DATA SHEET

T 2520 EN

Type 2405 Pressure Reducing Valve

Self-operated Pressure Regulators · DIN version

Application

Pressure regulators for set points from **2 mbar** to **10 bar** · Nominal sizes **DN 15** to **50** · Pressure rating **PN 16** to **40** · Suitable for liquids, gases and vapors · Temperature range from **-20** to **60 °C** (**0** to **150 °C**)[1)]

The valve **closes** when the **downstream** pressure rises.



Special features

- Low-maintenance regulator functioning as proportional or two-step controller; requiring no auxiliary energy
- Compact regulator design providing excellent control accuracy
- Internal set point springs with set point adjustment using a set point adjuster on the actuator
- Spring-loaded, single-seated valve balanced by a balancing diaphragm
- External connection of a control line
- Meets strict fugitive emission requirements
- Based on the fugitive emission requirements according to TA Luft (TA Luft compliant)[2)]
- Minimum leakage class IV

1) For versions without pressure balancing that have an FKM diaphragm and FKM soft seal

2) Applies to 80 to 640 cm^2 actuator area, actuator diaphragm made of EPDM or FKM and temperature range 0 to +150 °C

This regulator is used to control the pressure of flammable gases used as a source of energy (e.g. in boilers, driers, vaporizers, heat exchangers or industrial ovens). Alternatively, it can control the compressed air supply in process engineering applications.

An additional application of the regulator is the pressure control of inert gas used for inerting or blanketing reaction or storage tanks to protect the product in the tank from oxidation, explosion or escaping. To achieve an economical consumption of the inert gas, its pressure must be controlled to always remain slightly higher than atmospheric pressure while the tank is being filled or emptied.

Versions

Pressure reducing valve to regulate the downstream pressure p_2 to the adjusted set point. The valve **closes** when the **downstream** pressure rises.

Pressure reducing valve with proportional control action

– Valve DN 15 to 50 · Flanged connections · Plug with soft seal · Body made of cast iron EN-GJL-250, spheroidal graphite iron EN-GJS-400-18-LT, cast steel 1.0619, cast stainless steel 1.4408 or forged stainless steel 1.4404

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Pressure reducing valve with two-step control mode for millibar set point ranges

– Valve DN 32 to 50 · Flanged connections · Plug with soft seal · Body made of cast iron EN-GJL-250, spheroidal graphite iron EN-GJS-400-18-LT, cast steel 1.0619, cast stainless steel 1.4408 or forged stainless steel 1.4404

Special versions

– FDA version[1)]
– NACE version for sour gas applications
– Version with force limiter (for higher pressures across the operating diaphragm)
– Actuator with seal and leakage line connection
– Version with connected control line. Pressure tapped directly at the valve body; optionally also with pressure gauge

1) This version is not suitable for direct contact with products manufactured in the food and pharmaceutical industries. It can only be used close to the product.

Design and principle of operation

The medium flows through the regulator in the direction indicated by the arrow. The position of the plug (3) determines the cross-sectional area of flow between the plug and the seat (2).

– **Pressure reducing valve with proportional control action (see Fig. 1**)

In the pressureless state (control line not connected and no pressure applied) the valve is opened by the force of the set point springs (27). The spring force can be adjusted at the set point adjuster (30).

The downstream pressure p_2 to be controlled is tapped downstream of the regulator and transmitted over an external control line to the control line connection (9) on the actuator housing (20) where it is converted into a positioning force by the diaphragm plate (18) with operating diaphragm (21). The diaphragm moves the plug over the plug stem (4) depending on the force of the set point springs.

When the force resulting from the downstream pressure p_2 rises above the spring force adjusted at the set point springs, the valve closes proportionally to the change in pressure.

In the version with pressure balancing, the forces produced by the upstream and downstream pressures acting on the plug are eliminated by the balancing diaphragm (8). The plug is fully balanced.

– **Pressure reducing valve with two-step control mode (see Fig. 2**)

The regulator (nominal sizes DN 32 to 50; K_{VS} 16, 20 and 32 with set point ranges from 0.002 to 0.060 bar) operates as a two-step controller.

A differential pressure of at least 1.6 bar is required for the regulator to work properly.

In the idle state, the valve is closed when the pressure in the bottom actuator chamber is equal or higher than the set point. The set point is adjusted by tensioning the set point spring (27) at the set point adjuster (30).

The upstream pressure p_1 is routed through a hole in the plug stem to the chamber of the plug balancing unit above the balancing diaphragm (8). The valve is pressure balanced in this way.

The required closing force of the plug is generated by the compression spring (542) in the chamber.

