

# Self-operated Pressure Regulators



## Differential Pressure Regulators (closing) Type 42-24 A/B · Type 42-28 A/B



Type 42-24 A  
Differential Pressure Regulator



Type 42-28 A  
Differential Pressure Regulator

Fig. 1 · Differential pressure regulators

## Mounting and Operating Instructions

**EB 3003 EN**

Edition August 2008



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Definitions of the signal words used in these instructions

**CAUTION!**

*CAUTION* indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.

**Note:**

*Supplementary explanations, information and tips*

**NOTICE**

*NOTICE* indicates a property damage message.



### General safety instructions

- ▶ *The regulators must be installed, started up and serviced by fully trained and qualified personnel only, observing the accepted industry codes and practices. Make sure employees or third persons are not exposed to any danger.  
All safety instructions and warnings in these instructions, particularly those concerning installation, start-up, and maintenance, must be observed.*
- ▶ *The regulator complies with the requirements of the European Pressure Equipment Directive 97/23/EC. The declaration of conformity issued for a valve bearing the CE marking includes information on the applied conformity assessment procedure.  
The declaration of conformity can be provided on request.*
- ▶ *For appropriate operation, make sure that the regulator is only used in applications where the operating pressure and temperatures do not exceed the operating values based on the sizing data submitted in the order.*
- ▶ *Note that the manufacturer does not assume any responsibility for damage caused by external forces or any other external factors.*
- ▶ *Any hazards which could be caused in the regulator by the process medium or operating pressure are to be prevented by means of appropriate measures.*
- ▶ *Proper shipping and appropriate storage are assumed.*

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#### Note:

*Non-electric valve versions which do not have a valve body lined with an insulating coating do not have their own potential ignition source according to the ignition risk assessment stipulated in EN 13463-1: 2001, section 5.2, even in the rare incident of an operating fault. Therefore, they **do not** fall within the scope of Directive 94/9/EC.*

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## 1 Design and principle of operation

The differential pressure regulators are designed to maintain a constant pressure difference between the high pressure and low pressure lines to an adjustable set point (Type 42-24) or a fixed set point (Type 42-28).

The regulators basically consist of a valve with seat and plug and a closing actuator with an operating diaphragm.

Valve and actuator are delivered separately and must be assembled on site using a coupling nut (11).

The medium flows through the valve between the plug (3) and the seat (2) in the direction indicated by the arrow. The position of the valve plug determines the differential pressure prevailing across the plant.

The Type 2422 Valve is balanced. The forces acting on the valve plug created by the upstream and downstream pressures are balanced by a balancing bellows (5) or balancing diaphragm <sup>1)</sup> (5.1).

The principle of operation of the regulators with valves balanced by a bellows or diaphragm only differ concerning the pressure balancing. The valves balanced by a diaphragm have a balancing diaphragm (5.1) instead of a bellows (5). The downstream pressure  $p_2$  acts on the inside and the upstream pressure  $p_1$  on the outside of the dia-

phragm. As a result, the forces acting on the valve plug are balanced out.

To keep the pressures arising inside the valve separate from the actuator, Type 42-24 B and Type 42-28 B are fitted with a tight-sealing distance piece (10) (for regulators manufactured before July 2010).

The differential pressure across the plant is transmitted over the high pressure and low pressure lines to the operating diaphragm (13) where it is converted into a positioning force. This force moves the plug according to the force of the set point springs (16).

The set point springs are mounted inside the actuator for a fixed set point (Type 42-28). These springs can be adjusted externally for an adjustable set point (Type 42-24).

