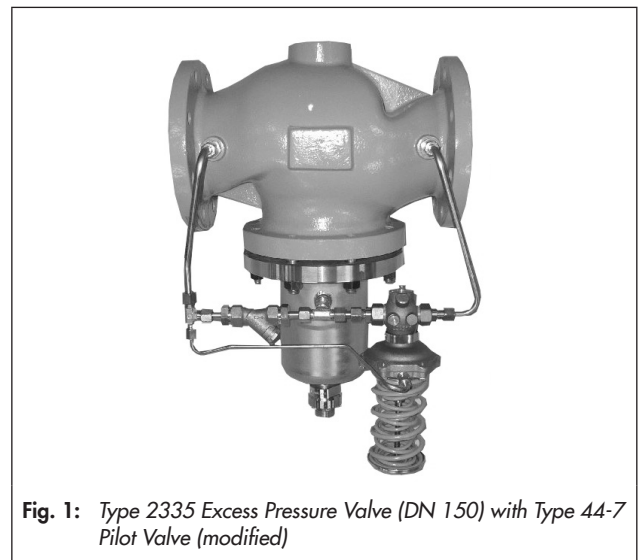
- Low-maintenance proportional regulators requiring no auxiliary energy
- High dynamic response and small system deviation, i.e. excellent control accuracy
- Convenient set point adjustment at the pilot valve
- Single-seated globe valve with flanged end connections
- Regulator delivered as ready-to-install 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 restrictor 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) for DN 65 to 100 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  $\Delta p_{\min}$
- 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  $p_s$ .

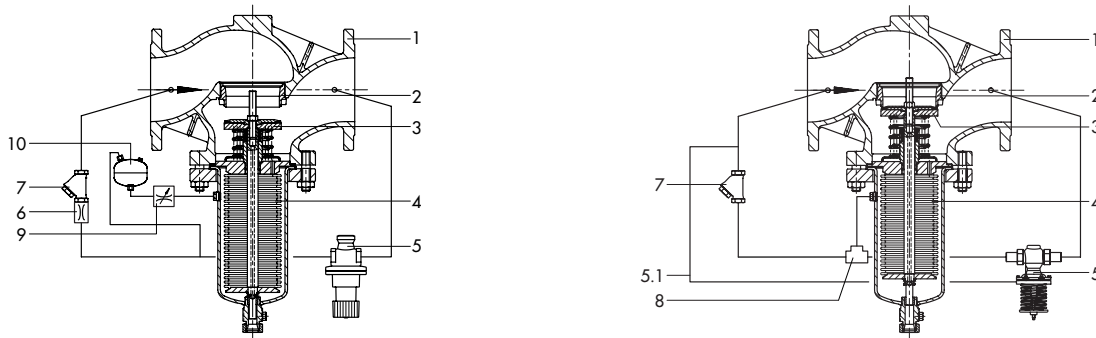
When the pilot valve is closed, the valve is fully balanced. The control pressure  $p_s$  between the pilot valve and Venturi nozzle acting on the outside of the balancing bellows (4) or balancing diaphragm (4) and the upstream pressure  $p_1$  balance each other out ( $p_s = p_1$ ). The set point spring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

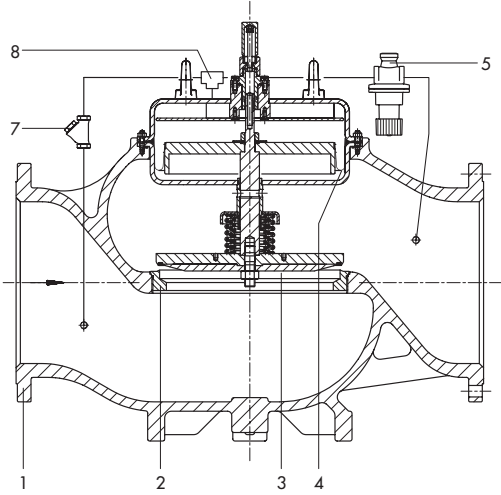
If the differential pressure falls below the minimum specification, pressure control is no longer possible. In this case, the pressure reducing valve reduces the downstream pressure to a constant level to balance the forces. The same applies to the excess pressure valve accordingly.

