

Self-operated Pressure Regulators

SAMSON

Type 42-20 · Type 42-25

Differential Pressure Regulators (opening)



Type 42-20 Differential Pressure Regulator



Type 42-25 Differential Pressure Regulator

Translation of original instructions

Mounting and Operating Instructions

EB 3007 EN

Edition June 2016

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.

- For the safe and proper use of these instructions, read them carefully and keep them for later reference.
- If you have any questions about these instructions, contact SAMSON's After-sales Service Department (aftersaleservice@samson.de).



The mounting and operating instructions for the devices are included in the scope of delivery. The latest documentation is available on our website (www.samson.de) > Product documentation. You can enter the document number or type number in the [Find:] field to look for a document.



WARNING!

Damage to health relating to REACH Regulation.

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

Information on safe use of the part affected, see ► <http://www.samson.de/reach-en.html>

Definition of signal words



DANGER!

Hazardous situations which, if not avoided, will result in death or serious injury



NOTICE

Property damage message or malfunction



WARNING!

Hazardous situations which, if not avoided, could result in death or serious injury



Note:

Additional information



Tip:

Recommended action

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1 General safety instructions

- All safety instructions and warnings given in these mounting and operating instructions, particularly those concerning installation, start-up, and maintenance, must be strictly observed.
- The device must be mounted, started up, or serviced by fully trained and qualified personnel only; the accepted industry codes and practices are to be observed. Make sure employees or third persons are not exposed to any danger.
- According to these mounting and operating instructions, trained personnel refers to individuals who are able to judge the work they are assigned to and recognize possible dangers due to their specialized training, their knowledge and experience as well as their knowledge of the applicable standards.
- The devices comply with the requirements of the European Pressure Equipment Directive 97/23/EC. The declaration of conformity issued for a regulator bearing the CE marking includes information on the applied conformity assessment procedure. This declaration of conformity can be provided on request.
- To ensure appropriate use, only use the device in applications where the operating pressure and temperatures do not exceed the specifications used for sizing the device at the ordering stage.
- The manufacturer does not assume any responsibility for damage caused by external forces or any other external factors.
- Any hazards that could be caused in the regulator by the process medium, operating pressure or by moving parts are to be prevented by taking appropriate precautions.
- Proper transport, storage, installation, operation, and maintenance are assumed.



Note:

Non-electric valve versions whose bodies are not lined with an insulating material coating do not have their own potential ignition source according to the risk assessment stipulated in EN 13463-1: 2009, section 5.2, even in the rare incident of an operating fault. Therefore, such valve versions do not fall within the scope of Directive 2014/34/EU.

For connection to the equipotential bonding system, observe the requirements specified in section 6.4 of EN 60079-14: 2011 (VDE 0165 Part 1).

2 Process medium and scope of application

Differential pressure regulators for extended heating systems and industrial applications.

Differential pressure set points Δp from **0.05 to 10 bar** · Valves **DN 15 to 250** · Nominal pressure **PN 16 to 40** · Suitable for **liquids and vapors** from **5 to 350 °C** as well as for **air** and **non-flammable gases** up to **80 °C**.

The valve **opens** when the differential pressure rises.

3 Transportation and storage

The device must be carefully handled, transported, and stored. Protect the regulator against adverse influences, such as dirt, moisture, or temperature outside the ambient temperature range.

Do not remove the protective caps from the valve ports until immediately before installing the valve into the pipeline.

When regulators are too heavy to be lifted by hand, fasten the lifting equipment to a suitable place on the valve body.



WARNING!

*Do not attach lifting slings or supports to mounting parts, such as control line etc.
The valve can fall or mounting parts may be damaged.*

Securely fasten slings or rigging equipment to the valve body and secure against slipping.

4 Design and principle of operation

See Fig. 1 on page 7.

The differential pressure regulators are designed to maintain a constant pressure difference between the upstream pressure line (+) and the downstream pressure line (-) to an adjustable set point (Type 42-25) or a fixed set point (Type 42-20).

The regulators basically consist of the valve with seat (2) and plug (3) and an opening actuator (Type 2425/2420) with an operating diaphragm (13).

Valve and actuator are delivered separately and must be assembled on site using a coupling nut (11, width across flats 41, max. tightening torque 120 Nm).

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

The Type 2422 Valve is balanced. The forces acting on the valve plug created by the upstream and downstream pressures are balanced by a balancing bellows (5) or balancing diaphragm¹⁾ (5.1).

The principle of operation of the regulator balanced by a bellows or diaphragm only differs concerning the pressure balancing. Valves balanced by a diaphragm have a balancing diaphragm (5.1) instead of the balancing bellows (5). The downstream pressure p_2 acts on the bottom of the diaphragm and the upstream pressure p_1 on the top of the diaphragm. As a result, the forces created by the upstream and downstream pressures acting on the plug are balanced out.

