**Self-operated Regulators**

# Type 46-5 N Differential Pressure and Flow Limiter

Type 46-5 N

## Mounting and Operating Instructions

## EB 3134 EN

Edition August 2015

**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*

# 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.

– 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.

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***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).*

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## 2 Process medium and scope of application

Differential pressure and flow limiter for local heat supplies and large heating networks · Flow rate set points from 0.1 to 1 m³/h · Differential pressure set points 0.2 bar, 0.3 bar or 0.5 bar · Nominal pressure PN 10 · Nominal size DN 15 · Suitable for treated water up to 110 °C and non-flammable gases up to 80 °C

The valve closes when the differential pressure exceeds the adjusted set point. The flow rate is limited.

## 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.

## 4 Design and principle of operation

*See Fig. 1 on page 6.*

The regulator basically consists of a valve body (1) with restriction (11), seat (2) and plug (3) as well as a closing actuator with an operating diaphragm (9).

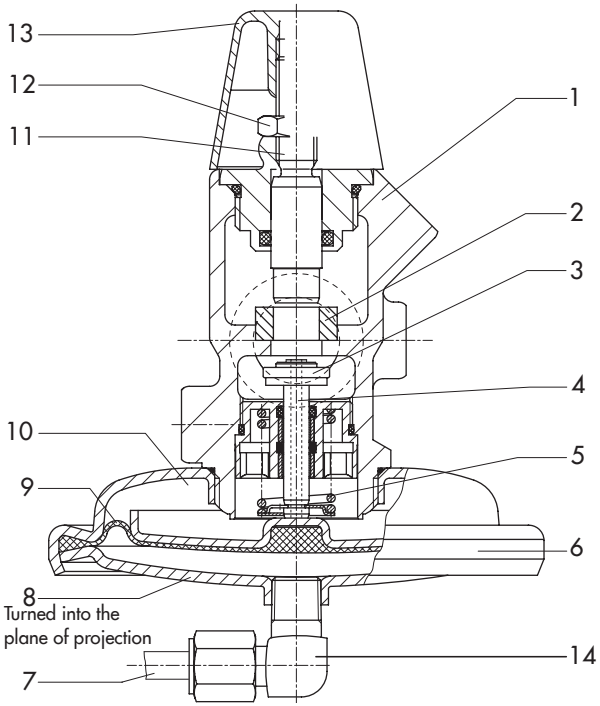
The regulator is designed to limit the differential pressure to a fixed value (0.2, 0.3 or 0.5 bar) and the flow rate to the adjusted set point in local heat supply networks and heating systems.

The medium flows through the valve in the direction indicated by the arrow on the valve body. The flow rate is determined by the area released by the valve plug (3) and the adjustable restriction (11).

The high pressure upstream of the restriction is transmitted to the high-pressure side of the actuator through the control line (7) attached on installing the regulator.

The low pressure downstream of the restriction acts on the low-pressure side (10) of the operating diaphragm (9) through a hole in the valve plug. The differential pressure generated at the restriction is converted into a positioning force by the operating diaphragm. If this force exceeds the force of the installed set point spring (5), the valve closes. In the same manner, the valve opens if the positioning force falls below the spring force.

The flow rate is restricted by turning the set point screw to change the flow cross-section at the restriction.




1 Valve body
2 Seat
3 Plug
4 Plug stem with hole
5 Set point spring
6 Actuator
7 High-pressure control line
8 High-pressure side
9 Operating diaphragm
10 Low-pressure side
11 Set point screw (restriction)
12 Lock nut
13 Cap
14 Angular screw joint

**Fig. 1:** *Functional diagram of Type 46-5 N*

# 5 Installation

## 5.1 Mounting position

*See Fig. 1 on page 6.*

The regulators are installed in the low-pressure line. This line is always the return flow pipe in local heat networks.

**Standard installation** · Install the regulators in horizontal pipelines with the actuator facing down.

The following generally applies:

– 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 1 NI) 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. Use the supplied angular screw joint to connect it to the regulator (see section 5.5).

