

## T 2552 EN

### Type 2333 Pressure Reducing Valve with pilot valve

### Type 2335 Excess Pressure Valve with pilot valve

Self-operated pressure regulators · Pilot operated by the process medium



#### Application

Pressure regulators for set points from **2 to 28 bar** · Valve sizes DN 65 to 400 · Pressure rating **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

The differential pressure across the regulator is used as auxiliary energy to operate the valve. This pressure must be at least as high as the minimum differential pressure  $\Delta p_{\min}$  specified in Table 1. If this minimum differential pressure does not exist, the regulator opens only partly and the maximum flow rate cannot be reached.

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

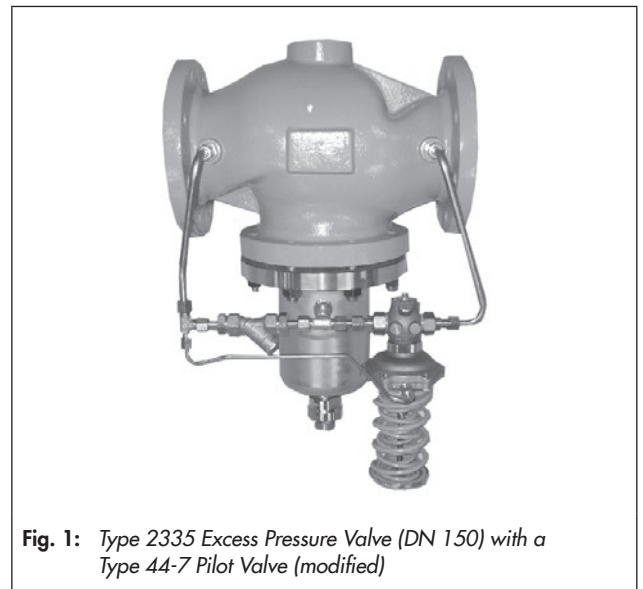
- Type 2422 Valve (modified), balanced by a bellows or a diaphragm, with soft-seated plug and internal closing spring
- Each regulator comes with one pilot valve with a strainer and a fixed restrictor or Venturi nozzle
- Valve body made of either cast iron, spheroidal graphite iron, cast steel or CrNiMo 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 a Type 44-7 Pilot Valve (modified)

#### Special versions

- With flow divider for noise reduction (not for liquids)
- Lower min. required differential pressure  $\Delta p$
- With internal parts made of 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
- Reinforced version 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 various forces (the upstream pressure  $p_1$  acting on the plug surface, the control pressure  $p_s$  acting on the bellows surface and the force of the set point spring) 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.

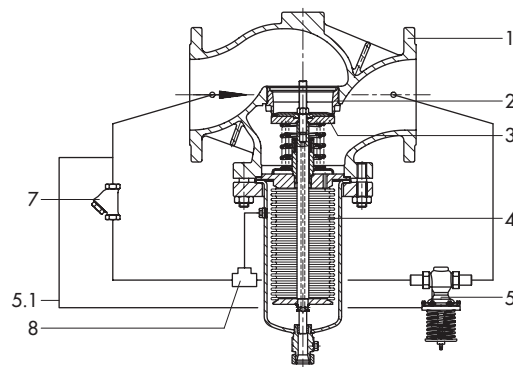
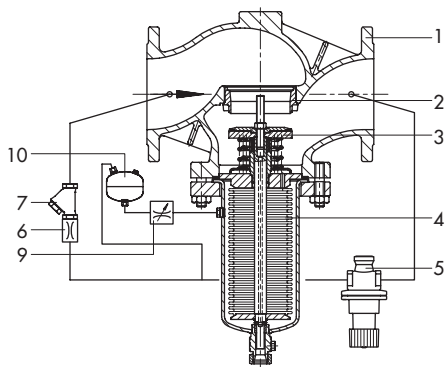
In the **Type 2335 Excess Pressure Valve**, the rising upstream pressure  $p_1$  causes the main valve to open. Together with the pilot valve, the Venturi nozzle (8) (the fixed restriction (6) and needle valve (9) in the version for steam) create the control pressure  $p_s$ .

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.