The differential pressure across the plant is transmitted over the upstream pressure line with the pressure p_1 (+) and the downstream pressure line with the pressure p_2 (-) 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).

The set point springs are mounted inside the actuator for a fixed set point (Type 42-20). These springs can be adjusted externally for an adjustable set point (Type 42-25).

- 1 Valve body
- 2 Seat
- 3 Plug
- 4 Plug stem
- 5 Balancing bellows
- 5.1 Balancing diaphragm (DN 65 to 250)
- 11 Coupling nut
- 12 Diaphragm stem
- 13 Operating diaphragm
- 14 Diaphragm housing
- 15 Nuts and bolts
- 16 Set point springs
- 17 Set point adjuster (nut)
- 18 Nut
- 18.1 Clamping nut
- 19 Diaphragm plate
- 20 Control line with pressure tapping at the valve
- 21 Needle valve

¹⁾ Type 2422 Valve, balanced by a diaphragm, DN 65 to 250 only

Regulator configurations

Regulator	=	Valve	+	Actuator
Type 42-20		Type 2422 balanced		Type 2420 fixed set point
Type 42-25		Type 2422 balanced		Type 2425 adjustable set point

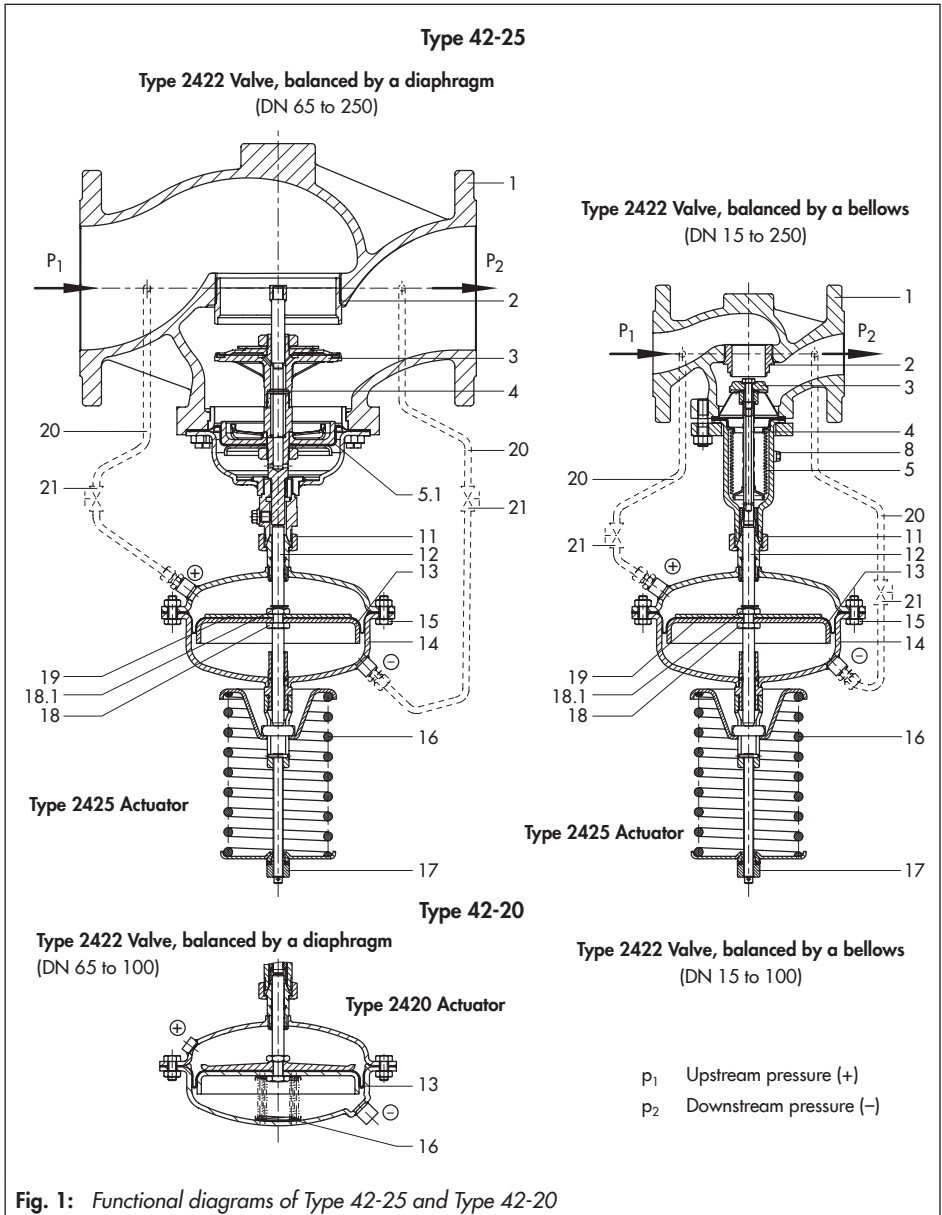


Fig. 1: Functional diagrams of Type 42-25 and Type 42-20

5 Installation

The **Type 42-20** and **Type 42-25** Regulators are designed for installation in the **bypass or short circuit** of the plant.