- 1 Valve body
- 2 Seat
- 3 Plug
- 4 Plug stem
- 5 Balancing bellows
- 5.1 Balancing diaphragm (DN 125 to 250)
- 10 Distance piece (for regulators manufactured before July 2010)
- 11 Coupling nut
- 12 Diaphragm stem
- 13 Operating diaphragm
- 14 Diaphragm housing
- 15 Nuts and bolts
- 16 Set point spring(s)
- 17 Set point adjustment (nut)
- 18 Nut
- 19 Diaphragm plate
- 20 Control line
- 21 Overload protection (force limiter with internal excess pressure limiter)

<sup>1)</sup> Type 2422 balanced by a diaphragm, DN 125 to 250 only

Table 1 · Regulator configurations

Regulator	=	Valve	+	Actuator
Type 42-24 A w/o ..., B with distance piece	Type 2422	Balanced	Type 2424	Adjustable set point
Type 42-28 A w/o ..., B with distance piece	Type 2422	Balanced	Type 2428	Fixed set point

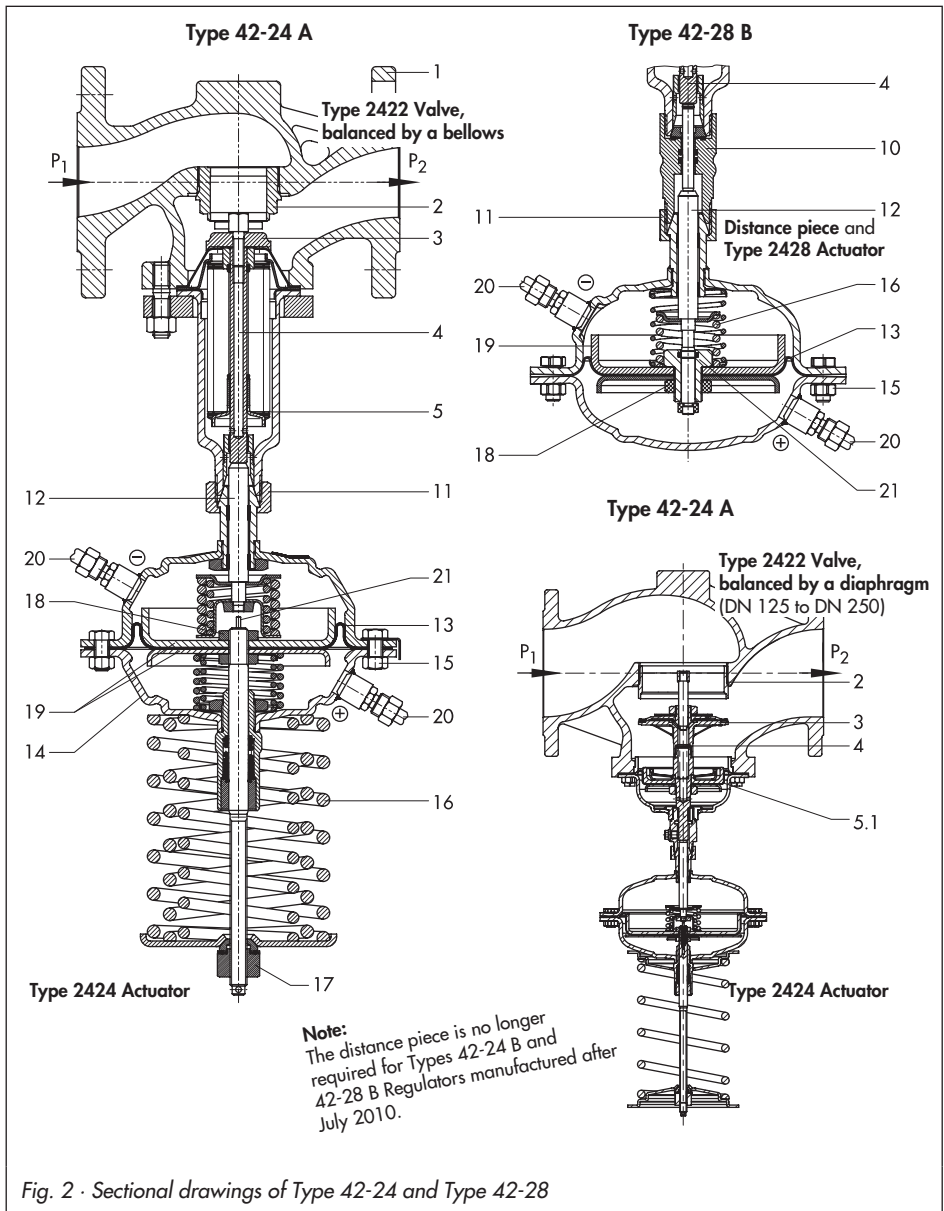


Fig. 2 · Sectional drawings of Type 42-24 and Type 42-28

## 2 Installation

The **Type 42-24 B** and **Type 42-28 B** Regulators are designed for installation in the **high pressure** (flow) line of the plant. In this case, a distance piece (no longer required for regulators manufactured after July 2010) must be installed between the valve and actuator. These regulators (Types 42-24 B/-28 B) cannot function properly without the distance piece.

