Self-operated Regulators

Type 46-7 Flow and Differential Pressure Regulator with additional pressure control actuator

Mounting and Operating Instructions

EB 3131-1 EN
Edition November 2017
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 (www.samson.de) > Product documentation. You can enter the document number or type number in the [Find:] field to look for a document.

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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1 Safety instructions and measures

Intended use

The Type 46-7 Flow and Differential Pressure Regulator with additional pressure control actuator is designed for the flow rate and differential pressure control of liquids up to 150 °C. The additional pressure control actuator closes the valve when the return flow pressure is too high. The Type 46-7 is mainly used in district heating supply networks and industrial plants. The regulator and actuator are designed to operate under exactly defined conditions (e.g. operating pressure, process medium, temperature). Therefore, operators must ensure that the regulator and actuator are only used in applications that meet the specifications used for sizing the devices at the ordering stage. In case operators intend to use the devices in other applications or conditions than specified, contact SAMSON.

SAMSON does not assume any liability for damage resulting from the failure to use the device for its intended purpose or for damage caused by external forces or any other external factors.

⇒ Refer to the technical data and nameplate for limits and fields of application as well as possible uses.

Reasonably foreseeable misuse

The regulator is not suitable for the following applications:
− Use outside the limits defined during sizing and by the technical data

Furthermore, the following activities do not comply with the intended use:
− Use of non-original spare parts
− Performing service and repair work not described in these instructions

Qualifications of operating personnel

The regulator must be mounted, started up, serviced and repaired by fully trained and qualified personnel only; the accepted industry codes and practices are to be 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 hazards due to their specialized training, their knowledge and experience as well as their knowledge of the applicable standards.
Safety instructions and measures

Personal protective equipment
We recommend wearing the following protective equipment depending on the process medium:

- Protective clothing, gloves, and eyewear in applications with hot, cold, and/or corrosive media
- Wear hearing protection when working near the valve.

⇒ Check with the plant operator for details on further protective equipment.

Revisions and other modifications
Revisions, conversions or other modifications to the product are not authorized by SAMSON. They are performed at the user’s own risk and may lead to safety hazards, for example. Furthermore, the product may no longer meet the requirements for its intended use.

Warning against residual hazards
To avoid personal injury or property damage, plant operators and operating personnel must prevent hazards that could be caused in the regulator by the process medium, the operating pressure or by moving parts by taking appropriate precautions. They must observe all hazard statements, warning and caution notes in these mounting and operating instructions, especially for installation, start-up, and service work.

Responsibilities of the operator
The operator is responsible for proper operation and compliance with the safety regulations. Operators are obliged to provide these mounting and operating instructions as well as the referenced documents to the operating personnel and to instruct them in proper operation. Furthermore, the operator must ensure that operating personnel or third persons are not exposed to any danger.

Responsibilities of operating personnel
Operating personnel must read and understand these mounting and operating instructions as well as the referenced documents and observe the hazard statements, warning and caution notes specified in them. Furthermore, the operating personnel must be familiar with the applicable health, safety and accident prevention regulations and comply with them.

Referenced standards and regulations
The regulators 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 is included in the Appendix of these instructions (see section 10.2).
Safety instructions and measures

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 2014/34/EU.

For connection to the equipotential bonding system, observe the requirements specified in section 6.4 of EN 60079-14 (VDE 0165 Part 1).

1.1 Notes on possible severe personal injury

⚠️ DANGER

Risk of bursting in pressure equipment.
Valves and pipelines are pressure equipment. Improper opening can lead to device components bursting.

⇒ Before starting any work on the device, depressurize all plant sections concerned as well as the valve.

⇒ Drain the process medium from all the plant sections concerned as well as the valve.

⇒ If necessary, a suitable overpressure protection must be installed on site in the plant section.

⇒ Wear personal protective equipment.

1.2 Notes on possible personal injury

⚠️ WARNING

Crush hazard arising from moving parts.
The regulator contains moving parts (actuator and plug stems), which can injure hands or fingers if inserted into the valve.

⇒ Do not insert hands or fingers between the set point springs while the regulator is in operation.

⇒ Before performing any work on the regulator, depressurize the plant. Disconnect or shut off the external control line.
**WARNING**

Risk of personal injury due to residual process medium in the valve.
While working on the valve, residual process medium can escape and, depending on its properties, may lead to personal injury, e.g. (chemical) burns.
- If possible, drain the process medium from all the plant sections concerned and the valve.
- Wear protective clothing, safety gloves, and eyewear.

Risk of burn injuries due to hot or cold components and pipelines.
Depending on the process medium, valve components and pipelines may get very hot or cold and cause burn injuries.
- Allow components and pipelines to cool down or heat up.
- Wear protective clothing and safety gloves.

Damage to health relating to the REACH regulation.
If a SAMSON device contains a substance which is listed as being a substance of very high concern on the candidate list of the REACH regulation, this circumstance is indicated on the SAMSON delivery note.
- Information on safe use of the part affected, see [www.samson.de/reach-de.html](http://www.samson.de/reach-de.html).