If the downstream pressure p_2 being controlled drops below the lower switching point of the adjusted set point, the force created by the diaphragm (21) is lower than the force of the set point spring (27). This causes the diaphragm plate (18), which is attached to the actuator stem (540), to be pushed down moving towards the plug. This results in a force being exerted on the tappet, which is part of the assembly (535) of the internal bypass valve.

The pressure in the balancing chamber is relieved to the downstream side.

The balancing pressure drops until it reaches the level of the downstream pressure p_2. As a result, the upstream pressure exerted on the plug is able to fully open the valve opposing the force of the compression spring (542).

If the downstream pressure p_2 starts to rise again and reaches the upper switching point of the adjusted set point, the diaphragm plate (18) and actuator stem (540) move upward. The internal bypass valve closes and the upstream pressure p_1 starts to build up again in the chamber of the plug balancing unit above the balancing diaphragm (8). The pressure-balanced state of the valve is restored and the compression spring (542) causes the plug to close.

The two-step control mode is determined by a switching accuracy of ≤1.5 mbar between the upper and lower switching point.

The regulator is additionally fitted with a shipping lock (222, 223), which must be removed before start-up. This is indicated by a yellow label (224) on the regulator. The shipping lock prevents any shocks or impacts from being transferred to the control unit, which could damage it.

The valve **closes** when the **downstream** pressure **rises**.

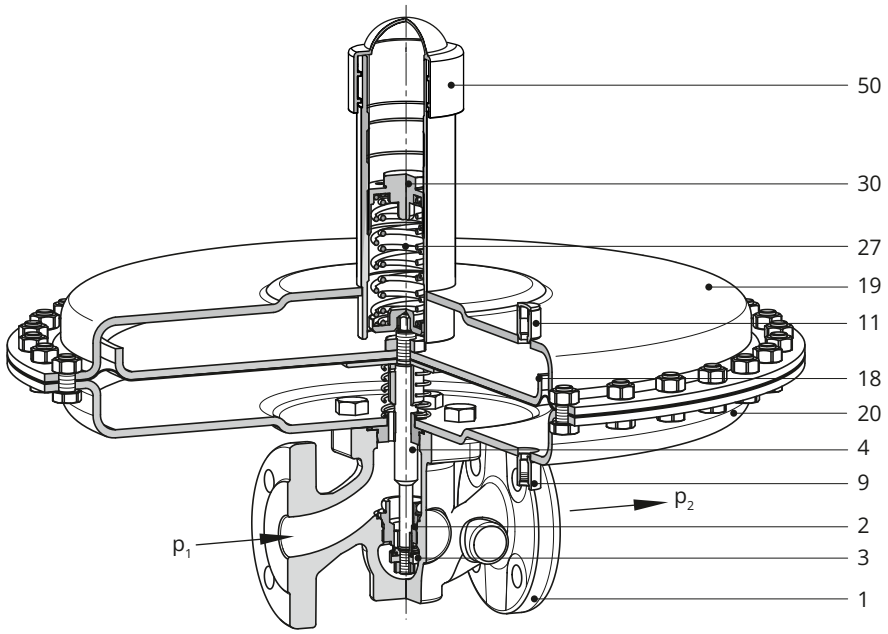


Fig. 1: *Type 2405 Pressure Reducing Valve without pressure balancing · K_{VS} 1.6 to 4 · Flow-to-open*

