MOUNTING AND
OPERATING INSTRUCTIONS

EB 3130 EN

Translation of original instructions

Type 46-5

Type 46-6

Type 46-5 and Type 46-6 Differential Pressure Regulators with Flow Limitation

Self-operated Regulators

Edition July 2021

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

Note
Additional information

Tip
Recommended action

1 Safety instructions and measures

Intended use

The Type 46-5 and Type 46-6 Regulators are designed to control the differential pressure and limit the flow rate. The regulators are 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 operating conditions 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.

Personal protective equipment

We recommend checking the hazards posed by the process medium being used (e.g. ▶ GESTIS (CLP) hazardous substance database).

➔ Provide protective equipment (e.g. safety gloves, eye protection) appropriate for the process medium used.

➔ 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 of 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 device 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.

We also recommend checking the hazards posed by the process medium being used (e.g. ▶ GESTIS (CLP) hazardous substance database).

➔ Observe safety measures for handling the device as well as fire prevention and explosion protection measures.

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 specified hazard statements, warnings and caution notes. 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 an EU declaration of conformity, which includes information about the applied conformity assessment procedure. This EU declaration of conformity is included in the Annex of these instructions (see section 10.2).

According to the ignition risk assessment performed in accordance with EN 13463-1:2009, section 5.2, the non-electrical regulators do not have their own potential ignition source even in the rare incident of an operating fault. As a result, they 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.

Regulators 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 regulator.
- ➔ Drain the process medium from all the plant sections concerned as well as the regulator.
- ➔ 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.

Risk of personal injury due to residual process medium in the regulator.

While working on the regulator, 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 regulator.

➔ Wear protective clothing, safety gloves and eyewear.

Risk of burn injuries due to hot or cold components and pipelines.

Depending on the process medium, regulator 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-en.html.

1.3 Notes on possible property damage

NOTICE

Risk of regulator 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 regulator and plant.

Risk of regulator damage due to unsuitable medium properties.

The regulator is designed for process media with defined properties.

➔ Only use process media specified for sizing the valve.

Risk of regulator damage due to excessively high or low tightening torques.

Observe the specified torques on tightening regulator components. Excessively tightened torques lead to parts wearing out quicker. Parts that are too loose may cause leakage.

➔ Observe the tightening torques specified in section 7.3.

Incorrect control due to the formation of ice on the regulator.

Medium temperatures below 0 °C may cause ice to form on the regulator, depending on the air humidity. This may affect, in particular, the functioning of the actuator stem guide or set point adjuster.

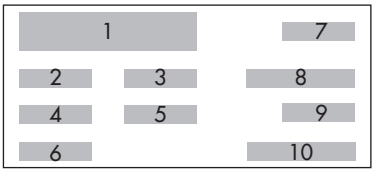
➔ Prevent the formation of ice by taking appropriate precautions (e.g. enclosure, trace heater, etc.). The plant operator is responsible for selecting and implementing appropriate precautions.

Regulator damage due to condensed glycol.

In principle, the materials are also resistant to high concentrations of glycol. Nevertheless, glycol reacts when it comes into contact with metals and causes acids to form. We cannot prevent this reaction.

➔ Use suitable inhibitors. The plant operator is responsible for selecting and using suitable inhibitors.

2 Markings on the device



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 m^3/h or gal/min
9 Maximum permissible temperature in °C or °F
10 Max. permissible differential pressure Δp in bar or psi

Fig. 1: *Nameplate*

2.1 Material number

Specifying the configuration ID, you can contact us to find out which material is used. The configuration ID is specified on the nameplate (1, configuration ID). For more details on the nameplate, see Fig. 1.

3 Design and principle of operation

The combined regulators basically consist of a valve body (1) with restriction (1.2) and balanced plug (3) as well as a closing actuator (6) with an operating diaphragm (6.1). In Type 46-5, the set point springs (8) integrated into the valve determine the set point. Whereas, in Type 46-6, the set point can be adjusted by the set point springs (8) on the actuator.

The regulators are used to limit the differential pressure and flow rate to the adjusted set points. The valve closes when the differential pressure (flow rate) increases.

The medium flows through the valve in the direction indicated by the arrow. The areas released by the restriction (1.2) and the valve plug (3) determine the flow rate and the differential pressure Δp. The upstream pressure is transmitted to the operating diaphragm (6.1) in the actuator over an externally routed control line (11). The pressure downstream of the restriction (1.2) is transmitted through a hole in the plug to the low-pressure side of the operating diaphragm. The resulting differential pressure creates a positioning force at the diaphragm which moves the plug depending on the force of the valve spring (5) or set point springs (8). The maximum flow rate (flow limitation) is adjusted at the restriction (1.2) using the set point screw (17). The cross-section of the valve is changed in such a way that the differential pressure and the differential pressure created at the restriction are identical when the required maximum flow rate exists. An overload protection (excess pressure limiter) (6.4) in the actuator protects the seat and plug from overload during exceptional operating conditions that could lead to valve or plant damage.

Legend for Fig. 2

1	Valve body
1.1	Connection nut with seal and welding end
1.2	Restriction
2	Seat
3	Plug
4	Plug stem
5	Valve spring
6	Actuator
6.1	Operating diaphragm
6.2	Actuator stem
6.3	Nut
6.4	Internal excess pressure limiter (overload protection)
8	Set point springs
9	Spring plate
10	Set point adjuster for differential pressure
11	Control line (high pressure)
14	Bottom section with manual adjuster
15	Screws
16	Lock nut
17	Set point screw for flow rate (hexagon socket screw SW 4)
18	Cap
19	Manual adjuster
20	Spindle
21	Support
25	Stopper for plug