- Choose a place of installation that allows you to freely access the regulator even after the entire plant has been completed.
- Install a strainer (e.g. SAMSON Type 2 N) upstream of the regulator (see section 5.2).
- Flush the pipeline thoroughly before installing the regulator to ensure that any sealing parts, weld spatter and other impurities carried along by the process medium do not impair the proper functioning of the valve, above all the tight shut-off.
- The direction of flow must match the direction indicated by the arrow on the body.

NOTICE

- Incorrectly installed regulator
The pressure regulator can be damaged.*
- Make sure the regulator is installed free of stress.
 - Do not attach supports (if required) directly to the valve or actuator. Attach the supports near to the connecting flanges.
 - Observe permissible mounting position.

5.1 Mounting position

See Fig. 1 on page 7.

See Fig. 2 for permissible mounting positions.

Standard mounting position · Install valve without actuator in a horizontal pipeline with the connection for the actuator facing downward. Make sure the medium flows through the valve in the direction indicated by the arrow.

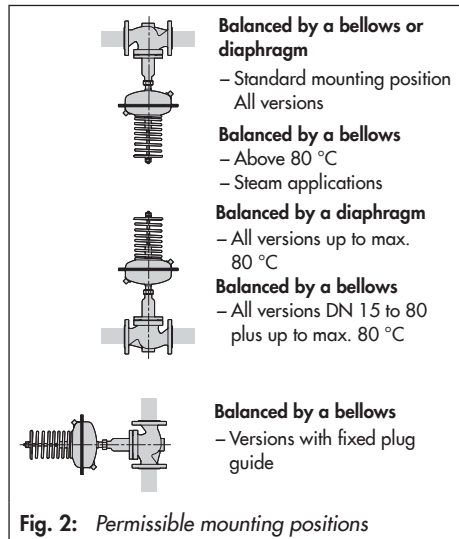


Fig. 2: Permissible mounting positions

Connect the actuator to the valve bottom section using the coupling nut (11, width across flats 41, max. tightening torque 120 Nm).

NOTICE

- The connection between the plug stem (4) and diaphragm stem (12) is force locking. Do not remove the screw plug.*

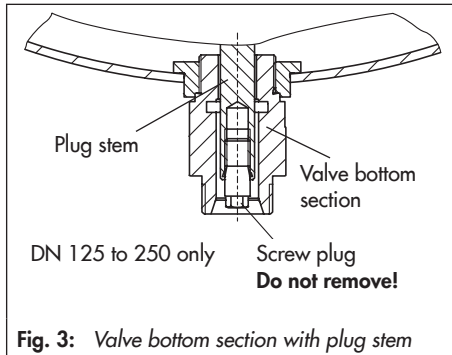


Fig. 3: Valve bottom section with plug stem

5.2 Strainer (filter)

Install the strainer upstream of the regulator. The direction of flow must correspond to the arrow on the body. The filter element must be installed to hang downwards or sideways for applications with steam. Remember to leave enough space to remove the filter element.

5.3 Shut-off valve

Install a hand-operated shut-off valve both upstream of the strainer and at the outlet of the return flow pipe (see Fig. 7). This allows the plant to be shut down for cleaning and maintenance, and when the plant is not used for longer periods of time.

5.4 Pressure gauge

Install a pressure gauge both upstream and downstream of the regulator to monitor the pressures prevailing in the plant. Install the pressure gauge on the downstream side behind the downstream pressure tapping point

(not between the tapping point and the valve).

