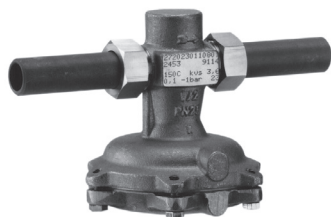


MOUNTING AND OPERATING INSTRUCTIONS

SAMSON

EB 3124 EN

Translation of original instructions



Type 45-1



Type 45-2

Differential Pressure Regulators

Type 45-1 · Type 45-2 · Type 45-3 · Type 45-4

Self-operated regulators · Installation in the flow or return flow pipe

Edition April 2022

CE

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. The images shown in these instructions are for illustration purposes only. The actual product may vary.

- 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 (aftersaleservice@samsongroup.com).



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.samsongroup.com > **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

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1 Safety instructions and measures

Intended use

The Type 45-1 and Type 45-2 Regulators are designed for differential pressure control in the flow pipe. The Type 45-3 and Type 45-4 Regulators are designed for differential pressure control in the return flow pipe. The regulators are mainly used in district heating supply networks with indirect connection and in industrial plants to control liquids.

The regulators are designed to operate under exactly defined conditions (e.g. operating pressure, process medium, temperature). Therefore, operators must ensure that the regulators 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 regulators in applications or conditions other than those 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 regulators are not suitable for the following applications:

- Use outside the limits defined during sizing and by the technical data
- Use outside the limits defined by the additional fittings mounted on the regulator

Furthermore, the following activities do not comply with the intended use:

- Use of non-original spare parts
- Performing service and repair work not described

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 must 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 checking the hazards posed by the process medium being used (e.g.

▶ GESTIS (CLP) hazardous substances database). Depending on the process medium and/or the activity, the protective equipment required includes:

- Provide protective equipment (e.g. safety gloves, eye protection) appropriate for the process medium used.
 - Wear hearing protection when working near the valve. Follow the instructions given by the plant operator.
 - Hard hat
 - Safety harness, e.g. when working at height
- ➔ 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 regulator by the process medium, the operating pressure or by moving parts by taking appropriate precautions. Plant operators and operating personnel must observe all hazard statements, warnings and caution notes in these mounting and operating instructions.

Hazards resulting from the special working conditions at the installation site of the regulator must be identified in a risk assessment and prevented through the corresponding safety instructions drawn up by the operator.

We also recommend checking the hazards posed by the process medium being used (e.g.

▶ GESTIS (CLP) hazardous substances database).

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

These mounting and operating instructions deal with the standard version of the device.

Components of the device that differ to those used for the standard version described in this document can be exchanged with other certain SAMSON components. The residual hazards of these components are described in the associated mounting and operating instructions (see section 'Referenced documentation').

Safety features

The Types 45-1, 45-2, 45-3 and 45-4 Regulators do not have any special safety features. When relieved of pressure, the valves are opened by the force of the set point springs.

Responsibilities of the operator

Operators are responsible for proper use 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, operators must ensure that operating personnel or third parties are not exposed to any danger.

Operators are additionally responsible for ensuring that the limits for the product defined in the technical data are observed. This also applies to the start-up and shutdown procedures. Start-up and shutdown procedures fall within the scope of the operator's duties and, as such, are not part of these mounting and operating instructions. SAMSON is unable to make any statements about these procedures since the operative details (e.g. differential pressures and temperatures) vary in each individual case and are only known to the operator.

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, operating personnel must be familiar with the applicable health, safety and accident prevention regulations and comply with them.

Referenced standards, directives and regulations

The regulators comply with the requirements of the European Pressure Equipment Directive 2014/68/EU. Regulators with a CE marking have an EU declaration of conformity, which includes information about the applied conformity assessment procedure. The EU declaration of conformity is included in the 'Certificates' chapter.

According to the ignition hazard assessment performed in accordance with Clause 5.2 of ISO 80079-36, 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 Clause 6.4 of EN 60079-14 (VDE 0165-1).

Referenced documentation

The following documents apply in addition to these mounting and operating instructions:

- Mounting and operating instructions for
e.g. **Type 2 N or 2 NI Strainer** ▶ EB 1015
- Data sheets for
e.g. **Type 2 N or 2 NI Strainer** ▶ T 1015
- Mounting and operating instructions as well as data sheets for additional fittings (e.g. shut-off valves, pressure gauges etc.).

1.1 Notes on possible severe personal injury

DANGER

Risk of bursting in pressure equipment.

Regulators and pipelines are pressure equipment. Impermissible pressure or improper opening can lead to regulator components bursting.

- Observe the maximum permissible pressure for regulator and plant.
- If necessary, a suitable overpressure protection must be installed on site in the plant section.
- Before starting any work on the regulator, depressurize all plant sections affected as well as the regulator.
- Drain the process medium from the plant sections affected as well as from the regulator.
- Wear personal protective equipment.

1.2 Notes on possible personal injury

WARNING

Risk of personal injury due to incorrect operation, use or installation as a result of information on the regulator being illegible.

Over time, markings, labels and nameplates on the regulator may become covered with dirt or become illegible in some other way. As a result, hazards may go unnoticed and the necessary instructions not followed. There is a risk of personal injury.

- Keep all relevant markings and inscriptions on the device in a constantly legible state.
- Immediately renew damaged, missing or incorrect nameplates or labels.

Risk of hearing loss or deafness due to loud noise.

The noise emissions depend on the valve version, plant facilities and process medium.

- Wear hearing protection when working near the valve. Follow the instructions given by the plant operator.

Crush hazard arising from moving parts.

The regulator contains moving parts (set point springs), which can injure hands or fingers if inserted into the regulator.

- 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 control line.

Risk of personal injury due to loaded springs.

The set point springs of regulators with adjusted set point are preloaded and are under tension.

- Before starting any work on the springs, relieve the compression from the preloaded springs.

WARNING

Risk of personal injury due to pressurized components and as a result of process medium being discharged.

Incorrect opening of pressure equipment or mounting parts may lead to the process medium escaping to the atmosphere.

- Do not unscrew the control line while the valve is pressurized.
- Do not start up the regulator until all parts have been mounted.

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 warm up to the ambient temperature.
- Wear protective clothing and safety gloves.

Damage to health relating to the REACH regulation.

If a SAMSON device contains a substance listed as a substance of very high concern on the candidate list of the REACH regulation, this is indicated on the SAMSON delivery note.

- Information on safe use of the part affected ► www.samsongroup.com/en/about-samson/environment-social-governance/material-compliance/.

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 the plant sections affected and from the regulator.
- Wear protective clothing, safety gloves and eye protection.

1.3 Notes on possible property damage

! NOTICE

Risk of regulator damage due to incorrectly attached slings.

- Do not attach load-bearing slings to the actuator housing (see section 'Lifting the regulator' in the 'Shipment and on-site transport' chapter).

Risk of regulator damage due to unsuitable medium properties.

The regulator is designed for a process medium with defined properties.

- Only use the process medium specified for sizing the equipment.

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.

Risk of regulator damage due to the use of unsuitable lubricants.

The lubricants to be used depend on the regulator material. Unsuitable lubricants may corrode and damage surfaces.

- Only use lubricants approved by SAMSON.
When in doubt, consult SAMSON.

Risk of leakage and regulator damage due to over- or under-torquing.

Observe the specified torques when tightening regulator components. Excessive tightening torques lead to parts wearing out more quickly. Parts that are too loose may cause leakage.

- Observe the specified tightening torques (see section 'Tightening torques' in the Appendix).

Risk of regulator damage due to the use of unsuitable tools.

Certain tools are required to work on the regulator.

- Only use tools approved by SAMSON.
When in doubt, consult SAMSON.

! NOTICE

Risk of the process medium being contaminated through the use of unsuitable lubricants and/or contaminated tools and components.

- Keep the regulator and the tools used free from solvents and grease.
- Make sure that only suitable lubricants are used.

Risk of excess pressure damaging plant sections due to construction-related seat leakage through the regulator.

- Always install a safety device (e.g. safety excess pressure valve or safety relief valve) in the plant.

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 plug or diaphragm stem guide.

- 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 (see the 'Installation' chapter).

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.

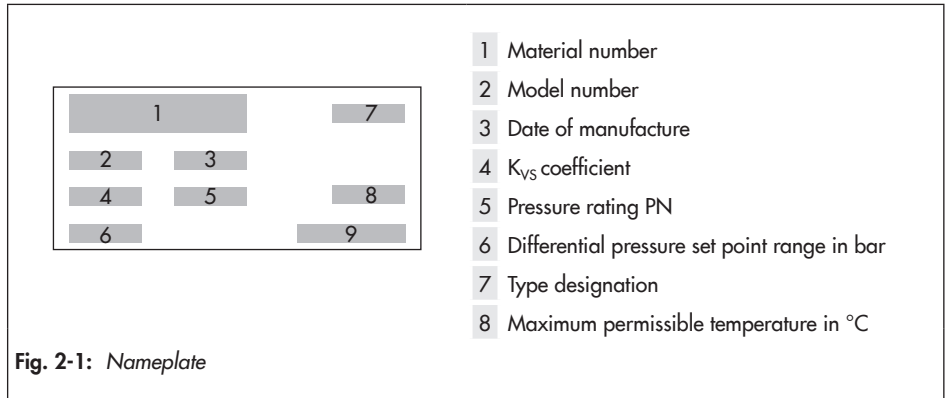
- Use suitable inhibitors. The plant operator is responsible for the selection and use of suitable inhibitors.

i Note

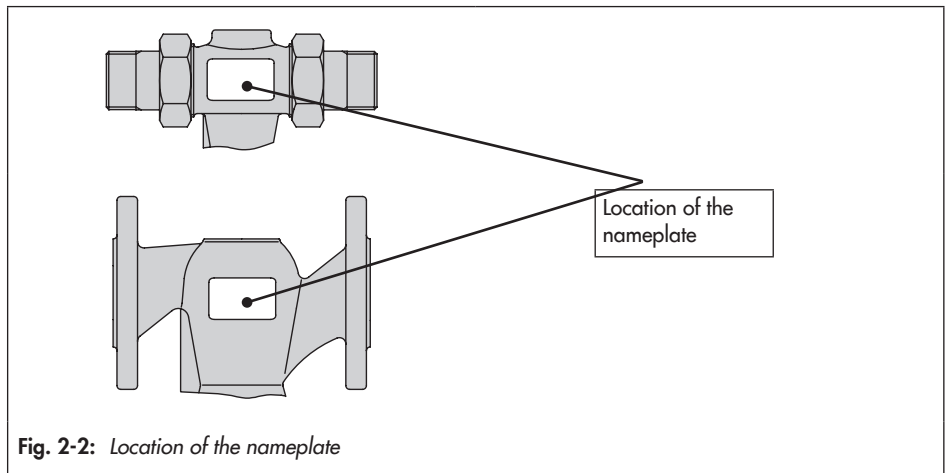
SAMSON's After-sales Service can support you concerning lubricant, tightening torques and tools approved by SAMSON.