### 1.3 Notes on possible property damage

**NOTICE**

Risk of valve damage due to contamination (e.g. solid particles) in the pipeline.
The plant operator is responsible for cleaning the pipelines in the plant.
- Flush the pipelines before start-up.
- Observe the maximum permissible pressure for valve and plant.

Risk of valve damage due to unsuitable medium properties.
The valve is designed for process media with defined properties.
- Only use process media specified for sizing the valve.
2 Markings on the device

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<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
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<td>4</td>
<td>5</td>
<td>6</td>
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<tr>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Nameplate of Type 46-7

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

Nameplate on the pressure control actuator

1 Configuration ID
2 Model number
3 Date of manufacture
4 $K_{VS}/C_V$
5 Pressure rating PN or Class
6 Differential pressure set point range in bar or psi
7 Type designation
8 Flow rate set point range in m³/h or gal/min
9 Maximum permissible temperature in °C or °F
10 Max. permissible differential pressure $\Delta p$ in bar or psi

1 Set point range (pressure) in bar or psi
3 Design and principle of operation

The combined regulators mainly consist of the valve (1), closing actuator (6) with two operating diaphragms (6.1, 6.3) and an adjustable restriction (9), on which an additional pressure control actuator (15) with diaphragm chamber E is mounted. Its purpose is to close the restriction (9) when the return flow pressure is too high to prevent damage to the consumers.

The regulator is used to limit the differential pressure and flow rate to the set points adjusted at the actuator. The valve closes when the differential pressure or flow rate increases. The additional pressure actuator closes the valve when the return flow pressure is too high.

The medium flows through the valve in the direction indicated by the arrow. The areas released by the restriction (9) and the plug (3) determine the flow rate. The installed spring (5) determines the differential pressure across the restriction of 0.2 bar.

To control the flow rate, the low pressure downstream of the restriction is transmitted through a hole in the plug to the top diaphragm chamber A. The high pressure of ∆p is transmitted through the attached control line to the diaphragm chamber B and C, which are connected to each other.

To control the differential pressure, the high pressure of ∆p must be transmitted through the external control line (13), which is attached on the site of installation, to the bottom diaphragm chamber D. The low pressure of ∆p is equal to the high pressure of the ∆p and is transmitted over the control line (11) to the diaphragm chambers B and C, which are connected to each other.

To safeguard the return flow pipe, the return flow pressure downstream of the valve is transmitted over the attached control line (15.2) to diaphragm chamber E of the additional pressure control actuator (15) and compared with the adjusted pressure set point. If the resulting pressure force is higher than the set point force adjusted at the set point adjuster (15.1), the restriction closes, causing the valve to close as well.

<table>
<thead>
<tr>
<th>1</th>
<th>Valve body</th>
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</thead>
<tbody>
<tr>
<td>2</td>
<td>Seat</td>
</tr>
<tr>
<td>3</td>
<td>Guide nipple with plug section</td>
</tr>
<tr>
<td>4</td>
<td>Plug stem</td>
</tr>
<tr>
<td>5</td>
<td>Valve spring</td>
</tr>
<tr>
<td>6</td>
<td>Actuator</td>
</tr>
<tr>
<td>6.1</td>
<td>First operating diaphragm</td>
</tr>
<tr>
<td>6.2</td>
<td>First actuator stem</td>
</tr>
<tr>
<td>6.3</td>
<td>Second operating diaphragm</td>
</tr>
<tr>
<td>6.4</td>
<td>Second actuator stem</td>
</tr>
<tr>
<td>8</td>
<td>Set point spring (differential pressure)</td>
</tr>
<tr>
<td>9</td>
<td>Restriction (flow rate)</td>
</tr>
<tr>
<td>9.1</td>
<td>Set point screw (flow rate, SW 4)</td>
</tr>
<tr>
<td>10</td>
<td>Set point adjuster (differential pressure)</td>
</tr>
<tr>
<td>11</td>
<td>Control line (+) V</td>
</tr>
<tr>
<td>13</td>
<td>External control line (+) ∆p</td>
</tr>
<tr>
<td>15</td>
<td>Pressure control actuator</td>
</tr>
<tr>
<td>15.1</td>
<td>Set point adjuster (pressure)</td>
</tr>
<tr>
<td>15.2</td>
<td>Control line (pressure)</td>
</tr>
<tr>
<td>15.3</td>
<td>G ⅛ blanking plug</td>
</tr>
<tr>
<td>15.4</td>
<td>Set point spring (pressure)</td>
</tr>
<tr>
<td>A to E</td>
<td>Diaphragm chambers</td>
</tr>
</tbody>
</table>
Fig. 1: Flow and differential pressure regulator with additional pressure control actuator · DN 15 and 25
Design and principle of operation

8 Set point spring (differential pressure)
9 Restriction
9.2 Knurled nut (flow rate, SW 5)
9.3 Nipple with retaining screw and lead-seal hole
10 Set point adjuster (differential pressure)

Fig. 2: Flow and differential pressure regulator with additional pressure control actuator · DN 40
3.1 Technical data

Process medium and scope of application
Flow rate and differential pressure control with pressure control in district heating supply networks and industrial plants. Valves DN 15, 25 and 40. Nominal pressure PN 16 and 25. Suitable for liquids up to 150 °C.
The valve closes when the flow rate, differential pressure or pressure rises.
Regulator for installation in the low-pressure pipe, e.g. plant return flow pipe of a district heating substation.