x = Turned into the plane of projection

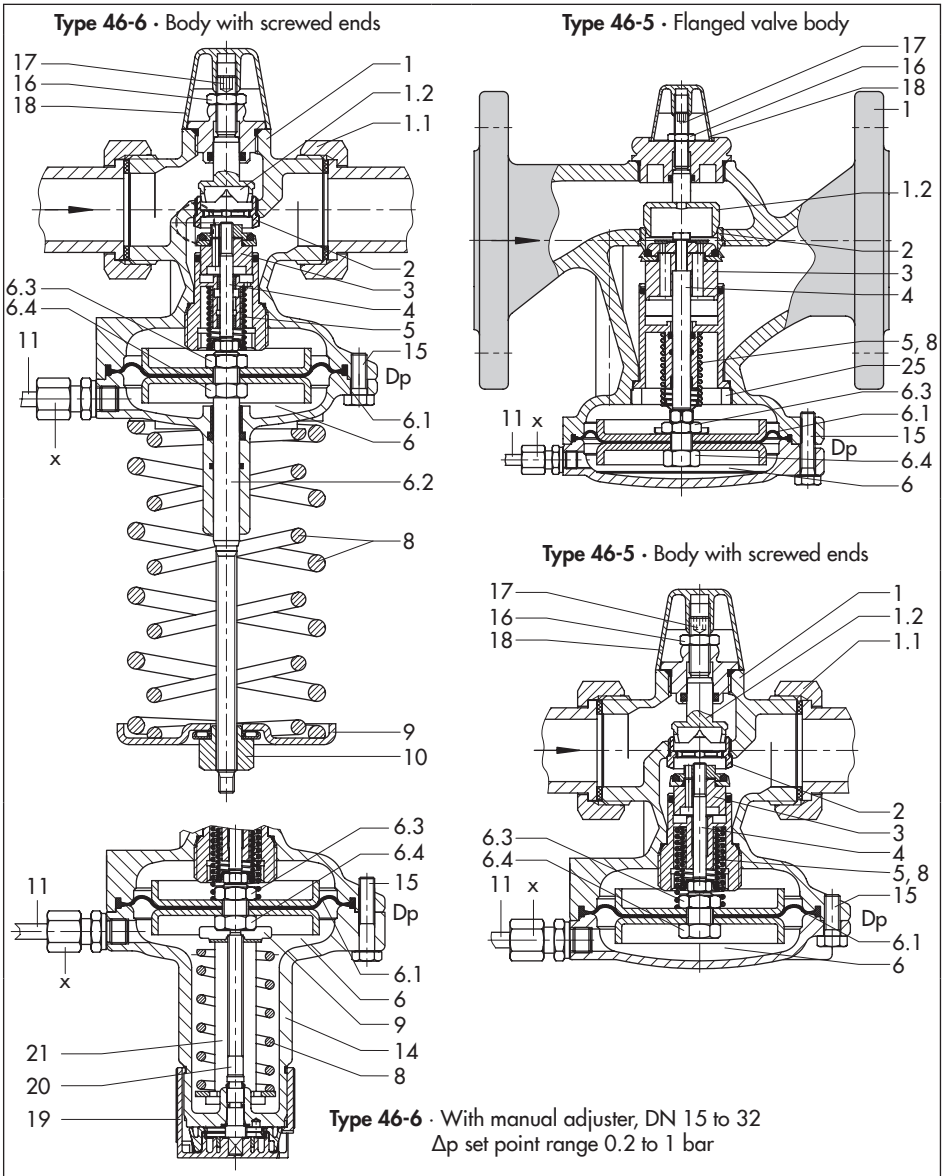


Fig. 2: *Functional diagram of Type 46-5 and Type 46-6 with body with flanges and screwed ends*

3.1 Versions

Type 46-5 and Type 46-6 Differential Pressure Regulators with Flow Limitation are designed for installation in the return flow pipe, e.g. a district heating station with indirect connection.

– **Type 46-5** · With fixed differential pressure control and adjustable flow rate · With internal overload protection (excess pressure limiter) in the actuator
– **Type 46-6** · With adjustable differential pressure control and flow limitation · With internal overload protection (excess pressure limiter) in the actuator

3.2 Mounting parts

See Table 1.

3.3 Technical data

3.3.1 Process medium and scope of application

Differential pressure control and flow rate limitation for district heating systems with indirect connection, extended piping systems and industrial applications · DN 15 to 50 · PN 16/25
Suitable for liquids [1] up to 150 °C and gases up to 80 °C
The valve closes when the differential pressure rises. The flow rate is limited.

[1] The materials used in the regulator are also resistant to high concentrations of glycol. Nevertheless, glycol reacts when it comes into contact with metals and causes acids to form. We cannot prevent this reaction. Therefore, prevent it by using suitable inhibitors.

Dimensions in mm · Weights in kg

The lengths and heights in the dimensional drawing are shown in page 17.

Table 1: *Connecting parts*

Valve size	DN 15	DN 20	DN 25	DN 32	DN 40	DN 50
Welding ends [1]	1400-6500	1400-6501	1400-6502	1400-6509	1400-6510	1400-6511
Threaded ends [1]	1400-6503	1400-6504	1400-6505	1400-6512	1400-6513	1400-6514
Gasket	8413-3000	8413-3001	8413-3002	8413-3003	8413-3004	8413-3005

[1] Pair including gaskets

Table 2: *Technical data*

Valve size	DN 15	DN 20	DN 25	DN 32 [1]	DN 40 [1]	DN 50 [1]
K_{VS} coefficient	2.5	6.3	8	12.5	16	20
Special version	0.4 · 1 · 4	–				
Flanged body	–			12.5	20	25
x_{FZ} value (standard)	0.6		0.55		0.5	0.45
Flanged body	–			0.45	0.45	0.4
Nominal pressure	PN 16 · PN 25			PN 25		
Max. permissible differential pressure Δp across the valve	10 [2] bar · 20 bar				16 bar	
Max. permissible temperature	For liquids 130 °C [2]/150 °C · For air and non-flammable gases 80 °C					
Pressure above adjusted differential pressure at which internal excess pressure limiter responds	0.5 bar					
Compliance	CE · EAC					
Differential pressure set point ranges						
Type 46-6 · Continuously adjustable set point	0.2 to 1 · 0.5 to 2 bar					
Type 46-5 · Fixed set point	0.2, 0.3, 0.4 or 0.5 bar					

[1] Additional version: valve with flanged body made of spheroidal graphite iron (EN-GJS-400-18-LT)
[2] For PN 16 version

Table 3: *Flow rate set points for water in m³/h*

Δp_{set} point	Δp_{plant}	$\Delta p_{restriction}$	DN ...	15				20	25	32	40 [1]	50 [1]
			K_{VS}	0.4	1	2.5	4	6.3	8	12.5	16/20 [2]	20/25 [2]
0.2 bar	0.1 bar	0.1 bar	$\dot{V}$ Max.	0.14	0.45	0.85	1.8	2.6	3.0	7.1	8.9	10.7
			Min.	0.01	0.12	0.2	0.5	0.8	0.8	2	3	4
0.5 bar	0.3 bar	0.2 bar	$\dot{V}$ Max.	0.2	0.65	1.2	2.5	3.6	4.2	10	12.5	14.1 [2]
				–	–	–	1.3 [2]	2.3 [2]	3.5 [2]	5.8 [2]	9.1 [2]	14.1 [2]

[1] Additional version: valve with flanged body made of spheroidal graphite iron (EN-GJS-400-18-LT)
[2] An increase in noise level can be expected when the specified flow rates are exceeded, even if cavitation does not occur.

