

Self-operated Pressure Regulators

SAMSON

Differential Pressure Regulators (closing)

Type 42-24 · Type 42-28



Type 42-24 Differential Pressure Regulator



Type 42-28 A Differential Pressure Regulator

Mounting and Operating Instructions

EB 3003 EN

Edition July 2015

CE

Definition of signal words



DANGER!

Hazardous situations which, if not avoided, will result in death or serious injury



WARNING!

Hazardous situations which, if not avoided, could result in death or serious injury



NOTICE

Property damage message or malfunction



Note:

Additional information



Tip:

Recommended action

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1 General safety instructions

- All safety instructions and warnings given in these mounting and operating instructions, particularly those concerning installation, start-up and maintenance, must be strictly observed.
- The device must be mounted, started up or serviced by fully trained and qualified personnel only; the accepted industry codes and practices are to be observed. Make sure employees or third persons are not exposed to any danger.
- According to these mounting and operating instructions, trained personnel refers to individuals who are able to judge the work they are assigned to and recognize possible dangers due to their specialized training, their knowledge and experience as well as their knowledge of the applicable standards.
- The devices comply with the requirements of the European Pressure Equipment Directive 2014/68/EU. Devices with a CE marking have a declaration of conformity, which includes information about the applied conformity assessment procedure. This declaration of conformity can be provided on request. This declaration of conformity can be provided on request.
- To ensure appropriate use, only use the device in applications where the operating pressure and temperatures do not exceed the specifications used for sizing the device at the ordering stage.
- The manufacturer does not assume any responsibility for damage caused by external forces or any other external factors.
- Any hazards that could be caused in the regulator by the process medium, operating pressure or by moving parts are to be prevented by taking appropriate precautions.
- Proper transport, storage, installation, operation and maintenance are assumed.



Note:

Non-electric valve versions whose bodies are not lined with an insulating material coating do not have their own potential ignition source according to the risk assessment stipulated in EN 13463-1: 2009, section 5.2, even in the rare incident of an operating fault. Therefore, such valve versions do not fall within the scope of Directive 94/9/EC.

For connection to the equipotential bonding system, observe the requirements specified in section 6.3 of EN 60079-14: 2011 (VDE 0165 Part 1).

2 Process medium and scope of application

Differential pressure regulators for district heating systems, extended heating systems and industrial applications

Differential pressure set points Δp from **0.05** to **10 bar** · Valves **DN 15** to **250** · Nominal pressure **PN 16** to **40** · Suitable for **liquids** and **vapors** from **5** to **350 °C** as well as for **air** and **non-flammable gases** up to **80 °C**

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

3 Transportation and storage

The regulator must be carefully handled, transported and stored. Protect the regulator against adverse influences, such as dirt, moisture or frost, during storage and transportation.



Note:

Before installing the regulator, tighten the blanking plug(s) at the side in the valve body using a suitable box wrench.

Torque: 50 Nm for G 1/4, 70 Nm for G 3/8

When regulators are too heavy to be lifted by hand, fasten the lifting sling to a suitable place on the valve body.



WARNING!

Incorrectly attached lifting slings or supports.

Risk of injury and property damage due to valve falling.

Securely fasten slings or supports to the valve body and secure against slipping.



WARNING!

Do not attach lifting slings or supports to mounting parts, such as control line etc.

The valve can fall or mounting parts may be damaged.

Securely fasten slings or supports to the body of the valve and secure against slipping.

4 Design and principle of operation

See Fig. 1 on page 7.

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 (2) and plug (3) and a closing actuator (Type 2424 or Type 2428) with an operating diaphragm (13).

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 ¹⁾ (5.1).

The principle of operation of the regulator balanced by a bellows or diaphragm only

differs concerning the pressure balancing. Valves balanced by a diaphragm have a balancing diaphragm (5.1) instead of the balancing bellows (5). The downstream pressure p_2 acts on the bottom of the diaphragm and the upstream pressure p_1 on the top of the diaphragm. As a result, the forces created by the upstream and downstream pressures acting on the plug are balanced out.

