Differential Pressure Regulators
Type 45-1
Type 45-2
Type 45-3
Type 45-4

Type 45-1 Differential Pressure Regulator

Type 45-2 Differential Pressure Regulator

Mounting and Operating Instructions

EB 3124 EN

Edition March 2008

Contents

General safety instructions

- *The differential pressure regulator must be installed, started up and serviced only by skilled or semi-skilled staff in accordance with good engineering practice so that employees and third persons are not exposed to danger. All safety instructions and warnings given in these mounting and operating instructions, particularly those concerning installation, start-up, and maintenance, must be strictly observed.*
- *The regulator complies with the requirements of the European Pressure Equipment Directive 97/23/EC. The declaration of conformity issued for a valve bearing the CE marking includes information on the applied conformity assessment procedure and will be provided on request.*
- *To ensure appropriate use, only use the regulator in applications where the operating pressure and temperatures do not exceed the operating values specified in the order.*
  Note that the manufacturer does not assume any responsibility for damage caused by external forces or any other external factors.
  Take appropriate safety precautions to prevent hazards that may be caused in the regulator by the process medium, operating pressure, or moving parts.
- *Make sure the regulator is shipped and stored properly.*

Note!

- *Depending on the field of application, allow the regulator to cool down or warm up to reach ambient temperature prior to starting any work.*
  Always depressurize the relevant section of the plant and, if necessary, also drain the pipeline prior to removing the regulator from the pipeline.
- *When controlling freezing media, protect the regulator against frost.*

Note!
Non-electric control valves, whose valve bodies are not lined with an ***insulating material coating****, do not have their own potential ignition source according to the ignition risk assessment stipulated in EN 13463-1: 2001, section 5.2, even in the rare incident of an operating fault. Therefore, such valve versions* ***do not*** *fall within the scope of Directive 94/9/EC.*

1 Design and principle of operation

The regulators consist of a valve with a balanced plug and a closing actuator with an operating diaphragm.
Types 45-1 and 45-3 have a fixed set point determined by the set point spring integrated in the valve body, whereas
Types 45-2 and 45-4 allow the set point to be adjusted by the set point springs attached to the actuator.

The regulators are designed to maintain the differential pressure between the high-pressure and low-pressure pipes at the adjusted set point. The valve closes when the differential pressure rises.

On **Types 45-1 and 45-2** installed in a flow pipe, the medium flows through the valve in the direction indicated by the arrow. The high pressure in the valve outlet is transmitted through the attached control line (11) to the high-pressure side of the operating diaphragm. The low pressure from the return pipe is transmitted to the low-pressure side of the diaphragm via the control line (12) which must be routed externally on site.

On Types 45-3 and 45-4 installed in a return pipe, the low pressure upstream of the valve is directed over an internal hole (13) to the low-pressure side of the diaphragm. The high pressure from the flow pipe is transmitted to the high-pressure side of the diaphragm through the control line (11) which must be routed externally on site.

The differential pressure acting on the operating diaphragm generates a positioning force, which positions the plug against the force of the set point springs (8, 10).

2 Installation

2.1 Mounting position

Install the differential pressure regulator in a horizontal pipeline with the actuator vertically suspended. Regulators in nominal sizes DN 15 to 25 may also be installed in vertical pipelines.

For medium temperatures above 80 °C, note that the regulator must not be installed with the diaphragm actuator pointing upward.

Make sure that the medium flows through the valve in the direction indicated by the arrow on the valve body.