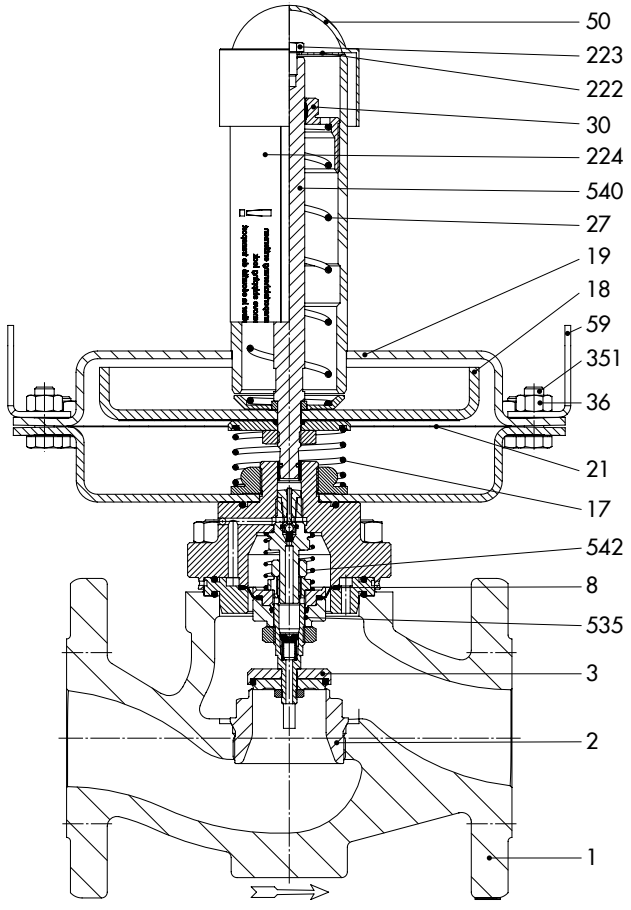


Fig. 2: *Type 2405 Pressure Reducing Valve with pressure balancing · Nominal size DN 32 to 50 · Set points 0.002 to 0.060 bar · Flow-to-open (two-step control mode)*

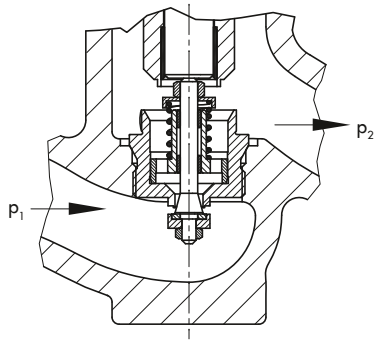


Fig. 3: *Type 2405 Pressure Reducing Valve without pressure balancing · K_{VS} 0.016 to 1 · Flow-to-close*

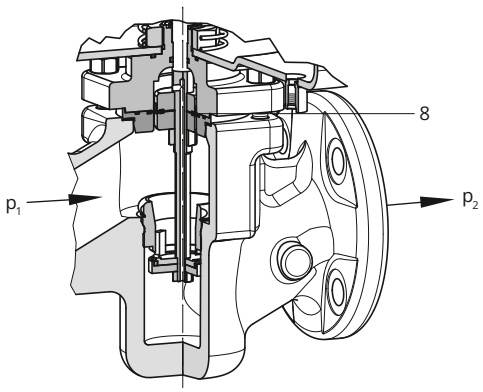


Fig. 4: *Type 2405 Pressure Reducing Valve with pressure balancing · K_{VS} 6.3 to 32*

Legend for Figs. 1 to 4

1 Valve body
2 Seat
3 Plug
4 Plug stem (regulator with proportional control action only)
8 Balancing diaphragm
9 Control line connection, G ¼ fitting
11 Leakage line connection (special version), G ¼ fitting
17 Compensation spring
18 Diaphragm plate
19 Top actuator case
20 Bottom actuator case
21 Operating diaphragm
27 Set point spring
30 Set point adjuster (A/F 27)
36 Nut
50 Cap
59 Lifting eyelet (on the right and left-hand side of the actuator)
222 Shipping lock washer
223 Shipping lock screw (A/F 13)
224 Label
351 Screw
535 Plug assembly (regulator with two-step control mode only)
540 Actuator stem
542 Compression spring (closing spring of the plug)

Table 1: *Materials*

Valve body	**Cast iron EN-GJL-250, spheroidal graphite iron EN-GJS-400-18-LT, cast steel 1.0619**	**Cast stainless steel 1.4408, forged stainless steel 1.4404**
Seat, plug and plug stem	1.4404	
Plug spring	1.4310[1)]	
Seal and balancing diaphragm	EPDM · FKM · NBR	
Actuator housing	1.0332	1.4301
Operating diaphragm	EPDM · FKM · NBR	

1) Only with K_{VS} 0.1 to 1

Table 2: *K_{VS} coefficients*

Nominal size	**DN 15**	**DN 20**	**DN 25**	**DN 32**	**DN 40**	**DN 50**
K_{VS} (standard version)	4.0	6.3	8.0	16[1)]	20[1)]	32[1)]
K_{VS} (reduced)	0.016 · 0.04 · 0.1 · 0.25 · 0.4 · 1.0 · 1.6 · 2.5	0.016 · 0.04 · 0.1 · 0.25 · 0.4 · 1.0 · 1.6 · 2.5 · 4.0	0.016 · 0.04 · 0.1 · 0.25 · 0.4 · 1.0 · 1.6 · 2.5 · 4.0 · 6.3	1.6 · 2.5 · 4.0 · 6.3 · 8.0	1.6 · 2.5 · 4.0 · 6.3 · 8.0 · 16	1.6 · 2.5 · 4.0 · 6.3 · 8.0 · 16 · 20

