

# Self-operated Pressure Regulators



## Differential Pressure Regulators (opening) Type 42-10 · Type 42-15



*Type 42-10 Differential Pressure  
Regulator*



*Type 42-15 Differential Pressure  
Regulator*

## Mounting and Operating Instructions

**EB 3005 EN**

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Definitions of the signal words used in these instructions

**CAUTION!**

*CAUTION* indicates a hazardous situation which, if not avoided, may result in injury.

**Note:** Supplementary explanations, information and tips

**NOTICE**

*NOTICE* indicates a property damage message.



### General safety instructions

- ▶ *The regulators must be installed, started up and serviced by fully trained and qualified personnel only, observing the accepted industry codes and practices. Make sure employees or third persons are not exposed to any danger.  
All safety instructions and warnings in these mounting and operating instructions, particularly those concerning installation, start-up and maintenance, must be 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.  
The declaration of conformity can be provided on request.*
- ▶ *For appropriate operation, make sure that the regulator is only used in applications where the operating pressure and temperatures do not exceed the operating values based on the sizing data submitted in the order.*
- ▶ *Note that the manufacturer does not assume any responsibility for damage caused by external forces or any other external factors.*
- ▶ *Any hazards which could be caused in the regulator by the process medium or operating pressure are to be prevented by means of appropriate measures.*
- ▶ *Proper shipping and appropriate storage are assumed.*

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**Note:** *Non-electric valve versions which do not have a valve body lined with an insulating 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, they **do not** fall within the scope of Directive 94/9/EC.*

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## 1 Design and principle of operation

The differential pressure regulators are designed to maintain the pressure difference between the high-pressure and low-pressure lines at an adjustable set point (Type 42-15) or a fixed set point (Type 42-10).

The regulators consist of a valve (1) with seat (2) and plug (3) and an opening actuator with an operating diaphragm.

Valve and actuator are delivered separately and must be assembled on site using a coupling nut.

The medium flows through the valve in the direction indicated by the arrow. The position of the plug (3) determines the cross-sectional area of flow between the plug (3) and the seat (2) and the differential pressure across the plant.

To prevent the pressures in the valve from acting on the actuator, these regulators are fitted with a tight-sealing distance piece (10).

The differential pressure across the plant is transmitted over the high-pressure and low-pressure lines to the operating diaphragm (13) where it is converted into a positioning force. This force moves the plug according to the force of the set point springs (16). Depending on the actuator version, the springs are installed in the actuator to provide a fixed set point (Type 42-10) or they are located outside to allow the set point to be adjusted as required (Type 42-15).

**Table 1** · Regulator configuration

| Regulator                      | = | Valve                | + | Actuator                       |
|--------------------------------|---|----------------------|---|--------------------------------|
| Type 42-10 with distance piece |   | Type 2421 Unbalanced |   | Type 2420 Fixed set point      |
| Type 42-15 with distance piece |   | Type 2421 Unbalanced |   | Type 2425 Adjustable set point |

## 2 Installation

**Type 42-10** and **Type 42-15** Regulators are designed for installation in a bypass or short-circuit pipe. The distance piece must be fitted between the valve and actuator. The regulators **cannot** function properly without it.

On selecting the position of installation, make sure that the regulator can still be easily accessed after completion of the plant.