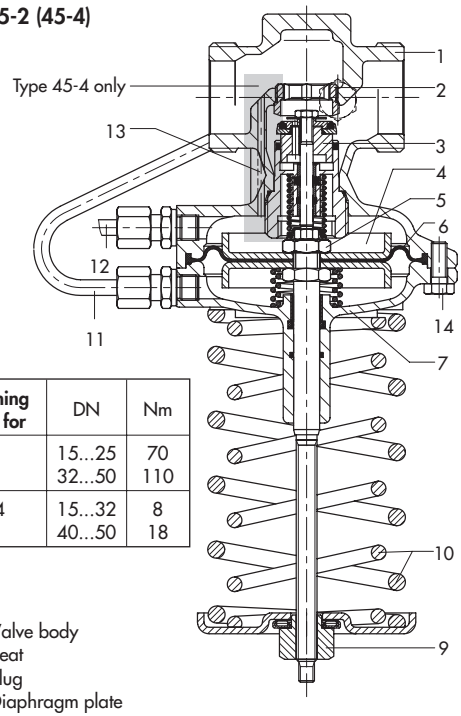
2.2 Control line

Adapt a control line with a 6 mm pipe diameter to the installation conditions on site. Then attach it to the valve and to the pipeline according to the applicable installation schematics (Fig. 1), making sure the control line is free of any dirt.

2.3 Strainer

Install a strainer (e.g. SAMSON Type 1 NI) upstream of the regulator to prevent sealing particles, weld spatter, pipe scale, and other impurities carried along by the process medium from impairing the proper operation, especially the tight shut-off of the regulator. Make sure that the medium flow corresponds with the direction indicated by the arrow on the strainer body. Install the strainer with the filter element vertically suspended. Ensure that ample space is available to remove the filter.

Type 45-2 (45-4)



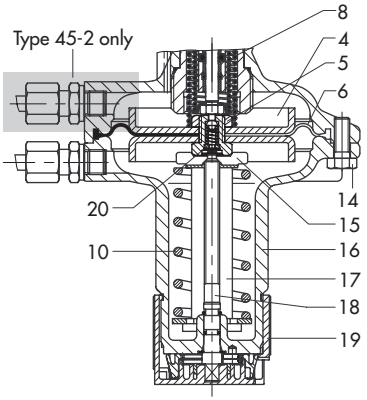
Tightening torque for	DN	Nm
Item 3 Plug	15...25 32...50	70 110
Item 14 Screw	15...32 40...50	8 18

Legend

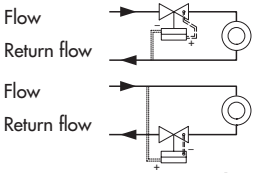
1	Valve body
2	Seat
3	Plug
4	Diaphragm plate
5	Nut
6	Operating diaphragm
7	Diaphragm case
8	Set point spring
9	Set point adjuster
10	Spring(s)
11	Control line, permanent (Type 45-1/-2) Control line, external (Type 45-3/-4)
12	Control line, external (Type 45-1/-2)
13	Internal hole (Type 45-3/-4)
14	Screws
15	Spring plate
16	Bottom section of valve body
17	Support
18	Spindle
19	Manual adjuster
20	Internal excess pressure limiter (overload protection) for Types 45-3/45-4 only

Fig. 1 · Sectional drawings

Type 45-4 (45-2): DN 15 to 32
Set point range 0.1 to 0.5 and 0.1 to 1 bar

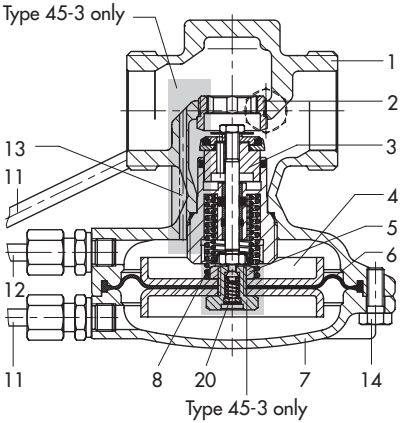


Types 45-1 and 45-2



Types 45-3 and 45-4

Type 45-1 (45-3)



2.4 Shut-off valves, pressure gauges

Ideally, install hand-operated shut-off valves both upstream of the strainer and downstream of the differential pressure regulator. This allows the plant to be shut down for cleaning and maintenance routines, or when the plant is not operated for long periods of time.
To monitor the pressures prevailing in the plant, install pressure gauges both upstream and downstream of the regulator and in the flow and return flow pipes at the pressure tapping points.