The **Type 42-24 A** and **Type 42-28 A** Regulators are designed for installation in the **low pressure** (return flow) line of the plant. These regulators do not have a distance piece.

On selecting the position of installation, make sure that the regulator can still be easily accessed after completion of the plant.

### NOTICE

A strainer (SAMSON Type 2 N) must be installed upstream of the differential pressure regulator (section 2.2).

Flush the pipeline thoroughly prior to installing the regulator otherwise sealing particles, welding spatter or other impurities carried along by the process medium could impair the proper functioning of the valve, especially tight shut-off.

### NOTICE

The regulator must be installed free of stress. If necessary, support the piping near the connections. However, do not attach supports to the valve or actuator.

## 2.1 Mounting position

See Fig. 3 for permissible mounting positions.

**Standard mounting position** - Install valve without actuator in a horizontal pipeline with the connection for the actuator facing downwards. Make sure the medium flows through the valve in the direction indicated by the arrow.

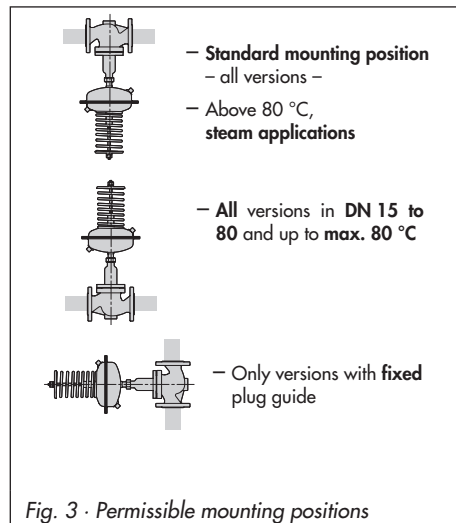


Fig. 3 · Permissible mounting positions

Then connect the actuator to the valve bottom section or the distance piece (10) using the coupling nut (11).

**NOTICE**

The connection between the plug stem (4) and diaphragm stem (12) is force-locking. Do not remove the screw plug.

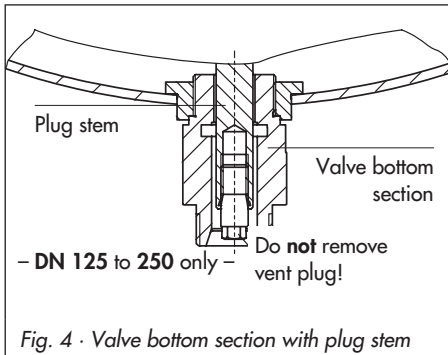


Fig. 4 · Valve bottom section with plug stem

**2.2 Strainer**

The strainer must be installed upstream of the regulator. Make sure the direction of medium flow corresponds with the direction indicated by the arrow on the strainer. The filter element must be suspended downwards or be located at the side for applications with steam. Remember to leave enough space to remove it.

**2.3 Shut-off valve**

We recommend installing a hand-operated shut-off valve (Fig. 4) both upstream of the strainer and at the outlet of the return flow pipe to be able to shut down the plant for cleaning and maintenance, and when the plant is not used for longer periods of time.