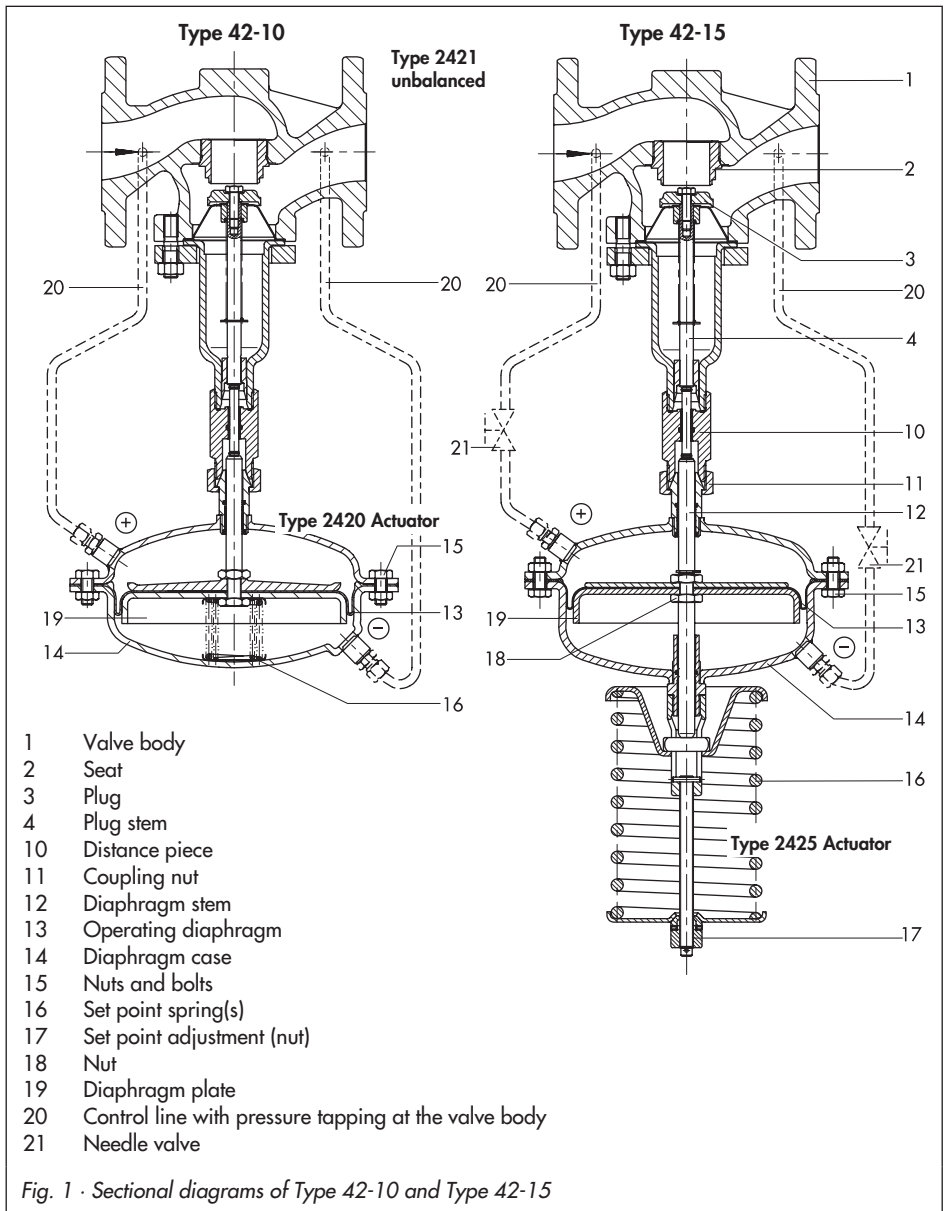
### NOTICE

*Install a strainer (e.g. SAMSON Type 2 N) upstream of the regulator. Refer to section 2.2.*

Flush pipeline thoroughly prior to installation of the regulator to prevent sealing particles, globules or other impurities carried along by the process medium from impairing the proper functioning of the valve.