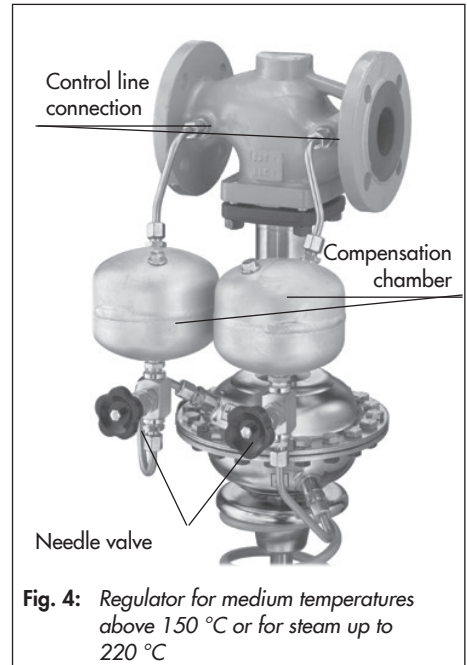


Fig. 4: Regulator for medium temperatures above 150 °C or for steam up to 220 °C

5.5 Control line, compensation chamber and needle valve

Control line - A control line preferably as an 8 x 1 mm stainless steel pipe must be provided at the site of installation. Connect the control lines on the valve body to the threaded boreholes (up to DN 100: G 1/4; DN 125 and larger: G 3/8) in the inlet and outlet. The free inlet and outlet lengths at the valve must be at least three times the nominal size (DN).

Install any instruments that can cause turbulence in the flow sufficiently far away from the pressure tapping points. (min. three times the nominal size (DN), see Fig. 6).

When the control lines are connected to the main pipe, keep the minimum distance of five times the nominal size (DN). Connect control lines at the side of the main pipe. Do **not** change the pipe diameter of the main pipeline so that it is **off center**.

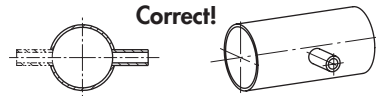
Control line kit · A control line kit for tapping pressure directly at the valve body is available as an accessories part from SAMSON (► T 3095). These control line kits for tapping pressure directly at the valve body already take into account the flow conditions. As a result, no special attention has to be paid to the flow conditions on connecting the regulators.

Compensation chamber · A compensation chamber is required for liquids above 150 °C as well as for steam (valve balanced by a bellows). The mounting position of the compensation chamber is indicated by an adhesive label on the chamber itself as well as by an arrow and the word "top" stamped on the top of the chamber. This mounting position must be adhered to; otherwise the safe functioning of the pressure reducing valve cannot be guaranteed.

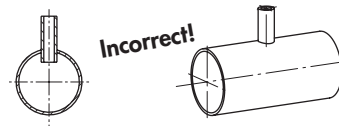


Note:

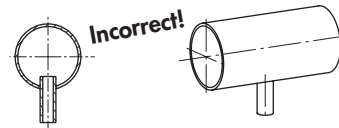
Only a valve balanced by a bellows can be used for steam control applications.



Connection at the side – optimal



Connection at the top – incorrect position



Connection at the bottom – incorrect position

Fig. 5: Control line connection

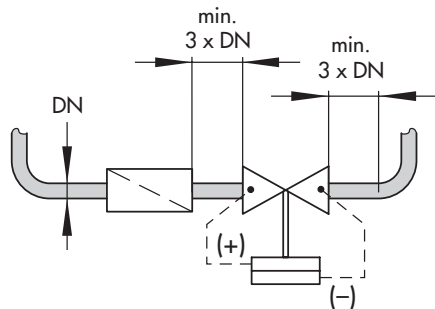


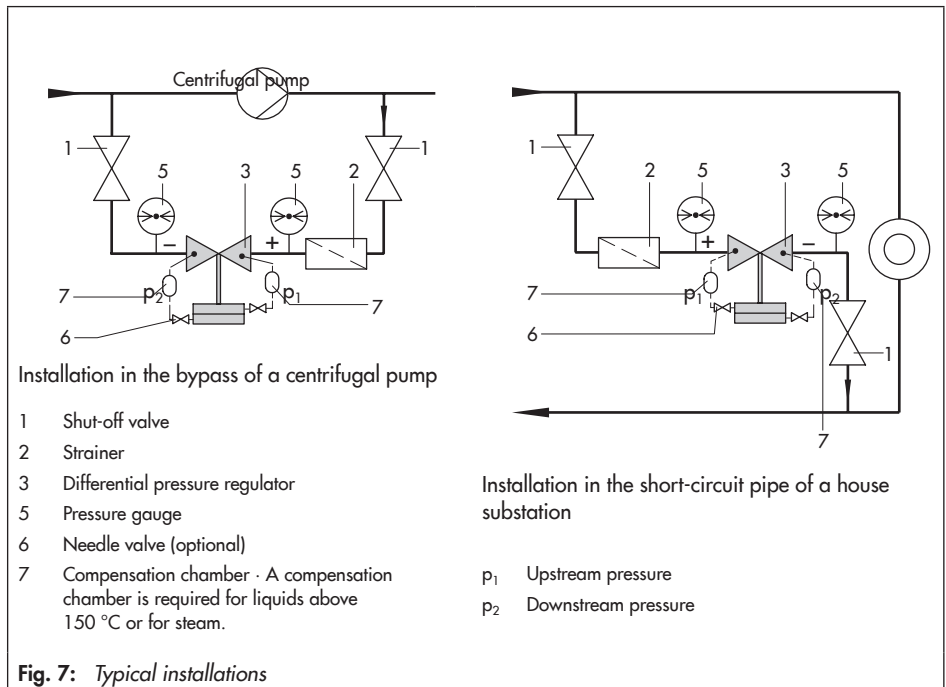
Fig. 6: Regulator installation · Distances

Needle valve · If the regulator tends to hunt, we recommend installing a SAMSON screw joint with restriction (needle valve) at the control line connection of the actuator.