1) For regulator version with two-step mode; only standard K_{VS} coefficients possible

Table 3: *Technical data · All pressures in bar (gauge)*

Nominal size		DN 15	DN 20	DN 25	DN 32	DN 40	DN 50
Pressure rating (valve)		PN 16, 25 or 40					
Max. permissible differential pressure Δp		10 bar · 12 bar [1]					
Min. required differential pressure Δp[5]		–			1.6 bar		
Switching accuracy[5]		–			≤1.5 mbar		
Max. permissible temperature range (medium temperature)		-20 to +60 °C (0 to 150 °C)[2]					
Set point ranges		2 to 15 mbar[5] · 5 to 15 mbar · 10 to 30 mbar · 25 to 60 mbar 50 to 200 mbar · 0.1 to 0.6 bar · 0.2 to 1 bar · 0.8 to 2.5 bar · 2 to 5 bar · 4.5 to 10 bar					
Max. perm. pressure at operating diaphragm	1200 cm²	5 to 15 mbar			2 to 15 mbar[5] · 10 to 30 mbar[5]		
		0.5 bar					
	640 cm²	10 to 30 mbar · 25 to 60 mbar			25 to 60 mbar[5]		
		1 bar					
	320 cm²	50 to 200 mbar · 0.1 to 0.6 bar					
		2 bar · 10 bar[3]					
	160 cm²	0.2 to 1 bar					
		3 bar · 16 bar[3]					
	80 cm²	0.8 to 2.5 bar					
		5 bar · 16 bar[3]					
	40 cm²	2 to 5 bar					
		10 bar · 16 bar[3]					
		4.5 to 10 bar					
		15 bar · 16 bar[3]					
Pressure balancing	K_{VS} 0.016 to 4	Without balancing diaphragm					
	K_{VS} 6.3 to 32	With balancing diaphragm					
Pressure tapping		External[4]					
Control line connection		G ¼					
Leakage class according to DIN EN 60534-4		Soft seal, minimum Class IV					
Conformity		CE					

1) Version with set points from 0.1 to 10 bar

2) For versions without pressure balancing that have an FKM diaphragm and FKM soft seal

3) Version with force limiter

4) Special version for 40, 80 and 160 cm² actuator areas with pressure tapping directly at the valve

5) For the regulator version with two-step control mode only

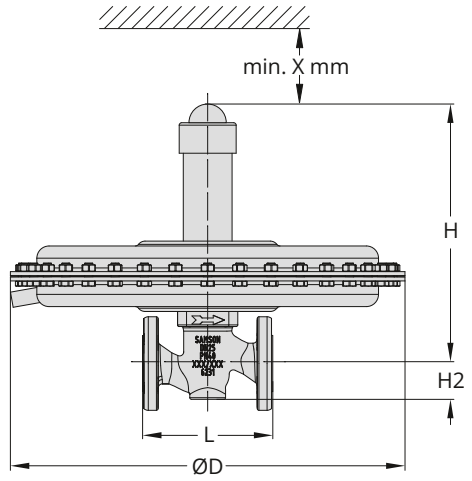
Table 4: *Weights in kg[1]*

Nominal size		DN 15 to 25	DN 32 to 50
Set point range	2 to 15 mbar[2]	–	40
	5 to 15 mbar	28	
	10 to 30 mbar	18	
	25 to 60 mbar	14	30
	50 to 200 mbar · 0.1 to 0.6 bar		26
	0.2 to 1 bar	10	22
	0.8 to 2.5 bar · 2 to 5 bar	8	20
	4.5 to 10 bar	9	21