Min. differential pressure $\Delta p_{\text{min}}$
The minimum required differential pressure $\Delta p_{\text{min}}$ across the valve is calculated as follows:

$$\Delta p_{\text{min}} = \Delta p_{\text{restriction}} + \left( \frac{\dot{V}}{K_{VS}} \right)^2$$

$\Delta p_{\text{min}}$ Minimum differential pressure across the valve in bar
$\Delta p_{\text{restriction}}$ Differential pressure created at the restriction for measuring the flow rate
$\dot{V}$ Adjusted flow rate in m³/h
$K_{VS}$ Valve flow coefficient in m³/h

Dimensions and weights
The lengths and heights in the dimension diagrams are shown on pages 15 and 16.
Dimensions in mm · Weights in kg

Note
The dimensions and weights of valves with flanged bodies (DN 40) are the same as valves with screwed-on flanges.
### Table 1: Technical data

<table>
<thead>
<tr>
<th>Valve size</th>
<th>DN 15</th>
<th>DN 25</th>
<th>DN 40</th>
</tr>
</thead>
<tbody>
<tr>
<td>$K_{vs}$ coefficient</td>
<td>4</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>$x_{FZ}$ value</td>
<td>0.6</td>
<td>0.55</td>
<td>0.55</td>
</tr>
<tr>
<td>Nominal pressure</td>
<td>PN 16/25</td>
<td>PN 16/25</td>
<td>PN 25</td>
</tr>
<tr>
<td>Max. permissible differential pressure $\Delta p$ across the valve</td>
<td>PN 16</td>
<td>10 bar</td>
<td>10 bar</td>
</tr>
<tr>
<td></td>
<td>PN 25</td>
<td>20 bar</td>
<td>20 bar</td>
</tr>
<tr>
<td>Max. permissible temperature</td>
<td>PN 16</td>
<td>130 °C</td>
<td>130 °C</td>
</tr>
<tr>
<td></td>
<td>PN 25</td>
<td>150 °C</td>
<td>150 °C</td>
</tr>
<tr>
<td>Pressure above adjusted differential pressure set point at which internal excess pressure limiter responds</td>
<td></td>
<td></td>
<td>0.5 bar</td>
</tr>
<tr>
<td>Compliance</td>
<td></td>
<td></td>
<td>CE · EAC</td>
</tr>
</tbody>
</table>

**Pressure set point ranges**

Pressure set point, continuously adjustable | 1 to 2.5 bar |

**Differential pressure set point ranges**

<table>
<thead>
<tr>
<th>Differential pressure set point, continuously adjustable</th>
<th>DN 15</th>
<th>DN 25</th>
<th>DN 40</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2 to 0.6 bar</td>
<td>0.2 to 1.0 bar</td>
<td>0.2 to 0.5 bar</td>
<td></td>
</tr>
<tr>
<td>0.5 to 2 bar</td>
<td>0.5 to 2 bar</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 2: Regulator without connecting parts

<table>
<thead>
<tr>
<th>Valve size</th>
<th>DN 15</th>
<th>DN 25</th>
<th>DN 40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe Ø d</td>
<td>21.3</td>
<td>32.7</td>
<td>48</td>
</tr>
<tr>
<td>Connection R</td>
<td>G 3/4</td>
<td>G 1 1/4</td>
<td>G 2</td>
</tr>
<tr>
<td>Width across flats SW</td>
<td>30</td>
<td>46</td>
<td>65</td>
</tr>
<tr>
<td>Length L</td>
<td>65</td>
<td>75</td>
<td>110</td>
</tr>
<tr>
<td>H</td>
<td>62</td>
<td>62</td>
<td>110</td>
</tr>
<tr>
<td>H1</td>
<td>185</td>
<td>185</td>
<td>420</td>
</tr>
<tr>
<td>H4</td>
<td>214</td>
<td>214</td>
<td>214</td>
</tr>
<tr>
<td>ØD1</td>
<td>116</td>
<td></td>
<td>160</td>
</tr>
<tr>
<td>ØD2</td>
<td></td>
<td></td>
<td>116 (40 cm² actuator)</td>
</tr>
</tbody>
</table>
Dimensional drawings