***NOTICE***

*Incorrectly installed regulator*

*The regulator can be damaged. Make sure the regulator is installed free of stress. Observe permissible mounting position.*

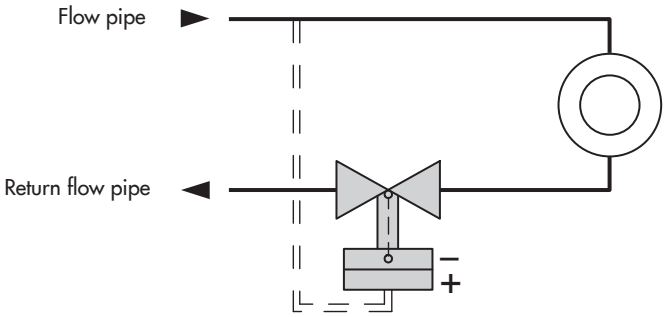



**Fig. 2:** *Sample application (schematic)*

## 5.2 Strainer (filter)

A strainer installed upstream in the flow pipe holds back any dirt or other foreign particles. 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 body.
– The filter element must be installed to hang downwards.
– 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. 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 at a suitable point to monitor the pressures prevailing in the plant.

## 5.5 Control line

A control line with 6 mm pipe diameter must be adapted and mounted on site. Route the control line as indicated in Fig. 2.

An angular screw joint (14) for connecting the control line to the actuator (6) is supplied with the regulator.

➔ To mount the control line, screw the screw joint clockwise (↻) into the intended hole on the high-pressure side (8) and align it.

***Note:***
*Do not turn the screw joint back again. Otherwise, the connection may start to leak.*

# 6 Operation

*See Fig. 1 on page 6.*

## 6.1 Start-up

➔ First start up the regulator after mounting all parts.

➔ Make sure the control line is open and correctly connected.

➔ Open all the consumers in the plant (minimum drag in the plant) to achieve maximum flow rate.

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***Note:***
*On filling the plant, make sure the restriction is open by turning the set point screw (11) counterclockwise (↺) as far as it will go.*

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**Rinsing the plant** · After filling the plant, first completely open the consumers. Set the maximum flow cross-section (by turning the set point screw counterclockwise (↺) as far as it will go). Rinse out the pipeline at full flow rate for several minutes. Check the installed strainer (e.g. by measuring the pressure drop). Clean the strainer, if necessary.

## 6.2 Adjusting the set point

If a bypass is installed in the plant, it must be closed.

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***Note:***
*Set point adjustment is always based on a closed restriction (11).*

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1. Unscrew the cap (13).
2. Undo the lock nut (12) and turn the set point screw (11) using a 4 mm Allen key.

➔ Turn clockwise ↻:
The restriction closes. The flow rate drops.

➔ Turn counterclockwise ↺:
The restriction opens. The flow rate rises.

Use the diagram in Fig. 3 as a guide for adjustment.

3. After adjustment, screw tight the lock nut and screw back on the cap (13).

## 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.

## 6.4 Sample application

Adjusting the flow limitation (medium: water) when the pressure loss across the plant is known.

*Note:*
*Set point adjustment is always based on a closed restriction (11).*

**Known:**

- A **Type 46-5 N, $K_{VS}$ = 1.0**, flow rate range from **0.12** to **0.5 m³/h** is to be used to limit the flow rate in the plant to **0.3 m³/h**.
- The pressure drop across the plant ($\Delta p_{plant}$) is **0.15 bar**.
- The differential pressure set point is **0.3 bar.**
- Determine the adjustment values using the adjustment diagram in Fig. 3.

**To be determined:**

How many turns of the set point screw are necessary to limit the flow rate?

**Solution:**

Sequence: points **A** to **E** in diagram (Fig. 3).

The calculation is based on the pressure drop Δp in the plant, therefore, this value must be known.

**Δp = 0.15 bar** is specified in the example and corresponds with **point A** in the diagram. The differential pressure at the restriction ($\Delta p_{restriction}$) assumed to be **0.15** bar in the example, must be added up to the line of the differential pressure set point of 0.3 bar.

A line representing this value is drawn from **A** across to the right and results in **point B**.

A vertical line is drawn from **point B** until it reaches the limiting curve for the flow rate (in the example, it is 0.3 m³/h). This is **point C**.

The horizontal line is drawn from **point C** across to the curve relevant for $K_{VS}$ = 1.0; this is **point D**.

When a line is drawn vertically upwards from **point D**, this results in **point E** which indicates how many turns of the set point screw are required.

The example shows that around **4 turns** are required.

Based on a closed restriction, turn the set point screw (11) approximately four turns counterclockwise ↺ to open the restriction.