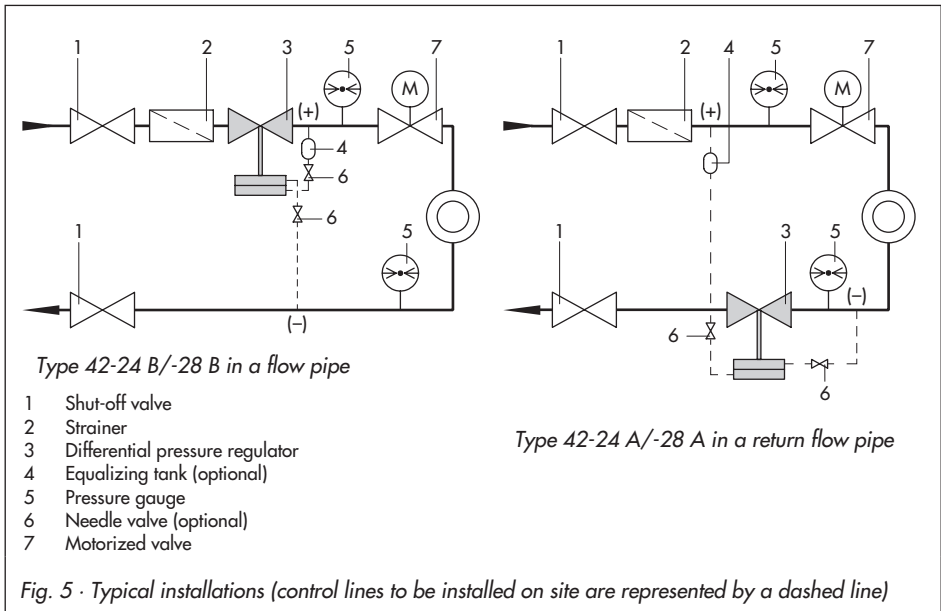


Fig. 5 · Typical installations (control lines to be installed on site are represented by a dashed line)

## 2.4 Pressure gauge

To monitor the pressures in the plant, install a pressure gauge both upstream and downstream of the regulator. Install the pressure gauge on the downstream side behind the downstream pressure tapping point.

## 2.5 Control line, equalizing tank and needle valve

**Control line** · A control line as an 8 x 1 mm pipe must be provided at the site of installation.

Connect the control line in the main pipeline at least five times  $\varnothing D$  away from the valve. If a manifold is located in between, increase the distance correspondingly (Fig. 6.1). How the lines are routed generally depends on the installation location.

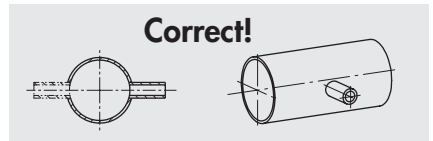
We recommend connecting the control line at the side of the main pipeline (Fig. 6.4). Install any instruments that can cause turbulence in the flow sufficiently far away from the pressure tapping points.

Do **not** change the pipe diameter of the main pipeline so that it is **off center**!

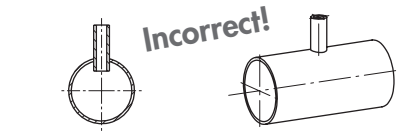
**Control line kit** · A control line kit for tapping pressure directly at the valve body is available as an accessory from SAMSON. Refer to Data Sheet T 3095 EN.

These control line kits for tapping pressure directly at the valve body already take into account the flow conditions. As a result, no special attention has to be paid to the flow conditions on connecting the regulators.

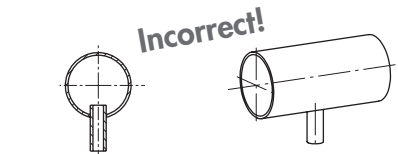
**Equalizing tank** · An equalizing tank is required for liquids above 150 °C as well as for steam. The mounting position of the equalizing tank is indicated by an adhesive label on



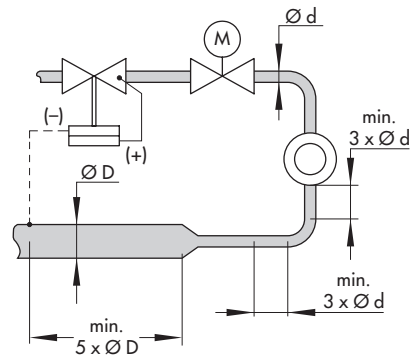
6.4 · Connection at the side – correct



6.3 · Connection at the top – incorrect



6.2 · Connection at the bottom – incorrect



6.1 · Control line connection, depending on how the pipeline is routed

Fig. 6 · Control line connection

the tank itself as well as by an arrow and the word "top" stamped onto the top of the tank.