2 Markings on the device

2.1 Nameplate



2.2 Location of the nameplates



2.3 Material identification number

The material designation can be found on the cast body or you can contact SAMSON (the material number is required) to find out which material is used. It is specified on the nameplate in the 'MNo.' field (1). For more details on the nameplate, see Chapter 2.1.

3 Design and principle of operation

→ See Fig. 3-1 and Fig. 3-2

The differential pressure regulators basically consist of the valve body (1) with balanced plug (3) as well as a closing actuator with an operating diaphragm.

In Type 45-1 and Type 45-3, the set point spring (8) installed into the valve determines the set point. Whereas, in Type 45-2 and Type 45-4, the set point can be adjusted by the set point springs (8) in the actuator.

The regulators are designed to maintain a constant differential pressure between the high-pressure and low-pressure lines to an adjustable set point. The valve closes when the differential pressure exceeds the adjusted set point.

Types 45-1 and 45-2 · Installation in the flow pipe

Type 45-1 · The set point is fixed.

Type 45-2 · The set point can be adjusted as required within the set point range.

The medium flows through the regulator in the direction indicated by the arrow. The pressure in the valve outlet (high pressure) is transferred to the high-pressure chamber of the actuator over the attached control line (11) and the low pressure from the return flow pipe is transferred to the low-pressure chamber of the actuator over a control line (12) to be installed on site. See Fig. 3-3.

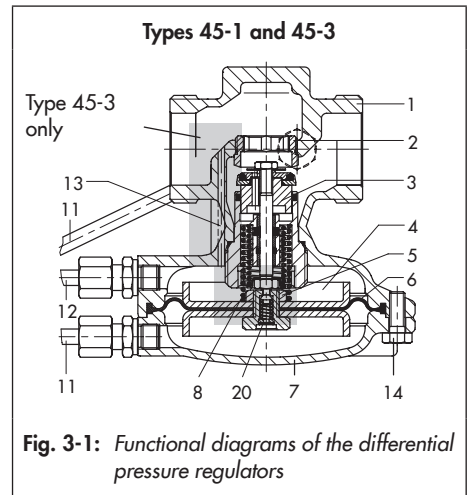
Types 45-3 and 45-4 · Installation in the return flow pipe

Type 45-3 · The set point is fixed.

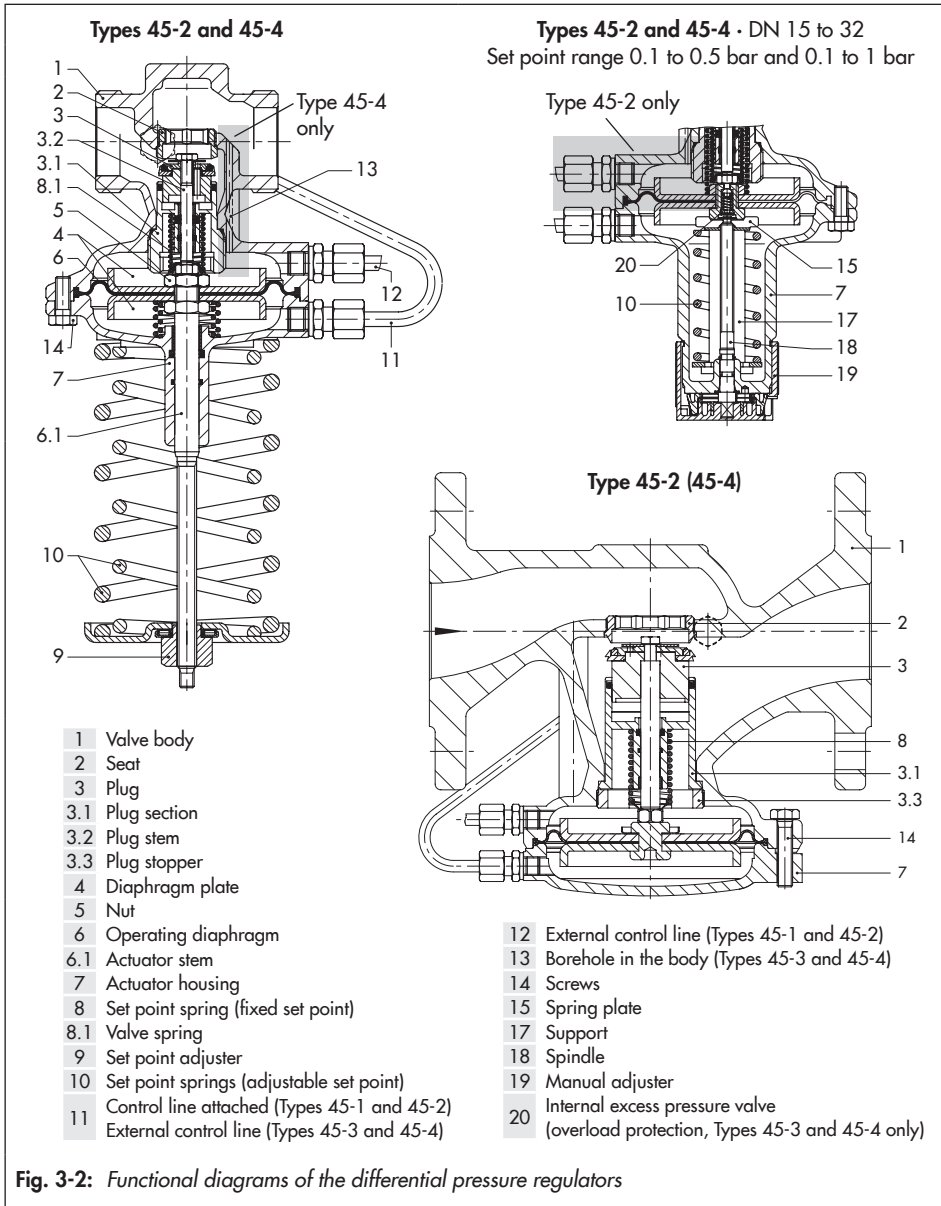
Type 45-4 · The set point can be adjusted as required within the set point range.

The pressure upstream of the valve (low pressure) is transferred to the low-pressure chamber of the actuator through the borehole (13) and the high pressure from the flow pipe is transferred to the high-pressure chamber of the actuator over a control line (11) to be installed on site.

The differential pressure creates a positioning force at the operating diaphragm which moves the valve plug depending on the force of the set point spring(s) (8/10). See Fig. 3-3.



Design and principle of operation



3.1 Additional fittings

→ See Fig. 3-3

Pressure gauges

Install a pressure gauge (3 and 5) at suitable points to monitor the pressures prevailing in the plant.

Shut-off valves

We recommend installing a shut-off valve (1 and 6) both upstream of the strainer and downstream of the regulator.

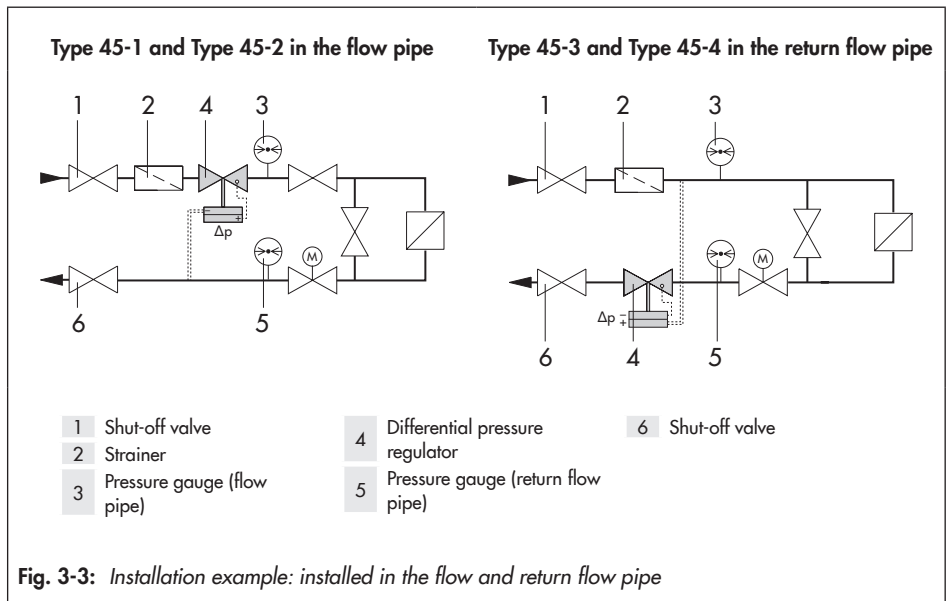
Strainer

We recommend installing a SAMSON strainer (2) upstream of the valve. It prevents solid particles in the process medium from damaging the regulator.

- Do not use the strainer to permanently filter the process medium.
- Select a strainer (mesh size) suitable for the process medium.

i Note

Any impurities carried along by the process medium may impair the proper functioning of the regulator. We recommend installing a strainer (e.g. SAMSON Type 2 NI) upstream of the pressure reducing valve (► EB 1015).



Insulation

Regulators can be insulated to reduce heat energy transfer.

Refer to the instructions in the 'Installation' chapter.

i Note

The Types 45-1, 45-2, 45-3 and 45-4 Regulators are not safety valves. If necessary, a suitable overpressure protection must be installed on site in the plant section.

3.1.1 Versions

The regulators are designed for installation in a district heating station with indirect connection.

- **Type 45-1** · With fixed differential pressure · For the installation in the flow pipe
- **Type 45-2** · With adjustable differential pressure · For the installation in the flow pipe
- **Type 45-3** · With fixed differential pressure · For the installation in the return flow pipe
- **Type 45-4** · With adjustable differential pressure · For the installation in the return flow pipe

3.2 Technical data

The regulator nameplate provides information on the regulator version (see the 'Markings on the device' chapter).

i Note

More information is available in Data Sheet ► T 3124.

Conformity

The Types 45-1, 45-2, 45-3 and 45-4 Regulators bear both the CE and EAC marks of conformity.



Process medium and scope of application

The differential pressure regulators are designed to maintain the differential pressure between the high-pressure and low-pressure lines to a defined set point.

- For **liquids and gases**
5 to 130 °C¹⁾ · **5 to 150 °C**²⁾
- Differential pressure set points
0.1 to 0.5 bar³⁾ · **0.1 to 4 bar**⁴⁾
- Nominal size **DN 15 to 50**
- Pressure rating **PN 16 and 25**

¹⁾ PN 16 only

²⁾ PN 25 only; only with elastomer made of FKM when used with liquids

³⁾ Type 45-1 and Type 45-3 only

⁴⁾ Type 45-2 and Type 45-4 only

The regulator is open when relieved of pressure. The valve **closes** when the differential pressure **rises**.

i Note

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 through the use of suitable inhibitors.