Table 4: *Regulator **with** connecting parts · Dimensions in mm and weights in kg*

Valve size		DN 15	DN 20	DN 25	DN 32	DN 40	DN 50
With welding ends							
L1		210	234	244	268	294	330
Weight, approx. kg	46-5	1.6	1.7	1.8	3	5.5	6
	46-6	2.0	2.1	2.2	3.2	10	10.5
With threaded ends							
L2		129	144	159	192	206	228
Male thread A		G ½	G ¾	G 1	G 1¼	G 1½	G 2
Weight, approx. kg	46-5	1.6	1.7	1.8	3	5.5	6
	46-6	2.0	2.1	2.2	3.2	10	10.5
With flanges [1] [2] or with flanged body (DN 32 to 50)							
L3		130	150	160	180	200	230
Weight, approx. kg	46-5	3.0	3.7	4.3	6.2	9.5	11
	46-6	3.4	4.1	4.7	6.4	14	15.5

1) PN 16/25
2) Flanges are already mounted on valves in DN 40 and 50.

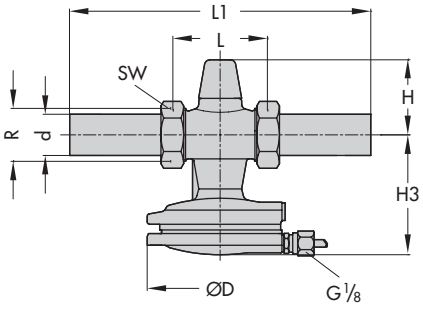
The dimensions and weights of valves with flanged bodies (DN 32, 40 and 50) are the same as valves with screwed-on flanges.

Table 5: *Regulators **without** connecting parts · Dimensions in mm*

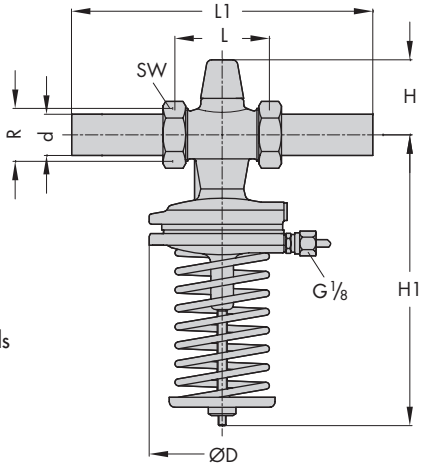
Valve size	DN 15	DN 20	DN 25	DN 32 [1]	DN 40 [1]	DN 50 [1]
Pipe Ø d	21.3	26.8	32.7	42	48	60
Width across flats SW	30	36	46	59	65	82
L	65	70	75	100	110	130
H	65			85		
H1	230			250	380	
H2	160			180	-	
H3	85			105	140	
ØD	116				160	

1) Additional version: valve with flanged body

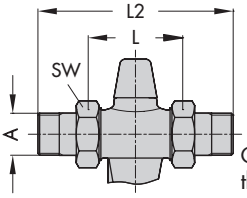
Dimensional drawings



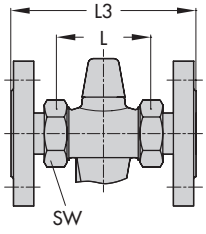
Type 46-5 · Connection nuts with welding ends



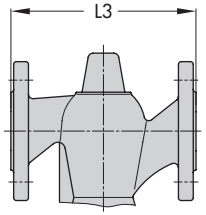
Type 46-6 · Connection nuts with welding ends



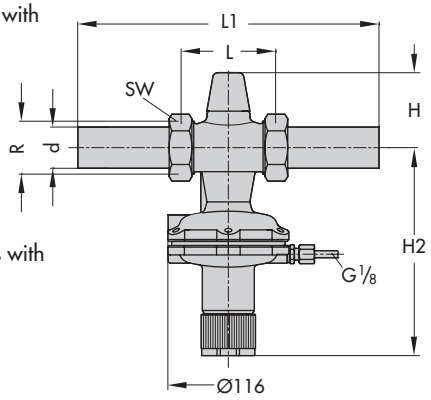
Connection nuts with threaded ends



Connection nuts with flanges



With flanged body (DN 32, 40 and 50)



Type 46-6 · With manual adjuster, DN 15 to 32, set point range 0.2 to 1 bar

Fig. 3: *Dimensional drawings*

4 Measures for preparation

After receiving the shipment, proceed as follows:

1. Check the scope of delivery. Compare the shipment received with 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

Note

Do not remove the packaging until immediately before installation.

Proceed as follows to lift and install the device:

1. Remove the packaging from the device.
2. Dispose of the packaging in accordance with the valid regulations.

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 3.3).

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 3.3).
- Do not place any objects on the device.

Special storage instructions for elastomers

Elastomer, e.g. diaphragm

- 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 regulator to make sure it is clean.

➔ Check the regulator for damage.

➔ Check to make sure that the type designation, valve size, material, pressure rating and temperature range of the regulator 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 actuator (6) facing downward (see Fig. 2).

The regulator in nominal sizes DN 15 to 25 can also be installed in vertical pipes.

Installation conditions

– Make sure that the regulator remains freely accessible after the 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 (see Fig. 6)

– Install the regulator free of stress.

NOTICE

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

– Do not install the device 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.

– In district heating plants, only install the regulators in return flow pipes.

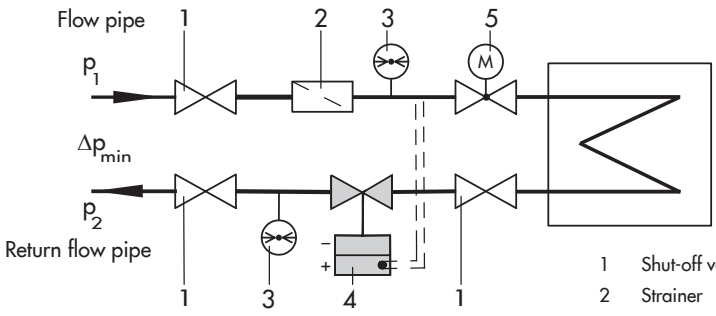


Fig. 4: *Sample application*

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).