- 1 Valve body
- 2 Seat
- 3 Plug
- 4 Plug stem
- 5 Balancing bellows
- 5.1 Balancing diaphragm (DN 65 to 250)
- 11 Coupling nut
- 12 Diaphragm stem
- 13 Operating diaphragm
- 14 Diaphragm case
- 15 Nuts and bolts
- 16 Set point springs
- 17 Set point adjuster (set point nut)
- 18 Nut
- 19 Diaphragm plate
- 20 Control line
- 21 Overload protection (force limiter with internal excess pressure limiter)

¹⁾ Type 2422 Valve, balanced by a diaphragm, DN 65 to 250 only

Regulator configurations

Regulator	=	Valve	+	Actuator
Type 42-24		Type 2422 balanced		Type 2424 adjustable set point
Type 42-28		Type 2422 balanced		Type 2428 fixed set point

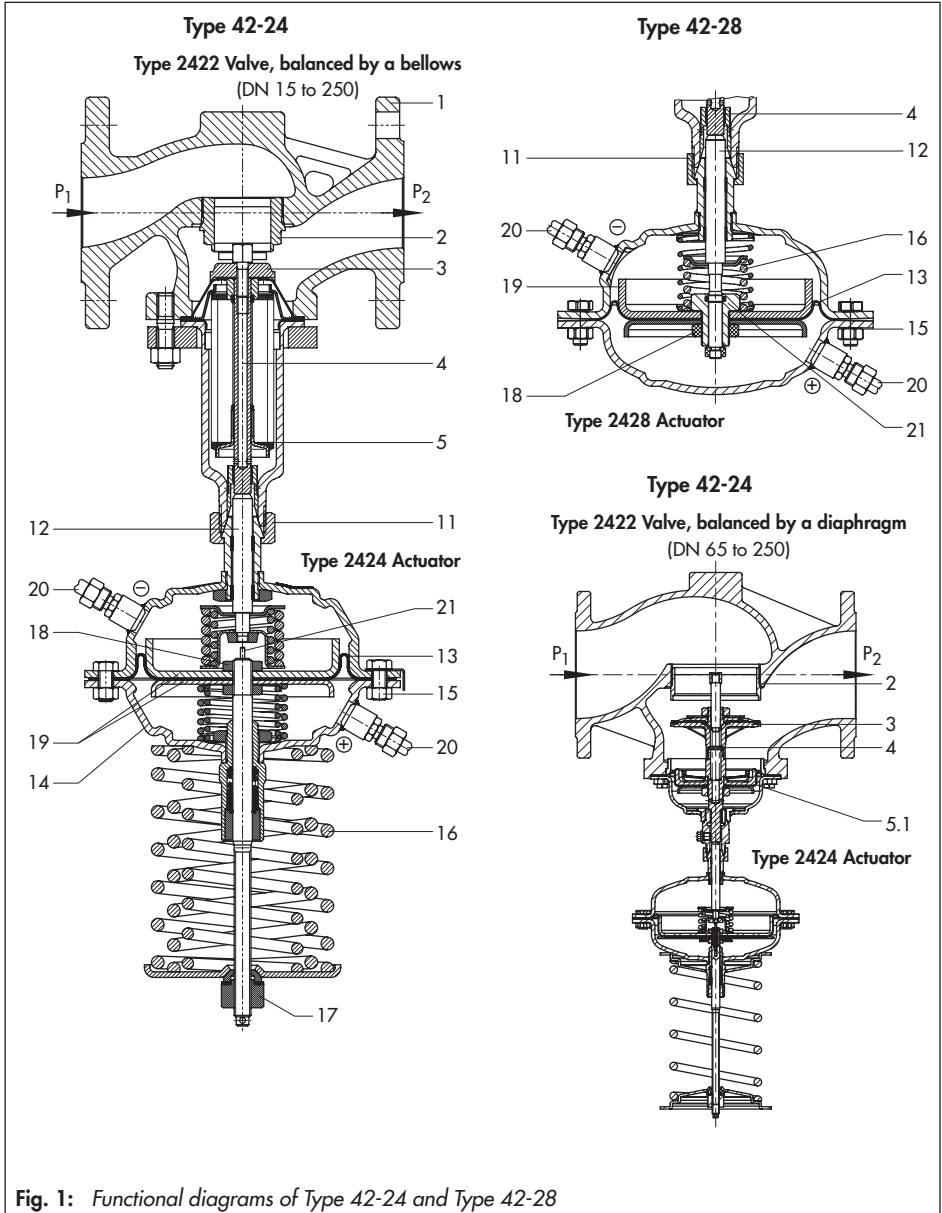


Fig. 1: Functional diagrams of Type 42-24 and Type 42-28

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).