Noise emissions

SAMSON is unable to make general statements about noise emissions. The noise emissions depend on the regulator version, plant facilities, process medium and operating conditions.

Leakage class

The metal-seated regulator has the leakage class I according to IEC 60534-4. The soft-seated regulator has the leakage class IV according to IEC 60534-4.

Temperature range

Depending on how the regulator is configured, it can be used up to temperatures of 150 °C/300 °F (see Table 3-1). The minimum temperature is limited by the actuator's diaphragm material (► T 3013).

⚠ WARNING

Risk of hearing loss or deafness due to loud noise.

– Wear hearing protection when working near the valve. Follow the instructions given by the plant operator.

i Note


The Types 45-1, 45-2, 45-3 and 45-4 Regulators are not safety valves. If necessary, a suitable overpressure protection must be installed on site in the plant section.

Dimensions and weights

Table 3-3 to Table 3-4 provide an overview of the dimensions and weights. The lengths and heights in the dimensional drawings are shown on page 3-8.

Design and principle of operation

Table 3-1: Technical data · All pressures in bar (gauge)

Nominal size		DN 15	DN 20	DN 25	DN 32 ³⁾	DN 40 ³⁾	DN 50 ³⁾
K _{V5} coefficient	Standard	4.0	6.3	8.0	12.5	16	20
	Special version	0.4 · 1.0 · 2.5					
	Flanged body	–			12.5	20	25
X _{Fz} value	Standard	0.6		0.55		0.45	
	Flanged body	–			0.45		0.40
Pressure rating	Types 45-2 and 45-4	PN 25					
	Types 45-1 and 45-3	PN 16 · PN 25			PN 25		
Max. permissible differential pressure Δp across the regulator		20 bar/10 bar ²⁾				16 bar	
Max. permissible temperature		Liquids: 150 °C/130 °C ²⁾ · Air and nitrogen: 150 °C ¹⁾					
Pressure above adjusted differential pressure set point at which internal excess pressure limiter responds (Type 45-3 and Type 45-4)		0.5 bar					
Conformity							
Differential pressure set point ranges	Type 45-2 and Type 45-4: continuously adjustable	0.1 to 0.5 bar ⁴⁾ · 0.1 to 1.0 bar				0.2 to 1.0 bar	
		0.5 to 2.0 bar · 1.0 to 4.0 bar · 2.4 to 6.3 bar · 6.0 to 10.5 bar					
	Type 45-1 and Type 45-3: fixed set point	0.1 bar · 0.2 bar · 0.3 bar · 0.4 bar · 0.5 bar					

¹⁾ Diaphragm and seals made of FKM; PN 25 version only

²⁾ For PN 16 version

³⁾ Additional version: regulator with flanged body made of spheroidal graphite iron (EN-GJS-400-18-LT)

⁴⁾ For Type 45-4 only

Table 3-2: Materials · Material numbers according to DIN EN

Types 45-1, 45-2, 45-3 and 45-4 Regulators		
Housing	CC499K (red brass Rg 5) · Spheroidal graphite iron EN-GJS-400-18-LT ¹⁾	
Seat	Stainless steel 1.4305	
Plug	PN 25	Brass, resistant to dezincification, with EPDM soft seal ²⁾
	PN 16	Brass, resistant to dezincification and plastic with EPDM soft seal
Diaphragm case	PN 25	CC499K (red brass, Rg 5)
	PN 16	DC 01
Valve springs	Stainless steel 1.4310	
Operating diaphragm	EPDM with fabric reinforcement ²⁾	
Seals	EPDM ²⁾	

¹⁾ Additional version in DN 32, 40 and 50: valve with flanged body made of spheroidal graphite iron

²⁾ Special version in PN 25, e.g. for mineral oils: FKM

Table 3-3: Dimensions in mm · Regulators without connecting parts

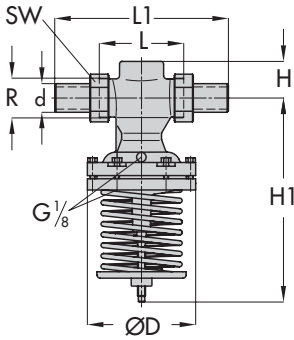
Nominal size	DN 15	DN 20	DN 25	DN 32 ¹⁾	DN 40 ¹⁾	DN 50 ¹⁾
Pipe Ø d	21.3	26.9	33.7	42.4	48.3	60.3
Connection R	G ¾	G 1	G 1¼	G 1¾	G 2	G 2½
Width across flats (A/F)	30	36	46	59	65	82
Length L	65	70	75	100	110	130
H	32			45		
H1	230			250	380	
H2	160			180	-	
H3	85			105	140	
ØD	116				160	

¹⁾ Additional version: regulator with flanged body

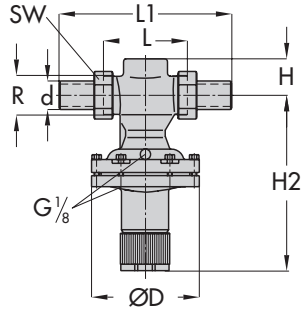
Table 3-4: Regulator with connecting parts

Nominal 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	Type 45-2 · Type 45-4	2.0	2.1	2.2	8.5	9.0	9.5
	Type 45-1 · Type 45-3	1.5	1.6	1.8	4.8	5.3	6.0
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	Type 45-2 · Type 45-4	2.0	2.1	2.2	8.5	9.0	9.5
	Type 45-1 · Type 45-3	1.5	1.6	1.8	4.8	5.3	5.8
With flanged valve body (DN 32 to 50)							
L3	130	150	160	180	200	230	
Weight, approx. kg	Type 45-2 · Type 45-4	3.4	4.1	4.7	11.7	13.0	14.5
	Type 45-1 · Type 45-3	2.9	3.6	4.3	8.0	9.3	10.8

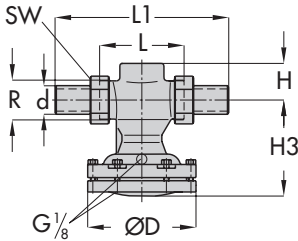
Dimensional drawings



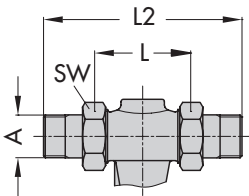
Type 45-2, Type 45-4 · DN 15 to 50
with welding ends



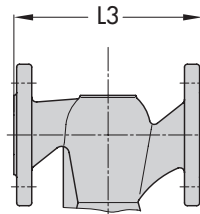
Type 45-2 and Type 45-4 · DN 15 to 32 · With welding ends · Version with manual adjuster to adjust the differential pressure set point



Type 45-1 and Type 45-3 · DN 15 to 50 · With welding ends



Types 45-1, 45-2, 45-3 and 45-4 · DN 15 to 50 · With threaded ends



Flanged valve body DN 32 to 50

Fig. 3-4: Dimensional drawings

4 Shipment and on-site transport

The work described in this chapter is to be performed only by personnel appropriately qualified to carry out such tasks.

4.1 Accepting the delivered goods

After receiving the shipment, proceed as follows:

1. Check the scope of delivery. Check that the specifications on the regulator nameplate match the specifications in the delivery note. See the 'Markings on the device' chapter for nameplate details.
2. Check the shipment for transportation damage. Report any damage to SAMSON and the forwarding agent (refer to delivery note).

4.2 Removing the packaging from the regulator

The tested regulator is delivered as an assembled unit.

Proceed as follows to lift and install the regulator:

- Do not open or remove the packaging until immediately before lifting to install the regulator into the pipeline.
- Leave the regulator components in its transport container or on the pallet to transport it on site.

- Do not remove the protective caps from the inlet and outlet until immediately before installing the regulator with flanges into the pipeline. They prevent foreign particles from entering the valve.
- Dispose and recycle the packaging in accordance with the local regulations.

4.3 Transporting and lifting the regulator

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 regulator against external influences (e.g. impact).
- Do not damage the corrosion protection (paint, surface coatings). Repair any damage immediately.
- Protect the regulator against moisture and dirt.
- Protect the piping and any mounted valve accessories against damage.
- The permissible ambient temperature of standard regulators is 5 to +65 °C.

4.4 Storing the regulator

NOTICE

Risk of regulator damage due to improper storage.

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

Note

We recommend to regularly check the regulator and the prevailing storage conditions during long storage periods.

Storage instructions

- Protect the regulator against external influences (e.g. impact).
- Do not damage the corrosion protection (paint, surface coatings). Repair any damage immediately.
- Protect the regulator 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.
- The permissible storage temperature of standard regulators is 5 to +65 °C.
- Do not place any objects on the regulator.

Special storage instructions for elastomers

Elastomer, e.g. operating diaphragm

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

Tip

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

5 Installation

The work described in this chapter is to be performed only by personnel appropriately qualified to carry out such tasks.

5.1 Installation conditions

Work position

The work position for the regulator is the front view onto all operating controls on the regulator (including any additional fittings) seen from the position of operating personnel.

Plant operators must ensure that, after installation of the device, the operating personnel can perform all necessary work safely and easily access the device from the work position.

Pipeline routing

The inlet and outlet lengths vary depending on several variables and process conditions and are intended as recommendations. Contact SAMSON if the lengths are significantly shorter than the recommended lengths.

To ensure that the regulator functions properly, proceed as follows:

- Observe the inlet and outlet lengths (see Table 5-1). Contact SAMSON if the regulator conditions or state of the medium process deviate.
- Install the regulator allowing sufficient space to remove it or to perform service work on it.
- Install the regulator free of stress and with the least amount of vibrations as

possible. Read information under “Mounting position” and “Support or suspension” in this chapter.

Mounting position

To ensure that the regulator functions properly, proceed as follows:

- Standard mounting position: install the actuator housing suspended downward in horizontal pipelines (see Fig. 5-1).
- Alternative mounting position (**DN 15 to 25**): install the actuator housing pointing to the side in horizontal pipelines (see Fig. 5-1).
- Make sure the direction of flow matches the direction indicated by the arrow on the body.
- Contact SAMSON if the mounting position is not as specified above.

! NOTICE

Damage due to freezing.

Protect the regulator from icing up when controlling media that can freeze. Unless the regulator is installed in locations where no frost occurs, remove the regulator from the pipeline when the plant is shut down.

Support or suspension

i Note

The plant engineering company is responsible for selecting and implementing a suitable support or suspension of the installed regulator and the pipeline.

NOTICE

Do not attach supports directly to the regulator.

Depending on the regulator version and mounting position, the regulator and pipeline must be supported or suspended.