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** (NPS 6 to 10), Type 2422 Valve **balanced by a bellows** · Version with compensation chamber and needle valve for steam (DN 65 to 100)

**Type 2335 Excess Pressure Valve** (DN 6 to 10), Type 2422 Valve **balanced by a bellows** · 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

**Type 2333 Pressure Reducing Valve** (NPS 6, 8 and 10), Type 2422 Valve **balanced by a diaphragm** · Version suitable for liquids and gases

**Fig. 2:** Functional diagram

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

Nominal size		NPS 2½ DN 65	NPS 3 DN 80	NPS 4 DN 100	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	$C_V$	60 <sup>1)</sup>	94 <sup>1)</sup>	145 <sup>1)</sup>	420	600	720
	$K_{VS}$	50 <sup>1)</sup>	80 <sup>1)</sup>	125 <sup>1)</sup>	360	520	620
Flow coefficient with flow divider ST 1	$C_V$	45 <sup>1)</sup>	70 <sup>1)</sup>	110 <sup>1)</sup>	310	460	590
	$K_{VS}$	38 <sup>1)</sup>	60 <sup>1)</sup>	95 <sup>1)</sup>	270	400	500
Flow coefficient with flow divider ST 3	$C_V$	30 <sup>1)</sup>	45 <sup>1)</sup>	70 <sup>1)</sup>	210	300	355
	$K_{VS}$	25 <sup>1)</sup>	40 <sup>1)</sup>	60 <sup>1)</sup>	180	260	310
Minimum differential pressure $\Delta p_{min}$							
Version for water		0.4 bar (320 cm <sup>2</sup> actuator) <sup>1)</sup>			15 psi/1.0 bar 43.5 psi/3.0 bar <sup>4)</sup>	10 psi/0.7 bar 43.5 psi/3.0 bar <sup>4)</sup>	
Version for steam		0.2 bar (640 cm <sup>2</sup> actuator) <sup>1)</sup>			30.5 psi/2.0 bar 43.5 psi/3.0 bar <sup>4)</sup>	20.5 psi/1.4 bar 43.5 psi/3.0 bar <sup>4)</sup>	
Max. permissible differential pressure $\Delta p_{max}$		290 psi · 20 bar		235 psi · 16 bar	175 psi · 12 bar 510 psi · 35 bar <sup>4)</sup>	145 psi · 10 bar 365 psi · 25 bar <sup>4)</sup>	
<b>Reduced flow coefficients (only for valves balanced by a bellows)</b>							
Flow coefficient	$C_V$	38 <sup>1)</sup>		95 <sup>1)</sup>	145 <sup>1)</sup>	420	
	$K_{VS}$	32 <sup>1)</sup>		80 <sup>1)</sup>	125 <sup>1)</sup>	360	
Flow coefficient with flow divider ST 1	$C_V$	-			110 <sup>1)</sup>	315	
	$K_{VS}$				95 <sup>1)</sup>	270	
Flow coefficient with flow divider ST 3	$C_V$	-			70 <sup>1)</sup>	210	
	$K_{VS}$				60 <sup>1)</sup>	180	
Minimum differential pressure $\Delta p_{min}$							
Version for water/air		0.8 bar (320 cm <sup>2</sup> actuator) <sup>1)</sup>			3 psi · 0.2 bar <sup>1)</sup>	3 psi · 1.0 bar	
Version for steam		0.4 bar (640 cm <sup>2</sup> actuator) <sup>1)</sup>			-	28.5 psi · 1.9 bar	30 psi · 2.0 bar
Max. permissible differential pressure $\Delta p_{max}$		290 psi · 20 bar			233 psi · 16 bar	175 psi · 12 bar	
$x_{Fz}$ value		0.4	0.35			0.3	
Leakage class according to ANSI/FCI 70-2		≤0.01 % of $C_V$ ( $K_{VS}$ ) coefficient (soft seal) <sup>2)</sup>					
Max. permissible temperature (depending on the pilot valve)		<b>Type 44-1 B:</b> 300 °F (150 °C) · <b>Type 44-0 B/Type 44-6 B:</b> max. 390 °F (200 °C) <b>Type 2405/Type 2406:</b> max. 140 °F (60 °C) · <b>Type 41-23/Type 41-73:</b> 660 °F (350 °C) <sup>3)</sup>					
Set point ranges, continuously adjustable at the pilot valve	psi	<b>Type 44-0 B/Type 44-1 B/Type 44-6 B:</b> 30 to 90, 60 to 150, 120 to 290 · <b>Type 2405/Type 2406:</b> 30 to 75, 65 to 145 <b>Type 41-23/Type 41-73:</b> 30 to 75, 65 to 145, 115 to 230, 145 to 290, 290 to 400					
	bar	<b>Type 44-0 B/Type 44-1 B/Type 44-6 B:</b> 2 to 6, 4 to 10, 8 to 20 · <b>Type 2405/Type 2406:</b> 2 to 5, 4.5 to 10 <b>Type 41-23/Type 41-73:</b> 2 to 5, 4.5 to 10, 8 to 16, 10 to 22, 20 to 28					
Conformity		<b>CE · EAC</b>					