3 Operation

3.1 Start-up

Fill the plant very slowly on start-up.

Note! *When carrying out a pressure test on the section of the plant equipped with the pressure regulator, make sure the diaphragm actuator cannot be damaged by the test pressure (max. differential pressure Δp).*

3.2 Set point adjustment

On Types 45-2 and 45-4, adjust the required differential pressure by tensioning the spring(s) at the set point adjuster (9):

- Turn the set point adjuster clockwise to increase the differential pressure.
- Turn the set point adjuster counterclockwise to reduce the differential pressure.

On valve sizes DN 15 to 32 with set point ranges from 0.1 to 0.5 and 0.1 to 1 bar, the set point springs are installed in the bottom section of the valve body. In this case, the set point can be directly adjusted according to the scale at the manual adjuster (19). One turn of the set point adjuster will cause a differential pressure change of 0.033 bar for a pressure range of 0.1 to 1 bar and 0.02 bar for a range of 0.1 to 0.5 bar.

Note!
Do not adjust the set point to a scale value smaller than "1"!
Under certain conditions, the set point ***cannot*** *be adjusted anymore as a result.*
In this case, the following steps are recommended:
- *Relieve the process pressure from both sides of the regulator.*
- *Turn the adjuster counterclockwise as far as it will go to its lowest position.*
- *Turn the adjuster back clockwise at least past the scale value "1" to "2".*
- *The regulator can now be readjusted.*

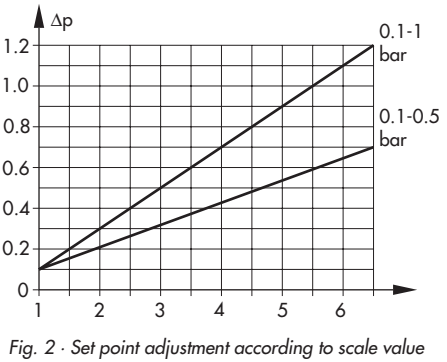


Fig. 2 · Set point adjustment according to scale value

4 Maintenance – Replacing parts

The differential pressure regulator is maintenance free. Nevertheless, it is subject to natural wear, particularly at the seat, plug and operating diaphragm. Depending on the operating conditions that prevail, inspect the regulator at regular intervals to avoid possible malfunctions.
Details on faults and the recommended action can be found in section 5. If a problem cannot be solved with the help of the information specified in the table, contact SAMSON.
To replace the plug and diaphragm, proceed as described in sections 4.1 and 4.2.

Caution!
Prior to carrying out any work, first allow the relevant section of the plant to cool down to ambient temperature if high temperatures prevail.
Depressurize this section and drain it depending on the medium.
We recommend that the regulator be removed from the pipeline for carrying out any work on the regulator.

4.1 Cleaning or replacing the plug

1. Unscrew the external control line.
   Remove the regulator from the pipeline.
2. For Types 45-2 and 45-4, completely release tension from the spring(s) by turning the set point adjuster (9) or manual adjuster (19) counterclockwise.
   For Types 45-1 and 45-2, unscrew the control line (11).
3. Remove the screws (14) and the complete actuator.
   If applicable, remove the set point spring (8) from the valve body.
4. For DN 15 to 25, unscrew the guide nipple of the plug assembly (3) using a socket wrench (order no. 1280-3001).
   The wrench can be made, for example from a Gedore screwdriver bit (IN 19-19) by boring a 17 mm hole with a 17 mm diameter into the 19 mm hexagon bit (Fig. 3).
5. For DN 32 to 50, screw out the stopper. Remove the plug assembly.
6. Clean the seat and plug assembly thoroughly. If the plug is damaged, replace the entire plug assembly.
7. Check the control lines and internal bore (of Types 45-3 and 45-4) for blockages.

   To reassemble the regulator, proceed in reverse order. Observe the tightening torques specified in Fig. 1.