Note:

Needle valves, condensation chambers, excess pressure relief equipment and compression-type screw fittings can be supplied as required. These accessories are listed in ► T 3095.



6 Operation

See Fig. 1 on page 7.

6.1 Start-up

- First start up the regulator after mounting all parts.
- Make sure the control lines are open and correctly connected.
- If needle valves are installed in the control lines, open them before start-up. Fill condensation chambers with the process medium before start-up.
- Open the shut-off valves **slowly** preferably starting from the downstream side.



NOTICE

Impermissible excessive pressure. The diaphragm actuator can be damaged.

The pressure at the actuator must also not exceed the nominal pressure by 1.5 times on testing the pressure of the plant when the regulator is already installed. The control lines must both transmit the test pressure to the actuator at the same time to ensure that the actuator diaphragm is not damaged.

Rinsing the plant · After filling the plant, first completely open the consumer and rinse out the pipeline at full flow rate for several minutes. Adjust the differential pressure set point only roughly at first. Check the installed strainer (e.g. by measuring the pressure drop). Clean the strainer, if necessary.

6.2 Adjusting the set point

Type 42-25 · Adjust the required set point by tensioning the set point springs at the nut (17).

If small differential pressure set points are to be adjusted, we recommend using a differential pressure gauge instead of the two pressure gauges to monitor the pressure. Turn the nut (17) clockwise (↻) to increase the pressure set point and counterclockwise (↺) to reduce the pressure set point.

Type 42-20 · Set point fixed to $\Delta p = 0.2, 0.3, 0.4$ or 0.5 bar.

6.3 Decommissioning

Preferably close first the shut-off valve on the upstream side of the valve and then on the downstream side of the valve.

7 Maintenance and troubleshooting

The regulators do not require any maintenance. Nevertheless, they are 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.

Details on faults and how to remedy them can be found in Table 1:

- We recommend removing the valve from the pipeline.



WARNING!

Excessive pressure may cause parts to move.

Before performing any work on the regulator, depressurize the relevant plant section and, depending on the process medium, drain it as well.

Shut off or disconnect the control lines.

High temperatures

When used at high temperatures, allow the plant section to cool down to ambient temperature.

Residual medium

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

Table 1: Troubleshooting

Malfunction	Possible reasons	Recommended action
Differential pressure exceeds the adjusted set point	Insufficient upstream pressure pulses on the actuator diaphragm	Clean the control line, needle valve, and screw joint with restriction.
	Leak between seat and plug due to wear	Disassemble the regulator and replace damaged parts.
	Strainer blocked	Clean strainer.
	Defective operating diaphragm	Replace the operating diaphragm (see section 7.1).
Differential pressure drops below the adjusted set point	Valve or K_{VS} coefficient too small for control task	Check valve sizing. Select valve with larger K_{VS} coefficient, if necessary.
	Valve or K_{VS} coefficient too large for control task	Check valve sizing. Select valve with smaller K_{VS} coefficient, if necessary.
	Control line downstream of valve blocked.	Clean the control line, needle valve, and screw joint with restriction.
Control loop hunts.	Leak between seat and plug due to wear	Disassemble the regulator and replace damaged parts.
	Valve or K_{VS} coefficient too large for control task	Check valve sizing. Select valve with smaller K_{VS} coefficient, if necessary.
Jerky control response	No damping of the pulses as the restriction in the screw fitting of the actuator is too large or is missing.	Install suitable needle valve in the control line at the actuator. Close this needle valve until the control loop becomes stable. Do not close the needle valve completely!
	Increased friction, e.g. due to foreign particles between seat and plug.	Remove valve from the pipeline and clean parts.

If faults cannot be remedied following the recommended action in the table, contact SAMSON (see section 8).

7.1 Replacing the operating diaphragm

See Fig. 1 on page 7.

If just the operating diaphragm is defective, it can be replaced without having to remove the valve from the pipeline. Drain the relevant section of the pipeline. Unscrew the control lines and separate the actuator from the valve.