This mounting position must be adhered to; otherwise the safe functioning of the regulator cannot be guaranteed.

**Needle valve** · If the regulator tends to hunt, we recommend installing a SAMSON screw joint with restriction (needle valve) at the control line connection of the actuator.

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**Note:** Needle valve, equalizing tanks, excess pressure relief equipment and compression-type screw fittings can be supplied as required. These accessories are listed in the Data Sheet T 3095 EN.

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## 3 Operation

### 3.1 Start-up

First start up the regulator after mounting all the components.

Make sure the control lines are open and correctly connected.

If needle valves are installed in the control lines, open them before start-up. Fill equalizing tanks with the process medium before start-up.

Open the shut-off valves **slowly** preferably starting from the return flow pipe side.

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### NOTICE

*The pressure at the actuator must not exceed the nominal pressure by 1.5 times on testing the pressure of the plant when the regulator is already installed (refer to Technical data in section 7).*

*Before performing the test, you can interrupt the external control lines to prevent the diaphragm actuator of the regulator from being damaged by the test pressure.*

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### 3.1.1 Rinsing the plant

After filling the plant, first completely open the consumers and rinse out the pipeline at full flow rate for several minutes. Roughly adjust the differential pressure set point. Check the installed strainer (e.g. by measuring the pressure drop). Clean the strainer, if necessary.

### 3.2 Set point adjustment

**Type 42-24 A/B** · Adjust the required set point by tensioning the set point springs at the nut (17).

If small differential pressure set points are to be adjusted, we recommend using a differential pressure gauge instead of the two pressure gauges to check the pressure.

Turning the nut (17) clockwise increases the set point and turning it counterclockwise reduces the set point.

**Type 42-28 A/B** · The set point is already fixed at  $\Delta p = 0.2, 0.3, 0.4$  or  $0.5$  bar.

### 3.3 Decommissioning

Close first the shut-off valve on the upstream side and then on the downstream side.

## 4 Maintenance

The regulators are maintenance free. Nevertheless, they are subject to natural wear, par-

ticularly at the seat, plug and operating diaphragm.

Depending on the operating conditions, the regulator needs to be checked at regular intervals to avoid possible malfunctions.

Details on faults and how to remedy them can be found in the table below.

Table 2 · Troubleshooting

Fault	Possible reasons	Recommended action
Differential pressure exceeds the adjusted set point	Insufficient pressure pulses reaching the actuator diaphragm	Clean the control line and the screw joint with restriction.
	Seat and plug worn down by deposits or foreign particles, impairing tight shut-off	Disassemble the regulator and replace damaged parts.
	Pressure tapped at the wrong place	Reconnect control lines at a different place. Do not tap pressure at pipe bends or necks. Observe min. distance to regulator.
	Operating diaphragm defective	Replace diaphragm (section 4.1).
	Valve too large for the control task at hand	Recalculate $K_{VS}$ coefficient. Contact SAMSON.
For Type 42-24 B or Type 42-28 B: Differential pressure exceeds the adjusted set point or cannot be adjusted	Distance piece has not been installed. <b>Note:</b> Distance piece is no longer required for regulators manufactured after July 2010.	Install distance piece. Re-adapt the control lines.
Differential pressure drops far below the adjusted set point	Valve or $K_{VS}$ coefficient too small	Check valve sizing. Select larger valve, if necessary.
	Safety equipment, e.g. pressure limiter, has been triggered	Check plant and unlock safety equipment.
Control loop hunting	Valve too large	Check valve sizing. Select valve with smaller $K_{VS}$ coefficient, if necessary.
	No damping of the pulses as the restriction in the screw fitting of the actuator is too large or is missing.	Install suitable needle valve in the control line at the inlet of the actuator. Close this needle valve until the control loop becomes stable. Do not close the needle valve completely!