Control lines (20) mounted on site transfer the high pressure and low pressure in all versions.

Type 2424 and Type 2428 Actuators are equipped with an overload protection (21). It prevents a rise in differential pressure during extreme operating conditions (e.g. vacuum at the heat exchanger) by opening an internal excess pressure limiter. As a result, plants and the regulator itself are protected against excessively high differential pressures.

5 Installation

The **Type 42-24** and **Type 42-28** Regulators are designed for installation in the **high pressure** (flow) line of the plant.

The **Type 42-24** and **Type 42-28** Regulators are designed for installation in the **low pressure** (return flow) line of the plant.

- Choose a place of installation that allows you to freely access the regulator even after the entire plant has been completed.
- Install a strainer (e.g. SAMSON Type 2 N) upstream of the regulator (see section 5.2).
- Flush the pipeline thoroughly before installing the regulator to ensure that any sealing parts, weld spatter and other impurities carried along by the process medium do not impair the proper functioning of the valve, above all the tight shut-off.
- The direction of flow must match the direction indicated by the arrow on the body.

NOTICE

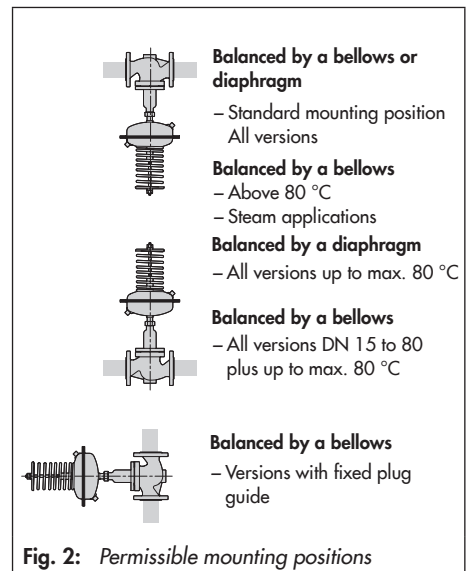
- Incorrectly installed regulator
The pressure regulator can be damaged.*
- Make sure the regulator is installed free of stress.
 - Do not attach supports (if required) directly to the valve or actuator. Attach the supports near to the connecting flanges.
 - Observe permissible mounting position.

5.1 Mounting position

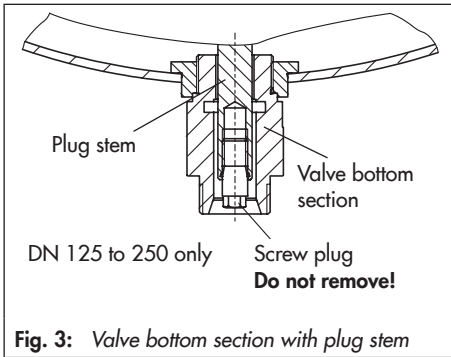
See Fig. 1 on page 7.

See Fig. 2 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.



Connect the actuator to the valve bottom section using the coupling nut (11).



5.2 Strainer (filter)

Install the strainer upstream of the regulator. The direction of flow must correspond to the arrow on the body. The filter element must be installed to hang downwards or sideways for applications with steam. Remember to

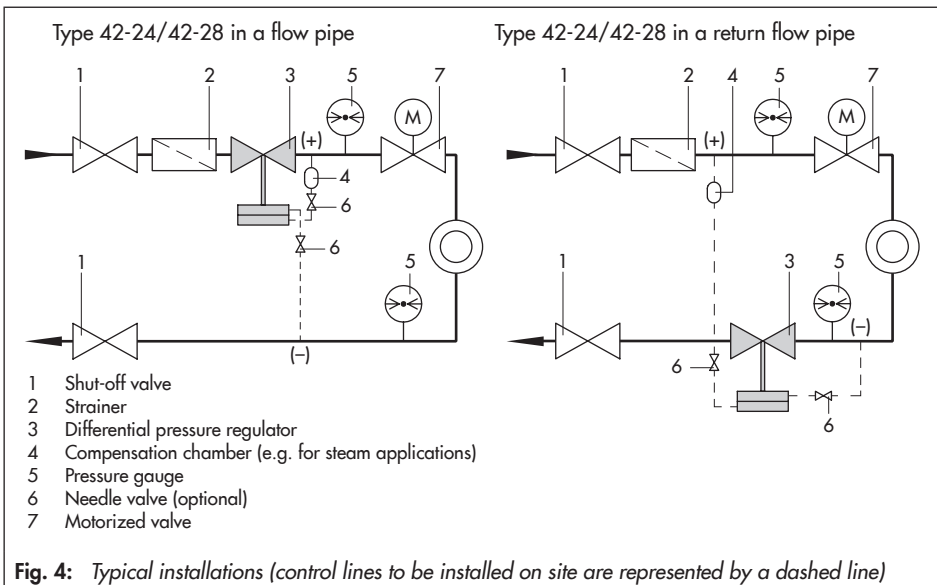
leave enough space to remove the filter element.