DN 15 and 25

DN 40
### Design and principle of operation

#### Table 3: Regulator with connecting parts

<table>
<thead>
<tr>
<th>Valve size</th>
<th>DN 15</th>
<th>DN 25</th>
<th>DN 40</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>With welding ends</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L1</td>
<td>210</td>
<td>244</td>
<td>294</td>
</tr>
<tr>
<td>Weight, approx. kg</td>
<td>2.6</td>
<td>2.8</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>2.2</td>
<td>2.4</td>
<td>6.2</td>
</tr>
<tr>
<td><strong>With threaded ends</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L2</td>
<td>129</td>
<td>159</td>
<td>206</td>
</tr>
<tr>
<td>Male thread A</td>
<td>G ½</td>
<td>G 1</td>
<td>G 1½</td>
</tr>
<tr>
<td>Weight, approx. kg</td>
<td>2.6</td>
<td>2.8</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>2.2</td>
<td>2.4</td>
<td>6.2</td>
</tr>
<tr>
<td><strong>With flanges ¹ ² or with flanged body (DN 40)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L3</td>
<td>130</td>
<td>160</td>
<td>200</td>
</tr>
<tr>
<td>Weight, approx. kg</td>
<td>4.0</td>
<td>5.3</td>
<td>16.0</td>
</tr>
<tr>
<td></td>
<td>3.6</td>
<td>4.9</td>
<td>10.2</td>
</tr>
</tbody>
</table>

¹) PN 16/25  
²) Flanges are already mounted on valves in DN 40.

#### Dimensional drawings

- Connection nuts with flanges
- Connection nuts with threaded ends
4 Measures for preparation

After receiving the shipment, proceed as follows:

1. Check the scope of delivery. Compare the shipment received against the delivery note.

2. Check the shipment for transportation damage. Report any damage to SAMSON and the forwarding agent (refer to delivery note).

4.1 Unpacking

Do not remove the packaging until immediately before installing the valve into the pipeline.

4.2 Transporting and lifting

Due to the low service weight, lifting equipment is not required to lift and transport the regulator (e.g. to install it into the pipeline).

Transport instructions

- Protect the device against external influences (e.g. impact).
- Do not damage the corrosion protection (paint, surface coatings). Repair any damage immediately.
- Protect the device against moisture and dirt.
- Observe the permissible ambient temperatures (see section 3.1).

4.3 Storage

NOTICE

Risk of regulator damage due to improper storage.

- Observe storage instructions.
- Avoid long storage times.
- Contact SAMSON in case of different storage conditions or long storage periods.

Note

We recommend regularly checking the device and the prevailing storage conditions during long storage periods.

Storage instructions

- Protect the device against external influences (e.g. impact).
- Do not damage the corrosion protection (paint, surface coatings). Repair any damage immediately.
- Protect the device against moisture and dirt. Store it at a relative humidity of less than 75 %. In damp spaces, prevent condensation. If necessary, use a drying agent or heating.
- Make sure that the ambient air is free of acids or other corrosive media.
- Observe the permissible ambient temperatures (see section 3.1).
- Do not place any objects on the device.

Special storage instructions for elastomers

Elastomer, e.g. actuator diaphragm
Measures for preparation

- To keep elastomers in shape and to prevent cracking, do not bend them or hang them up.
- We recommend a storage temperature of 15 °C for elastomers.
- Store elastomers away from lubricants, chemicals, solutions and fuels.

Tip

SAMSON's After-sales Service department can provide more detailed storage instructions on request.

4.4 Preparation for installation

Proceed as follows:

➔ Flush the pipelines.

Note

The plant operator is responsible for cleaning the pipelines in the plant.

➔ Check the valve to make sure it is clean.
➔ Check the valve for damage.
➔ Check to make sure that the type designation, valve size, material, pressure rating and temperature range of the valve match the plant conditions (size and pressure rating of the pipeline, medium temperature etc.).
➔ Check any mounted pressure gauges to make sure they function.
5 Mounting and start-up

5.1 Mounting position

Standard mounting position

→ Install the regulator in a horizontal pipeline with the set point adjuster (10) facing downward (see Fig. 1 and Fig. 2).

Installation conditions

− Make sure that the regulator remains freely accessible after the plant has been completed.

− Install a strainer upstream of the regulator (see section 5.2).

− The direction of flow must match the direction indicated by the arrow on the body.

− Connect external control lines at the side of the main pipe (see Fig. 5)

− Install the regulator free of stress.

**NOTICE**

Possible malfunction and damage due to adverse effects of weather conditions (temperature, humidity).

− Do not install the regulator outdoors or in rooms prone to frost.

− Protect the regulator against frost if it is used to control freezing media.

− Either heat the regulator or remove it from the plant and completely drain the residual medium.

5.2 Additional fittings

**Strainer**

A strainer installed upstream in the flow pipe holds back any dirt or other foreign particles carried along by the medium. For example, the SAMSON Type 1 NI Strainer is suitable (☞ T 1010).