**NOTICE**

*On performing any work on the regulator, make sure the relevant section of the pipeline is depressurized and, depending on the process medium, drained as well. We recommend to remove the valve from the pipeline.*

*For high temperatures, allow the regulator to cool down to ambient temperature before starting any work on it.*

*Interrupt or shut off the control line to avoid any hazards which could be caused by moving parts.*

*As valves are not free of cavities, remember that residual process medium might still be contained in the valve.*

## 4.1 Replacing the operating diaphragm

A defective operating diaphragm can be replaced without having to remove the valve from the pipeline. Relieve the relevant section of the pipeline of pressure and drain it. Unscrew the control lines and separate the actuator from the valve.

1. Undo bolts (15) at the actuator and take off the top cover together with the actuator stem and spring assembly.
2. Unscrew nut (18), while holding the bottom diaphragm stem stationary using a suitable tool.
3. Lift off diaphragm plate (19) and pull out diaphragm.
4. Insert a new diaphragm.
5. Proceed in the reverse order to reassemble the actuator.

Start up as described in section 3.1.

## 5 Customer service

Should any malfunctions or any defect occur, SAMSON's After-Sales Service is prepared to help you on site.

You can also send the defective regulator directly to your local SAMSON representative for repair. Addresses of SAMSON subsidiaries, agencies and service centers are listed in the product catalogs and in the Internet at [www.samson.de](http://www.samson.de).

To allow SAMSON to find the fault and to have an idea of the installation situation, specify the following details (refer to the nameplate):

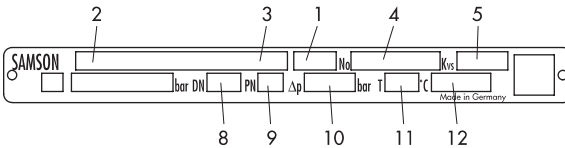
- ▶ Type and nominal size of the valve
- ▶ Model number with index
- ▶ Upstream and downstream pressure
- ▶ Temperature and control medium
- ▶ Minimum and maximum flow rate
- ▶ Has a strainer been installed?
- ▶ Sketch of the installation with exact position of regulator and all additional installed components (shut-off valves, pressure gauges, etc.).

## 6 Nameplates

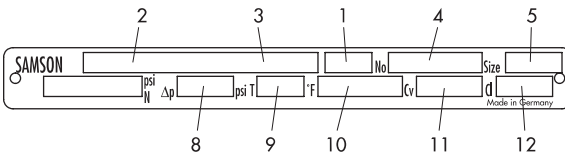
Valve and actuator both have a nameplate.

### Valve nameplates

DIN version



ANSI version



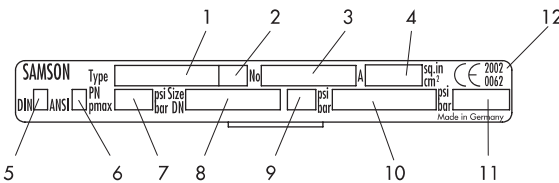
### DIN version

- 1 Valve type
- 2 Model number
- 3 Model number index
- 4 Order number or order date
- 5  $K_{VS}$  coefficient
- 8 Nominal size
- 9 Nominal pressure
- 10 Perm. differential pressure
- 11 Perm. temperature
- 12 Body material

### ANSI version

- 5 Nominal size
- 8 Perm. differential pressure
- 9 Perm. temperature (°F)
- 10 Body material
- 11  $C_v$  coefficient ( $K_{VS} \times 1.17$ )
- 12 ANSI Class (pressure rating)

### Actuator nameplate



- 1 Model number
- 2 Model number index
- 3 Order number or order date
- 4 Effective diaphragm area
- 5 Labeling acc. to DIN
- 6 Labeling acc. to ANSI
- 7 Max. perm. pressure
- 8 Nominal size
- 9 Differential pressure
- 10 Set point range
- 11 Diaphragm material
- 12 Year of production