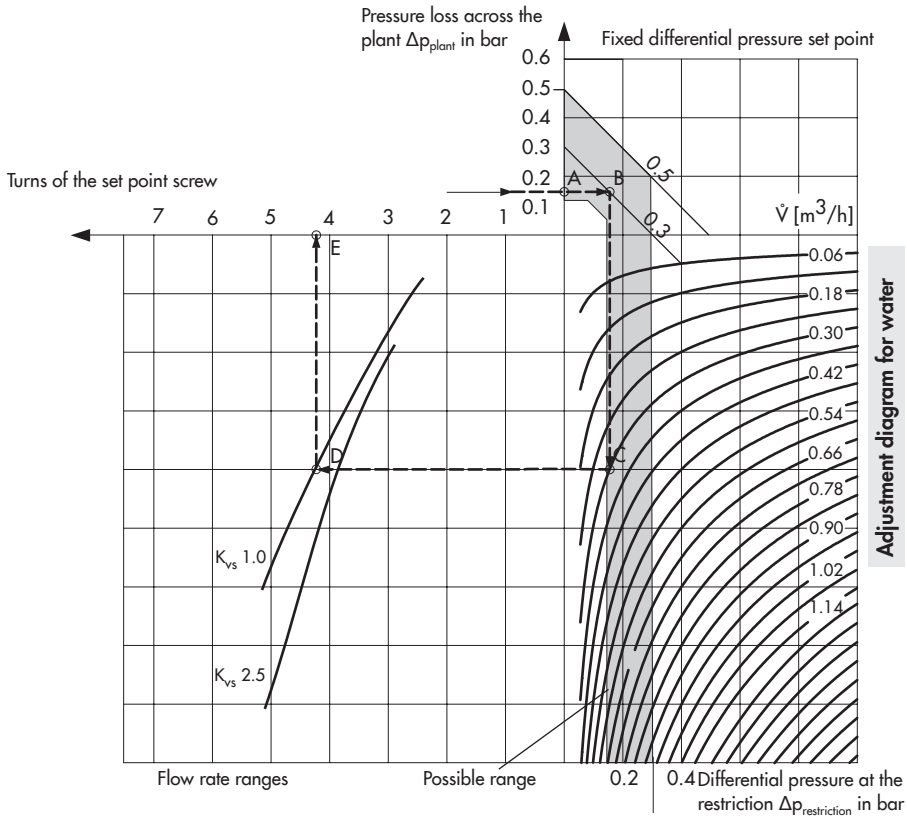



**Fig. 3:** *Adjustment diagram for flow limitation*

# 7 Maintenance and troubleshooting

The regulator does not require any maintenance. Nevertheless, it is subject to natural wear, particularly at the seat, plug and operating diaphragm.

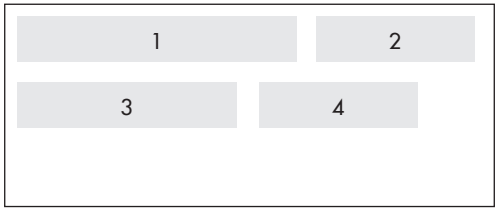
If the flow rates deviates considerably from the set point, first check the control line for blockage. Furthermore, the seat and plug may leak due to dirt particles or natural wear. Therefore, check the regulator and replace it, if necessary.

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

The SAMSON After-sales Service department provides support for maintenance and inspection work (see section 9).

***WARNING!***
*Before performing any work on the regulator, make sure the relevant plant section has been depressurized and, depending on the process medium, drained as well. We recommend removing the valve from the pipeline. When used at high temperatures, allow the plant section to cool down to ambient temperature.*
*Disconnect or shut off the control line to prevent the risk of moving regulator parts. As valves are not free of cavities, remember that residual process medium might still be contained in the valve.*

# 8 Nameplate




1 Configuration ID (Var.-ID)
2 Type designation
3 Model number
4 Date of manufacture

In the other fields:
$K_{VS}$ or $C_V$ coefficient
Max. permissible temperature in °C or °F
Differential pressure set point range in bar or psi
Flow rate set point range in $m^3/h$
Max. perm. differential pressure Δp
Nominal pressure PN or ANSI Class

**Fig. 4:** *Nameplate*

# 9 Service

Contact SAMSON's After-sales Service department for support concerning maintenance or repair work or when malfunctions or defects arise.
**E-mail:** aftersalesservice@samson.de