Type 42-20



WARNING!

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

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

Tightening torques (see Table 2).

For start-up, proceed as described in section 6.

Type 42-25

1. Unscrew the nut (17) and remove the entire spring assembly.
2. Remove bolts (15) and pull both diaphragm cases from the diaphragm stem.
3. Place the diaphragm stem together with nut (18) into a vise and unscrew the nut (18.1) together with the top part of the diaphragm stem.
4. Lift off the diaphragm plate (19) and pull out the diaphragm.
5. Insert a new diaphragm.
6. To reassemble, proceed in reverse order. Tightening torques (see Table 2).

For start-up, proceed as described in section 6.1.

Table 2: Tightening torques for assembly

Actuator	40/ 80 cm ²	160/ 320 cm ²	640 cm ²	PN 40/ 160 cm ²
Item 15	20 Nm	25 Nm	25 Nm	40 Nm
Item 18	40 Nm			

8 After-sales service

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

E-mail

You can reach the After-sales Service Department at aftersaleservice@samson.

Addresses of SAMSON AG and its subsidiaries

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

To assist diagnosis and in case of an unclear mounting situation, specify the following details (so far as possible). See section 9:

- Type and nominal size of the valve
- Model number with index
- Upstream and downstream pressure
- Temperature and process medium
- Min. and max. flow rate
- Is a strainer installed?
- Installation drawing showing the exact location of the regulator and all the additionally installed components (shut-off valves, pressure gauge, etc.)

9 Nameplate

Nameplates are attached to the valve and the actuator.