– Do not use the strainer to permanently filter the process medium.
– Install the strainer upstream of the regulator.
– The direction of flow must correspond to the arrow on the valve body.
– The filter element must be installed to hang downward.
– Allow sufficient space to remove the filter.

Shut-off valves

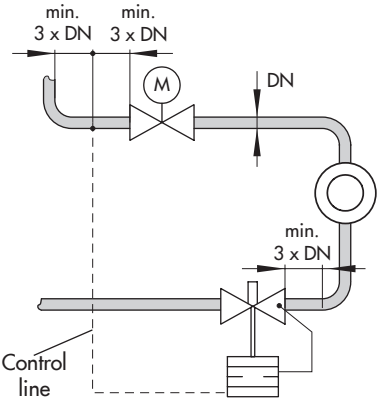
Install a hand-operated shut-off valve both upstream of the strainer and at the outlet of the return flow pipe (see Fig. 4). This allows the plant to be shut down for cleaning and maintenance, and when the plant is not used for longer periods of time.

Pressure gauge

Install a pressure gauge at a suitable point to monitor the pressures prevailing in the plant (see Fig. 4).

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.



DN = Nominal size

Fig. 5: *Control line connection, depending on how the pipeline is routed*

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 with an eccentric reducer.

➔ Refer to installation schematics (Fig. 4) for line routing.

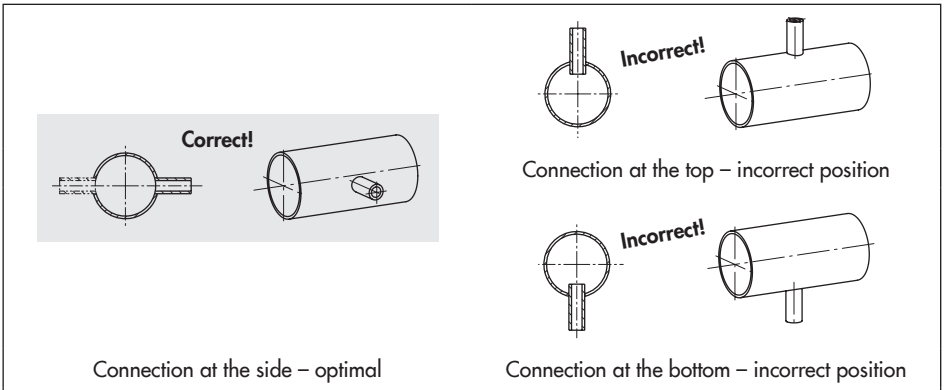


Fig. 6: *Control line connection, depending on how the pipeline is routed*

5.3 Start-up

➔ First start up the regulator after mounting all parts.

➔ Make sure the control lines are open and correctly connected.

➔ Make sure that the restriction (1.2) is open while filling the plant. Turn the set point screw (17) counterclockwise (↺) as far as it will go.

➔ Starting on the upstream side, open the shut-off valves slowly over a time period of several minutes. Afterwards, open all the valves downstream of the regulator.

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.

Pressure testing the plant

All plant components must be designed for the test pressure. Remove the regulator from the pipeline, if necessary.

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 6.1.2).
3. Adjust the maximum differential pressure at the regulator (see section 6.1.1).
4. Rinse out the pipeline at full flow rate for several minutes.

5. Check the strainer (e.g. measure the pressure drop) and clean it, if necessary.

6 Operation

6.1 Adjusting the set points

The following generally applies: First adjust the differential pressure set point and the flow limitation afterwards.

6.1.1 Adjusting the differential pressure

Type 46-6 · Adjust the desired differential pressure at the set point adjuster (10) or manual adjuster (19) with the plant almost shut and with the restriction (1.2) fully open. First afterwards adjust the limit value for the flow rate.

i ***Note***

Using the set point adjuster (10) or manual adjuster (19)
– Turn clockwise ↻:
Tension the springs to increase the set point.
– Turn counterclockwise ↺:
Relieve the spring tension to reduce the set point.

How to proceed:

1. Close the motorized valve.
2. Unscrew the cap (18) and undo the lock nut (16).
3. Open the restriction (1.2) so that the flow restriction does not take effect by turning the set point screw (17) counterclockwise (↺) as far as it will go.
4. Slightly open the motorized valve (approx. 10 % valve travel).
5. Adjust the differential pressure by turning the set point adjuster (10) or manual adjuster (19) to load the set point springs (8).

For regulators in sizes DN 15 to 32 with set point range from 0.2 to 1 bar, the set point spring is installed in the bottom section of the valve body.

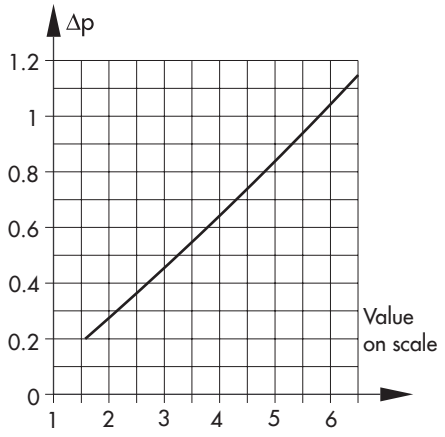


Fig. 7: *Differential pressure set point adjusted at the manual adjuster according to the value on the scale*

In this case, the set point can be directly adjusted at the manual adjuster (19) according to the scale.

One turn of the manual adjuster will change the differential pressure by 0.033 bar.

NOTICE

Do not adjust the set point to a value on the scale lower than 1. Under unfavorable conditions, the set point cannot be adjusted anymore as a result. In this case, the following action is recommended:

– Relieve the regulator of pressure.
– Turn the manual adjuster counterclockwise ↺ as far as it will go to its lowest position.
– Turn the manual adjuster back clockwise ↻ at least past the value '1' to '2' on the scale.
– The set point can be adjusted again.

6.1.2 Adjusting the flow limitation

NOTICE

Set point adjustment is always based on a closed restriction (1.2).