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

Nominal 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	
<b>Standard <math>K_{VS}</math> coefficients</b>						
$C_V$ coefficient		445	760	930	1440 · (1090) <sup>5)</sup>	2300
$K_{VS}$ coefficient		380	650	800	1250 · (950) <sup>5)</sup>	2000
$x_{Fz}$ value		0.35	0.3		0.2	
Minimum differential pressure $\Delta p_{min}$		12 psi · 0.8 bar	6 psi · 0.4 bar		7 psi · 0.5 bar	4.5 psi · 0.3 bar
Max. perm. differential pressure $\Delta p_{max}$		175 psi · 12 bar	150 psi · 10 bar		150 psi · 10 bar / 365 psi · 25 bar <sup>5)</sup>	90 psi · 6 bar
Leakage class according to IEC 60534-4		IV ≤0.01 % of $C_V$ ( $K_{VS}$ ) coefficient				
Max. permissible temperature (depending on the pilot valve) <sup>6)</sup>		<b>Type 44-1 B/Type 44-6 B/Type 41-23/Type 41-73:</b> 300 °F (150 °C) · <b>Type 2405/Type 2406:</b> 140 °F (60 °C) Steam pressure regulator as special version on request				
Set point ranges in bar, continuously adjustable at the pilot valve	psi	<b>Type 44-1 B/Type 44-6 B:</b> 30 to 90, 60 to 150, 120 to 290 · <b>Type 2405/Type 2406:</b> 30 to 75, 65 to 145 <b>Type 41-23/Type 41-73:</b> 30 to 75, 65 to 145, 115 to 230, 145 to 290, 290 to 400				
	bar	<b>Type 44-1 B/Type 44-6 B:</b> 2 to 6, 4 to 10, 8 to 20 · <b>Type 2405/Type 2406:</b> 2 to 5, 4.5 to 10 <b>Type 41-23/Type 41-73:</b> 2 to 5, 4.5 to 10, 8 to 16, 10 to 22, 20 to 28				
Conformity		<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 ▶ T 3210)<sup>2)</sup> ≤0.05 % of  $C_V$  ( $K_{VS}$ ) coefficient with metal-seated plug<sup>3)</sup> Without compensation chamber: 150 °C only<sup>4)</sup> Reinforced version with bellows<sup>5)</sup> Reinforced version only available with reduced  $C_V$  ( $K_{VS}$ ) coefficient<sup>6)</sup> NPS 16: max. 175 °F · DN 400: max. 80 °C

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

**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 41-23** · Suitable for gases, liquids and steam 300 °F (150 °C)

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

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

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

**Type 41-73** · Suitable for gases, liquids and steam 300 °F (150 °C)

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

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

Pilot valve	Pressure rating	Connection <sup>1)</sup>	Material	K <sub>VS</sub> coefficient	Set point ranges	Medium	Data Sheet
Type 44-0 B Pressure Reducing Valve	PN 25	G 1/2, DN 15	Spheroidal graphite iron · Stainless steel	1	30 to 290 psi (2 to 20 bar)	Steam up to 390 °F (200 °C)	T 2626
Type 44-1 B Pressure Reducing Valve						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)	
Type 44-6 B Excess Pressure Valve						Liquids and air up to 300 °F (150 °C) · Non-flammable gases up to 175 °F (80 °C) · Nitrogen up to 300 °F (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	30 to 145 psi (2 to 10 bar)	Gases in temperature range -5 to +140 °F (-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	30 to 145 psi (2 to 10 bar)	Gases in temperature range -5 to +140 °F (-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	30 to 400 psi (2 to 28 bar)	Gases, liquids and steam up to 660 °F (350 °C)	T 2512
Type 41-73 Excess Pressure Valve							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>VS</sub> = 5 (threaded connection) or C<sub>v</sub> = 9.6 | K<sub>VS</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		
Seal	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 <sup>4)</sup>
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)		1.4571 with PTFE soft seal, 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). NPS 16: max. 175 °F · DN 400: max. 80 °C