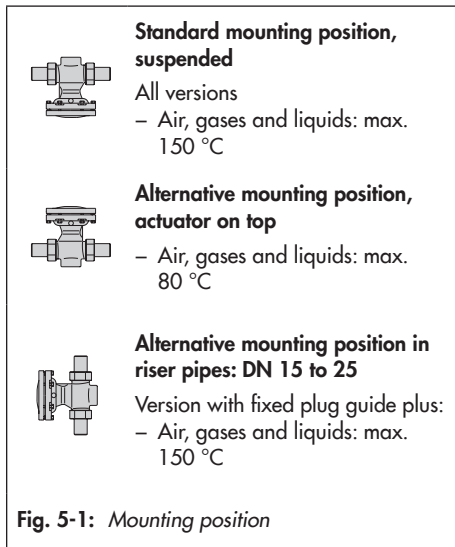


Fig. 5-1: Mounting position

Control line

Route the control lines on site preferably using a 8x1 mm (stainless) steel pipe. The pressure tapping point must at least three times the nominal size (DN) away from any pipe fittings (e.g. restrictions, bends or branches), 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 (see Fig. 5-2 and Table 5-1).
- Do not change the pipe diameter of the main pipeline with an eccentric reducer.

Needle valve

To additionally dampen the regulator or to shut off the control lines, we recommend also installing a needle valve in the control line in addition to the standard SAMSON screw joint with restriction. The standard SAMSON screw joint with restriction is located in the compression-type fitting at the (+) connection of the diaphragm actuator (see Fig. 5-2 and Table 5-1).

5.2 Preparation for installation

Before mounting, make sure the following conditions are met:

- The regulator is clean.
- The regulator and all piping are not damaged.
- Install a strainer upstream of the regulator.
- The valve data on the nameplate (type designation, nominal size, material, pressure rating and temperature range) match the plant conditions (nominal size and pressure rating of the pipeline, medium temperature etc.). See the 'Markings on the device' chapter for nameplate details.
- The requested or required additional fittings (see the 'Design and principle of operation' chapter) have been installed

or prepared as necessary before installing the valve.

Proceed as follows:

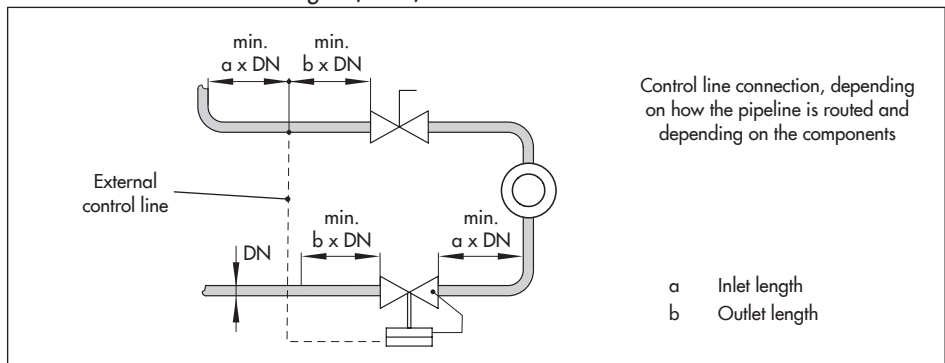
- Lay out the necessary material and tools to have them ready during installation work.
- Flush the pipeline **before** installing the regulator (see Chapter "Cleaning the pipeline").
The plant operator is responsible for cleaning the pipelines in the plant.
- Check any mounted pressure gauges to make sure they function properly.

5.2.1 Cleaning the pipeline

We recommend additionally flushing the pipeline without an installed regulator over a time period of several minutes before start-up. In this case, install a suitable length of pipe into the pipeline in place of the regulator.

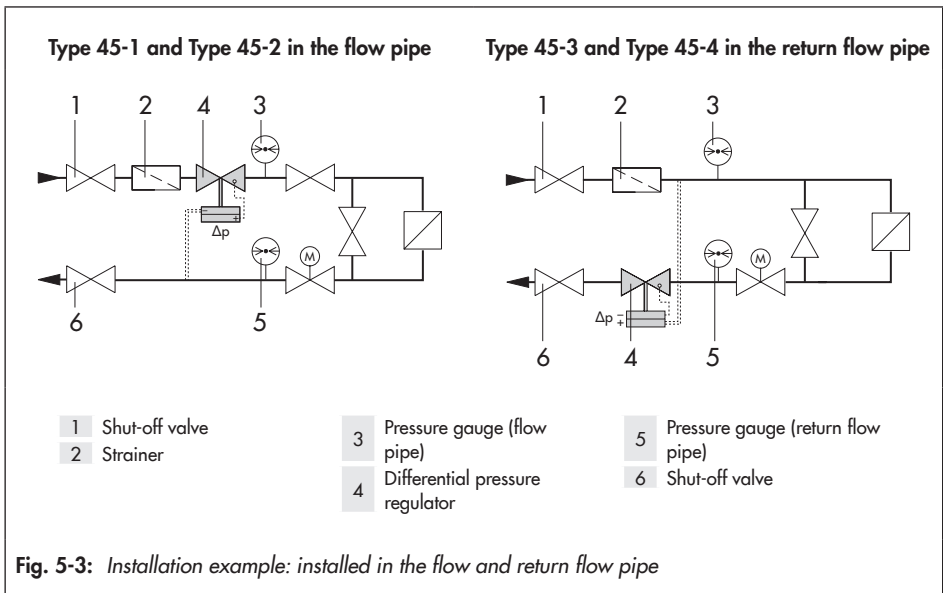
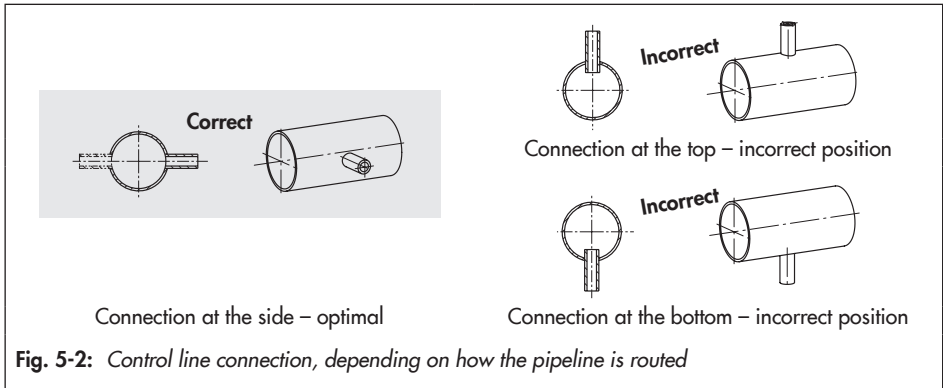
- Before flushing the plant with the process medium, read the section 'Starting up the plant' in the 'Start-up' chapter.
- Observe the mesh size of the upstream strainer for the maximum particle size. Use strainers to suit the process medium.
- Check the strainer for dirt each time the pipeline is flushed and clean it, if necessary.

Table 5-1: Inlet and outlet lengths (valve) and control line connections



State of process medium	Valve conditions	Inlet length a	Outlet length b
Gas	$Ma \leq 0.3$	2	4
Liquid	Free of cavitation/ $w < 3 \text{ m/s}$	2	4
	Cavitation producing noise/ $w \leq 3 \text{ m/s}$	2	4

Installation



5.3 Installation

The SAMSON regulators are delivered as assembled units. The activities listed below are necessary for installation and before start-up of the regulator.

⚠ NOTICE

Risk of regulator damage due to the use of unsuitable tools.

→ Only use tools approved by SAMSON (see section 'Tools' in the Appendix).

⚠ NOTICE

Risk of regulator damage due to the use of unsuitable lubricants.

→ Only use lubricants approved by SAMSON (see section 'Lubricants' in the Appendix).

⚠ NOTICE

Risk of regulator damage due to over- or under-torquing.

Observe the specified torques when tightening regulator components. Excessive tightening torques lead to parts wearing out more quickly. Parts that are too loose may cause leakage.

→ Observe the specified tightening torques (see section 'Tightening torques' in the Appendix).

5.3.1 Installing the regulator

The Type 45-1 and Type 45-2 Regulators are installed in the flow pipe and the Type 45-3 and Type 45-4 Regulators are installed in the return flow pipe of the plant. See installation examples in Fig. 5-3.

1. Close the shut-off valves (1, 6) upstream and downstream of the regulator while the regulator is being installed.
2. Remove the protective caps from the valve ports of regulators with flanges before installation.
3. Observe the flow direction through the valve. The arrow on the valve indicates the direction of flow.
4. Make sure that the correct flange gaskets are used.
5. Bolt the regulator to the pipeline free of stress.
6. Mount the control lines (to be installed on site) and any needle valves and open them.
 - Mount the control lines (to be installed on site) on the actuator. Observe the specified tightening torques (see section 'Tightening torques' in the Appendix).

5.3.2 Filling the plant

Open the shut-off valves slowly over a time period of several minutes preferably starting from the upstream pressure side to fill the plant (all consumers are open).

- Make sure that the pressure rises simultaneously upstream and downstream of the regulator to avoid damaging the balancing bellows.
- Avoid pressure surges.

5.4 Testing the regulator

⚠ DANGER

Risk of bursting due to incorrect opening of pressurized equipment or components.

Regulators and pipelines are pressure equipment that may burst when handled incorrectly. Flying projectile fragments or the release of process medium under pressure can cause serious injury or even death.

Before working on the regulator:

- Depressurize all plant sections concerned and the regulator.
- Disconnect the control line.
- Drain the process medium from the plant sections affected as well as from the valve.

⚠ WARNING

Crush hazard arising from moving parts.

The regulator contains moving parts (actuator and plug stem), 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 pressurized components and as a result of process medium being discharged.

Incorrect opening of pressure equipment or mounting parts may lead to the process medium escaping to the atmosphere.

- Do not unscrew the control line while the valve is pressurized.
 - Do not start up the regulator until all parts have been mounted.
-

⚠ WARNING

Risk of hearing loss or deafness due to loud noise.

Noise emission (e.g. cavitation) may occur during operation caused by the process medium and the operating conditions.

- Wear hearing protection when working near the valve. Follow the instructions given by the plant operator.
-

⚠ WARNING

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

Depending on the process medium, valve components and pipelines may get very hot or cold and cause burn injuries.

→ Wear protective clothing and safety gloves.

The regulator components are delivered by SAMSON ready for use. To test the regulator functioning before start-up or putting back the regulator into operation, perform the following tests:

5.4.1 Leakage

The plant operator is responsible for performing the leak test and selecting the test method. The leak test must comply with the requirements of the national and international standards that apply at the site of installation.

💡 Tip

SAMSON's After-sales Service can support you to plan and perform a leak test for your plant.

- All required control lines are connected to the actuator and are not shut off.
- 1. Install the regulator into the pipeline (see Chapter "Installation").
- 2. Apply the required test pressure.
- 3. Check the regulator for leakage to the atmosphere.