### NOTICE

*The regulator must be installed free of stress. If necessary, support the piping near the connections. However, do not attach supports to the valve or actuator.*

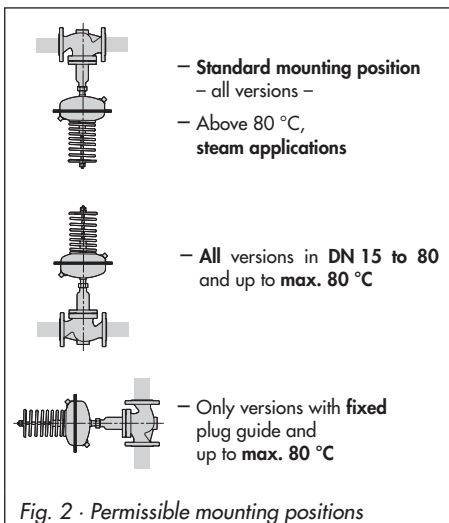


## 2.1 Mounting position

See Fig. 2 for permissible mounting positions.

**Standard mounting position** · Install valve without actuator in a horizontal bypass or short-circuit pipe with the connection for the actuator facing downwards. Make sure the medium flows through the valve in the direction indicated by the arrow.

Then connect the actuator to the valve using the coupling nut (11) at the distance piece (10).



## 2.2 Strainer

Install the strainer upstream of the regulator. Make sure the direction of medium flow corresponds with the direction indicated by the arrow on the strainer. The filter element must be suspended downwards or be located at the side for applications with steam. Remember to leave enough space to remove it.

## 2.3 Shut-off valve

We recommend installing a hand-operated shut-off valve (Fig. 5) both upstream of the strainer and at the outlet of the bypass pipe. This allows the plant to be shut down for cleaning and maintenance, and when the plant is not used for longer periods of time.

## 2.4 Pressure gauge

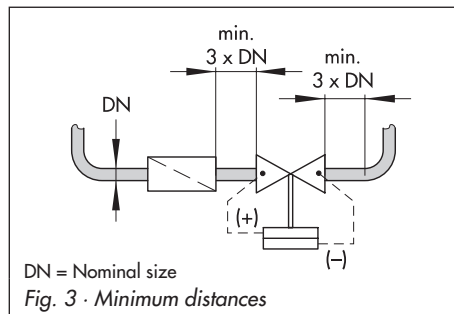
To monitor the pressures in the plant, install a pressure gauge both upstream and downstream of the regulator.

## 2.5 Control line, needle valve and equalizing tank

**Control lines** · Control lines preferably using 8 x 1 mm steel or stainless steel pipe must be provided at the site of installation.

Connect the control lines at the valve body to the G 1/4 threaded holes at the side to the inlet and outlet (Fig. 4). The free inlet and outlet lengths at the valve must be at least three times the nominal size of the pipe (DN).

Any pipe accessories that can cause turbulence in the flow must be located sufficiently



far away from the control line connections (min.  $3 \times \text{DN}$ , see Fig. 3).

When the control lines are connected to the main pipeline, keep a minimum distance of five times the nominal size (DN) from the regulator. Connect the control line at the side of the main pipeline.

Do **not** change the pipe diameter of the main pipeline so that it is **off center**!

**Control line kit** · A control line kit for tapping pressure directly at the valve body is available as an accessory from SAMSON. Refer to Data Sheet T 3095 EN.

**Needle valve** · If the regulator tends to hunt, we recommend installing a SAMSON needle valve in the control line at the actuator connection.

**Equalizing tank** · An equalizing tank is required for liquids above  $150\text{ }^{\circ}\text{C}$  and for steam applications. Install the tank directly downstream of the pressure tapping point at the valve. The mounting position of the equalizing tank is indicated by an adhesive label on the tank itself as well as by an arrow and the word "top" stamped on the top of the tank. Adhere to the mounting position prescribed (Fig. 4), otherwise the safe functioning of the regulator cannot be guaranteed.

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**Note:** Needle valves, equalizing tanks and compression-type screw fittings can be supplied as required. These accessories are listed in the Data Sheet T 3095 EN.