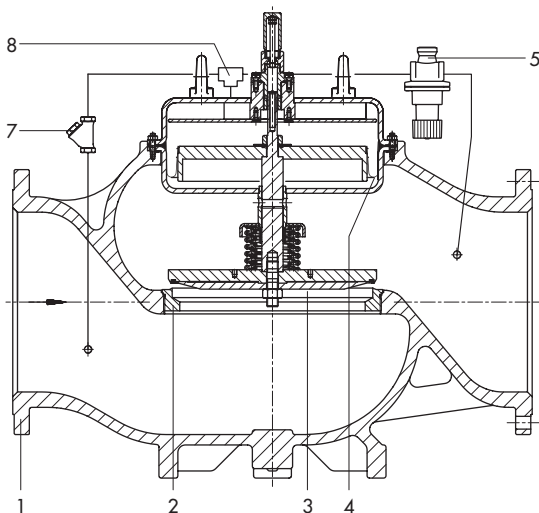
To ensure proper functioning, the minimum differential pressure  $\Delta p_{min}$  specified in Table 1 must be available as specified depending on the field of application. If the differential pressure falls below the minimum specification, pressure control is no longer possible. In this case, the pressure 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** (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




- 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 (version for steam only)
  - 7 Strainer
  - 8 Venturi nozzle (for gases and liquids)
  - 9 Needle valve (version for steam only)
  - 10 Compensation chamber (version for steam only)
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- $p_s$  Control pressure
  - $p_1$  Upstream pressure
  - $p_2$  Downstream pressure


**Type 2333 Pressure Reducing Valve** (DN 125 to 400), 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

Valve size	DN 65	DN 80	DN 100	DN 125	DN 150	DN 200	DN 250
Pressure rating	PN 16 to 40						
<b>Standard <math>K_{VS}</math> coefficients</b>							
$K_{VS}$ coefficient	50 <sup>1)</sup>	80 <sup>1)</sup>	125 <sup>1)</sup>	200	360	520	620
$K_{VS}$ coefficient (with flow divider ST 1)	38 <sup>1)</sup>	60 <sup>1)</sup>	95 <sup>1)</sup>	150	270	400	500
$K_{VS}$ coefficient (with flow divider ST 3)	25 <sup>1)</sup>	40 <sup>1)</sup>	60 <sup>1)</sup>	100	180	260	310
$x_{fZ}$ value	0.4	0.35				0.3	
<b>Minimum differential pressure <math>\Delta p_{min}</math></b>							
Version for water	0.4 bar (320 cm <sup>2</sup> actuator) <sup>1)</sup>			1.0 bar/3.0 bar <sup>4)</sup>		0.7 bar/3.0 bar <sup>4)</sup>	
Version for steam	0.2 bar (640 cm <sup>2</sup> actuator) <sup>1)</sup>			1.9 bar/3.0 bar <sup>4)</sup>	2.0 bar/3.0 bar <sup>4)</sup>	1.4 bar/3.0 bar <sup>4)</sup>	
Max. perm. differential pressure $\Delta p_{max}$	20 bar		16 bar	16 bar/35 bar <sup>4)</sup>	12 bar/35 bar <sup>4)</sup>	10 bar/25 bar <sup>4)</sup>	
<b>Reduced <math>K_{VS}</math> coefficient</b>							
$K_{VS}$ coefficient	32 <sup>1)</sup>	32 <sup>1)</sup>	80 <sup>1)</sup>	80 <sup>1)</sup>	125 <sup>1)</sup>	360	
$K_{VS}$ coefficient (with flow divider ST 1)	-			60 <sup>1)</sup>	95 <sup>1)</sup>	270	
$K_{VS}$ coefficient (with flow divider ST 3)				40 <sup>1)</sup>	60 <sup>1)</sup>	180	
$x_{fZ}$ value	0.4	0.35				0.3	
<b>Minimum differential pressure <math>\Delta p_{min}</math></b>							
Version for water/air	0.8 bar (320 cm <sup>2</sup> actuator) <sup>1)</sup>			0.2 bar <sup>1)</sup>		1.0 bar	
Version for steam	0.4 bar (640 cm <sup>2</sup> actuator) <sup>1)</sup>			-	-	1.9 bar	2.0 bar
Max. perm. differential pressure $\Delta p_{max}$	20 bar				16 bar	12 bar	
Leakage class according to IEC 60534-4	I $\leq 0.05$ % of $K_{VS}$ coefficient (metal seal) IV $\leq 0.01$ % of $K_{VS}$ coefficient (soft seal)						
Max. permissible temperature (depending on the pilot valve)	Types 44-1 B, 44-2 and 44-7: 150 °C · Types 44-0 B and 44-6 B: 200 °C Types 2405 and 2406: 60 °C · Types 41-23 and 41-73: 350 °C <sup>2)</sup>						
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 Types 44-0 B, 44-1 B and 44-6 B: 2 to 6, 4 to 10, 8 to 20 · Types 2405 and 2406: 2 to 5, 4.5 to 10 Types 41-23 and 41-73: 2 to 5, 4.5 to 10, 8 to 16, 10 to 22, 20 to 28						
Compliance							