- 4. Depressurize the pipeline section and regulator.
- 5. Rework any parts that leak and repeat the leak test.

5.4.2 Pressure test

ⓘ NOTICE

Risk of valve damage due to a sudden pressure increase.

– Slowly open the shut-off valves.

i Note

The plant operator is responsible for performing the pressure test. SAMSON's After-sales Service can support you to plan and perform a pressure test for your plant.

During the pressure test, make sure the following conditions are met:

- All required control lines are connected to the actuator and are not shut off.
- Do not allow the pressure to exceed the 1.5 times the pressure rating of the valve body.
- Do not apply a pressure higher than the maximum specified pressure rating or maximum operating pressure to the actuator (see section 'Technical data' in the 'Design and principle of operation' chapter).
- Make sure that the pressure rises simultaneously upstream and downstream of the regulator to avoid damaging it.

- Make sure that the regulator is open while filling the plant. To proceed, turn the set point adjuster (9) or manual adjuster (19) counterclockwise (↺) as far as it will go.

If the **test pressure** of the valve is **higher** than the specified maximum permissible operating pressure of the diaphragm actuator:

- Depressurize the plant.
- Remove the control line mounted on site. Close any control line connection in the plant by closing the installed shut-off valve or inserting a blanking plug.
- Install a suitable length of pipe into the pipeline in place of the regulator before performing the pressure test.

5.5 Insulation

To insulate cold systems, we recommend first filling the plant and carefully rinsing it. The regulator must not yet be insulated at this stage.

1. Start up the plant and adjust the set point (see the 'Start-up' chapter).
2. Shut down the plant again and let it heat up until the condensation water has dried off.
3. Insulate the regulator and pipes conveying the process medium using insulation material with a water vapor barrier. Use a stable sleeve to protect the external set point springs against touching or friction and include it in the insulation. If a control line is to be routed through the insulation, special care must be taken with the sealing since slight changes in shape may occur. The insulation thickness depends on the medium temperature and the ambient conditions. 50 mm is a typical thickness.

! NOTICE

Risk of regulator damage due to incorrect insulation.

- *The actuator must be insulated for medium temperatures below 0 °C.*
 - *The regulator must not be insulated for medium temperatures above 80 °C.*
-

6 Start-up

The work described in this chapter is to be performed only by personnel appropriately qualified to carry out such tasks.

⚠ WARNING

Risk of personal injury due to pressurized components and as a result of process medium being discharged.

Incorrect opening of pressure equipment or mounting parts may lead to the process medium escaping to the atmosphere.

- Do not unscrew the control line while the valve is pressurized.
- Do not start up the regulator until all parts have been mounted.

⚠ WARNING

Crush hazard arising from moving parts.

The regulator contains moving parts (actuator and plug stem), 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 hearing loss or deafness due to loud noise.

Noise emission may occur during operation caused by the process medium and the operating conditions.

- Wear hearing protection when working near the valve. Follow the instructions given by the plant operator.

⚠ 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 warm up to the ambient temperature.
- Wear protective clothing and safety gloves.

Before start-up or putting the device back into service, make sure the following conditions are met:

- The regulator is properly installed in the pipeline (see the 'Installation' chapter).
- The leak and function tests have been completed successfully (see section 'Testing the regulator' in the 'Installation' chapter).
- The prevailing conditions in the plant section concerned meet the regulator sizing requirements (see section 'Intended use' in the 'Safety instructions and measures' chapter).

6.1 Start-up and putting the device back into operation

1. Depending on the field of application, allow the regulator to cool down or warm up to reach ambient temperature before start up.
2. All consumer valves are open.
3. Open the shut-off valves slowly over a time period of several minutes. Slowly opening these valves prevents a sudden surge in pressure and high flow velocities which can damage regulator parts.
4. Check the regulator to ensure it functions properly (see section 'Adjusting the differential pressure set point' in the 'Operation' chapter).

Before starting up the plant, make sure the following conditions are met:

- The control line installed on site is open (needle valve) and correctly connected.

6.2 Starting up the plant

1. The plant is filled with the process medium (see section 'Filling the plant' in the 'Installation' chapter).
2. The control line (if installed on site) is open (needle valve) and correctly connected.
→ To start up the pressure regulator, open shut-off valves **slowly**.
3. Slowly open the shut-off valves upstream of the pressure regulator.
4. Slowly open all the valves downstream of the regulator (consumer side).
5. Avoid pressure surges.
6. Put the pressure regulator into operation.

7 Operation

⚠ 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 warm up to the ambient temperature.
- ➔ Wear protective clothing and safety gloves.

⚠ WARNING

Risk of personal injury due to pressurized components and as a result of process medium being discharged.

Incorrect opening of pressure equipment or mounting parts may lead to the process medium escaping to the atmosphere.

- ➔ Do not unscrew the control line while the valve is pressurized.
- ➔ Do not start up the regulator until all parts have been mounted.

⚠ WARNING

Crush hazard arising from moving parts.

The regulator contains moving parts (actuator and plug stem), 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 hearing loss or deafness due to loud noise.

Noise emission (e.g. cavitation) may occur during operation caused by the process medium and the operating conditions.

- ➔ Wear hearing protection when working near the valve. Follow the instructions given by the plant operator.

Immediately after completing start-up or placing the regulator back into service (see the 'Start-up' chapter), the regulator is ready for use.

7.1 Adjusting the differential pressure set point

The differential pressure set point can only be adjusted on the Type 45-2 and Type 45-4 Regulators. The differential pressure set point of the Type 45-1 and Type 45-3 Regulators is determined by the internal set point springs (16).

- ➔ The control and shut-off valves as well as all consumers or a bypass valve (if installed) must be open.

i Note

We recommend adjusting the regulator at an operating point at which the consumer valve is open by approximately 5%. This results in the highest controlled differential pressure.

Operation

Procedure for the Type 45-2 and Type 45-4 Regulators

See Fig. 7-1 and Fig. 7-2.

Adjust the required set point by tensioning the set point springs (10) at the set point adjuster (9) or manual adjuster (19).

For smaller differential pressure set points, we recommend using a differential pressure pressure gauge instead of the pressure gauges (3 and 5) to check the pressure.

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. Relieve the tension from the set point springs (10).
3. Slightly open the motorized valve (approx. 10 % valve travel). See Fig. 7-3.
4. Adjust the differential pressure by turning the set point adjuster (9) or manual adjuster (19) to load the set point springs:
 - Turn the set point adjuster (9) or manual adjuster (19) clockwise (↻) to increase the pressure set point.
 - Turn the set point adjuster (9) or manual adjuster (19) counterclockwise (↺) to reduce the pressure set point.

Change the plant throughput (e.g. by opening and closing the consumer valve) to check the adjusted differential pressure at the regulator. Correct it, if necessary.

For regulators **with manual adjuster**, the set point spring is installed in the bottom section of the valve body (see Fig. 7-1). The set point can be continuously adjusted using the set point adjuster/manual adjuster according to the value on the scale (see Fig. 7-2).

i Note

The maximum value on the scale of the manual adjuster is 8. However, the maximum set point is reached earlier (see Fig. 7-1).

One turn of the manual 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.

! NOTICE

Risk of regulator malfunction due to incorrect setting.

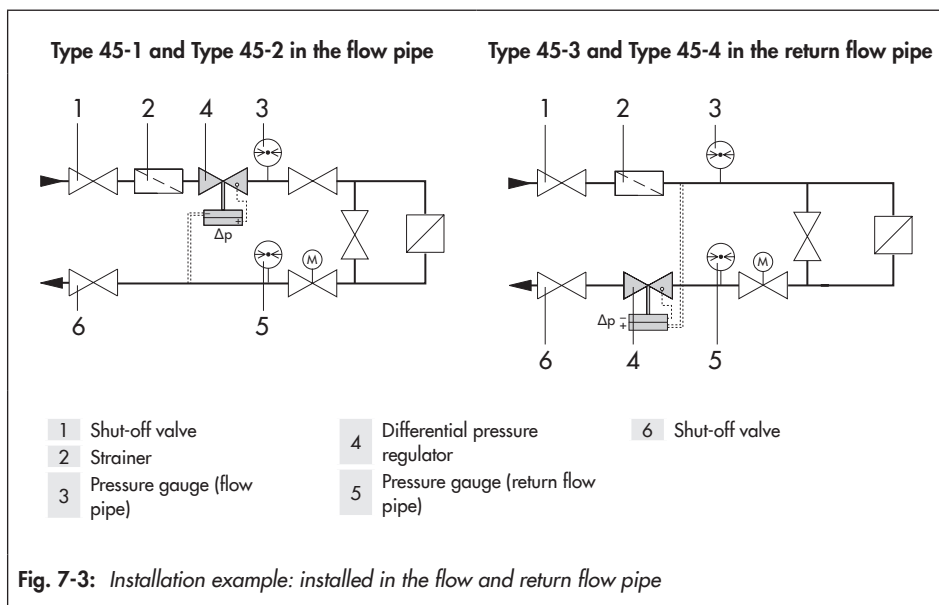
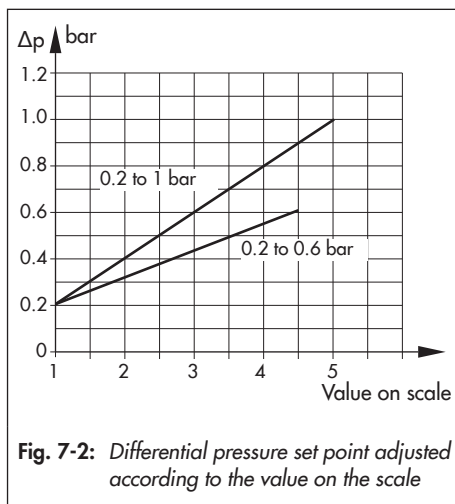
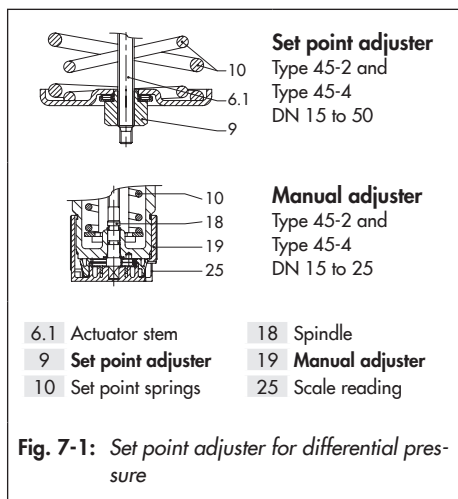
A scale value below 1 may lead to incorrect control.

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.



7.2 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 ($\Delta p_{\text{set point}}$) results from the known pressure drop across the fully open plant (Δp_{plant}) and the differential pressure created at the restriction ($\Delta p_{\text{restriction}}$). See Fig. 7-4.

