Type 2422/2424 Pressure Reducing Valve
Self-operated Pressure Regulators

Edition March 2014
Note on these mounting and operating instructions

These mounting and operating instructions assist you in mounting and operating the device safely. The instructions are binding for handling SAMSON devices.

→ For the safe and proper use of these instructions, read them carefully and keep them for later reference.

→ If you have any questions about these instructions, contact SAMSON’s After-sales Service Department (aftersalesservice@samson.de).

The mounting and operating instructions for the devices are included in the scope of delivery. The latest documentation is available on our website at www.samson.de > Service & Support > Downloads > Documentation.

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

ℹ️ Note
Additional information

☀️ Tip
Recommended action
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<td>20</td>
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</tbody>
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1 General safety instructions

- 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.

- All safety instructions and warnings given in these mounting and operating instructions, particularly those concerning installation, start-up, and maintenance, must be strictly observed.

- 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.
Process medium and scope of application

Note
Non-electric actuators and control valve versions do not have their own potential ignition source according to the ignition risk assessment stipulated in EN 13463-1: 2009, 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. For connection to the equipotential bonding system, observe the requirements specified in section 6.3 of EN 60079-14 (VDE 0165 Part 1).

2 Process medium and scope of application

Pressure regulator for liquids, gases and vapors up to 350 °C
For controlling the downstream pressure $p_2$ to the adjusted set point. The valve closes when the downstream pressure rises. The downstream pressure is transmitted to the actuator over a control line that must be installed on site.

The pressure regulators are not shut-off devices guaranteeing tight shut-off. When closed, these regulators can have a leakage rate of $\leq 0.05 \%$ of the $K_{VS}$ coefficient.

Overpressure protection must be installed in the plant.

2.1 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 before being installed.

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

WARNING
Risk of injury due to valve falling. Fasten the lifting sling only to the valve body and secure against slipping.
3 Design and principle of operation

See Fig. 1 on page 7 and Fig. 2 on page 8.

The Type 2422/2424 Pressure Reducing Valve consists of the Type 2422 Valve and the Type 2424 Actuator. The Type 2422 Valve is available either balanced by a bellows or a diaphragm.

The pressure reducing valve is used to maintain the pressure downstream of the valve to an adjusted set point. The valve closes when the downstream pressure rises.

The medium flows through the valve in the direction indicated by the arrow. The position of the plug (3) determines the flow rate across the area released between plug (3) and valve seat (2). The plug stem (4) with the plug is connected to the actuator stem (4.1) of the actuator (10).

The downstream pressure $p_2$ is regulated by the positioning springs (11) and the set point adjuster (13). When relieved of pressure, the valve is opened by the force of the positioning springs.

The downstream pressure $p_2$ to be controlled is tapped downstream of the valve and transmitted over the control line to the operating diaphragm (9) where it is converted into a positioning force. This force is used to move the valve plug according to the force of the positioning springs. When the force resulting from the downstream pressure $p_2$ rises above the adjusted set point, the valve closes proportionally to the change in pressure.

The principle of operation of the Type 2422/2424 Pressure Reducing Valve balanced by a bellows or diaphragm only differs concerning the pressure balancing. The valves balanced by a diaphragm have a balancing diaphragm (5.2) instead of a bellows (5). In both cases, the forces created by the upstream and downstream pressures that act on the valve plug are balanced out.

The valves can be supplied with flow divider ST 1 or ST 3. The valve seat must be replaced on retrofitting the flow divider.

The control of vapors and liquids above 150 °C is only possible with a Type 2422 Valve balanced by a bellows. In this case, compensation chamber (20) is already installed in the control line 1). The needle valve (18) is open and lead-sealed.

Before start-up, fill the compensation chamber with the process medium at the top filler opening.

1) Only in combination with a control line kit. Otherwise, the compensation chamber must be ordered separately (► T 2595).
Design and principle of operation

Type 2422 Valve, balanced by a bellows

Type 2424 Actuator

Fig. 1: Functional diagram of Type 2422/2424 balanced by a bellows

1 Type 2422 Valve
2 Seat (exchangeable)
3 Plug
4 Plug stem
4.1 Actuator stem
5 Balancing bellows
6 Bellows housing
6.1 Vent screw (bellows housing)
7 Coupling nut
8 Top diaphragm stem
8.1 Nut
9 Operating diaphragm
10 Type 2424 Actuator
11 Positioning springs
12 Bottom diaphragm stem
13 Set point adjuster
14 Nuts and bolts
15 Nut
16 Diaphragm plate
17 Control line connection (for steam including screw joint with restriction and needle valve)
18 Control line
19 Compensation chamber (for temperatures above 150 °C and for steam)
20 Filler plug
21 Upstream pressure
P1
P2
Downstream pressure
4 Installation

See Fig. 1 on page 7 and Fig. 2 on page 8.