− Install the strainer upstream of the regulator.

− The direction of flow must correspond to the arrow on the valve body.

---

Fig. 3: Sample application
Mounting and start-up

- The filter element must be installed to hang downward.
- Allow sufficient space to remove the filter.

**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. 3). This allows the plant to be shut down for cleaning and maintenance, and when the plant is not used for longer periods of time.

**Pressure gauge**
Install a pressure gauge at a suitable point to monitor the pressures prevailing in the plant (see Fig. 3).

**Control line**
Depending on the regulator version, a control line (standard: 6x1 mm pipe diameter) must be adapted and mounted on site. Make sure that the control line is free of dirt.

We recommend installing the control line for tapping pressure from the pipeline at a distance of at least three times the nominal size (DN) away from any pipe fittings (e.g. manifolds, bends, branches or other valves), that may cause turbulence in the flow.

How the lines are routed generally depends on the installation site. Preferably connect the control line to the side of the main pipe.
- Do not change the pipe diameter of the main pipeline so that it is off center.
- Refer to installation schematics (Fig. 3) for line routing.

![Control line connection, depending on how the pipeline is routed](image)

**5.3 Putting the regulator into operation**

- First start up the regulator after mounting all parts.
- Make sure the control lines are open and correctly connected.
- Make sure that the restriction (9) is open while filling the plant. To open it, turn the set point adjuster of the pressure control actuator (15.1) counterclockwise (\(\theta\)) (see section 6.1.3).
- Open the shut-off valves slowly over a time period of several minutes, preferably starting from the return flow pipe.

**NOTICE**
Risk of valve damage due to a sudden pressure increase and resulting high flow velocities.
Slowly open the shut-off valve in the pipeline during start-up.
Mounting and start-up

Pressure testing the plant

All plant components must be designed for the test pressure. If necessary, remove the regulator from the pipeline or remove the control line of the pressure actuator at the valve and seal the open connection with a blanking plug (see Table 4).

**NOTICE**

Risk of damage to the diaphragm actuator due to impermissible excess pressure. The test pressure must not exceed the nominal pressure at the actuator by 1.5 times on testing the pressure of the plant when the regulator is already installed.

Rinsing the plant

1. After filling the plant, first completely open the consumer.
2. Adjust the maximum flow rate at the regulator (see section 6.1.1).
3. Adjust the maximum differential pressure at the regulator (see section 6.1.2).
4. Adjust the maximum pressure at the pressure control actuator (see section 6.1.3).
5. Rinse out the pipeline at full flow rate for several minutes.
6. Check the strainer (e.g. measure the pressure drop) and clean it, if necessary.

<table>
<thead>
<tr>
<th>Table 4: Accessories</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accessories</strong></td>
</tr>
<tr>
<td>Blanking plugs</td>
</tr>
<tr>
<td>Seal</td>
</tr>
</tbody>
</table>

Fig. 5: Control line connection
6 Operation

6.1 Adjusting the set points

6.1.1 Flow control

1. Adjust the maximum differential pressure at the regulator (see section 6.1.2).
2. Completely open the control and shut-off valves or a bypass valve in the plant.

DN 15 and 25

1. To place the restriction (9) in the end position, relieve the tension from the set point spring (15.4) at the pressure control actuator (15) by turning the set point adjuster (15.1) counterclockwise (∅) as far as it will go.
2. Use a suitable tool (Allen key, SW 4) to turn the set point screw (9.1) clockwise (⊙) as far as it will go.
3. Fully load the set point spring (15.4) at the pressure control actuator (15) by turning the set point adjuster (15.1) clockwise (⊙) as far as it will go.
4. Refer to Fig. 8 to find out how many turns are required to set the flow rate.
5. Use a suitable tool (Allen key, SW 4) to turn the set point screw (9.1) by the required number of turns. Turn it counterclockwise (∅) to open the restriction. The flow rate rises.
6. Guide the wire through the lead-seal hole and lead-seal it to fix the adjusted flow rate.

DN 40

1. To place the restriction (9) in the end position, turn the knurled nut (9.2) clockwise (∅) as far as it will go.
2. Fully load the set point spring (15.4) at the pressure control actuator (15) by
turning the set point adjuster (15.1) clockwise (↻) as far as it will go.

3. Refer to Fig. 8 to find out how many turns are required to set the flow rate.

4. Turn the knurled nut (9.2) by the required number of turns. Turn it counterclockwise (↺) to open the restriction. The flow rate rises.

5. Tighten the retaining screw (9.3) with a suitable tool (Allen key, SW 5) to fix the adjusted flow rate. Pull the wire through the lead-seal hole and lead-seal it.

---

**Tip**

For exact adjustment, verify adjusted value with a heat or flow meter.