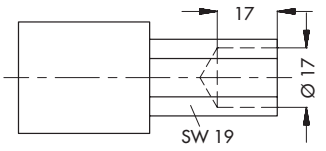


Fig. 3 · Socket wrench

4.2 Replacing the diaphragm

1. Unscrew the external control line. Remove the regulator from the pipeline.

Types 45-1 and 45-2

2. For Type 45-1, unscrew the control line (11).
3. Loosen the screws (14). Remove the lower diaphragm case (7) including the operating diaphragm (6) and diaphragm plates (4) from the body. If applicable, remove the set point spring (8) from the valve body.
4. Unthread the nut (5). Remove the diaphragm plate. Replace the diaphragm. To reassemble the regulator, proceed in reverse order. Observe the tightening torques specified in Fig. 1.

Types 45-2 and 45-4, version without manual adjuster

2. Completely release the tension from the spring(s) by turning the set point adjuster (9) counterclockwise.
3. For Type 45-2, unscrew the control line (11).
4. Loosen the screws (14). Take off the lower diaphragm case including all actuator parts as well as the diaphragm and diaphragm plate.
5. Unthread the nut (5). Remove the diaphragm plate. Then replace the diaphragm. To reassemble, proceed in reverse order. Observe the tightening torques specified in Fig. 1.

Types 45-2 and 45-4, version with manual adjuster

1. For Type 45-2, unscrew the control line (11).
2. Completely release the tension from the spring(s) (10) by turning the manual adjuster (19) counterclockwise.
3. Remove the screws (14). Take off the bottom section of the valve body (16). If applicable, remove the set point spring (8) from the valve body.
4. Unscrew the diaphragm assembly including the diaphragm plates, spring, and support (17) from the spindle (18) by turning the assembly counterclockwise. Remove it from the bottom section of the valve body.
5. **Caution!** Push the spring (10) up over the support (17) so that the spring plate (15) is tensioned and cannot slide off the support.
6. Fasten the bottom diaphragm plate. Unthread the nut (5).
7. Replace the diaphragm. Tighten the nut (5) to 22 Nm.
8. Push the complete assembly over the spindle into the bottom section and screw it onto the spindle by turning it clockwise one turn.
9. Lift the diaphragm plate to check whether the thread of the spring plate (15) has engaged. If not, turn again.
10. Hold the diaphragm stationary. Turn the manual adjuster clockwise until the set

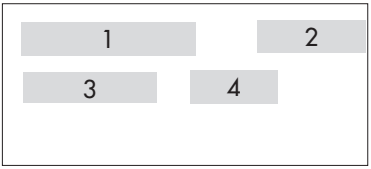
point spring is tensioned sufficiently to keep the lower diaphragm plate in place in the body and to prevent it from moving freely.

11. If applicable, insert the set point spring (8) into the valve body.
12. Align the bottom section of the valve body to fit the control line connections. Thread the screws (14) evenly into the valve body (8 Nm).
13. For Type 45-2, screw on the control line.
14. Install the regulator in the pipeline. Mount the external control line. Adjust the differential pressure set point as described in section 3.2.

5 Troubleshooting

Fault	Possible causes	Recommended action
Differential pressure exceeds adjusted set point	Valve too large for control task	Recalculate K_{VS} and contact SAMSON.
	Seat and plug untight	Remove valve, clean seat and plug. If necessary, replace plug (section 4.1). Otherwise, return device for repair.
	Operating diaphragm defective	Replace diaphragm (section 4.2) or return device for repair.
	Control line blocked	Remove and clean control line.
Differential pressure set point not reached	Valve too small for control task	Check set point range and contact SAMSON.
	Safety device, e.g. pressure limiter, has been triggered	Check plant, unlock safety device.
	Insufficient pressure drop across the plant	Compare existing differential pressure in the plant with the plant's drag.
	Strainer blocked	Drain and clean filter of the strainer.
	Valve installed against direction of flow	Re-install valve such that direction of flow corresponds to arrow on the body.
Control loop hunts	Valve too large for control task	Recalculate K_{VS} and contact SAMSON.