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

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

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

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

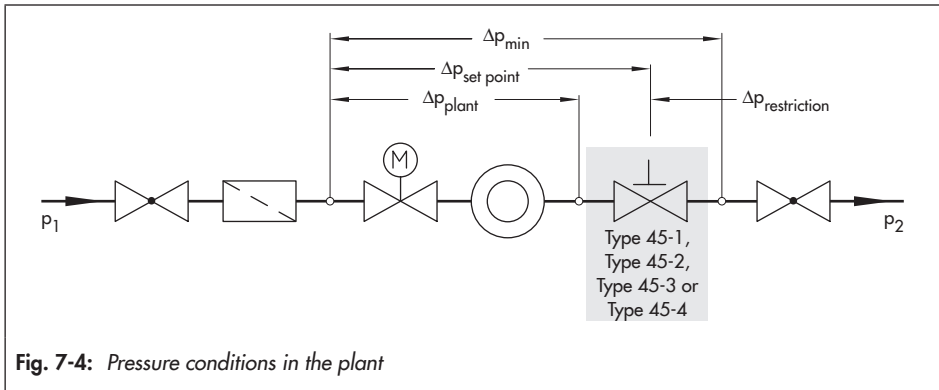


Fig. 7-4: Pressure conditions in the plant

8 Malfunctions

8.1 Troubleshooting

Malfunction	Possible reasons	Recommended action
Differential pressure exceeds adjusted set point.	Insufficient pressure pulses on the operating diaphragm	→ Clean the control line, needle valve and screw fittings.
	Foreign particles blocking the plug	→ Remove foreign particles. → Replace damaged parts. → Contact SAMSON's After-sales Service.
	Seat and plug are worn or leak.	→ Replace the damaged seat and plug. → Contact SAMSON's After-sales Service.
	Regulator or K_{VS}/C_V coefficient too large	→ Check the sizing. → Change K_{VS}/C_V coefficient, if necessary or install a different sized regulator. → Contact SAMSON's After-sales Service.
	Safety device, e.g. pressure limiter, has been triggered	→ Check plant. If necessary, unlock safety device.
	Pressure tapped at the wrong place.	→ Reconnect control lines at a different place. Do not tap pressure at pipe bends or necks.
	Defective operating diaphragm	→ Replace damaged diaphragm.
Differential pressure fluctuates.	Regulator or K_{VS}/C_V coefficient too large	→ Check the sizing. → Change K_{VS}/C_V coefficient, if necessary or install a different sized regulator. → Contact SAMSON's After-sales Service.
	The restriction in the control line for pressure tapping is too large or missing.	→ Install a restriction. → Install a smaller restriction.
Slow control response	Restriction in the screw joint dirty	→ Do not close the screw joint with restriction completely. → Clean screw joint or install larger screw joint.
	Dirt in the control line	→ Clean the control line.
Jerky control response	Increased friction, e.g. due to foreign particles between seat and plug	→ Remove foreign particles. → Replace damaged parts. → Contact SAMSON's After-sales Service.

Malfunctions

Malfunction	Possible reasons	Recommended action
Differential pressure set point not reached	Regulator installed against the flow	→ Install the regulator so that the direction of flow matches the direction indicated by the arrow on the body.
	Plant differential pressure Δp too low	→ Compare differential pressure in the plant with the plant's drag. Plant differential pressure $\Delta p_{\min} = \Delta p_{\text{restriction}} + (V/K_{VS})^2$
	Regulator or K_{VS}/C_V coefficient too small	→ Check the sizing. → Change K_{VS}/C_V coefficient, if necessary or install a different sized regulator. → Contact SAMSON's After-sales Service.
	Safety device, e.g. pressure limiter, has been triggered	→ Check plant. If necessary, unlock safety device.
	Incorrect set point range selected	→ Check set point range → Contact SAMSON's After-sales Service.
	Foreign particles blocking the plug	→ Remove foreign particles. → Replace damaged parts. → Contact SAMSON's After-sales Service.
	Insufficient pressure pulses on the operating diaphragm	→ Clean the control line, needle valve and screw fittings.
	Strainer blocked	→ Clean the strainer.
Loud noises	Defective operating diaphragm	→ Replace damaged diaphragm.
	High flow velocity, cavitation	→ Check the sizing. → Install larger regulator, if necessary.

i Note

Contact SAMSON's After-sales Service for malfunctions not listed in the table.

The malfunctions listed in Chapter 8.1 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 rectify the fault.

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.

**Tip**

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

8.2 Emergency action

Plant operators are responsible for emergency action to be taken in the plant.

We recommend removing the regulator from the pipeline before repairing it.

In the event of a regulator malfunction:

1. Close the shut-off valves upstream and downstream of the regulator to stop the process medium from flowing through the regulator.
2. Perform troubleshooting (see Chapter 8.1).
3. Rectify those malfunctions that can be remedied following the information given in this document. Contact SAMSON's After-sales Service in all other cases.

Putting the device back into operation after a malfunction

See the 'Start-up' chapter.

9 Servicing

The regulator does not require much 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.

Plant operators are responsible for drawing up an inspection and test plan. Details on faults and how to remedy them can be found in the 'Malfunctions' chapter.

The work described in this chapter is to be performed only by personnel appropriately qualified to carry out such tasks.

We recommend removing the regulator from the pipeline before performing any maintenance or service work.

⚠ DANGER

Risk of bursting due to incorrect opening of pressurized equipment or components.

Regulators and pipelines are pressure equipment that may burst when handled incorrectly. Flying projectile fragments or the release of process medium under pressure can cause serious injury or even death.

Before working on the regulator:

- ➔ *Depressurize all plant sections concerned and the regulator.*
- ➔ *Disconnect the control line.*
- ➔ *Drain the process medium from the plant sections affected as well as from the valve.*

⚠ 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 warm up to the ambient temperature.*
- ➔ *Wear protective clothing and safety gloves.*

⚠ 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 eye protection.*

ⓘ NOTICE

Risk of regulator damage due to over- or under-torquing.

Observe the specified torques when tightening regulator components. Excessive tightening torques lead to parts wearing out more quickly. Parts that are too loose may cause leakage.

- ➔ *Observe the specified tightening torques (see section 'Tightening torques' in the Appendix).*

NOTICE

Risk of regulator damage due to the use of unsuitable tools.

→ Only use tools approved by SAMSON (see section 'Tools' in the Appendix).

NOTICE

Risk of regulator damage due to the use of unsuitable lubricants.

→ Only use lubricants approved by SAMSON (see section 'Lubricants' in the Appendix).

NOTICE

Risk of regulator damage due to incorrect servicing or repair.

Only allow trained staff to perform service and repair work.

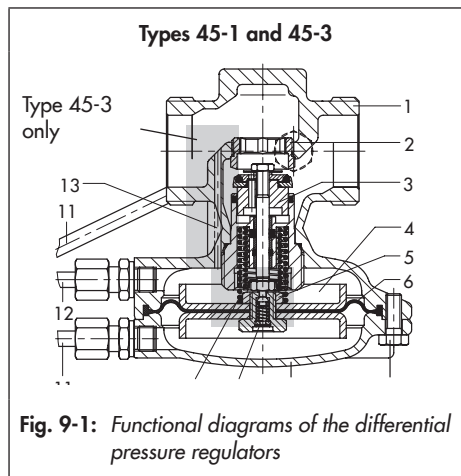
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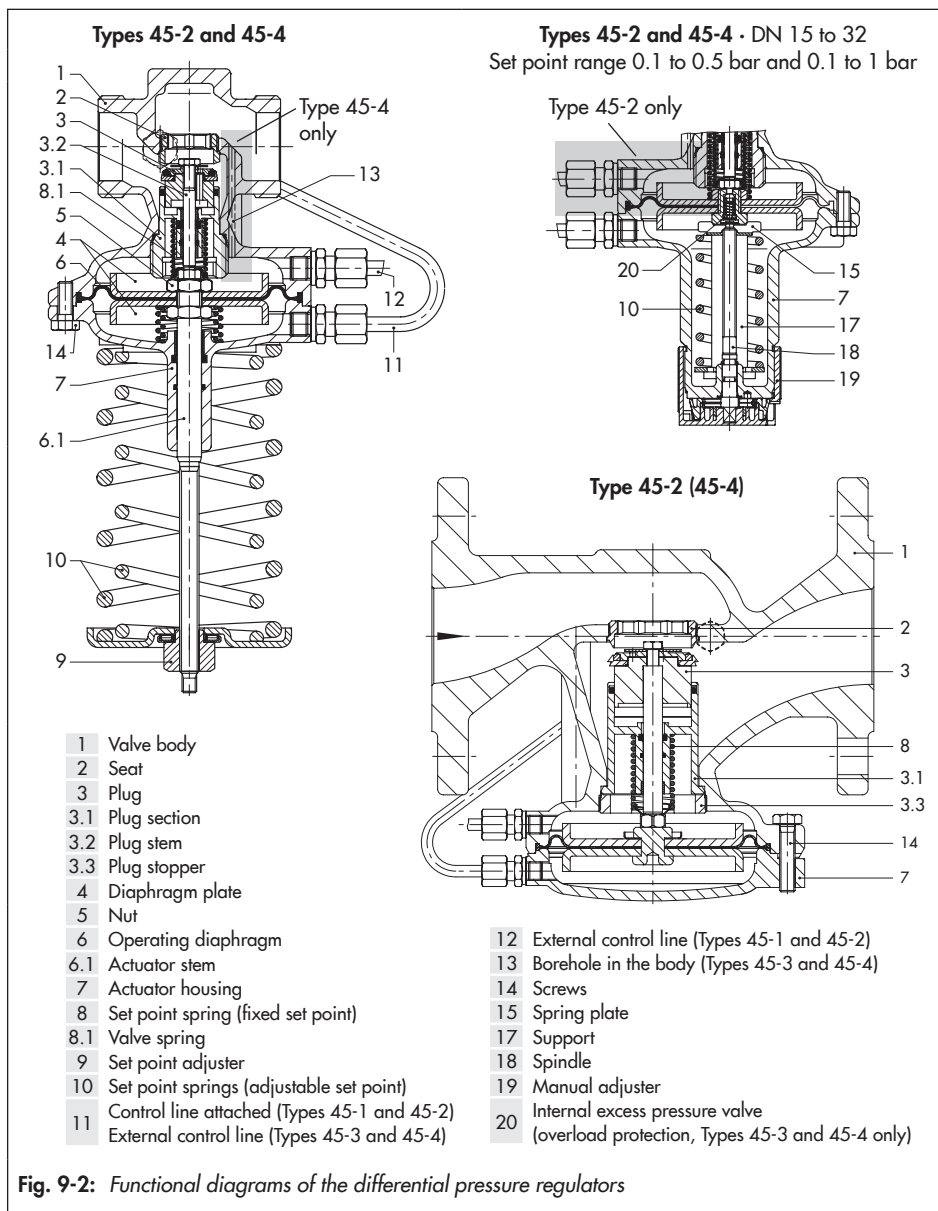
The regulator was checked by SAMSON before it left the factory.