How to proceed:

1. To achieve the maximum flow rate, all control and shut-off valves as well as all consumers including the motorized valve must be open (to ensure minimum drag in the plant).
2. Close the bypass valve, if installed.
3. Unscrew the cap (18).
4. Undo the lock nut (16) and adjust the set point screw (17, hexagon socket screw SW 4):

   Turning it clockwise (↻) closes the restriction; the flow rate drops.

   Turning it counterclockwise (↺) opens the restriction; the flow rate rises.

6.1.3 Based on a known plant pressure drop

To adjust the flow rate limit when the pressure drop of the plant is known, use the adjustment diagrams for water (Fig. 9, Fig. 10 and Fig. 11).

How to proceed:

1. Unscrew the cap (18).
2. Undo lock nut (16) and turn the set point screw (17) clockwise as far as it will go to close the restriction.
3. Adjust the flow rate according to the value determined (number of turns in counterclockwise direction ↺).
4. Secure restriction setting using the lock nut (16) at the set point screw (17). Screw cap (18) back on.
5. Lead-seal the set point setting at set point screw (17) and cap (18).

For special versions with a scaled cap, the limit value can be adjusted directly. One scale division corresponds to one turn of the set point screw (17).

NOTICE

To determine the flow limitation to be adjusted and for Type 46-6 additionally the differential pressure required, the differential pressure across the restriction ($\Delta p_{restriction}$) must be added to the known pressure drop of the plant (Δp_{plant}). From experience, the differential pressure at the restriction is assumed to be 0.2 bar.
The curves of the flow ranges in the following diagrams (Fig. 9, Fig. 10 and Fig. 11) apply to 0.2 and 0.4 bar.

6.1.4 Based on an unknown plant pressure drop

How to proceed:

1. Unscrew the cap (18).
2. Undo lock nut (16) and turn the set point screw (17) clockwise ↻ to close the restriction.
3. Completely open the motorized valve.
4. Open the restriction initially one turn at a time. Check the flow rate at the heat meter (reading of flow measuring unit). Adjust the flow rate in smaller steps until the required flow rate is constant (2 % deviations are generally acceptable).

   If the maximum flow rate is not reached, the differential pressure set point (in Type 46-6) must be increased.
5. After reaching the required flow rate, secure the restriction setting using the lock nut (16). Screw cap (18) back on.
6. Lead-seal the set point setting at set point screw (17) and cap (18).

6.2 Pressure conditions in the plant and at the regulator

On selecting the differential pressure set point or set point range, 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.

The flow rate set points for water at a differential pressure at the restriction $\Delta p_{restriction}$ of 0.1 and 0.2 bar are specified in Table 3.

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

The minimum required differential pressure Δp_{min} across the valve is calculated as follows:

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

Δp_{min}	Minimum differential pressure across the valve in bar
$\Delta p_{restriction}$	Differential pressure created at the restriction for measuring the flow rate
$\Delta p_{set\ point}$	Differential pressure set point in bar
Δp_{plant}	Differential pressure (pressure loss) when the plant is completely open in bar
$\dot{V}$	Adjusted flow rate in m^3/h
K_{VS}	Valve flow coefficient in m^3/h

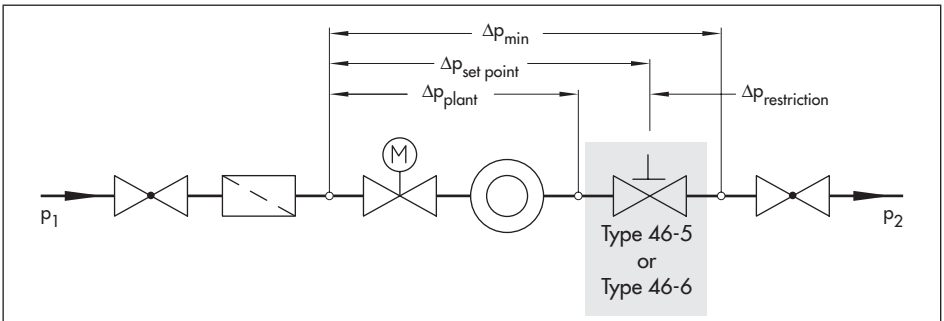


Fig. 8: *Pressure conditions in the plant*

6.3 Sample application

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

Known:

- **Type 46-6, DN 15, K_{VS} = 1**
  The regulator is to limit the flow rate in the plant to **0.63 m³/h**.
- The pressure drop across the plant (Δp_{plant}) is **0.4 bar**.
- Determine the adjustment values using the adjustment diagram Fig. 9 on page 28.

To be determined:

What is the limit value of the differential pressure set point and how many turns of the set point screw are necessary?

Solution:

Sequence: points **A** to **E** in diagram (Fig. 9).

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

Δp = 0.4 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 **0.2** bar in the example, must be added.

A line representing this value is drawn from **A** across to the right and results in **point B**. Point B is situated on the same straight line for the differential pressure Δp = 0.6 bar.

Differential pressure to be set: **Δp = 0.6 bar.**

A vertical line is drawn from **point B** until it reaches the limiting curve for the flow rate (in the example, it is 0.63 m³/h). This is **point C**.

The horizontal line is drawn from **point C** across to the curve relevant for the nominal size (DN) or K_{VS} coefficient used; 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 6 turns are required.

Based on a closed restriction, turn the set point screw (17) six turns counterclockwise ↺ to open the restriction.