<sup>1)</sup> Version with Type 2420 Diaphragm Actuator, 640 cm<sup>2</sup><sup>3)</sup> Only balanced by a bellows<sup>2)</sup> Without compensation chamber: 150 °C only<sup>4)</sup> Reinforced version with bellowsType 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
Pressure rating	PN 16 to 40					
<b>Standard <math>K_{VS}</math> coefficients</b>						
$K_{VS}$ coefficient	250	380	650	800	1250	2000
$x_{fZ}$ value	0.35		0.3		0.2	
<b>Minimum differential pressure <math>\Delta p_{min}</math></b>						
Minimum differential pressure $\Delta p_{min}$	0.8 bar		0.4 bar		0.5 bar	0.3 bar
Max. permissible differential pressure $\Delta p_{max}$	12 bar		10 bar		10 bar/25 bar <sup>1)</sup>	6 bar
<b>Reduced <math>K_{VS}</math> coefficient</b>						
$K_{VS}$ coefficient	-		380		950	-
$x_{fZ}$ value	-		0.35		0.2	-
<b>Minimum differential pressure <math>\Delta p_{min}</math></b>						
Minimum differential pressure $\Delta p_{min}$			0.8 bar		0.95 bar	-
Max. permissible differential pressure $\Delta p_{max}$			12 bar		25 bar	-
Leakage class according to IEC 60534-4	IV $\leq 0.01$ % of $K_{VS}$ coefficient					
Max. permissible temperature (depending on the pilot valve) <sup>2)</sup>	Types 44-2 and 44-7: 150 °C · Types 44-1 B and 44-6 B: 150 °C · Types 2405 and 2406: 60 °C Types 41-23 and 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 11 Types 44-1 B and 44-6 B: 2 to 6, 4 to 10, 8 to 20 · Types 2405 and 2406: 2 to 5, 4.5 to 10 Types 41-23 and 41-73: 2 to 5, 4.5 to 10, 8 to 16, 10 to 22, 20 to 28					
Conformity						

<sup>1)</sup> Reinforced version only available with reduced  $K_{VS}$  coefficient ( $K_{VS}$  950)<sup>2)</sup> Maximum 50 °C for DN 400

### 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), steam (200 °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)

### 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.

**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
<b>Type 44-2</b> 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
<b>Type 44-7</b> Excess Pressure Valve					2 to 11 bar		
<b>Type 44-0 B</b> Pressure Reducing Valve	PN 25	G 1/2, DN 15	Red brass · Spheroidal graphite iron · Stainless steel	1	2 to 20 bar	Steam up to 200 °C	► T 2628
<b>Type 44-1 B</b> Pressure Reducing Valve						Liquids and mineral oil up to 150 °C · Flammable and non-flammable gases up to 80 °C · Nitrogen up to 150 °C	
<b>Type 44-6 B</b> Excess Pressure Valve						Liquids and air up to 150 °C · Flammable and non-flammable gases up to 80 °C · Steam and nitrogen up to 150 °C · Vapors up to 200 °C	
<b>Type 2405</b> Pressure Reducing Valve	PN 16 to 40	DN 15	Cast iron · Cast steel Spheroidal graphite iron Stainless steel · Forged steel	1	2 to 10 bar	Gases in temperature range -20 to +60 °C	► T 2520
<b>Type 2406</b> Excess Pressure Valve	PN 16 to 40	DN 15	Cast iron · Cast steel Spheroidal graphite iron Stainless steel · Forged steel	1	2 to 10 bar	Gases in temperature range -20 to +60 °C	► T 2522
<b>Type 41-23</b> 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
<b>Type 41-73</b> Excess Pressure Valve							► T 2517

<sup>1)</sup> Main valve DN 300/400: all pilot valves with DN 25 flanged connection K<sub>vs</sub> 8 or with G 1 threaded connection or K<sub>vs</sub> 5

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

Type 2422 Valve · Balanced by a bellows				
Pressure rating	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			1.4401/1.4404
Plug	Standard version	1.4301 with PTFE soft seal <sup>1)</sup> , max. 220 °C		1.4401/1.4404 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			
Seal	Graphite on metal core			
Type 2422 Valve · Balanced by a diaphragm				
Pressure rating	PN 16	PN 16/25	PN 16, 25 and 40	PN 16/25/40 <sup>2)</sup>
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	CC499K <sup>3)</sup>		1.4409
	DN 300, 400	Stainless steel 1.4301		
Plug	DN 125 to 250	CC499K <sup>3)</sup>		1.4409
	DN 300	Stainless steel 1.4301 with EPDM soft seal <sup>4)</sup> , max. 150 °C		
	DN 400	Stainless steel 1.4301 with EPDM soft seal, max. 50 °C		
Pressure balancing	Balancing cases made of sheet steel DD11 · EPDM balancing diaphragm, max. 150 °C			