- Certain test results certified by SAMSON lose their validity when the regulator is opened. Such testing includes seat leakage and leak tests.
- 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.
- Only use original spare parts by SAMSON, which comply with the original specifications.

Tip

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





9.1 Service work preparations

1. Lay out the necessary material and tools to have them ready for the service work.
2. Put the regulator out of operation (see the 'Decommissioning' chapter).



Tip

We recommend removing the regulator from the pipeline before performing any service work (see the 'Removing the regulator from the pipeline' chapter).

The following service work can be performed after preparation is completed:

- Replace the seat and plug (see Chapter 9.4)
- Replace the operating diaphragm (see Chapter 9.5)

9.2 Installing the regulator after service work

- Put the regulator back into operation (see the 'Start-up' chapter). Make sure the requirements and conditions for start-up or putting the valve back into operation are met.

9.3 Service work

- Before performing any service work, preparations must be made to the regulator (see Chapter 9.1).
- After all service work is completed, check the regulator before putting it back into operation (see section 'Testing the regulator' in the 'Installation' chapter).

9.4 Replacing the seat and plug

See Fig. 9-1 and Fig. 9-2.

Disassembly

1. Put the regulator out of operation (see the 'Decommissioning' chapter).
2. For **Type 45-4 and Type 45-2**, completely relieve the tension from the set point spring (10) by turning the set point adjuster (9) or manual adjuster (19) counterclockwise (↺).
3. Unscrew the control lines (11, 12).
4. Unscrew and remove the screws (14) and lift the actuator (7) off the valve body (1).
5. Pull the valve spring (8.1), if installed, out of the body.
6. **DN 15 to 25:** unscrew the guide nipple of the plug (3.1) using a socket wrench (order no. 1280-3001) and pull out the plug (3).
DN 32 to 50 unscrew stopper (3.3) and pull out the guide nipple (3.1) with plug (3).
7. Thoroughly clean the seat and plug. If the plug is damaged, replace the entire plug with a new one.
8. Check the control lines (11, 12) and the borehole in the body (13, Type 45-3 and Type 45-4) for blockage. Clean, if necessary.

Installation

1. Insert cleaned or new plug.
2. **DN 15 to 25:** tighten the guide nipple with plug (3.1) using a socket wrench (order no. 1280-3001). Observe the specified tightening torques (see section 'Tightening torques' in the Appendix).
DN 32 to 50: insert the plug (3) followed by the stopper of the plug (3.3). Observe the specified tightening torques (see section 'Tightening torques' in the Appendix).
3. Insert the valve spring (8.1), if installed, into the body.
4. Place the actuator on the body. Tighten screws (14). Observe the specified tightening torques (see section 'Tightening torques' in the Appendix).
5. Install the regulator into the pipeline.
6. Fasten the control lines (11, 12). Observe the specified tightening torques (see section 'Tightening torques' in the Appendix).
7. Put the regulator back into operation (see the 'Start-up' chapter).

9.5 Exchanging the operating diaphragm unit in the actuator

See Fig. 9-1 and Fig. 9-2.



Tip

The associated order number is written on the actual operating diaphragm.

9.5.1 Version without manual adjuster

WARNING

Stored energy in the set point springs can cause components to move in an uncontrolled manner resulting in injury to hands or fingers.

Removing the operating diaphragm unit

1. Put the regulator out of operation (see the 'Decommissioning' chapter).
2. Additional step for **Type 45-4** and **Type 45-2**: completely relieve the tension from the set point spring (10) by turning counterclockwise (↺).
3. Unscrew the control lines (11, 12).
4. Remove the regulator from the pipeline.
5. Remove the bolts (14).
6. Lift off the actuator housing (7) with actuator stem (6.1) and set point springs.
7. Pull the valve spring (8.1), if installed, out of the body.

8. Clamp the actuator housing (7) with actuator stem (6.1) and set point springs into a vise.
9. Unscrew the nut (5) and lift off the top diaphragm plate (4).
10. Note which side of the damaged operating diaphragm (6) is the pressurized side and remove the diaphragm.

Installing the operating diaphragm unit

1. Place the new operating diaphragm (6) with pressurized side on the bottom diaphragm plate (4).
2. Place on the top diaphragm plate (4) and mount the nut (5). Observe the specified tightening torques (see section 'Tightening torques' in the Appendix).
3. Insert the valve spring (8.1), if installed, into the body.
4. Place on the actuator housing (7) with actuator stem (6.1) and set point springs and tighten the screws (14) evenly. Observe the specified tightening torques (see section 'Tightening torques' in the Appendix).
5. Install the regulator into the pipeline.
6. Fasten the control lines (11, 12). Observe the specified tightening torques (see section 'Tightening torques' in the Appendix).
7. Put the regulator back into operation (see the 'Start-up' chapter).

9.5.2 Version with manual adjuster

Disassembly

1. Put the regulator out of operation (see the 'Decommissioning' chapter).
2. To completely relieve the tension from the set point springs (8), turn the manual adjuster (19) counterclockwise (↺) until you hear it a clicking noise.
3. Unscrew the control lines (11, 12).
4. Remove the regulator from the pipeline.
5. Remove the bolts (14).
6. Lift off the actuator housing (7).
7. Pull the valve spring (8.1), if installed, out of the body.
8. Unscrew the assembly, consisting of operating diaphragm (6) together the diaphragm plates, set point spring (10) and support (17), from the spindle (18) by turning the assembly counterclockwise. Pull it out the bottom section of the valve body.

Installation

1. Slide the new assembly over the spindle (18) into the actuator housing.
2. Turn the assembly clockwise (↻) by one turn to screw it onto the spindle (18). Lift the diaphragm plate to check whether the thread of the assembly has engaged. Turn the assembly one turn further, if necessary.
3. Insert the valve spring (8.1), if installed, into the body.
4. Place on the actuator housing (7) with actuator stem (6.1) and set point springs and tighten the screws (14) evenly. Observe the specified tightening torques (see section 'Tightening torques' in the Appendix).
5. Install the regulator into the pipeline.
6. Fasten the control lines (11, 12). Observe the specified tightening torques (see section 'Tightening torques' in the Appendix).
7. Put the regulator back into operation (see the 'Start-up' chapter).

9.6 Ordering spare parts and operating supplies

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

Spare parts

See Appendix for details on spare parts.

Lubricants

Contact SAMSON's After-sales Service for more information on lubricants.

Tools

Contact SAMSON's After-sales Service for more information on tools.

10 Decommissioning

The work described in this chapter is to be performed only by personnel appropriately qualified to carry out such tasks.

⚠ DANGER

Risk of bursting due to incorrect opening of pressurized equipment or components.

Regulators and pipelines are pressure equipment that may burst when handled incorrectly. Flying projectile fragments or the release of process medium under pressure can cause serious injury or even death.

Before working on the regulator:

- Depressurize all plant sections concerned and the regulator.
- Drain the process medium from the plant sections affected as well as from the valve.

⚠ 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 warm up to the ambient temperature.
- Wear protective clothing and safety gloves.

⚠ WARNING

Risk of personal injury due to pressurized components and as a result of process medium being discharged.

Incorrect opening of pressure equipment or mounting parts may lead to the process medium escaping to the atmosphere.

- Do not unscrew the control line while the valve is pressurized.
- Do not start up the regulator until all parts have been mounted.

⚠ WARNING

Risk of hearing loss or deafness due to loud noise.

Noise emission (e.g. cavitation) may occur during operation caused by the process medium and the operating conditions.

- Wear hearing protection when working near the valve. Follow the instructions given by the plant operator.

⚠ WARNING

Crush hazard arising from moving parts.

- Do not insert hands or fingers between the set point springs while the regulator is in operation.
- Before starting any work on the regulator, depressurize plant sections as well as the regulator.

Decommissioning

⚠ 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.

➔ *Wear protective clothing, safety gloves and eye protection.*

To decommission the regulator for service work or disassembly, proceed as follows:

1. Close the shut-off valve (1) on the upstream side of the regulator.
2. Close the shut-off valve (6) on the downstream side of the regulator.
3. Depressurize the plant.
4. Completely drain the pipelines and valve.
5. If necessary, allow the pipeline and regulator components to cool down or warm up to the ambient temperature.

11 Removal

The work described in this chapter is to be performed only by personnel appropriately qualified to carry out such tasks.

⚠ 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 warm up to the ambient temperature.*
- *Wear protective clothing and safety gloves.*

⚠ 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.

- *Wear protective clothing, safety gloves and eye protection.*

Before removing the valve, make sure the following conditions are met:

- The regulator is put out of operation (see the 'Decommissioning' chapter).

11.1 Removing the regulator from the pipeline

1. Support the regulator to hold it in place when separated from the pipeline (see the 'Shipment and on-site transport' chapter).
2. Undo the flange joints or pipe connections.
3. Remove the regulator from the pipeline (see the 'Shipment and on-site transport' chapter).

11.2 Removing the actuator from the valve

See the 'Servicing' chapter.

12 Repairs

If the regulator does not function properly according to how it was originally sized or does not function at all, it is defective and must be repaired or exchanged.

! NOTICE

Risk of regulator damage due to incorrect service or repair work.

→ Contact SAMSON's After-sales Service for service and repair work.

12.1 Returning devices to SAMSON

Defective devices can be returned to SAMSON for repair.

Proceed as follows to return devices:

1. Exceptions apply concerning some special device models
 - ▶ www.samsongroup.com > Service & Support > After-sales Service.
2. Send an e-mail ▶ retouren@samsongroup.com to register the return shipment including the following information:
 - Type
 - Material number
 - Item numbers of accessories
 - Original order

- Completed Declaration on Contamination, which can be downloaded from our website at
 - ▶ www.samsongroup.com > Service > After-sales Service.

After checking your registration, we will send you a return merchandise authorization (RMA).

3. Attach the RMA (together with the Declaration on Decontamination) to the outside of your shipment so that the documents are clearly visible.
4. Send the shipment to the address given on the RMA.

i Note

Further information on returned devices and how they are handled can be found at

▶ www.samsongroup.com > Service > After-sales Service.

13 Disposal



SAMSON is a producer registered at the following European institution ► <https://www.ewrn.org/national-registers/national-registers>.
WEEE reg. no.:
DE 62194439/FR 025665

- Observe local, national and international refuse regulations.
- Do not dispose of components, lubricants and hazardous substances together with your other household waste.

i Note

We can provide you with a recycling passport according to PAS 1049 on request. Simply e-mail us at offersaleservice@samsongroup.com giving details of your company address.

Tip

On request, we can appoint a service provider to dismantle and recycle the product as part of a distributor take-back scheme.