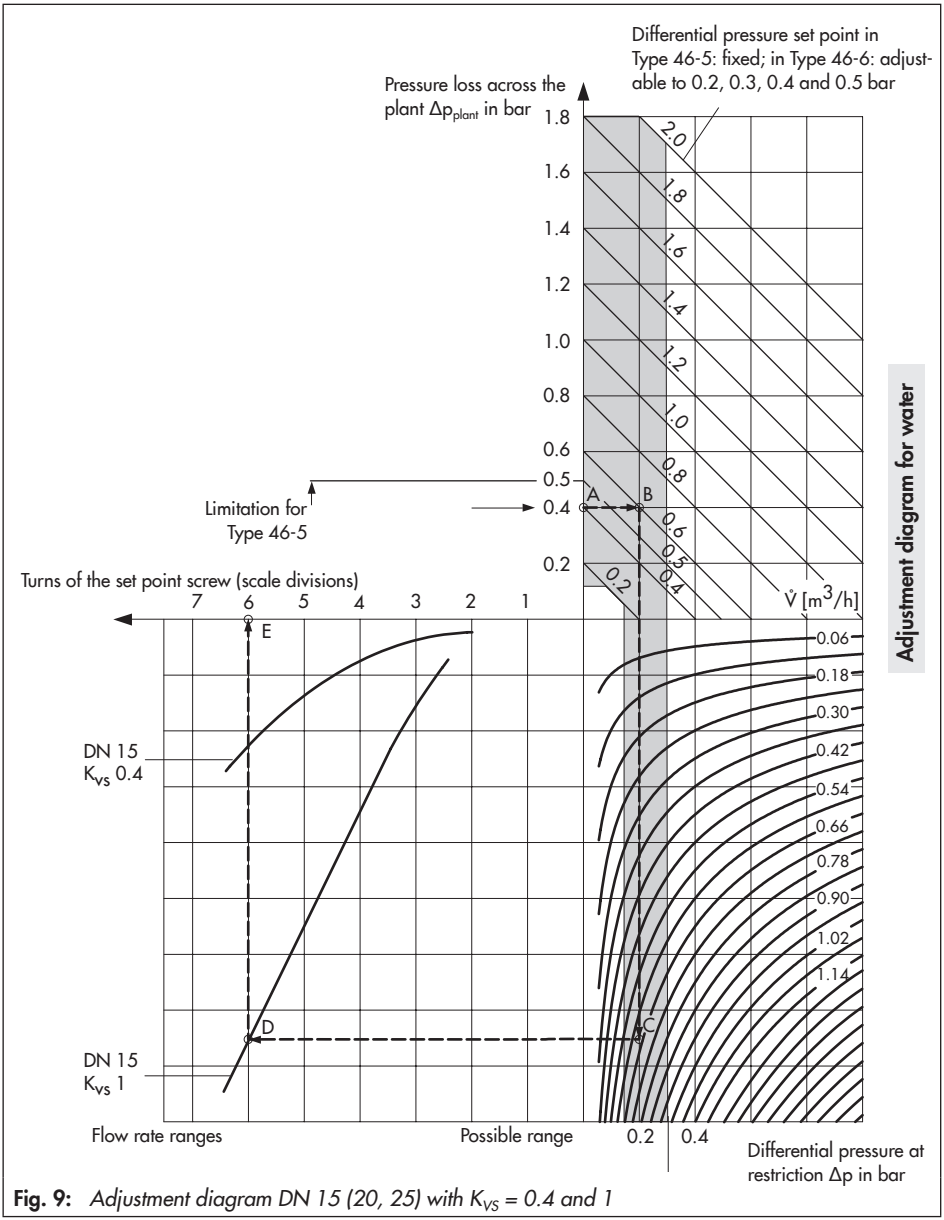


Fig. 9: *Adjustment diagram DN 15 (20, 25) with K_{VS} = 0.4 and 1*

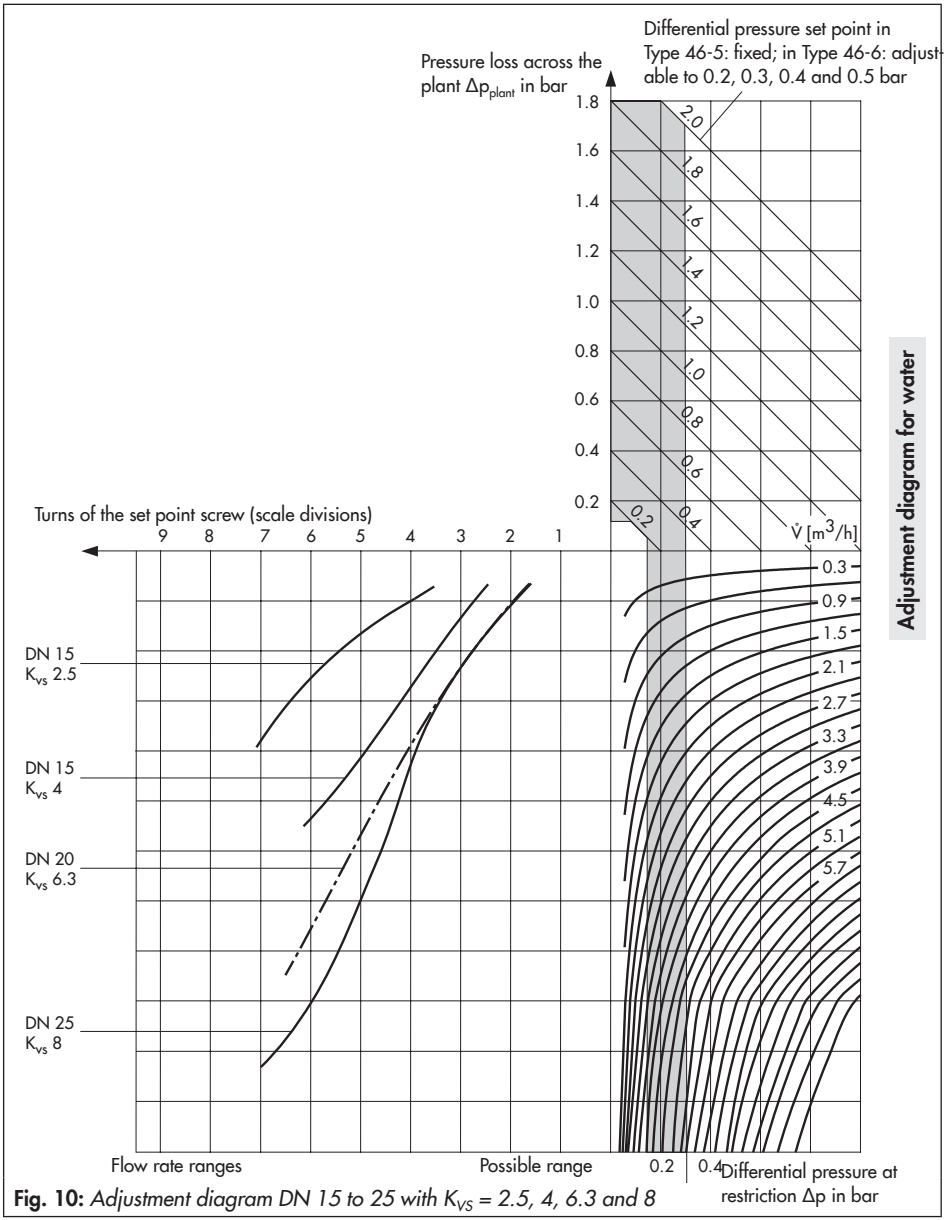


Fig. 10: *Adjustment diagram DN 15 to 25 with K_{VS} = 2.5, 4, 6.3 and 8*

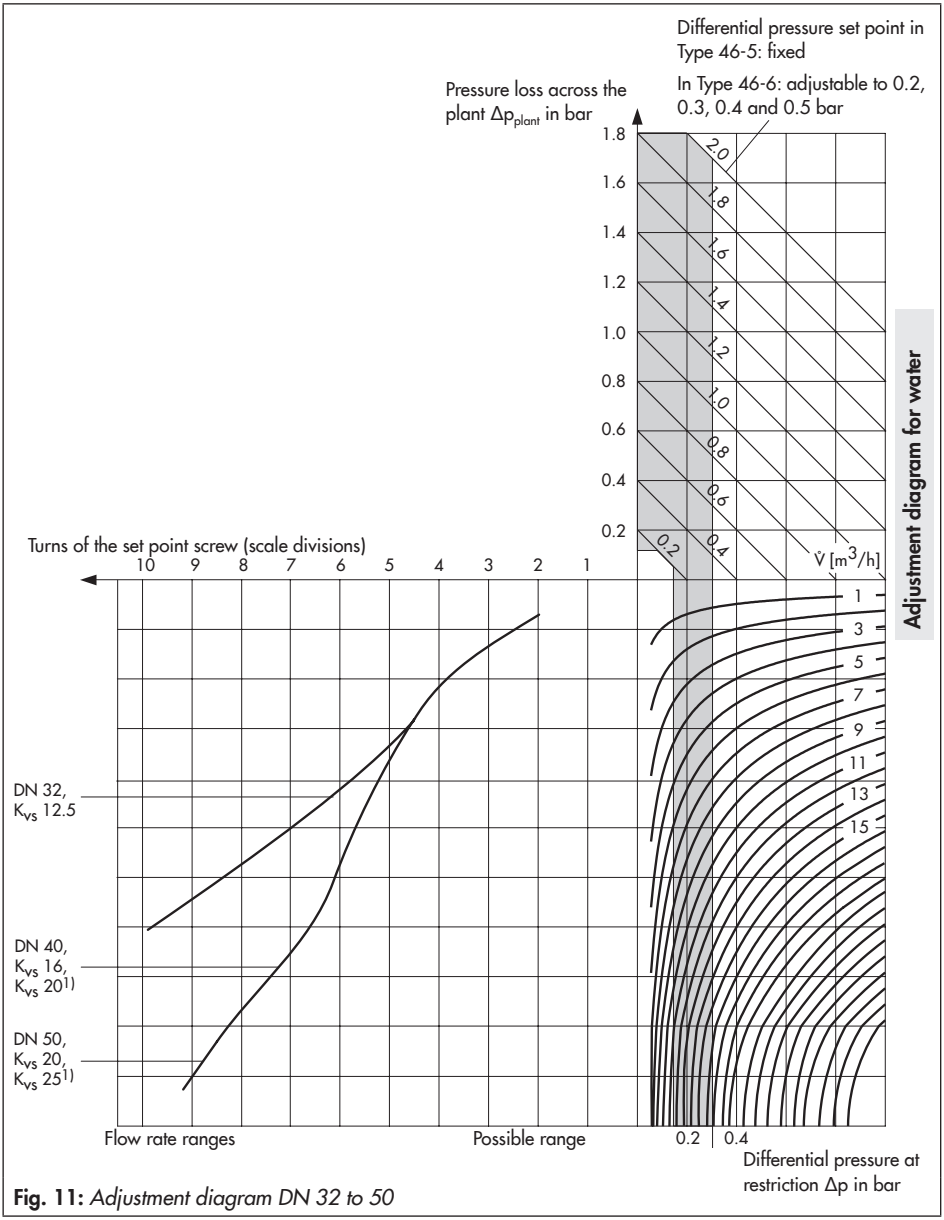


Fig. 11: *Adjustment diagram DN 32 to 50*

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.

Tip

SAMSON's After-sales Service department can support you in drawing up an inspection and test plan for your plant.

DANGER

Risk of bursting in pressure equipment.

Regulators 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 regulator.*
- *Drain the process medium from all the plant sections concerned as well as the regulator.*
- *If necessary, a suitable overpressure protection must be installed on site in the plant section.*
- *Wear personal protective equipment.*

WARNING

Risk of personal injury due to residual process medium in the regulator.

While working on the regulator, 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 regulator.*
- *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, regulator 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.*

NOTICE

Risk of regulator damage due to incorrect servicing or repair.

Service and repair work must only be performed by trained staff.

NOTICE

Risk of regulator damage due to excessively high or low tightening torques.

Observe the specified torques on tightening regulator components. Excessively tightened torques lead to parts wearing out quicker. Parts that are too loose may cause leakage. Observe the tightening torques specified in section 7.3.