4.1 Assembly

Valve and actuator can be assembled before or after the valve has been installed in the pipeline.

- Relieve the positioning springs of tension by turning the set point adjuster (13).
- Place the actuator on the bellows housing and carefully screw it in as far as it will go. Make sure the control line connection points toward the downstream pressure side.
- Hold the actuator and fasten it to the bellows housing using the coupling nut (7).
4.2 Mounting position

Select the installation location making sure that the regulator is installed at a distance of at least six times the nominal size (DN) away from pipe fittings or instruments that cause flow turbulence (e.g. pipe bends, manifolds, pressure measuring points or other valves). They can change the flow conditions which may lead to an instable control process especially in applications with gases, air or steam. Contact SAMSON to obtain the TV-SK 17041 documentation which contains more details on installation requirements.

4.3 Notes on installation

Install the pressure reducing valve in horizontal pipelines.

- Flush the pipeline thoroughly before installing the regulator to ensure that no impurities 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.
- Install the regulator free of stress. If necessary, support the pipeline near to the connecting flanges. Do not attach supports directly to the valve or actuator.
- Install a strainer upstream of the regulator.
- Protect the regulator from icing up when controlling media that can freeze. If necessary, depressurize and drain the regulator and remove it from the pipeline while the plant is shut down.

![Diagram of pressure reducing valve installation](image)

**Fig. 3: Sample application**
Installation

Mounting position
Valve balanced by a bellows/diaphragm
- Actuator facing downward

Pressure testing of the plant
- The pressure must not exceed the maximum permissible pressure of the regulator and plant when the regulator is already installed. An excessive test pressure can damage the operating diaphragm in the actuator.

⚠️ WARNING
Uncontrolled excess pressure in the plant may damage the diaphragm and cause personal injury.
The maximum permissible pressure at the actuator must not exceed the pressure specified in Table 1.

<table>
<thead>
<tr>
<th>Actuator area</th>
<th>Max. perm. pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>640 cm²</td>
<td>1.5 bar</td>
</tr>
<tr>
<td>320 cm²</td>
<td>3 bar</td>
</tr>
</tbody>
</table>

To prevent damage to the diaphragm, take one of following precautions:
- Remove the regulator from the pipeline or isolate the regulator in the pipeline and install a bypass (see Fig. 3 on page 9) or
- Detach the control line and seal the openings with end plugs or Install a shut-off valve in the control line.

4.4 Control line, compensation chamber and needle valve

Control line
- A control line must be provided at the site of installation, e.g. a ¾" pipe for steam or an Ø8 x 1 or Ø6 x 1 mm copper pipe for air/water.
- Connect the control line to the downstream line (p₂) at least one meter away from the valve outlet. If a manifold is located downstream of the pressure reducing valve, connect the valve to the manifold, even if it is several meters away. If the downstream line behind the valve is extended by a conical expansion piece, connect the control line in the expanded section of the line. Weld the control line at the side in the middle of the pipe, inclining at a ratio of approximately 1:10 up to the compensation chamber.
- Weld the line coming from the pressure tapping point to the ¾“ pipe socket on the chamber. Install the compensation chamber at the highest point of the pipeline. Consequently, the control line between compensation chamber and actuator must also be installed with a downward slope. In this case, use a ¾“ pipe with screw fittings.
- If the control line connection is located below the middle of the valve outlet flange, arrange the compensation chamber at the same level as the outlet flange. In this case, use a pipe which is at least ½“ in size for the control line from the tapping point to the compensation chamber.
Installation

If the control line is connected above the middle of the valve outlet flange, install the compensation chamber at the same level as the downstream pressure tapping point. The additional pressure of the condensate head must be compensated for by adjusting the set point to a higher value.

Control line kit · A control line kit for tapping pressure directly at the valve body is available as an accessories part from SAMSON (for set points ≥0.8 bar).

Compensation chamber · A compensation chamber is required for liquids above 150 °C as well as for steam. 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.

Needle valve · If the regulator tends to hunt, install a needle valve at the control line connection (18) in addition to the standard SAMSON screw joint with restriction.

4.5 Strainers
Install the strainer upstream of the pressure reducing valve (see Fig. 3 on page 9).

Do not use the strainer to permanently filter the process medium.

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.

Tip
Remember to leave enough space to remove the filter element.

4.6 Shut-off valve
Install a hand-operated shut-off valve both upstream of the strainer and downstream of the regulator. This allows the plant to be shut down for cleaning and maintenance and when the plant is not used for longer periods of time (see Fig. 3 on page 9).

4.7 Pressure gauge
Install a pressure gauge both upstream and downstream of the regulator to monitor the pressures prevailing in the plant (see Fig. 3 on page 9).

Install the pressure gauge on the downstream side behind the downstream pressure tapping point.
5 Operation

See Fig. 1 on page 7 and Fig. 2 on page 8.