---

**Fig. 7: Flow control · DN 40**
### Table 5: Flow rate set point range for water in m³/h

<table>
<thead>
<tr>
<th>Nominal size DN</th>
<th>15</th>
<th>25</th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
<td>K&lt;sub&gt;VS&lt;/sub&gt; coefficient</td>
<td>4</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>Set point range with Δp&lt;sub&gt;restriction&lt;/sub&gt; of 0.2 bar</td>
<td>0.6 to 2.5 m³/h</td>
<td>0.8 to 3.5 m³/h</td>
<td>3 to 6.6 m³/h</td>
</tr>
</tbody>
</table>

**Fig. 8:** Set point adjustment for flow rate: differential pressure across the restriction
Δp<sub>restriction</sub> = 0.2 bar
6.1.2 Differential pressure control

1. Close the shut-off valves or the bypass to reduce the maximum flow rate to approx. 5 to 10%.
   If you are using a motorized valve, close it to approx. 10% of its travel.

2. Adjust the required differential pressure at the set point adjuster (10).
   Turn clockwise (↺) to load the set point spring (8). The Δp set point increases.
   Turn counterclockwise (↻) to relieve the tension from the set point spring (8). The Δp set point is reduced.

The set point spring is installed in the bottom section of the housing in DN 15 and 25. The set point spring is located externally in the DN 40 version (see Fig. 9). The set point can be continuously adjusted using the set point spring.
adjuster according to the value on the scale (see Fig. 10).

**Note**
The maximum value on the scale of the set point adjuster is 8. However, the maximum set point is reached earlier (see Fig. 10).

In the DN 15 and 25 version, one turn of the set point adjuster will change the differential pressure by approx. 0.033 bar in the range from 0.2 to 1 bar and by approx. 0.02 bar in the range from 0.2 to 0.6 bar.

In the DN 40 version, one turn of the set point adjuster will change the differential pressure by approx. 0.022 bar in the range from 1.0 to 2.2 bar.

### NOTICE
Risk of regulator malfunction due to incorrect setting.
A scale value below 1 may lead to incorrect control.
Only adjust values above 1 on the scale.
If the setting is incorrect (value on the scale below 1), proceed as follows:
- Depressurize the regulator.
- Turn the set point adjuster counterclockwise (↺) as far as it will go (minimum setting).
- Turn the set point adjuster back clockwise to a value between 1 to 2 on the scale.
The set point can now be adjusted.

**Fig. 10:** Differential pressure set point adjusted according to the value on the scale · DN 15 and 25
6.1.3 Pressure control

Adjusting the pressure set point at the set point adjuster

Adjust the pressure set point while watching the pressure gauge on the downstream pressure side. To do this, load the set point spring (15.4) at the set point adjuster (15.1) on the pressure control actuator.

Turn clockwise \( \leftarrow \) to increase the pressure set point.

Turn counterclockwise \( \rightarrow \) to reduce the pressure set point.

The adjusted pressure changes by 0.03 bar after each turn of the set point adjuster with a set point range from 1.0 to 2.2 bar.

Adjusting the pressure set point by changing the spring height \( H_F \)

An adjustment of the set point can also be made by changing the adjustable spring height \( H_F \) of the set point spring.

A rough initial set point adjustment is only possible by changing the spring height \( H_F \). Check the pressure at the pressure gauge downstream of the regulator for a precise set point adjustment.

Fig. 11: Set point adjustment

Spring height \( H_F \)

Fig. 12: Pressure set point adjustment according to the diagram · Spring height \( H_F \)
The adjustment diagram in Fig. 12 applies to the pressure control when the valve is closed (deviation ±0. bar).

The associated spring travel is assigned to a certain set point in the range from 1.0 to 2.5 bar.

6.2 Pressure measurement at the regulator

Screw a suitable pressure gauge in place of the blanking plug (G 1/8, 15.3) to directly measure the pressure at the pressure regulator.

Fig. 13: Pressure control
7 Servicing

The regulator does not require any maintenance. Nevertheless, it is 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.

The regulator was checked by SAMSON before it left the factory.

– The product warranty becomes void if service or repair work not described in these instructions is performed without prior agreement by SAMSON’s After-sales Service department.
– Only use original spare parts by SAMSON, which comply with the original specifications.

Note

SAMSON’s After-sales Service department can support you to draw up an inspection plan for your plant.

7.1 Preparation for return shipment

Defective devices can be returned to SAMSON for repair. Proceed as follows to return devices to SAMSON:

1. Put the regulator out of operation (see section 9).

2. Decontaminate the valve. Remove any residual process medium.

3. Fill in the Declaration on Contamination, which can be downloaded from our website at www.samson.de > Services > Check lists for after sales service > Declaration on Contamination.

4. Send the device together with the filled-in form to your nearest SAMSON subsidiary. SAMSON subsidiaries are listed on our website at www.samson.de > Contact.

7.2 Ordering spare parts and operating supplies

Contact your nearest SAMSON subsidiary or the SAMSON After-sales Service department for information on spare parts, lubricants and tools.
8 Troubleshooting

The malfunctions listed in Table 6 are caused by mechanical faults and incorrect regulator sizing. In the simplest case, the functioning can be restored following the recommended action. Special tools may be required to repair the regulator.