Fig. 7 · Nameplates

## 7 Technical data

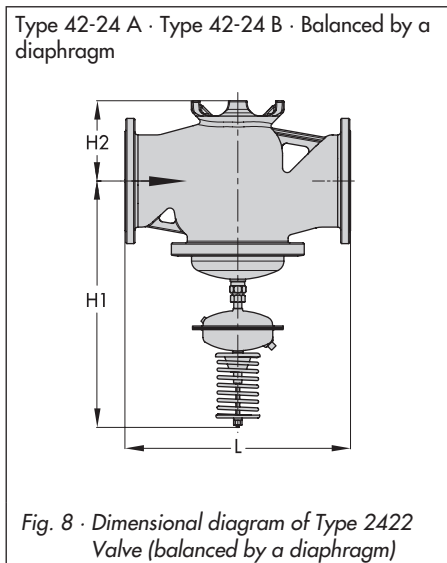
**Table 3 · Technical data**

Type	42-24 A · 42-24 B				42-28 A · 42-28 B	
Nominal size	DN 15 to DN 250				DN 15 to DN 100	
Nominal pressure	PN 16, 25 or 40 (acc. to DIN EN 12516-1)					
Max. perm. temperature	Valve body	See pressure-temperature diagram				
	Actuator 1)	With equalizing tank: Steam and liquids up to 220 °C Without equalizing tank: Liquids up to 150 °C · Air and gases up to 80 °C				
Set point ranges in bar	0.05 to 0.25 · 0.1 to 0.6 · 0.2 to 1 · 0.5 to 1.5 1 to 2.5 · 2 to 5 · 4.5 to 10 <sup>2)</sup>				0.2 · 0.3 · 0.4 or 0.5	
Effective diaphragm area A	80 cm <sup>2</sup>	160 cm <sup>2</sup>	320 cm <sup>2</sup>	640 cm <sup>2</sup>	160 cm <sup>2</sup>	320 cm <sup>2</sup>
Pressure above adjusted set point at which internal excess pressure limiter responds	2.4 bar	1.2 bar	0.6 bar	0.3 bar	0.6 bar	0.3 bar
Max. perm. operating pressure for actuator with two diaphragms	40 bar	40 bar	25 bar	25 bar	-	
Leakage rate	≤ 0.05 % of K <sub>V5</sub> coefficient					

1) Higher temperatures on request · 2) DN 125 to DN 250: 4.5 to 10 bar on request

Terms for valve sizing according to DIN EN 60534, Parts 2-1 and 2-2:  $F_L = 0.95$ ;  $x_T = 0.75$

## 8 Dimensions



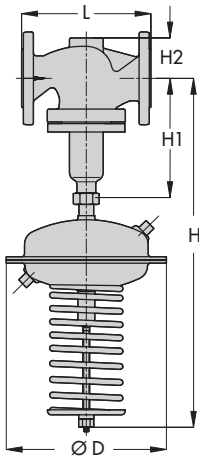
**Table 4 · Dimensions in mm and weights Type 42-24 A/B balanced by a diaphragm**

Nominal size DN	125	150	200	250
Length L	400	480	600	730
Height H1 Type 42-24 A	720	745	960	
Height H1 <sup>1)</sup> Type 42-24 B	775	800	1015	
Height H2	145	175	260	
Weight in kg, approx.	75	95	250	

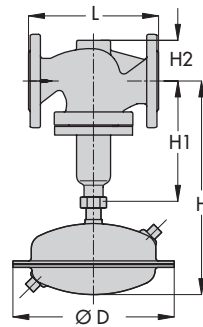
1) The installed distance piece increases the height by approx. 55 mm compared to Type 42-24 A.

**Note:** The distance piece is no longer required for regulators manufactured after July 2010.

Type 42-24 A/B · Type 42-28 A/B · Balanced by a bellows



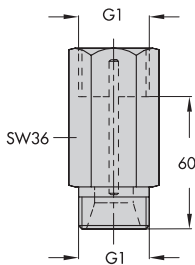
**Type 42-24 A**



**Type 42-28 A**

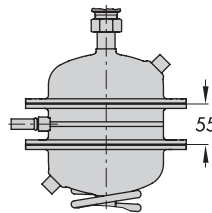
Fig. 9 · Dimensional diagrams of Type 2422 Valve balanced by a bellows

Distance piece · Actuator with two diaphragms



**Note:**  
The distance piece is no longer required for Types 42-24 B and 42-28 B Regulators manufactured after July 2010.