5.1 Start-up

Do not start up the regulator until all parts have been mounted. Make sure the control line is open and correctly connected. Fill the plant slowly with the process medium. Avoid pressure surges. Open the shut-off valves first on the upstream pressure side. Afterwards, open all the valves on the consumer side (downstream of the regulator).

Regulation of steam

Observe the following points for applications with steam:

− Before start-up, all pipes conveying the process medium must be completely drained and dry (to prevent steam hammering).

− Before start-up, fill the compensation chamber (20) with water at the filling opening (21) until it overflows. Screw the plug back in.

− Slowly start up the plant and allow time for the pipes and valves to heat up.

Air and condensate must be allowed to escape from the plant. Install steam trap (e.g. SAMSON Type 13 E) or air vent for steam-operated systems (e.g. SAMSON Type 3) at a suitable location.

Regulation of liquids

To start up the pressure reducing valve, open shut-off valves slowly. To vent the bellows space, unscrew the vent screw (6.1). After the air has escaped from the bellows space, retighten the vent screw (6.1).

For temperatures above 150 °C, first fill the compensation chamber with the process medium.

5.2 Adjusting the set point

Adjust the required downstream pressure by turning the set point adjuster (13).

Turn clockwise

− The downstream pressure is increased (higher pressure set point)

Turn counterclockwise

− The downstream pressure is reduced (lower pressure set point)

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

Tip

Monitor the adjusted set point pressure at the pressure gauge on the downstream pressure side.

Changing the set point range

The set point range is determined by the size of the actuator and its positioning springs. The set point range can only be changed by exchanging the entire actuator assembly. Therefore, we recommend contacting us if you want to change the set point range.
5.3 Decommissioning

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

6 Maintenance and troubleshooting

If the downstream pressure deviates considerably from the set point, check the control line for blockage and check the diaphragm for leakage.

In case of other causes, such as a damaged seat or plug, we recommend contacting SAMSON's After-sales Service (see section 8).

If the diaphragm is damaged, proceed as described in section 6.1.

WARNING

Hot process medium can escape uncontrolled on dismantling the regulator. Risk of scalding.

Allow the regulator to cool down before depressurizing and draining it and remove it from the pipeline.

6.1 Replacing the operating diaphragm

See Fig. 1 on page 7 and Fig. 2 on page 8.

Shut down the plant by slowly closing the shut-off valves. Depressurize the relevant section of the pipeline and, if necessary, drain it as well.

The actuator can be removed from the valve without having to remove the valve from the pipeline. However, in this case, do not forget that the actuator cone seals off the bellows housing. Consequently, the process medium will drain out of the valve on removing the actuator.

1. Relieve the spring assembly of tension by turning the set point adjuster (13) counterclockwise.
2. Unscrew the control line and clean it.
3. Undo the coupling nut (7) and remove the actuator.
4. Unscrew the set point adjuster (13). Remove bearing, bushing, spring(s) and spring plate.
5. Remove nuts and bolts (15). Lift the top cover plate off the actuator stem.
6. Pull the diaphragm stems together with the diaphragm plates and the diaphragm out of the lower diaphragm case.
7. Hold the bottom nut (16) stationary using a socket wrench and unscrew the top diaphragm stem by loosening the nut (8.1) (the nut is sealed with paint!).
8. Take off the top diaphragm plate (17). Replace the operating diaphragm (9) with a new one.

Proceed in the reverse order to reassemble the regulator. For start-up, proceed as described in section 5.1.
Nameplates are attached to the valve and the actuator.

**Valve nameplate**

**DIN version**

**ANSI version**

**Actuator nameplate**

**DIN valve version**

1. Valve type
2. Model number with index
3. Configuration ID
4. Order number or date
5. $K_{VS}$ coefficient
6. Spring force/set point range
7. Valve size
8. Pressure rating
9. Perm. differential pressure
10. Perm. temperature
11. Body material

**ANSI valve version**

5. Valve size
7. Spring force
8. Perm. differential pressure
9. Perm. temperature [°F]
10. Body material
11. $C_v$ coefficient ($K_{VS} \times 1.17$)
12. Class (pressure rating)

**DIN/ANSI actuator version**

1. Effective area (DIN/ANSI)
2. Type
3. Configuration ID
4. ID number
7. Valve size (DIN/ANSI)
9. Set point range (DIN/ANSI)
10. Diaphragm material

Fig. 4: Nameplates
8 After-sales service

If malfunctions or defects occur, contact the SAMSON’s After-sales Service department for support.