Exceptional operating and installation conditions may lead to changed situations that may affect the control response and lead to malfunctions. For troubleshooting, the conditions, such as installation, process medium, temperature and pressure conditions, must be taken into account.

SAMSON’s After-sales Service department can help during troubleshooting. Further information is available in section 10.1.

We recommend removing the valve from the pipeline.

⚠️ DANGER
Risk of bursting in pressure equipment. Valves and pipelines are pressure equipment. Improper opening can lead to device components bursting.
– Before starting any work on the device, depressurize all plant sections concerned as well as the valve. Disconnect or shut off the external control line.
– Drain the process medium from all the plant sections concerned as well as the valve.
– Wear personal protective equipment.

⚠️ WARNING
Risk of personal injury due to residual process medium in the valve.
While working on the valve, residual process medium can escape and, depending on its properties, may lead to personal injury, e.g. (chemical) burns.
– If possible, drain the process medium from all the plant sections concerned and the valve.
– Wear protective clothing, safety gloves, and eyewear.

⚠️ WARNING
Risk of burn injuries due to hot or cold components and pipelines.
Depending on the process medium, valve components and pipelines may get very hot or cold and cause burn injuries.
– Allow components and pipelines to cool down or heat up.
– Wear protective clothing and safety gloves.
## Table 6: Troubleshooting

<table>
<thead>
<tr>
<th>Malfunction</th>
<th>Possible reasons</th>
<th>Recommended action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow rate or differential pressure exceeds adjusted set point</td>
<td>Leak between seat and plug</td>
<td>Remove valve from the pipeline and clean seat and plug. Replace the plug, if necessary. If this is not possible, return regulator to SAMSON for repair.</td>
</tr>
<tr>
<td></td>
<td>Defective operating diaphragm</td>
<td>Replace diaphragm or return regulator to SAMSON for repair.</td>
</tr>
<tr>
<td></td>
<td>Control line with needle valve blocked.</td>
<td>Remove control line and needle valve. Clean them.</td>
</tr>
<tr>
<td></td>
<td>Valve too large for control task (flow rate) or too small (differential pressure)</td>
<td>Recalculate K&lt;sub&gt;Vs&lt;/sub&gt; and contact SAMSON for further action.</td>
</tr>
<tr>
<td>Flow or differential pressure set point not reached</td>
<td>Incorrect set point range selected.</td>
<td>Check set point range and contact SAMSON for further action.</td>
</tr>
<tr>
<td></td>
<td>Safety device, e.g. pressure limiter, has been triggered.</td>
<td>Check plant. Unlock safety device.</td>
</tr>
<tr>
<td></td>
<td>Plant differential pressure too low.</td>
<td>Compare differential pressure in the plant with the plant’s drag.</td>
</tr>
<tr>
<td></td>
<td>Strainer blocked</td>
<td>Drain and clean filter of the strainer.</td>
</tr>
<tr>
<td></td>
<td>Incorrectly installed valve (direction of flow).</td>
<td>Install the valve in such a way that the flow of direction corresponds with the direction indicated by the arrow on the valve body.</td>
</tr>
<tr>
<td>Pressure exceeds the pressure set point.</td>
<td>Leak between seat and restriction or restriction is blocked.</td>
<td>Remove valve from the pipeline and clean seat and restriction. Replace the restriction, if necessary. If this is not possible, return regulator to SAMSON for repair.</td>
</tr>
<tr>
<td>Control loop hunts.</td>
<td>Valve too large for control task</td>
<td>Recalculate K&lt;sub&gt;Vs&lt;/sub&gt; and contact SAMSON for further action.</td>
</tr>
</tbody>
</table>

**Note**

Contact SAMSON’s After-sales Service department for malfunctions not listed in the table and when the malfunction cannot be remedied as described.
9 Decommissioning and disassembly

**DANGER**
Risk of bursting in pressure equipment. Control valves and pipelines are pressure equipment. Improper opening can lead to bursting of the valve.
- Before starting any work on the control valve, depressurize all plant sections concerned as well as the valve.
- Drain the process medium from all the plant sections concerned as well as the valve.
- Wear personal protective equipment.

**WARNING**
Risk of personal injury due to residual process medium in the valve. While working on the valve, residual process medium can escape and, depending on its properties, may lead to personal injury, e.g. (chemical) burns. Wear protective clothing, safety gloves, and eyewear.

**WARNING**
Risk of burn injuries due to hot or cold components and pipeline. Valve components and the pipeline may become very hot or cold. Risk of burn injuries.
- Allow components and pipelines to cool down or heat up.
- Wear protective clothing and safety gloves.