5.3 Shut-off valve

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

5.4 Pressure gauge

Install a pressure gauge both upstream and downstream of the regulator to monitor the pressures prevailing in the plant. Install the pressure gauge on the downstream side behind the downstream pressure tapping point (not between the tapping point and the valve).



5.5 Control line, compensation chamber and needle valve

Control line · A control line preferably as an 8 x 1 mm stainless steel pipe must be provided at the site of installation. Connect the control line to the main pipeline at least five times $\varnothing D$ away from the valve. If a manifold is located in between, increase the distance correspondingly. How the lines are routed generally depends on the installation site. We recommend connecting the control line at the side of the main pipeline. 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 accessories part from SAMSON (▶ T 3095). 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.

Compensation chamber · A compensation chamber is required for liquids above 150 °C as well as for steam (valve balanced by a bellows). The mounting position of the compensation chamber is indicated by an adhesive label on the chamber itself as well as by an arrow and the word "top" stamped on the top of the chamber. This mounting position must be adhered to; otherwise the safe functioning of the pressure reducing valve cannot be guaranteed.

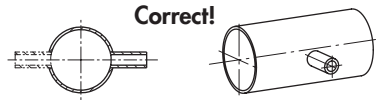


Fig. 5.4: Connection at the side – optimal

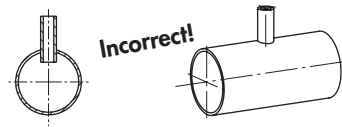


Fig. 5.3: Connection at the top – incorrect position

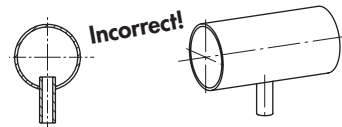


Fig. 5.2: Connection at the bottom – incorrect position

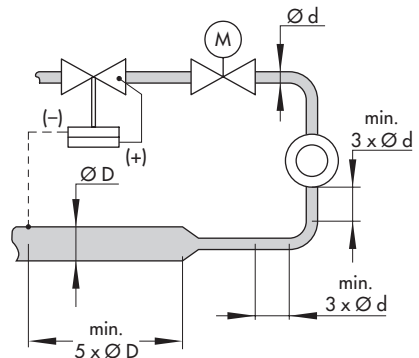


Fig. 5.1: Control line connection, depending on how the pipeline is routed

Fig. 5: Control line connection

**Note:**

Only a valve balanced by a bellows can be used for steam control applications.

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.

**Note:**

Needle valves, condensation chambers, excess pressure relief equipment and compression-type screw fittings can be supplied as required. These accessories are listed in ► T 3095.

6 Operation

See Fig. 1 on page 7.

6.1 Start-up

- First start up the regulator after mounting all parts.
- 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 condensation chambers with the process medium before start-up.
- Open the shut-off valves **slowly** preferably starting from the return flow pipe side.

**NOTICE**

Impermissible excessive pressure. The diaphragm actuator can be damaged.

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. Shut off any external control lines before performing a pressure test.

Rinsing the plant · After filling the plant, first completely open the consumer 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.

6.2 Adjusting the set point

Type 42-24 · 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 monitor the pressure. Turn the nut (17) clockwise to increase the set point and counterclockwise to reduce the set point.

Type 42-28 · Set point fixed to $\Delta p = 0.2, 0.3, 0.4$ or 0.5 bar.

6.3 Decommissioning

Preferably close first the shut-off valve on the upstream side of the valve and then on the downstream side of the valve.

7 Maintenance and troubleshooting

The regulators do not require any maintenance. Nevertheless, they are subject to natural wear, particularly at the seat, plug and operating diaphragm.