<sup>4)</sup> NPS 16 on request

## 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).

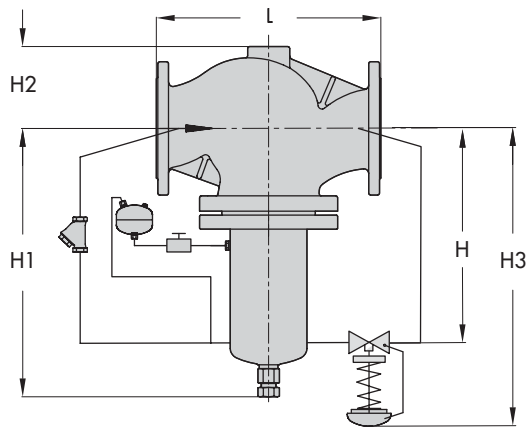


For further details on installation refer to Mounting and Operating Instructions

▶ EB 2552-1 or ▶ EB 2552-2.

## Dimensions

### Type 2422 Valve · Balanced by a bellows



Nominal size	NPS	6	8	10	
Length L	Class 125/150	inch	17.8	21.4	26.5
		mm	451	543	673
Height H	Class 300	inch	18.6	22.4	27.9
		mm	473	568	708
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
Approx. weight <sup>1)</sup> (Class 125) <sup>2)</sup>	lb	260	570	670	
	kg	118	260	305	

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

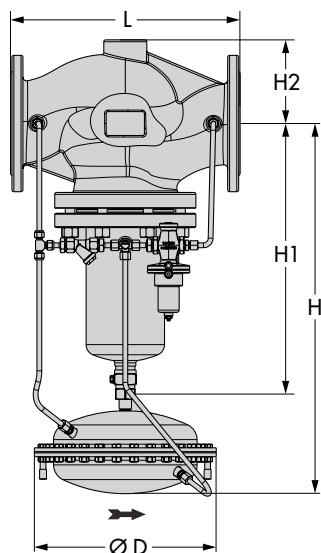
<sup>2)</sup> With Type 41-23 Pilot Valve

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

NPS 6 to 10 · Version balanced by a bellows, with compensation chamber and needle valve for steam (DN 65 to 100)

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 bellows (with diaphragm actuator)



Nominal size	NPS	2½	3	4	6	8	10	
Length L	Class 125/150	inch	10.9	11.8	13.9	17.8	21.4	26.5
		mm	276	298	352	451	543	673
Height H	Class 300	inch	11.5	12.5	14.5	18.6	22.4	27.9
		mm	292	318	368	473	568	708
Height H		inch	18.3	20.5	30.6	36.4		
		mm	465	520	775	925		
Height H1, approx.		inch	11.8	14	23.2	28.7		
		mm	300	355	590	730		
Height H2, approx.		inch	4.0	4.8	6.9	10.2		
		mm	100	120	175	260		
Ø D	mm	285 (320 cm <sup>2</sup> )		380 (640 cm <sup>2</sup> )				
Weight, approx.	lb	On request						
	kg							

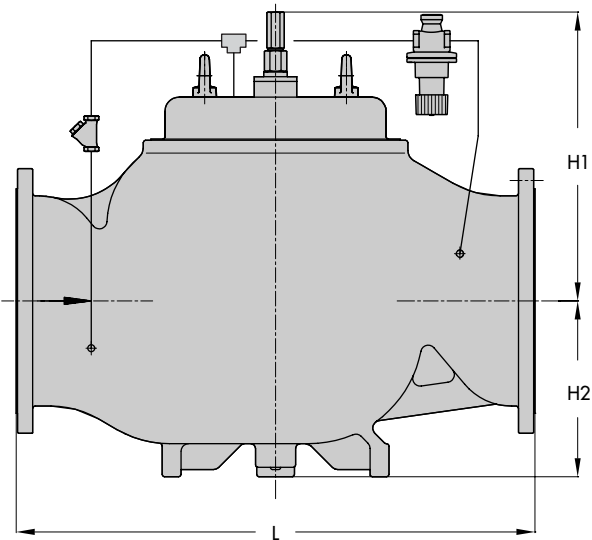
### Type 2333 Pressure Reducing Valve/Type 2335 Excess Pressure Valve

NPS 2½ to 10 · Version balanced by a bellows · Optional with compensation chamber for steam control

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.

## Dimensions

### Type 2422 Valve · Balanced by a diaphragm



Nominal 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 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

NPS ... (DN ...), valve balanced by a bellows/diaphragm (NPS 2½ and larger)

Body material ..., Class ...

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

Medium ..., max. medium temperature ...

Optionally, special version