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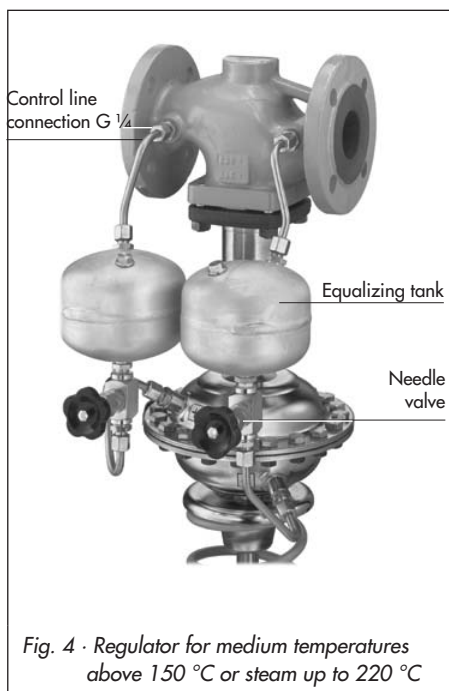


Fig. 4 · Regulator for medium temperatures above  $150\text{ }^{\circ}\text{C}$  or steam up to  $220\text{ }^{\circ}\text{C}$

## 3 Operation

### 3.1 Start-up

First start up the regulator after mounting all the components.

Make sure the control lines are open and correctly connected before start-up.

If needle valves are installed in the control lines, open them before start-up. Fill the equalizing tanks with the process medium before start-up.

**Slowly** open the shut-off valves starting on the return flow pipe first.

**NOTICE**

The pressure at the actuator must not exceed the **nominal pressure by 1.5 times** on testing the pressure of the plant when the regulator is already installed.

Both control lines must route the test pressure to the actuator at the same time to prevent the actuator diaphragm from being damaged.

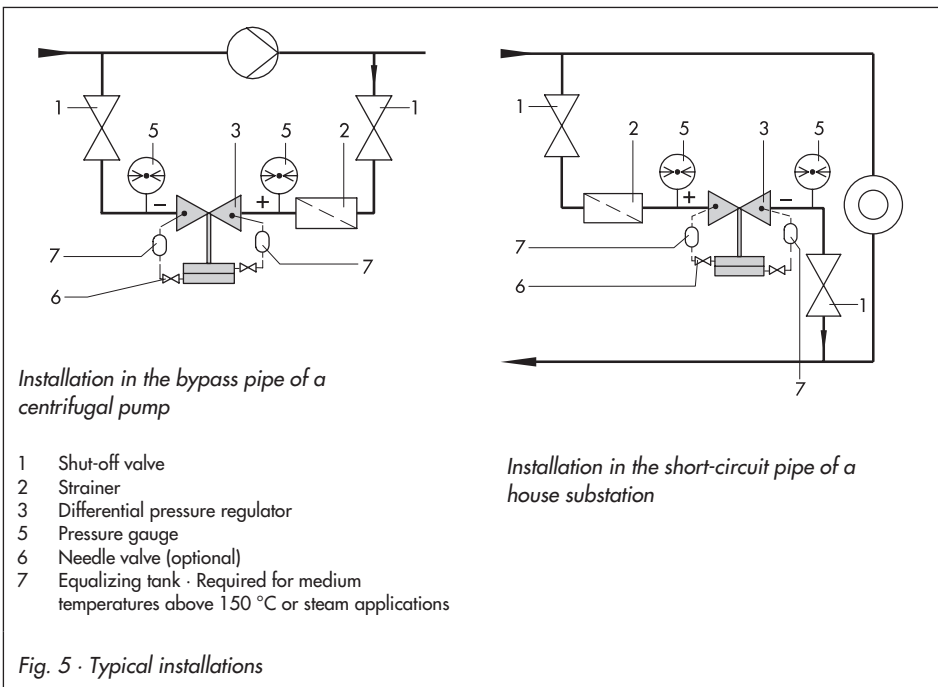
**3.2 Set point adjustment**

**Type 42-15** · Turn the nut (17) to load the set point springs (16).

If you want to adjust small differential pressure set points, we recommend using a differential pressure gauge instead of two pressure gauges.