Depending on the operating conditions, check the regulator at regular intervals to avoid possible malfunctions.

Details on faults and how to remedy them can be found in Table 1:

- We recommend removing the valve from the pipeline.
- When used at high temperatures, allow the plant section to cool down to ambient temperature.
- As valves are not free of cavities, remember that residual process medium might still be contained in the valve.



WARNING!

Excessive pressure may cause parts to move.

- Before performing any work on the regulator, depressurize the relevant plant section and, depending on the process medium, drain it as well.*
 - Shut off or disconnect the control lines.*
-

Table 1: *Troubleshooting*

Malfunction	Possible reasons	Recommended action
Differential pressure exceeds the adjusted set point	Insufficient pressure pulses on the actuator diaphragm	Clean the control line and the screw joint with restriction.
	Leak between seat and plug due to wear	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.
	Diaphragm defective	Replace the diaphragm (see section 7.1).
	Valve too large for control task	Recalculate K_{VS} coefficient. Contact SAMSON.
Differential pressure drops far below the adjusted set point	Valve or K_{VS} coefficient too small	Check valve sizing. Install larger valve, if necessary.
	Safety device, e.g. pressure limiter, has been triggered	Check plant. Unlock safety device.
Control loop hunts.	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 actuator. Close this needle valve until the control loop becomes stable. Do not close the needle valve completely!

7.1 Replacing the operating diaphragm

See Fig. 1 on page 7.

If just the operating diaphragm is defective, it can be replaced without having to remove the valve from the pipeline. Drain the relevant section of the pipeline. Unscrew the control lines and separate the actuator from the valve.

1. Loosen the bolts (15) at the actuator and remove the top casing together with the actuator stem and spring assembly.
2. Unscrew the 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 regulator.

For start-up, proceed as described in section 6.1.

Addresses of SAMSON AG and its subsidiaries

The addresses of SAMSON AG, its subsidiaries, representatives and service facilities worldwide can be found on the SAMSON website (► www.samson.de) in all SAMSON product catalogs or on the back of these Mounting and Operating Instructions.

To assist diagnosis and in case of an unclear mounting situation, specify the following details (so far as possible). See section 9:

- Type and nominal size of the valve
- Model number with index
- Upstream and downstream pressure
- Temperature and process medium
- Min. and max. flow rate
- Is a strainer installed?
- Installation drawing showing the exact location of the regulator and all the additionally installed components (shut-off valves, pressure gauge, etc.)

8 Customer inquiries

Contact SAMSON's After-sales Service department for support concerning maintenance or repair work or when malfunctions or defects arise.

E-mail

You can reach the After-sales Service Department at aftersalesservice@samson.

9 Nameplate

Nameplates are attached to the valve and the actuator.