**Distance piece** for Types **42-24 B** and **42-28 B** (weight approx. 0.2 kg).  
Add approx. **55 mm** to H1 and H.



**Actuator with two diaphragms** for **Type 42-24 B**.

Add approx. **55 mm** to the total height H.

Fig. 10 · Dimensional drawings of distance piece and actuator with two diaphragms

Table 5 · Dimensions and weights · Type 42-24 A, Type 42-28 A balanced by a bellows

Nominal size DN	15	20	25	32	40	50	65	80	100	125	150	200	250		
Length L	130	150	160	180	200	230	290	310	350	400	480	600	730		
Height H1	225						300		355	460	590	730			
Height H2	Other materials		55		72		100		120	145	175	235	260		
	Forged steel		53	–	70	–	92	98	–	–	–	–	–		
<b>Type 42-28 A Differential Pressure Regulator</b>															
Set point 0.2 · 0.3 0.4 or 0.5 bar	Height H		390						465		520				
	Actuator		∅ D = 225 mm, A = 160 cm <sup>2 3)</sup>						∅ D = 285 mm, A = 320 cm <sup>2</sup>				–		
	Weight <sup>1)</sup> in kg		11.5	12	13	19.5	20	22.5	38	43	57				
<b>Type 42-24 A Differential Pressure Regulator</b>															
Set point range 0.05 to 0.25 bar	Height H		610						685		740		990	1120	1260
	Actuator		∅ D = 285 mm · A = 320 cm <sup>2 2)</sup>										∅ D = 390 mm A = 640 cm <sup>2</sup>		
	Weight <sup>1)</sup> in kg		21	21.5	22.5	29	29.5	32	46	51	65	135	185	425	485
Set point range 0.1 to 0.6 bar	Height H		610						685		740		990	1120	1260
	Actuator		∅ D = 225 mm, A = 160 cm <sup>2 3)</sup>						∅ D = 285 mm, A = 320 cm <sup>2 3)</sup>				∅ D = 390 mm, A = 640 cm <sup>2 3)</sup>		
	Weight <sup>1)</sup> in kg		16	16.5	17.5	24	24.5	27	46	51	65	135	185	425	485
Set point range 0.2 to 1 bar	Height H		610						685		740		990	1120	1260
	Actuator		∅ D = 225 mm · A = 160 cm <sup>2 3)</sup>										∅ D = 390 mm A = 640 cm <sup>2</sup>		
	Weight <sup>1)</sup> in kg		16	16.5	17.5	24	24.5	27	42	47	61	135	185	425	485
Set point range 0.5 to 1.5 bar	Height H		610						685		740		910	1040	1180
	Actuator		∅ D = 225 mm · A = 160 cm <sup>2 3)</sup>										∅ D = 390 mm A = 320 cm <sup>2</sup>		
	Weight <sup>1)</sup> in kg		16	16.5	17.5	24	24.5	27	42	47	61	125	175	415	475
Set point range 1 to 2.5 bar	Height H		610						685		740		940	1070	1210
	Actuator		∅ D = 225 mm · A = 160 cm <sup>2</sup>												
	Weight <sup>1)</sup> in kg		16	16.5	17.5	24	24.5	27	42	47	61	125	175	415	475
Set point range 2 to 5 bar/ 4.5 to 10 bar	Height H		610						685		740		910	1040	1180
	Actuator		∅ D = 170 mm · A = 80 cm <sup>2</sup>										∅ D = 225 mm A = 160 cm <sup>2 4)</sup>		
	Weight <sup>1)</sup> in kg		16	16.5	17.5	24	24.5	27	42	47	61	102	170	410	470

<sup>1)</sup> The weight applies to the version with the material specifications EN-JL1040/PN 16 (GG-25).

Add 10 % to all other materials

<sup>2)</sup> Optionally with actuator A = 640 cm<sup>2</sup> · <sup>3)</sup> Optionally with actuator A = 320 cm<sup>2</sup>

<sup>4)</sup> DN 125 to DN 250: 4.5 to 10 bar on request

**Type 42-24 B, Type 42-28 B balanced by a bellows: Add approx. 55 mm (distance piece) to H1 and H.**

**Note:** The distance piece is no longer required for regulators manufactured after July 2010.



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