- ▶ Turn the nut (17) clockwise to increase the set point.
- ▶ Turn the nut (17) counterclockwise to reduce the set point.

**Type 42-10** · The set point is fixed at  $\Delta p = 0.2, 0.3, 0.4$  or  $0.5$  bar.





### 3.3 Decommissioning

Close the shut-off valves starting from the upstream side and then the downstream side.

## 4 Maintenance and troubleshooting

The regulators are maintenance free. Nevertheless, they are subject to natural wear, particularly at the seat, plug and operating diaphragm.

Depending on the operating conditions, the regulator needs to be checked at regular intervals to avoid possible malfunctions.

Refer to Table 2 for possible reasons for malfunctions and the recommended action.

### **CAUTION!**

*On performing any work on the regulator, make sure the relevant section of the pipeline is depressurized and, depending on the process medium, drained as well.*

*We recommend to remove the valve from the pipeline.*

*For high temperatures, allow the regulator to cool down to ambient temperature before starting any work on it.*

*Interrupt or shut off the control line to avoid any hazards which could be caused by moving parts.*

*As valves are not free of cavities, remember that residual process medium might still be contained in the valve.*

### 4.1 Replacing the operating diaphragm

See Fig. 1.

If only the operating diaphragm is defective, drain the relevant section of the plant and unscrew the control lines. Separate the actuator from the valve. The valve does not need to be removed the valve from the pipeline.

#### Type 42-10

### **CAUTION!**

*The set point springs may be loaded. Before opening the actuator, first unscrew the short bolts and then the long bolts in an even pattern.*

1. Undo the bolts (15) at the actuator housing.
2. Remove the bottom cover together with the spring assembly. Pull the top part of the diaphragm case from the diaphragm stem (12).
3. Unscrew nut (18) while holding the opposite nut or bottom diaphragm stem stationary with a suitable tool.
4. Lift off the diaphragm plate (19) and pull out the diaphragm.
5. Insert new diaphragm.
6. For reassembly, proceed in reverse order.

Perform start-up as described in section 3.1.

### Type 42-15

1. Unscrew nut (17) and remove the entire spring assembly.
2. Remove the bolts (15) and pull both diaphragm cases off the diaphragm stem.
3. Fixate diaphragm stem together with nut in a vise and unscrew the nut (18) together with the upper part of the diaphragm stem.
4. Lift off diaphragm plate (19) and pull off the diaphragm.
5. Insert new diaphragm.
6. For reassembly, proceed in reverse order.

Perform start-up as described in section 3.1.

Table 2 · Troubleshooting

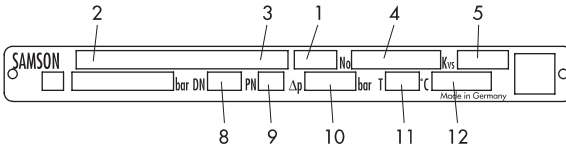
| Malfunction  | Possible reasons  | Recommended action  |
|--|---|---|
| Differential pressure exceeds the adjusted set point     | Insufficient pressure pulses from the high-pressure side on the operating diaphragm                       | Clean the control line, needle valve and screw joint with restriction orifice.  |
|  | Wear at seat and plug due to deposits or foreign matter   | Remove valve and replace damaged parts.   |
|  | Operating diaphragm defective   | Replace diaphragm (see section 4.1).  |
|  | Valve too small for the control task at hand  | Check sizing and install larger valve, if need be.  |
|  | Strainer blocked  | Drain and clean filter of the strainer  |
| Differential pressure falls below the adjusted set point | Valve too large for the control task at hand  | Check sizing and install smaller valve, if need be.   |
|  | Control line on the low-pressure side blocked   | Clean the control line, needle valve and screw joint with restriction orifice.  |
|  | Seat and plug untight   | Remove valve and clean parts. Contact SAMSON if still defective.  |
| Control loop hunts                                       | Valve too large for the control task at hand  | Check sizing and install smaller valve, if need be.   |
|  | No dampening of pressure pulses as the restriction in the actuator screw joint is missing or is too large | Install a needle valve to fit in the control line at the inlet to the actuator. Start to close the needle valve until the control loop is stable. Do not close the needle valve completely! |
| Jerky control behavior                                   | Increased friction, e.g. due to foreign matter in the seat/plug region                                    | Remove valve and clean parts.   |