6 Nameplate

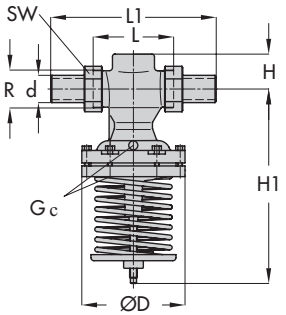


1 Configuration ID
2 Type designation
3 Model number
4 Date of manufacture

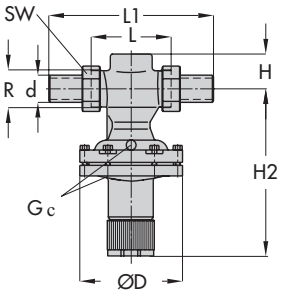
In the other fields:
Nominal pressure PN or ANSI Class
K_{vs} or C_v
Max. perm. temperature in °C or °F
Differential pressure set point range in bar or psi
Max. perm. differential pressure Δp

Fig. 4 · Nameplate

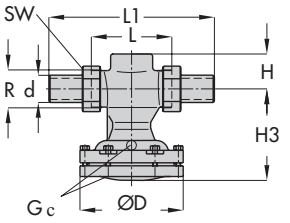
7 Dimensions and weights



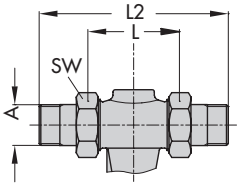
Types 45-2 and 45-4



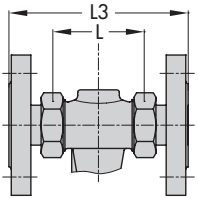
Types 45-2 and 45-4, DN 15 to 32
0.1 to 0.5 bar and 0.1 to 1.0 bar



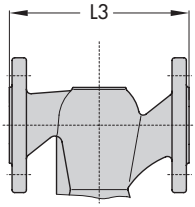
Types 45-2 and 45-4
Connection nuts with welding ends



Connection nuts with threaded ends



Connection nuts with flanges



Flanged body, DN 32/40 and 50

Fig. 5 · Dimensional drawings (Dimensions in mm)

Nominal size DN	15	20	25	32	40	50
External pipe Ø d	21.3	26.8	32.7	42	48	60
Connection D	G ¾	G 1	G 1¼	G 1¾	G 2	G 2½
Width across flats SW	30	36	46	59	65	82
Length L	65	70	75	100	110	130
Height H	32			45	45	
Height H1	230			250	380	
Height H2	160			180	–	
Height H3	85			105	140	
Diameter D	116				160	
Welding ends L1	210	234	244	268	294	330
Weight 45-2/-4	2.0	2.1	2.2	8.5	9	9.5
App. kg 45-1/-3	1.5	1.6	1.8	4.8	5.3	6.0
Special version with threaded ends (male thread)						
Length L2	129	144	159	180	196	228
Male thread A	G ½	G ¾	G 1	G 1¼	G 1½	G 2
Weight 45-2/-4	2.0	2.1	2.2	8.5	9	9.5
App. kg 45-1/-3	1.5	1.6	1.8	4.8	5.3	5.8
Special version with flanges PN 16/25 or version with flanged body (DN 32/40/50)						
Length L3	130	150	160	180	200	230
Weight 45-2/-4	3.4	4.1	4.7	11.7	13	14.5
App. kg 45-1/-3	2.9	3.6	4.3	8	9.3	10.8

8 Customer inquiries

Should you have any inquiries, please submit the following details:

- Type and nominal size of the regulator
- Threaded ends or flanges
- Order and model numbers
- Upstream and downstream pressures
- Flow rate in m^3/h
- Has a strainer been installed?
- Installation drawing

SAMSON AG · MESS- UND REGELTECHNIK
Weismüllerstraße 3 · 60314 Frankfurt am Main · Germany
Phone: +49 69 4009-0 · Fax: +49 69 4009-1507
Internet: http://www.samson.de

EB 3124 EN

S/Z 2008-03