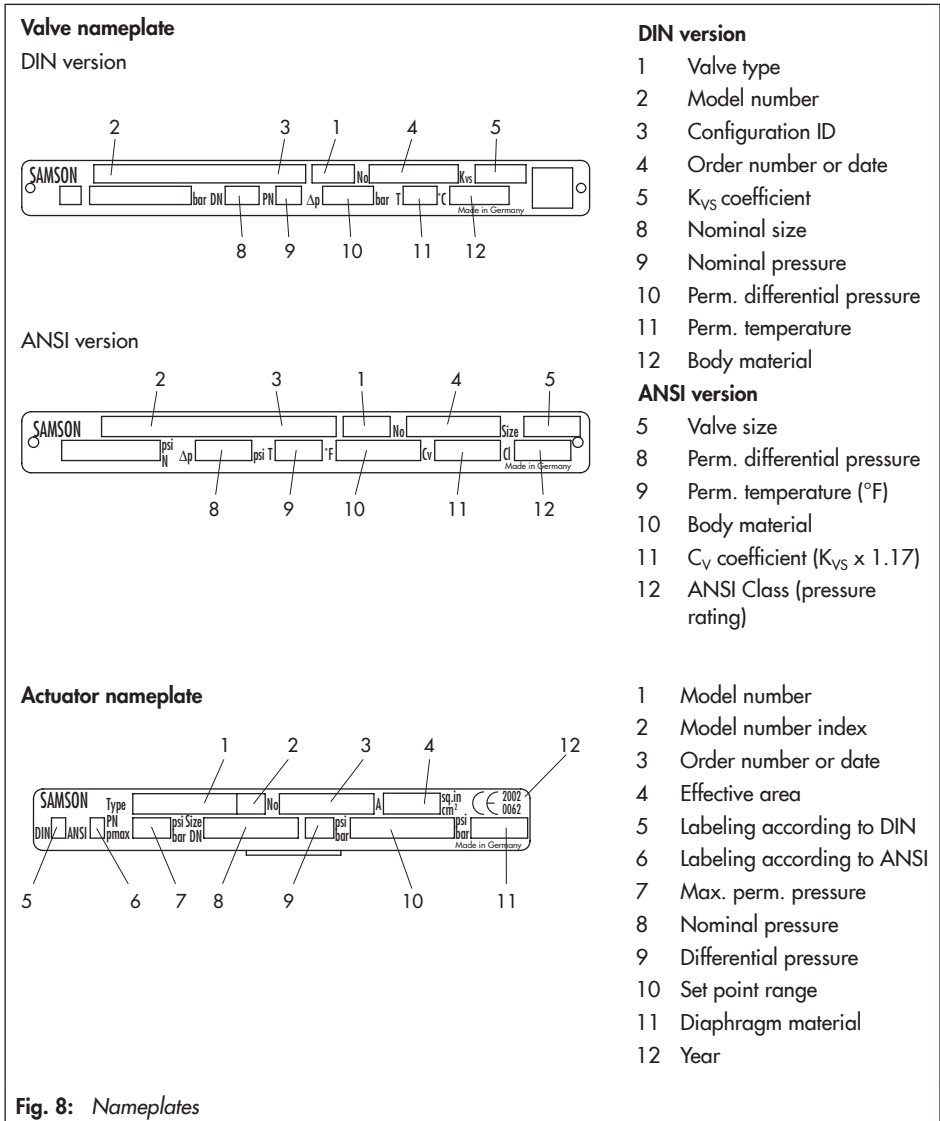


Fig. 8: Nameplates

10 Appendix

10.1 Technical data

Type	42-25				42-20	
Valve size	DN 15 to 250				DN 15 to 100	
Nominal pressure	PN 16, 25 or 40					
Max. permissible temperature	Valve	See pressure-temperature diagram in ► T 3000				
	Actuator ¹⁾	With compensation chamber: steam and liquids up to 350 °C Without compensation chamber: liquids up to 150 °C Air and gases up to 80 °C				
Set point ranges in bar	0.05 to 0.25 · 0.1 to 0.6 · 0.2 to 1 0.5 to 1.5 · 1 to 2.5 · 2 to 5 · 4.5 to 10				0.2 · 0.3 · 0.4 or 0.5	
Actuator area A	80 cm ²	160 cm ²	320 cm ²	640 cm ²	160 cm ²	320 cm ²
Max. perm. operating pressure for actuator with two diaphragms	40 bar	40 bar	25 bar	25 bar	–	–
Leakage class according to IEC 60534-4	≤0.05 % of K _{VS} coefficient					

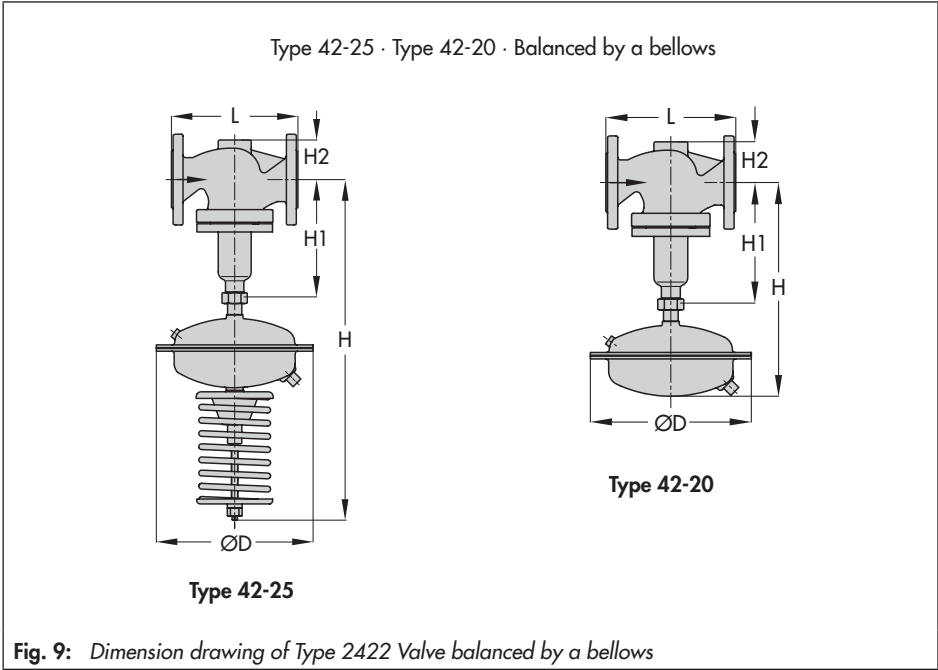
¹⁾ Higher temperatures on request

Terms for control valve sizing according to IEC 60534, Parts 2-1 and 2-2: $F_L = 0.95$, $X_T = 0.75$

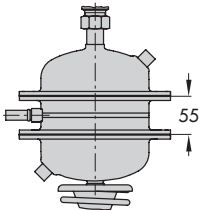
See section 1 for the assignment of actuator and valve.

11 Dimensions

Valve balanced by a bellows



Type 42-25 with actuator with two diaphragms (special version)



Add approx. 55 mm to the overall height H.