## 5 Nameplates

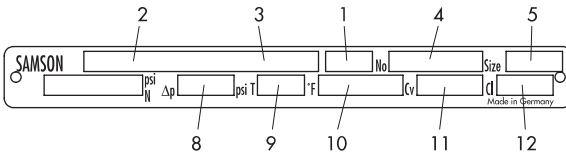
Valve and actuator both have a nameplate.

### Valve nameplates

DIN version



ANSI version



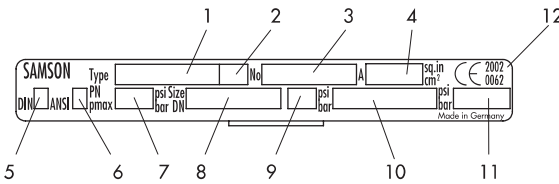
### DIN version

- 1 Valve type
- 2 Model number
- 3 Model number index
- 4 Order number or order date
- 5  $K_{VS}$  coefficient
- 8 Nominal size
- 9 Nominal pressure
- 10 Perm. differential pressure
- 11 Perm. temperature
- 12 Body material

### ANSI version

- 5 Nominal size
- 8 Perm. differential pressure
- 9 Perm. temperature (°F)
- 10 Body material
- 11  $C_v$  coefficient ( $K_{VS} \times 1.17$ )
- 12 ANSI Class (pressure rating)

### Actuator nameplate



- 1 Model number
- 2 Model number index
- 3 Order number or order date
- 4 Effective diaphragm area
- 5 Labeling acc. to DIN
- 6 Labeling acc. to ANSI
- 7 Max. perm. pressure
- 8 Nominal size
- 9 Differential pressure at the restriction  $\Delta P_{\text{restriction}}$
- 10 Set point range
- 11 Diaphragm material
- 12 Year of production

Fig. 6 · Nameplates

## 6 Technical data

Table 3 · Technical data

| Type   | 42-10  | 42-15   |                     |
|--|--|---|---------------------|
| Nominal size   | DN 15 to 25  | DN 15 to 50   |                     |
| Nominal pressure   | PN 16, 25 or 40 (acc. to DIN EN 12516-1)   |   |                     |
| Max. perm. temperature   | Actuator 1)<br>With equalizing tank: Liquids up to 220 °C<br>Without equalizing tank: Liquids up to 150 °C · Air and gases up to 80 °C |   |                     |
| Set point ranges   | 0.2 bar · 0.3 bar · 0.4 bar · 0.5 bar  | 0.1 to 0.6 bar · 0.2 to 1 bar · 0.5 to 1.5 bar<br>5 to 10 bar | 0.05 to 0.25 bar    |
| Diaphragm area   | 160 cm <sup>2</sup>  | 160 cm <sup>2</sup>   | 320 cm <sup>2</sup> |
| Max. permissible operating pressure for actuator with two diaphragms | 12 bar   | 12 bar  | 10 bar              |
| Leakage rate   | ≤ 0.05 % of K <sub>V5</sub> coefficient  |   |                     |

**Terms** for valve sizing according to DIN EN 60534, Parts 2-1 and 2-2:  $F_l = 0.95$ ;  $x_r = 0.75$

## 7 Customer service

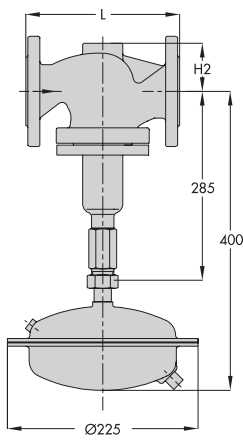
Should any malfunctions or any defect occur, SAMSON's After-Sales Service is prepared to help you on site.