Note

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.*

7.1 Cleaning and replacing the plug

See Fig. 2.

Disassembly

1. Put the regulator out of operation (see section 9.1).
2. For **Type 46-6**, completely relieve the tension from the set point spring (8) by turning the set point adjuster (10) or manual adjuster (19) counterclockwise (↺).
3. Unscrew the screws (15) and lift the actuator off the valve body.
4. Pull the valve spring (5), if installed, out of the body.
5. **DN 15 to 25:** unscrew and pull out the guide nipple with plug (3) using a socket wrench (order no. 1280-3001).

   DN 32 to 50: unscrew the stopper (25) at the plug and pull out the plug.
6. Clean the seat and plug thoroughly. Check the control line for any blockages. If the plug is damaged, replace the entire plug with a new one.

Assembly

1. Insert cleaned or new plug.
2. **DN 15 to 25:** tighten the guide nipple with plug (3) using a socket wrench (order no. 1280-3001). Observe the tightening torques specified in section 7.3.

   DN 32 to 50: insert the plug followed by the stopper (25) of the plug. Observe the tightening torques specified in section 7.3.
3. Insert the valve spring (5), if installed, into the body.
4. Place the actuator on the body. Tighten screws (15). Observe the tightening torques specified in section 7.3.
5. Fasten tight the control line (11).
6. Install the regulator into the pipeline.
7. Put the regulator into operation (see section 5.3).

7.2 Replacing the diaphragm

i ***Note***

The diaphragm in some versions can only be replaced together with the diaphragm plate.

See Fig. 2.