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

Please send your inquiries to: service@samsongroup.com

To assist diagnosis, specify the following details (see section 7):

- Type and nominal size of the valve
- Model number and configuration ID
- Order number or date
- Upstream and downstream pressure
- Temperature and process medium
- Min. and max. flow rate in m³/h
- 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.)
### 9 Dimensions

**Type 2422/2424 · Balanced by a bellows**

Dimensions in mm and weights in kg · The values in parentheses apply to temperatures from 220 to 350 °C

<table>
<thead>
<tr>
<th>Valve size</th>
<th>DN 125</th>
<th>DN 150</th>
<th>DN 200</th>
<th>DN 250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length L</td>
<td>400</td>
<td>480</td>
<td>600</td>
<td>730</td>
</tr>
<tr>
<td>Height H1</td>
<td>460 (600)</td>
<td>590 (730)</td>
<td>730 (870)</td>
<td></td>
</tr>
<tr>
<td>Height H2</td>
<td>145</td>
<td>175</td>
<td>235</td>
<td>260</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Set point ranges in bar</th>
<th>0.05 to 0.25</th>
<th>0.1 to 0.6</th>
<th>0.2 to 1.0</th>
<th>0.5 to 1.5</th>
<th>1 to 2.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height H</td>
<td>990 (1130)</td>
<td>990 (1130)</td>
<td>990 (1130)</td>
<td>910 (1050)</td>
<td>910 (1080)</td>
</tr>
<tr>
<td>Actuator</td>
<td>ØD = 380, A = 640 cm²</td>
<td>ØD = 380, A = 640 cm²</td>
<td>ØD = 380, A = 640 cm²</td>
<td>ØD = 285, A = 320 cm²</td>
<td>ØD = 285, A = 320 cm²</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weight 1) based on cast iron, PN 16, approx. kg</th>
<th>0.05 to 1.0</th>
<th>0.5 to 1.5/1 to 2.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05 to 1.0</td>
<td>135</td>
<td>125</td>
</tr>
<tr>
<td>0.5 to 1.5/1 to 2.5</td>
<td>116</td>
<td>110</td>
</tr>
</tbody>
</table>

1) +10 % for cast steel, spheroidal graphite iron and forged steel

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Fig. 5: Dimensions · Type 2422/2424 · Balanced by a bellows
Dimensions in mm and weights in kg

<table>
<thead>
<tr>
<th>Valve size</th>
<th>DN 125</th>
<th>DN 150</th>
<th>DN 200</th>
<th>DN 250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length L</td>
<td>400</td>
<td>480</td>
<td>600</td>
<td>730</td>
</tr>
<tr>
<td>Height H</td>
<td>720</td>
<td>745</td>
<td>960</td>
<td>960</td>
</tr>
<tr>
<td>Height H2</td>
<td>145</td>
<td>175</td>
<td>260</td>
<td>260</td>
</tr>
</tbody>
</table>

**Weight** (actuator with valve), approx. kg

<table>
<thead>
<tr>
<th>Range</th>
<th>DN 125</th>
<th>DN 150</th>
<th>DN 200</th>
<th>DN 250</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05 to 1 bar</td>
<td>80</td>
<td>93</td>
<td>238</td>
<td>248</td>
</tr>
<tr>
<td>0.5 to 2.5 bar</td>
<td>75</td>
<td>87</td>
<td>232</td>
<td>242</td>
</tr>
</tbody>
</table>

**Fig. 6:** Dimensions · Type 2422/2424 · *Balanced by a diaphragm*
## 10 Technical data

### Type 2422 Valve

<table>
<thead>
<tr>
<th>Valve size</th>
<th>DN 125</th>
<th>DN 150</th>
<th>DN 200</th>
<th>DN 250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure rating</td>
<td></td>
<td></td>
<td></td>
<td>PN 16, 25 or 40</td>
</tr>
<tr>
<td>Max. permissible temperature</td>
<td>Balanced by a bellows</td>
<td>Metal seal: max. 350 °C · PTFE soft seal: max. 220 °C EPDM or FKM soft seal: max. 150 °C NBR soft seal: max. 80 °C ¹</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Balanced by a diaphragm</td>
<td>EPDM soft seal, max. 150 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leakage class according to IEC 60534-4</td>
<td></td>
<td></td>
<td></td>
<td>≤0.05 % of $K_{VS}$ coefficient</td>
</tr>
</tbody>
</table>

### Type 2424 Actuator

| Set point ranges | 0.05 to 0.25 bar · 0.1 to 0.6 bar · 0.2 to 1 bar · 0.5 to 1.5 bar · 1 to 2.5 bar ² |
| Max. permissible pressure at actuator | Effective diaphragm area | 320 cm² | 640 cm² |
| Pressure | 3 bar | 1.5 bar |
| Max. permissible temperature | Gases 80 °C at the actuator ¹ · Liquids 150 °C, with compensation chamber max. 350 °C · Steam with compensation chamber max. 350 °C |

¹) For oxygen max. 60 °C
²) Set point ranges above 2.5 bar ➔ T 2552 (Type 2333 Pressure Reducing Valve)