9.1 Decommissioning
To decommission the regulator for service and repair work or disassembly, proceed as follows:
1. Close the shut-off valve on the upstream side of the valve.
2. Close the shut-off valve on the downstream side of the valve.
3. Completely drain the pipelines and valve.
4. Depressurize the plant. Shut off or disconnect the control line.
5. If necessary, allow the pipeline and device to cool down or heat up.
6. Remove the valve from the pipeline.

9.2 Disposal
➤ Observe local, national and international refuse regulations.
➤ Do not dispose of components, lubricants and hazardous substances together with your other household waste.
10 Annex

10.1 After-sales service

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

E-mail

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

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) or in all SAMSON product catalogs.

To assist diagnosis and in case of an unclear mounting situation, specify the following details (so far as possible). See section 2:

- Device type and nominal size
- Model number and configuration ID
- 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.)

10.2 Certificates

The declaration of conformity is provided on the next page.
SAMSON erklärt in alleiniger Verantwortung für folgende Produkte:
For the following products, SAMSON hereby declares

ventile für druck-, differenzdruck-, volumenstrom- und temperaturregler/valves for pressure, differential pressure, volume flow and temperature regulators

2333 (Erz.-Nr./Model No. 2333), 2334 (2334), 2335 (2335), 2336, 2373, 2375, 44-0B, 44-1B, 44-2, 44-3, 44-6B, 44-7, 44-8, 45-1, 45-2, 45-3, 45-4, 45-5, 45-6, 2468, 2478 (2720), 45-9, 46-5, 46-6, 46-7, 46-9, 47-1, 47-4, 47-5, 47-9, 2487, 2488, 2489, 2491, 2494, 2495 (2730), 2405, 2406, 2421 (2811), 2392, 2412 (2812), 2114 (2814), 2417 (2817), 2422 (2814), 2423 (2823)

die konformität mit nachfolgender Anforderung/the conformity with the following requirement.

richtlinie des europäischen parlaments und des rates zur harmonisierung der rechtsvorschriften
der Mitgliedstaaten über die bereitstellung von Druckgeräten auf dem markt.

directive of the european parliament and of the council on the harmonization of the laws of the
Member States relating to the making available on the market of pressure equipment.

angewandtes konformitätsbewertungsverfahren für fluide nach Art. 4(1)(c.ii) und (c.i) zweiter
gedankenstrich.

Conformity assessment procedure applied for fluids according to Article 4(1)(c.ii) and (c.i), second
indent

See table for module

| Druckstufe | DN | 15 | 20 | 25 | 32 | 40 | 50 | 65 | 80 | 100 | 125 | 150 | 180 | 200 | 250 | 300 | 400 |
|------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| PN 16      | ohne/without (1) | A | (2)(3)| H |
| PN 25      | ohne/without (1) | A | (2)(3)| H |
| PN 40      | ohne/without (1) | A | (2)(3)| H |
| PN 100 und PN 160 | ohne/without (1) | A | (2)(3)| H |
| Class 150  | ohne/without (1) | A | (2)(3)| H |
| Class 300  | ohne/without (1) | A | (2)(3)| H |
| Class 600 und Class 900 | ohne/without (1) | A | (2)(3)| H |

(1) Das auf dem Stellgerät aufgebrachte CE-Zeichen hat keine Gültigkeit im Sinne der Druckgerätierichtlinie.

The CE marking affixed to the control valve is not valid in the sense of the Pressure Equipment Directive.

(2) Das auf dem Stellgerät aufgebrachte CE-Zeichen gilt ohne Bezeichnung der benannten Stelle (Kenn-Nr. 0062).

The CE marking affixed to the control valve is valid without specifying the notified body (ID number 0062).

(3) Die Identifikationsnummer 0062 von Bureau Veritas S.A. gilt nicht für Modul A.

The identification number 0062 of Bureau Veritas S.A. is not valid for Modul A.

Geräte, denen laut Tabelle das Konformitätsbewertungsverfahren Modul H zugrunde liegt, beziehen sich auf die
„Zulassungsbescheinigung eines Qualitätssicherungssystems“ ausgestellt durch die benannte Stelle.

Devices whose conformity has been assessed based on Module H refer to the certificate of approval for the quality management system issued by the notified body.

Dem Entwurf zu Grunde gelegt sind Verfahren aus/The design is based on the procedures specified in the following standards:

DIN EN 12516-2, DIN EN 12516-3 bzw./or ASME B16.1, ASME B16.24, ASME B16.34, ASME B16.42

Das Qualitätssicherungssystem des Herstellers wird von folgender benannter Stelle überwacht:

The manufacturer's quality management system is monitored by the following notified body:

Bureau Veritas S.A. Nr./No. 0062, Newtime, 52 Boulevard du Parc, Ile de la Jatte, 92200 Neuilly sur Seine, France

Hersteller/Manufacturer: SAMSON AG, Weismüllerstraße 3, 60314 Frankfurt am Main, Germany

Frankfurt am Main, 08. Februar 2017/08 February 2017