Version without manual adjuster

Disassembly

1. Put the regulator out of operation (see section 9.1).

For **Type 46-6**, completely relieve the tension from the set point spring (8) by turning the set point adjuster (10) counterclockwise (↺).

2. Unscrew the screws (15). Remove the bottom diaphragm case together with the operating diaphragm (6.1) and diaphragm plate.
3. Pull the valve spring (5), if installed, out of the body.
4. Hold the bottom nut (6.4) stationary and unscrew the nut (6.3).
5. Replace diaphragm.

Assembly

1. Hold the bottom nut (6.4) stationary and tighten the nut (6.3). Observe tightening torques specified in section 7.3.
2. Insert the valve spring (5), if installed, into the body.
3. Fasten the bottom diaphragm case together with the operating diaphragm (6.1) and diaphragm plate onto the body with the screws (15).
4. Put the regulator into operation (see section 5.3).

Version with manual adjuster

Disassembly

1. Put the regulator out of operation (see section 9.1).

Type 46-6: completely relieve the tension from the set point springs (8) by turning the manual adjuster (19) counterclockwise (↺) until you hear it a clicking noise.

2. Unscrew the screws (15). Take off the bottom section with manual adjuster (14).
3. Pull the valve spring (5), if installed, out of the body.

Unscrew the complete unit, consisting of diaphragm (6.1) together the diaphragm plates, spring (8) and support (21), from the spindle (20) by turning the unit counterclockwise (↺). Remove it from the bottom section with manual adjuster.

4. Unscrew the complete unit.

Assembly

1. Push the complete assembly unit into the bottom section over the spindle (20) and turn it clockwise (↻) one turn to fasten it onto the spindle.
2. Lift the diaphragm plate to check whether the thread of the spring plate (9) has engaged. If not, turn it once more.

3. Insert the valve spring (5), if installed, into the body.
4. Place the actuator on the body. Tighten screws (15). Observe tightening torques specified in section 7.3.
5. Put the regulator into operation (see section 5.3).

7.3 Tightening torques

Part	DN	Tightening torque in Nm
Plug (3)	15 to 25	70
	32 to 50	110
Screws (15)	15 to 32	8
	40 to 50	18
Nut (6.3)	15 to 50	22

7.4 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 regulator. Remove any residual process medium.

Fill in the Declaration on Contamination.
The declaration form can be downloaded from our website at
▶ www.samsongroup.com > SERVICE & SUPPORT > After-sales Service > Returning goods.

3. Proceed as described in
▶ www.samsongroup.com > SERVICE & SUPPORT > After-sales Service > Returning goods.

7.5 Ordering spare parts and operating supplies

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

8 Malfunctions

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 for repair work.

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 can help during troubleshooting. Further information is available in section 10.1.

i ***Note***

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

Table 6: *Troubleshooting*

Malfunction	Possible reasons	Recommended action
Flow rate or differential pressure exceeds adjusted set point	Leak between seat and plug	Remove valve from the pipeline and clean seat and plug. Renew plug, if necessary (see section 7.1). If this is not possible, return regulator to SAMSON for repair.
	Defective operating diaphragm	Replace diaphragm (see section 7.2) or return regulator to SAMSON for repair.
	Control line blocked	Remove control line and clean it.
	Valve too large for control task (flow rate) or too small (differential pressure)	Recalculate K_{VS} and contact SAMSON for further action.
Flow or differential pressure set point not reached	Leak between seat and plug	Remove valve from the pipeline and clean seat and plug. Renew plug, if necessary (see section 7.1). If this is not possible, return regulator to SAMSON for repair.
	Incorrect set point range selected.	Check set point range and contact SAMSON for further action.
	Safety device, e.g. pressure limiter, has been triggered.	Check plant. Unlock safety device.
	Plant differential pressure too low	Compare differential pressure in the plant with the plant's drag.
	Strainer blocked	Drain and clean filter of the strainer.
	Incorrectly installed valve (direction of flow).	Install the valve in such a way that the flow of direction corresponds with the direction indicated by the arrow on the valve body.
Control loop hunts.	Valve too large for control task	Recalculate K_{VS} and contact SAMSON for further action.

9 Decommissioning and disassembly

⚠ DANGER

Risk of bursting in pressure equipment.

Regulators and pipelines are pressure equipment. Improper opening can lead to bursting of the valve.

– Before starting any work on the regulator, depressurize all plant sections concerned as well as the control line.
– Drain the process medium from all the plant sections concerned as well as the regulator.
– Wear personal protective equipment.

⚠ WARNING

Risk of personal injury due to residual process medium in the regulator and control line.

While working on the regulator and control line, 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.

Regulator 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 regulator.
2. Close the shut-off valve on the downstream side of the regulator.
3. If necessary, allow the pipeline and regulator to cool down or heat up.
4. Depressurize the plant.
5. Unscrew the control line (11).
6. Completely drain the pipelines and regulator.
7. Remove the regulator 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 household waste.

10 Annex

10.1 After-sales service

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

E-mail contact

You can reach our After-sales Service at aftersalesservice@samsongroup.com.

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.samsongroup.com) 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 EU declaration of conformity is provided on the next page.

SMART IN FLOW CONTROL

SAMSON

EU-KONFORMITÄTSERKLÄRUNG
EU DECLARATION OF CONFORMITY

Modul H/Module H, Nr./No. / N° CE-0062-PED-H-SAM 001-16-DEU-rev-A

SAMSON erklärt in alleiniger Verantwortung für folgende Produkte:/For the following products, SAMSON hereby declares under its sole responsibility:

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.	2014/68/EU	vom 15.05.2014
Directive of the European Parliament and of the Council on the harmonization of the laws of the Member States relating of the making available on the market of pressure equipment.	2014/68/EU	of 15 May 2014
Angewandtes Konformitätsbewertungsverfahren für Fluide nach Art. 4(1)(c.ii) und (c.i) zweiter Gedankenstrich.	Modul siehe Tabelle	durch certified by Bureau Veritas S. A. (0062)
Conformity assessment procedure applied for fluids according to Article 4(1)(c.ii) and (c.i), second indent	See table for module	

Nenndruck *Pressure rating*	**DN** *NPS*	**15** ½	**20** ¾	**25** 1	**32** 1¼	**40** 1½	**50** 2	**65** -	**80** 3	**100** 4	**125** -	**150** 6	**200** 8	**250** 10	**300** 12	**400** 16
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)						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)						H					-			

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

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Revision 03

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