Fig. 10: Dimension drawing of actuator with two diaphragms

Table 3: Dimensions mm and weights · Type 42-20 and Type 42-25 · Balanced by a bellows

Nominal size DN	15	20	25	32	40	50	65	80	100	125	150	200	250		
Length L	130	150	160	180	200	230	290	310	350	400	480	600	730		
Height H1	225						300	355	460	590	730				
Height H2	Other materials	55			72			100	120	145	175	235	260		
	Forged steel	53	-	70	-	92	98	-							
Type 42-20 Differential Pressure Regulator															
Set point 0.2 · 0.3 0.4 or 0.5 bar	Height H	390						465	520	-					
	Actuator	ØD = 225 mm, A = 160 cm ^{2 3)}						ØD = 285 mm, A = 320 cm ²			-				
	Weight ¹⁾ in kg	11.5	12	13	19.5	20	22.5	38	43	57	-				
Type 42-25 Differential Pressure Regulator															
Set point range 0.05 to 0.25 bar	Height H	625						700	755	990	1120	1260			
	Actuator	ØD = 285 mm, A = 320 cm ^{2 2)}						ØD = 285 mm, A = 640 cm ²			ØD = 390 mm, A = 640 cm ²				
	Weight ¹⁾ in kg	21	21.5	22.5	29	29.5	32	46	51	65	135	185	425	485	
Set point range 0.1 to 0.6 bar	Height H	625						700	755	990	1120	1260			
	Actuator	ØD = 225 mm, A = 160 cm ^{2 3)}						ØD = 285 mm, A = 320 cm ^{2 2)}			ØD = 390 mm, A = 640 cm ²				
	Weight ¹⁾ in kg	16	16.5	17.5	24	24.5	27	46	51	65	135	185	425	485	
Set point range 0.2 to 1 bar	Height H	635						700	755	990	1120	1260			
	Actuator	ØD = 225 mm, A = 160 cm ^{2 3)}						ØD = 390 mm, A = 640 cm ²			ØD = 390 mm, A = 640 cm ²				
	Weight ¹⁾ in kg	16	16.5	17.5	24	24.5	27	42	47	61	135	185	425	485	
Set point range 0.5 to 1.5 bar	Height H	625						700	755	940	1070	1210			
	Actuator	ØD = 225 mm, A = 160 cm ^{2 3)}						ØD = 285 mm, A = 320 cm ²			ØD = 285 mm, A = 320 cm ²				
	Weight ¹⁾ in kg	16	16.5	17.5	24	24.5	27	42	47	61	125	175	415	475	
Set point range 1 to 2.5 bar	Height H	625						700	755	940	1070	1210			
	Actuator	ØD = 225 mm, A = 160 cm ²													
	Weight ¹⁾ in kg	16	16.5	17.5	24	24.5	27	42	47	61	125	175	415	475	
Set point range 2 to 5 bar	Height H	605						680	735	940	1070	1210			
	Actuator	ØD = 170 mm, A = 80 cm ²						ØD = 225 mm, A = 160 cm ²			ØD = 225 mm, A = 160 cm ²				
	Weight ¹⁾ in kg	16	16.5	17.5	24	24.5	27	42	47	61	102	170	410	470	
Set point range 4.5 to 10 bar	Height H	685						760	815	On request					
	Actuator	ØD = 170 mm, A = 80 cm ²													
	Weight ¹⁾ in kg	16	16.5	17.5	24	24.5	27	42	47						61

¹⁾ The weight applies to the version made of EN-GJL-250/PN 16. Add +10 % for all other materials.

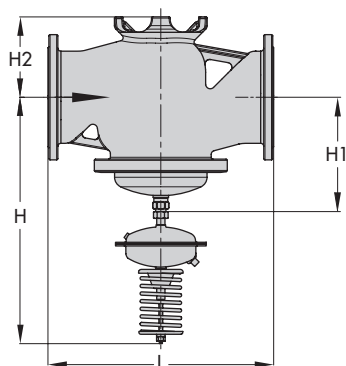
²⁾ Optionally with actuator A = 640 cm²

³⁾ Optionally with actuator A = 320 cm²

Dimensions

Valve balanced by a diaphragm

Type 42-20/42-25 balanced by a diaphragm



Type 42-25 with two diaphragms: Add approx. 55 mm to the total height H.

Table 4: Dimensions in mm and weights · Type 42-20 and Type 42-25 · Balanced by a diaphragm

Valve size	DN 65	DN 80	DN 100	DN 125	DN 150	DN 200	DN 250
Length L	290	310	350	400	480	600	730
Height H1 ¹⁾	355		375	-			
Height H2	98	118	145	175	260		
Height H	575		595	720	745	960	
Weight for PN 16 ²⁾							
Type 42-25, approx. kg	42	47	55	75	95	250	

¹⁾ For Type 42-20

²⁾ Valve in PN 25/PN 40: +10 %

Fig. 11: Dimension drawing of Type 2422 Valve balanced by a diaphragm

**Note:****Conversion from chromate coating to iridescent passivation**

We at SAMSON are converting the surface treatment of passivated steel parts in our production. As a result, you may receive a device assembled from parts that have been subjected to different surface treatment methods. This means that the surfaces of some parts show different reflections. Parts can have an iridescent yellow or silver color. This has no effect on corrosion protection.

For further information go to ► www.samson.de/chrome-en.html



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