14 Certificates

The EU declarations of conformity are included on the next pages:

- EU declaration of conformity in compliance with Pressure Equipment Directive 2014/68/EU on page 14-2.



**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-, Temperatur- und Volumenstromregler/Valves for pressure, temperature, flowregulators and differential pressure regulators

Typ 2336, 2373, 2375, 44-1B, 44-2, 44-3, 44-4, 44-6B, 44-9, 45-1, 45-2, 45-3, 45-4, 45-6, (Erz.-Nr. 2720), 45-9, 47-4, 2488, 2489, (2730), 2405, 2406, 2421 (2811), 2412 (2812), 2417 (2817), 2422 (2814), 2423 (2823), 2423E (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 to the making available on the market of pressure equipment (see also Articles 41 and 48). 2014/68/EU of 15 May 2014

Angewandtes Konformitätsbewertungsverfahren für Fluide nach Art. 4(1)(c.i) erster Gedankenstrich. Modul siehe Tabelle durch Bureau Veritas S. A. (0062)
Conformity assessment procedure applied for fluids according to Article 4(1)(c.i), first indent See table for module certified by Bureau Veritas S. A. (0062)

Nenndruck Pressure rating	DN NPS	15	20	25	32	40	50	65	80	100	125	150	200	250	300	400
		½	¾	1	1¼	1½	2	-	3	4	-	6	8	10	12	16
PN 16		ohne/without ⁽¹⁾			A ⁽²⁾⁽³⁾			-	-	-	-	-	-	-	-	-
PN 25		ohne/without ⁽¹⁾			A ⁽²⁾⁽³⁾						H					
PN 40		ohne/without ⁽¹⁾								H						
PN 100 und PN 160		ohne/without ⁽¹⁾							H					-	-	-
Class 150		ohne/without ⁽¹⁾			A ⁽²⁾⁽³⁾						H					
Class 300		ohne/without ⁽¹⁾								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 methods of:
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

i.v. Klaus Wille
Klaus Hörschken
Zentralabteilungsleiter / Head of Central Department
Entwicklung Ventile und Antriebe / R&D, Valves and Actuators

Dr. Michael Heß
Dr. Michael Heß
Zentralabteilungsleiter / Head of Central Department
Product Management & Technical Sales

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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	20	25	32	40	50	65	80	100	125	150	200	250	300	400	
		½	¾	1	1¼	1½	2	-	3	4	-	6	8	10	12	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, 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

i.V. Klaus Hörtschen

Klaus Hörtschen
Zentralabteilungsleiter/Head of Central Department
Entwicklung Ventile und Antriebe/R&D, Valves and Actuators

i.V. Dr. Michael Heß

Dr. Michael Heß
Zentralabteilungsleiter/Head of Central Department
Product Management & Technical Sales

15 Appendix

15.1 Tightening torques

Component	DN	Tightening torque in Nm
Plug section (3.1)	15 to 25 32	70 110
Plug stopper (3.3)	40 to 50	110
Nut (5)	15 to 50	22
Control line (11, 12)	15 to 50	22
Screws (14)	15 to 32 40 to 50	8 18
Connection nut on the threaded/welding end	15 to 50	80

15.2 Accessories/mounting parts

Nominal 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 flat gasket

15.3 Lubricants

SAMSON's After-sales Service can support you concerning lubricants and sealants approved by SAMSON.

15.4 Tools

SAMSON's After-sales Service can support you concerning tools approved by SAMSON.

15.5 Spare parts

Legend for Fig. 15-1 and Fig. 15-2

2	Plug	105	Shim
6	Diaphragm stem	110, 112	Diaphragm case
30	Body	124, 125	Diaphragm
31...34	Seat	130	Screw
56	Set point adjuster	134, 135	O-ring
57	Hex nut	137...139	Seal
65	Differential pressure spring	146	Plain bearing
70, 71	Set point springs	150	Axial needle bearing
90	Diaphragm plate	220	Diaphragm
95	Spring plate		

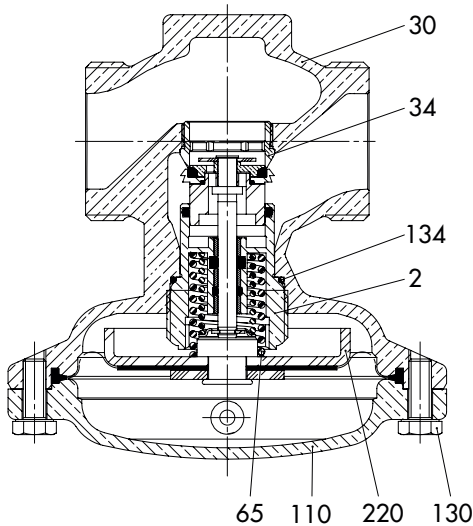


Fig. 15-1: Type 45-1 Regulator, DN 15 to 50

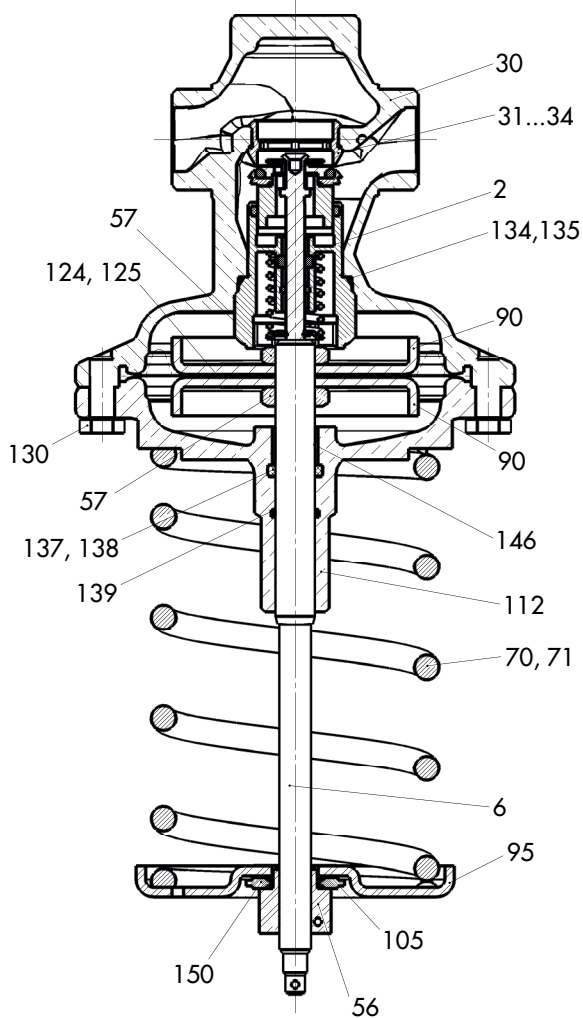


Fig. 15-2: Type 45-2 Regulator, DN 15 to 50

Legend for Fig. 15-3 and Fig. 15-4

2	Plug	105	Shim
6	Diaphragm stem	110, 112	Diaphragm case
30	Body	124, 125	Diaphragm
31...34	Seat	130	Screw
56	Set point adjuster	134, 135	O-ring
57	Hex nut	137...139	Seal
65	Differential pressure spring	146	Plain bearing
70, 71	Set point springs	150	Axial needle bearing
90	Diaphragm plate	220	Diaphragm
95	Spring plate		

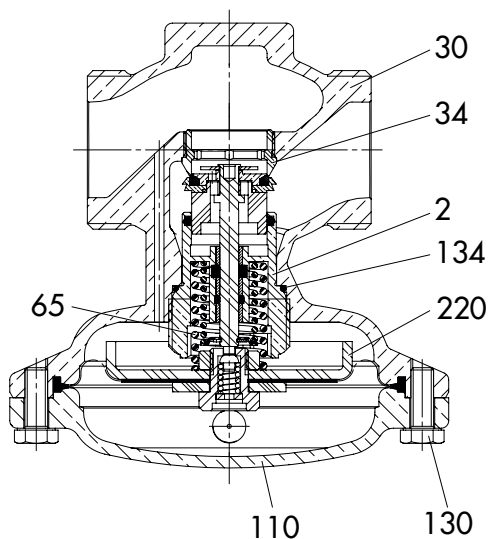


Fig. 15-3: Type 45-3 Regulator, DN 15 to 50

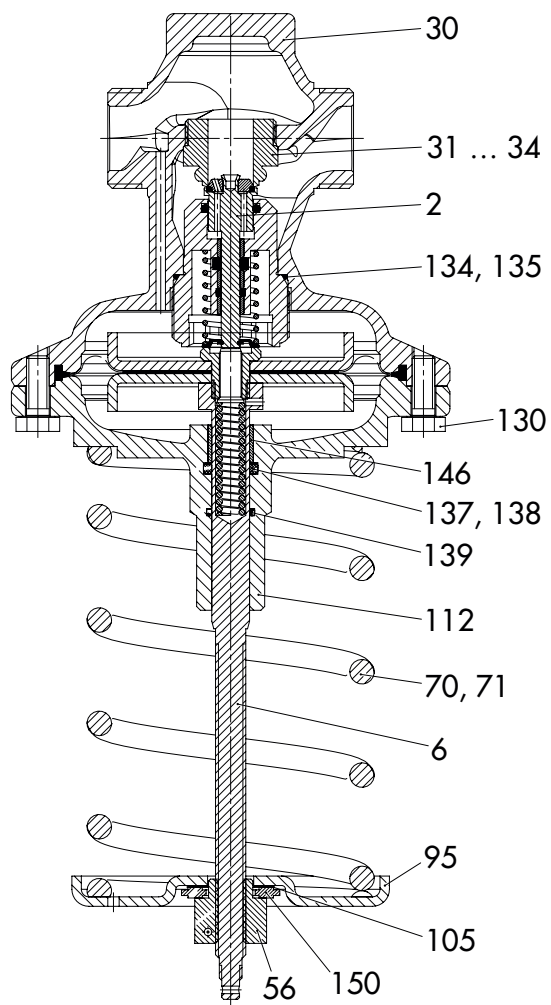


Fig. 15-4: Type 45-4 Regulator, DN 15 to 50

15.6 After-sales service

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

E-mail address

You can reach our after-sales service at aftersalesservice@samsongroup.com.

Addresses of SAMSON AG and its subsidiaries

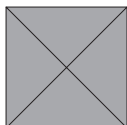
The addresses of SAMSON, its subsidiaries, representatives and service facilities worldwide can be found on our website (▶ www.samsongroup.com) or in all SAMSON product catalogs.

Required specifications

Please submit the following details:

- Device type and nominal size
- Valve balanced by a bellows or diaphragm
- Model number or material number
- Upstream and downstream pressure
- Temperature and process medium
- Min. and max. flow rate in m³/h
- Is a strainer installed?
- Installation drawing showing the exact location of the regulator and all the additionally installed components (shut-off valves, pressure gauge etc.)

EB 3124 EN



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