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

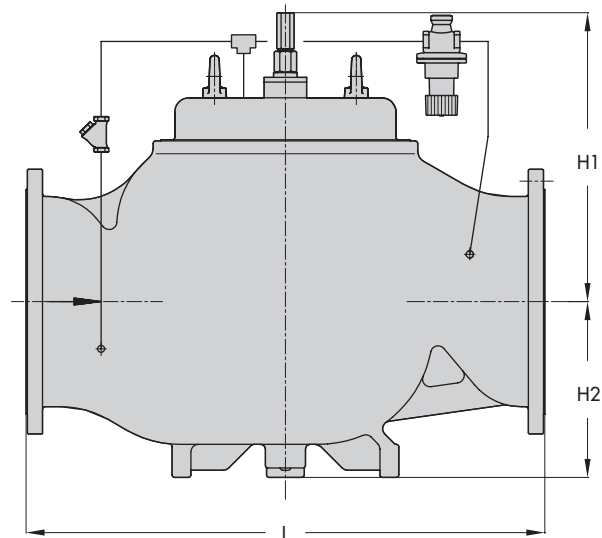
<sup>2)</sup> DN 125 to 250

<sup>3)</sup> Optionally 1.4409

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

### Dimensions

#### Type 2422 Valve · Balanced by a diaphragm



Valve size	DN	125	150	200	250	300	400
Length L	mm	400	480	600	730	850	1100
Height H1	mm	285	310	380	380	510	610
Height H2	mm	145	175	260	260	290	390
Weight <sup>1)</sup> , approx. (PN 16, with Type 44-1 B Pilot Valve)	kg	52	72	212	307	317	627

<sup>1)</sup> +10 % for cast steel 1.0619 (PN 25) and spheroidal graphite iron EN-GJS-400-18-LT (PN 25)

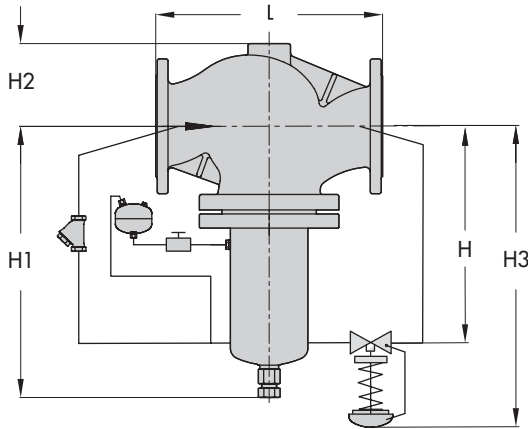
#### Type 2333 Pressure Reducing Valve/Type 2335 Excess Pressure Valve DN 125 to 400 · Version balanced by a diaphragm

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**

## Dimensions

### Type 2422 Valve balanced by a bellows



Valve 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 <sup>2)</sup>	mm	≤725	≤825	≤890	≤890
Weight <sup>1)</sup> , approx. (PN 16, with Type 41-23 Pilot Valve)	kg	77	120	262	307

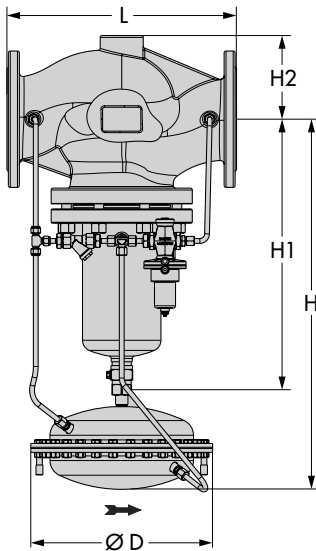
<sup>1)</sup> +10 % for cast steel 1.0619 (PN 25) and spheroidal graphite iron EN-GJS-400-18-LT (PN 25)

<sup>2)</sup> The overall height depends on the pilot valve used

### Type 2333 Pressure Reducing Valve/Type 2335 Excess Pressure Valve DN 65 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 bellows (with diaphragm actuator)



Valve size	DN	65	80	100	125	150	200	250
Length L	mm	290	310	350	400	480	600	730
Height H	mm	465	520	685	775	925	925	
Height H1	mm	300	355	460	590	730	730	
Height H2	mm	100	120	145	175	260	260	
Ø D	mm	285 (320 cm <sup>2</sup> ) 380 (640 cm <sup>2</sup> )			380 (640 cm <sup>2</sup> )			
Weight, approx.	kg	On request						

### Type 2333 Pressure Reducing Valve/Type 2335 Excess Pressure Valve DN 65 to 250 · 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.

Fig. 4: 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 ..., DN ..., K<sub>VS</sub> ...

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

Medium ..., max. medium temperature

Optionally, special version (e.g. flow divider etc.)