You can also send the defective regulator directly to your local SAMSON representative for repair. Addresses of SAMSON subsidiaries, agencies and service centers are listed in the product catalogs and in the Internet at [www.samson.de](http://www.samson.de).

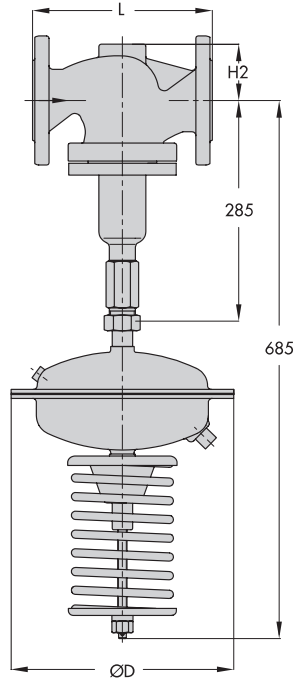
To allow SAMSON to find the fault and to have an idea of the installation situation, specify the following details (refer to the nameplate):

- ▶ Type and nominal size of the valve
- ▶ Model number with index
- ▶ Upstream and downstream pressure
- ▶ Temperature and process medium
- ▶ Min. and max. flow rate
- ▶ Has a strainer been installed?
- ▶ Sketch of the installation with exact position of regulator and all additional installed components (shut-off valves, pressure gauges, etc.).

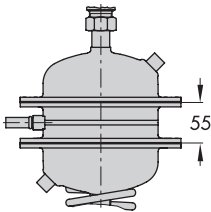
## 8 Dimensions



**Type 24-10**



**Type 42-15**



**Special version with actuator  
with two diaphragms  
Add 55 mm to overall height**

*Fig. 7 · Dimensional drawings*

Table 4 · Dimensions in mm and weights

| Nominal size                                      | DN 15  | DN 20 | DN 25 | DN 32 | DN 40 | DN 50 |
|---|--|-------|-------|-------|-------|-------|
| Length L  | 130  | 150   | 160   | 180   | 200   | 230   |
| Height H2   | Other materials                                |       |       | 72    |       |       |
|   | Forged steel                                   | 53    | –     | 70    | –     | 92    |
| <b>Type 42-10 Differential Pressure Regulator</b> |  |       |       |       |       |       |
| Set point ranges                                  | 0.2 · 0.3 · 0.4 · 0.5 bar                      |       |       | –     |       |       |
| Actuator size A<br>Diaphragm Ø D                  | 160 cm <sup>2</sup><br>225 mm                  |       |       |       |       |       |
| Weight <sup>1)</sup> , approx. kg                 | 11.5   | 12    | 13    |       |       |       |
| <b>Type 42-15 Differential Pressure Regulator</b> |  |       |       |       |       |       |
| Set point ranges                                  | 0.05 to 0.25 bar                               |       |       |       |       |       |
| Actuator size A<br>Diaphragm Ø D                  | 320 cm <sup>2</sup><br>285 mm                  |       |       |       |       |       |
| Set point ranges                                  | 0.1 to 0.6 bar · 0.2 to 1 bar · 0.5 to 1.5 bar |       |       |       |       |       |
| Actuator size A<br>Diaphragm Ø D                  | 160 cm <sup>2</sup> <sup>2)</sup><br>225 mm    |       |       |       |       |       |
| Weight <sup>1)</sup> , approx. kg                 | 16   | 16.5  | 17.5  | 24    | 24.5  | 27    |

1) The weight applies to the version with material specifications EN-JL1040/PN 16 (GG-25). Add 10 % to this weight for other versions

2) Optionally with actuator A = 320 cm<sup>2</sup>



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