**Addresses of SAMSON AG and its subsidiaries**

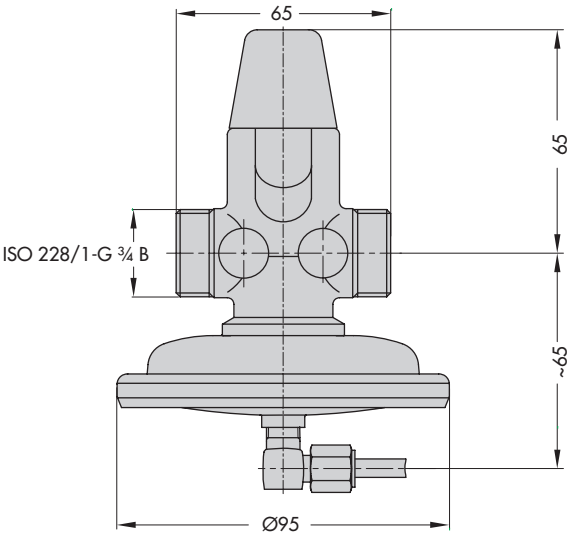
The addresses of SAMSON AG, its subsidiaries, representatives and service facilities worldwide can be found on the SAMSON website (▶ www.samson.de) in all SAMSON product catalogs or on the back of these Mounting and Operating Instructions.

To assist diagnosis and in case of an unclear mounting situation, specify the following details:

- Device type and nominal size
- Model number or configuration ID (Var.-ID) on the nameplate
- Upstream and downstream pressure
- Temperature and process medium
- Min. and max. flow rate in $m^3/h$
- 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.)

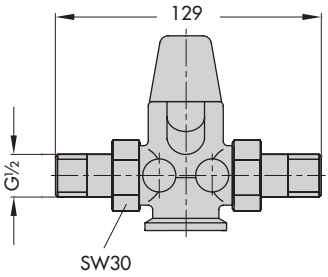
***Note:***
***Conversion from chromate coating to iridescent passivation***
*We at SAMSON are converting the surface treatment of passivated steel parts in our production. As a result, you may receive a device assembled from parts that have been subjected to different surface treatment methods. This means that the surfaces of some parts show different reflections. Parts can have an iridescent yellow or silver color. This has no effect on corrosion protection.*
*For further information go to ▶ www.samson.de/chrome-en.html*

# 10 Dimensions and weights

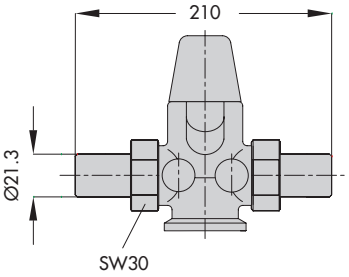



**Type 46-5 N**

Weight without accessories, approx. 0.85 kg




With threaded ends




With welding ends

**Fig. 5:** *Dimensional drawings*

# 11 Technical data

| Nominal size | DN 15 |
|---|---|
| Connection | ISO 228/1-G ¾ B |
| Type of connection | Threaded ends G ½ · Welding ends |
| $K_{VS}$ coefficient<br>Standard version<br>Special version | <br>2.5<br>1.0 |
| Nominal pressure | PN 10 |
| Max. perm. differential pressure Δp | 4 bar |
| Max. permissible temperature<br>Treated water<br>Non-flammable gases | <br>110 °C<br>80 °C |
| $x_{FZ}$ value | 0.43 |
| Flow rate set point range for water with a differential pressure at restriction of 0.2 bar<br>Standard version<br>Special version | <br>0.2 to 1 m³/h<br>0.12 to 0.5 m³/h |
| Differential pressure set point [1], optionally | 0.2 · 0.3 · 0.5 bar |
| Compliance | CE · EAC |

[1] To achieve the maximum flow rate, the differential pressure set point must be at least 0.2 bar higher than that of the plant.

**Pressure conditions in the plant and at the regulator**

On selecting the differential pressure set point $\Delta p_{set\ point}$, note that the differential pressure set point results from the known pressure drop across the fully open plant and the differential pressure created at the restriction.

$$\Delta p_{set\ point} = \Delta p_{plant} + \Delta p_{restriction}$$

To achieve the maximum flow rate, the differential pressure set point must be at least 0.2 bar higher than that of the plant. If the differential pressure set point is only 0.1 bar higher than the pressure drop across the fully open plant, the maximum flow rate is reduced to 0.7 m³/h. The minimum required differential pressure $\Delta p_{min}$ across the valve is calculated as follows:

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

| | |
|---|---|
| $\Delta p_{min}$ | Minimum differential pressure between flow and return pipes in bar |
| $\Delta p_{restriction}$ | Differential pressure created at restriction for measuring the flow rate |
| $\Delta p_{set\ point}$ | Differential pressure set point in bar |
| $\Delta p_{plant}$ | Differential pressure (pressure loss) when the plant is completely open in bar |
| $\dot{V}$ | Adjusted flow rate in m³/h |
| $K_{VS}$ | Valve flow coefficient in m³/h |

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