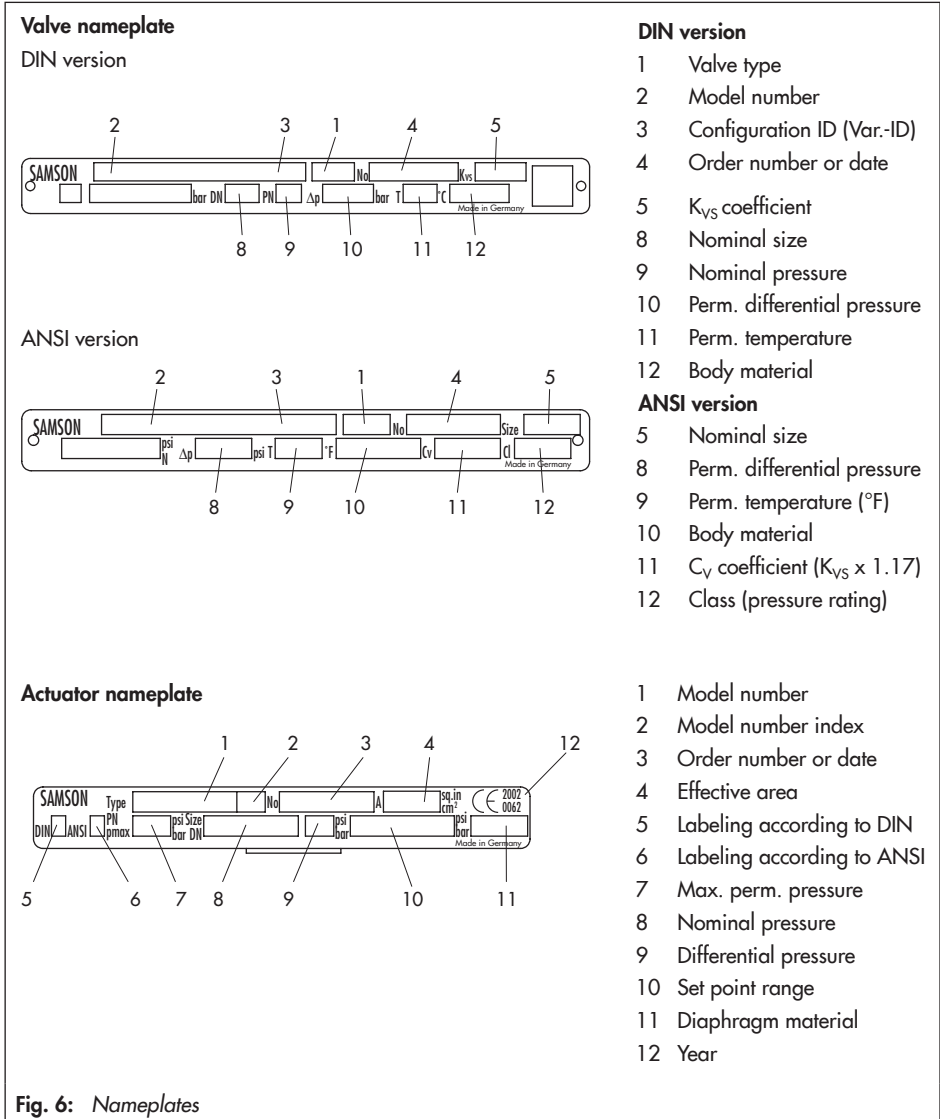


Fig. 6: Nameplates

10 Appendix

10.1 Technical data

Type	42-24 · 42-24				42-28 · 42-28	
Nominal size	DN 15 to 250				DN 15 to 100	
Nominal pressure	PN 16, 25 or 40					
Max. permissible temperature	Valve	See pressure-temperature diagram in ► T 3000				
	Actuator ¹⁾	With compensation chamber: steam and liquids up to 350 °C ²⁾ Without compensation chamber: 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 ³⁾				0.2 · 0.3 · 0.4 or 0.5	
Actuator area A	80 cm ²	160 cm ²	320 cm ²	640 cm ²	160 cm ²	320 cm ²
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 class according to IEC 60534-4	≤0.05 % of K _{VS} coefficient					

¹⁾ Higher temperatures on request

²⁾ Steam version only for valves balanced by a bellows

³⁾ DN 125 to 250: 4.5 to 10 bar on request

Terms for control valve sizing according to IEC 60534, Parts 2-1 and 2-2: $F_L = 0.95$, $X_T = 0.75$

Type 42-24 · Type 42-28 · Balanced by a bellows

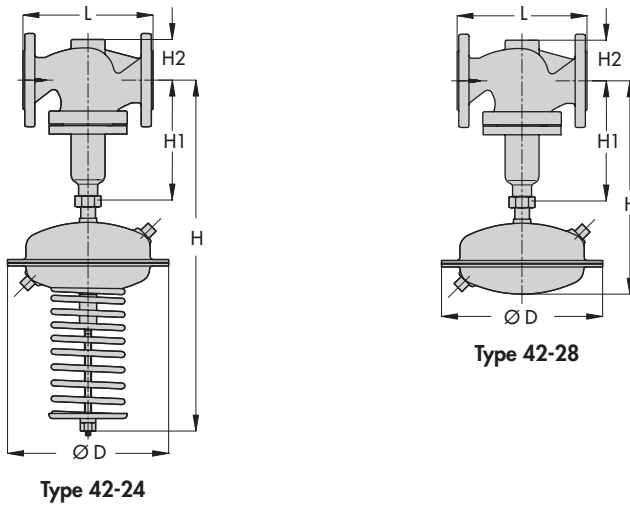
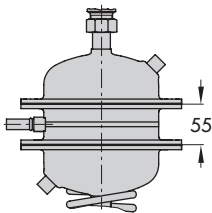


Fig. 7: Dimension drawing of Type 2422 Valve balanced by a bellows

Type 42-24 with actuator with two diaphragms (special version)



Add approx. 55 mm to the overall height H.