1) Body made of cast steel 1.0619: +10 %

2) For the regulator version with two-step control mode only

Dimensional drawings



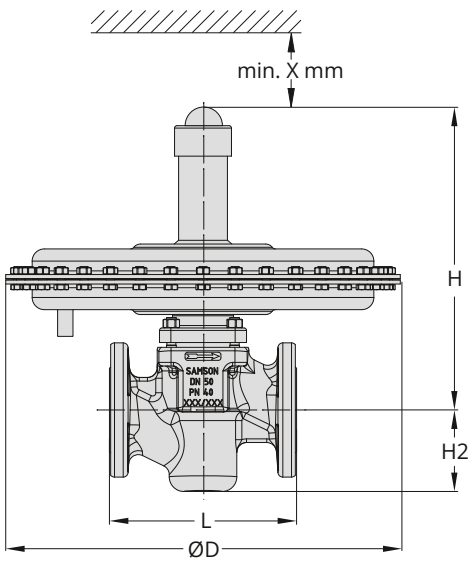


Fig. 5: *Dimensions of Type 2405*

Table 5: *Dimensions in mm*

				Nominal size	DN 15	DN 20	DN 25	DN 32	DN 40	DN 50
Length L					130	150	160	180	200	230
Height H2		Forged steel			53	–	70	–	92	98
		Other materials			44			72		
Height X					150					
Set point ranges	2 to 15 mbar[1]	Height H	Without balancing		–			–		
			With balancing		–			387		
		Actuator			–			ØD = 485 mm, A = 1200 cm²		
	5 to 15 mbar	Height H	Without balancing		325			370		
			With balancing		352			387		
		Actuator			ØD = 485 mm, A = 1200 cm²					
	10 to 30 mbar	Height H	Without balancing		318			366		
			With balancing		345			387[1]		
		Actuator			ØD = 380 mm, A = 640 cm²			ØD = 485 mm, A = 1200 cm²		
	25 to 60 mbar	Height H	Without balancing		318			366		
			With balancing		345			380[1]		
		Actuator			ØD = 285 mm, A = 320 cm²			ØD = 380 mm, A = 640 cm²		
	50 to 200 mbar	Height H	Without balancing		318			366		
			With balancing		345			370		
		Actuator			ØD = 285 mm, A = 320 cm²					
	0.1 to 0.6 bar	Height H	Without balancing		318			366		
			With balancing		345			370		
		Actuator			ØD = 285 mm, A = 320 cm²					
	0.2 to 1 bar	Height H	Without balancing		318			366		
			With balancing		345			370		
		Actuator			ØD = 225 mm, A = 160 cm²					
	0.8 to 2.5 bar	Height H	Without balancing		330			365		
			With balancing		356			369		
		Actuator			ØD = 170 mm, A = 80 cm²					
	2 to 5 bar	Height H	Without balancing		333			368		
			With balancing		359			373		
		Actuator			ØD = 170 mm, A = 40 cm²					
	4.5 to 10 bar	Height H	Without balancing		437			485		
			With balancing		463			489		
		Actuator			ØD = 170 mm, A = 40 cm²					

[1] For the regulator version with two-step control mode only

Installation

Normally, the valve is installed with the actuator on top. Install pipelines horizontally with a slight downward slope on both sides of the valve for drainage of the condensate.

Mounting position:



- Make sure the direction of flow matches the direction indicated by the arrow on the body.
- Adapt the control line to the conditions on site. The control line is not included in the scope of delivery. A control line kit is available on customer request for tapping the pressure directly at the valve body.
- In applications in which the blanketing gas can liquefy, condensate may form in the control line, causing damage to the regulator. To allow condensate to run back into the tank, install the control line with an approximate 10 % slope to the pressure tapping point at the tank.
- Observe the recommended inlet and outlet lengths of the regulator and for the pressure tapping point (control line).
- Install the regulator allowing sufficient space to remove it or to perform service work on it.
- Contact SAMSON if the installation conditions are different from those specified.
- Further information can be found in the Mounting and Operating Instructions ▶ EB 2520.

If the pressure p of the inert gas in the tank falls below the set point p_2 adjusted at the **Type 2405** Pressure Reducing Valve (1), it opens to allow more gas to enter the tank. The regulator (1) closes when the pressure p of the blanketing gas rises to the adjusted set point p_2. If the pressure is too high, the gas is vented off over the **Type 2406** Excess Pressure Valve (2).

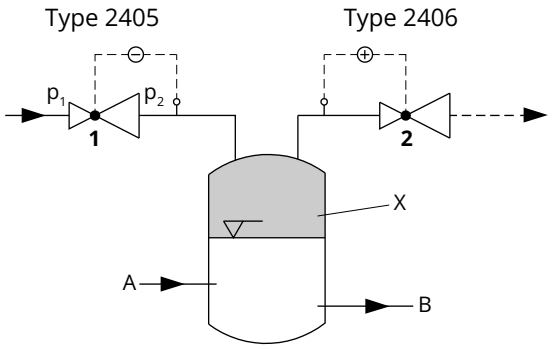


Fig. 6: *Sample application, Type 2405 used for tank blanketing*

1	Type 2405 Pressure Reducing Valve
2	Type 2406 Excess Pressure Valve
A	Inlet for product medium
B	Outlet for product medium
X	Inert gas for blanketing

Ordering text

Type 2405 Pressure Reducing Valve

Nominal size DN …

Set point range … bar

or Set point range … mbar

Body material …

Pressure rating PN …

K_{VS} coefficient …

Optionally, special version …

Materials:
Plug seal …,
balancing diaphragm …,
operating diaphragm …