Fig. 8: Dimension drawing of actuator with two diaphragms

Table 2: Dimensions in mm and weights in kg · Type 42-24 and Type 42-28 *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	-					
Type 42-28/42-28 Differential Pressure Regulator														
Set point 0.2 · 0.3 0.4 or 0.5 bar	Height H		390						465	520				
	Actuator		ØD = 225 mm, A = 160 cm ^{2 2)}						ØD = 285 mm, A = 320 cm ²					
	Weight ¹⁾ in kg		11.5	12	13	19.5	20	22.5	38	43	57			
Type 42-24/42-24 Differential Pressure Regulator														
Set point range 0.05 to 0.25 bar	Height H		610						685	740	990	1120	1260	
	Actuator		ØD = 285 mm, A = 320 cm ^{2 2)}						ØD = 380 mm, A = 640 cm ²					
	Weight ¹⁾ in kg		21	21.5	22.5	29	29.5	32	46	51	65	135	185	425
Set point range 0.1 to 0.6 bar	Height H		625						685	740	990	1120	1260	
	Actuator		ØD = 225 mm, A = 160 cm ^{2 3)}						ØD = 285 mm, A = 320 cm ^{2 2)}			ØD = 380 mm, A = 640 cm ²		
	Weight ¹⁾ in kg		16	16.5	17.5	24	24.5	27	46	51	65	135	185	425
Set point range 0.2 to 1 bar	Height H		610						685	740	990	1120	1260	
	Actuator		ØD = 225 mm, A = 160 cm ^{2 3)}						ØD = 380 mm, A = 640 cm ²					
	Weight ¹⁾ in kg		16	16.5	17.5	24	24.5	27	42	47	61	135	185	425
Set point range 0.5 to 1.5 bar	Height H		610						685	740	910	1040	1180	
	Actuator		ØD = 225 mm, A = 160 cm ^{2 3)}						ØD = 285 mm, A = 320 cm ²					
	Weight ¹⁾ in kg		16	16.5	17.5	24	24.5	27	42	47	61	125	175	415
Set point range 1 to 2.5 bar	Height H		610						685	740	940	1070	1210	
	Actuator		ØD = 225 mm, A = 160 cm ²											
	Weight ¹⁾ in kg		16	16.5	17.5	24	24.5	27	42	47	61	125	175	415
Set point range 2 to 5 bar/ 4.5 to 10 bar	Height H		610						685	740	910	1040	1180	
	Actuator		ØD = 170 mm, A = 80 cm ²						ØD = 225 mm, A = 160 cm ^{2 4)}					
	Weight ¹⁾ in kg		16	16.5	17.5	24	24.5	27	42	47	61	102	170	410

¹⁾ The weight applies to the version with the material specifications EN-JL1040/PN 16 (GG-25). Add +10 % for all other materials.

²⁾ Optionally with actuator A = 640 cm²

³⁾ Optionally with actuator A = 320 cm²

⁴⁾ DN 125 to 250: 4.5 to 10 bar on request

10.2 Dimensions

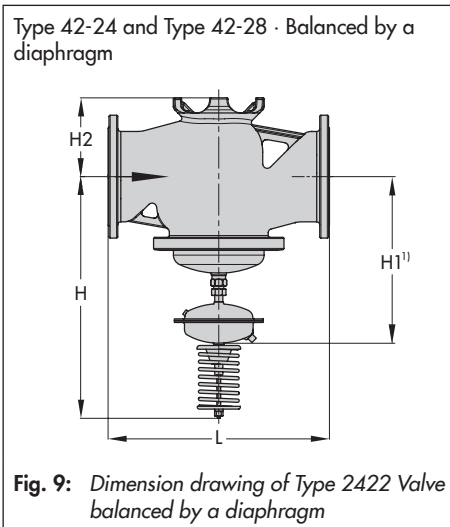


Table 3: Dimensions in mm and weights in kg

Types 42-24 and 42-28 · **Balanced by a diaphragm**

DN	65	80	100	125	150	200	250
Length L	290	310	350	400	480	600	730
Height H	575	595	720	745	960		
Height H1 ¹⁾	355	375	-				
Height H2	98	118	145	175	260		
Weight, approx. kg	42	47	55	75	95	250	270
	38 ¹⁾	43 ¹⁾	51 ¹⁾	-			

¹⁾ Type 42-28



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