

Self-operated Pressure Regulators

Type 41-73 Universal Excess Pressure Valve



Type 41-73 Excess Pressure Valve

Mounting and Operating Instructions

EB 2517 EN

Edition October 2015



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 General safety instructions

- The regulator is to 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.
- All safety instructions and warnings given in these mounting and operating instructions, particularly those concerning installation, start-up and maintenance, must be strictly 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 dangers due to their specialized training, their knowledge and experience as well as their knowledge of the applicable standards.
- The regulators comply with the requirements of the European Pressure Equipment Directive 97/23/EC. Devices with a CE marking have a declaration of conformity, which includes information about the applied conformity assessment procedure. This declaration of conformity can be provided on request.
- To ensure appropriate use, only use the regulator in applications where the operating pressure and temperatures do not exceed the specifications used for sizing the regulator 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.

2 Process medium and scope of application

Pressure regulators for set points from **0.05 to 28 bar** · Valve nominal sizes **DN 15 to 100**
Nominal pressure **PN 16 to 40** · Suitable for **liquids, gases and vapors** up to **350 °C**

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



NOTICE

The Type 41-73 Excess Pressure Valve is not a safety valve. If necessary, a suitable overpressure protection must be installed on site in the plant section.

2.1 Transportation and storage

The regulator must be carefully handled, transported and stored. Protect the regulator against adverse influences, such as dirt, moisture or frost before it is installed.

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



NOTICE

Do not attach any lifting equipment, slings or supports to mounting parts, such as the adjusting screw or control line.

3 Design and principle of operation

See Fig. 1 on page 7.

The Type 41-73 Excess Pressure Valve consists of a Type 2417 Opening Valve and a Type 2413 Actuator. The valve and actuator are delivered separately and must be assembled according to the instructions in section 4.1.

The excess pressure valve is used to maintain the pressure upstream of the valve to an adjusted set point.

The process medium flows through the valve between seat (2) and plug (3) in the direction indicated by the arrow on the body. The position of the valve plug determines the flow rate and the pressure ratio across the valve. The plug stem is sealed by a frictionless bellows

(5.1). The upstream pressure p_1 is transmitted through the compensation chamber (18) and control line (17) to the operating diaphragm (12) where it is converted into a positioning force. For actuator versions with a bellows, the pressure is transmitted to the operating bellows (12.1). The positioning force is used to move the valve plug according to the force of the positioning springs (7). The spring force is adjustable at the set point adjuster (6). Valves with K_{VS} 4 and higher feature a balancing bellows (4). The upstream pressure acts on the outside of the bellows and the downstream pressure on the inside of the bellows. As a result, the forces produced by the upstream and downstream pressures acting on the plug are balanced.

Depending on the valve and actuator used, the regulator can be upgraded to create a safety excess pressure valve.

4 Installation

4.1 Assembly

See Fig. 1 on page 7.

Valve and actuator can be assembled before or after the valve has been installed in the pipeline.

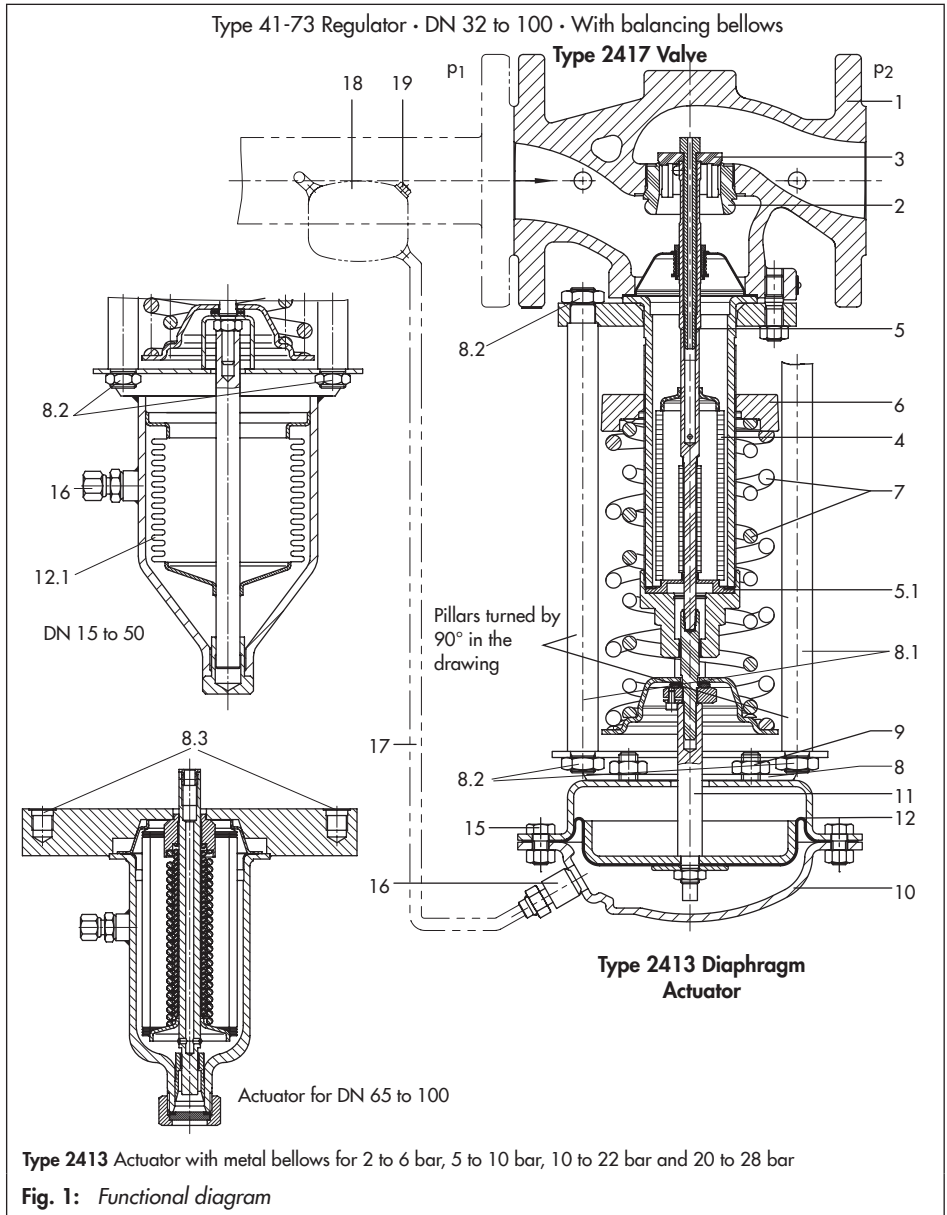
Push the diaphragm actuator (10) with actuator stem (11) through the hole in the crossbeam (8) onto the spigots of the bellows (5.1). Align it and fasten with nuts (width across flats 16, 9) onto the valve flange (approx. 25 Nm).

For **metal bellows actuators in DN 15 to 50**, remove the crossbeam (8) from the valve.

Push the actuator stem (11) onto the spigots of the bellows (5.1). Align the pillars (8.1) and fasten with nuts (width across flats 24, 8.2) to the actuator (max. 60 Nm).

For **metal bellows actuators in DN 65 to 100**, remove the crossbeam (8) from the valve and unscrew the pillars (8.1). Screw the pillars into the threaded holes (8.3) of the actuator flange as far as they will go. Push the actuator with actuator stem (11) onto the spigots of the bellows (5.1). Fasten the pillars with nuts (width across flats 24, 8.2) onto the valve flange (max. 60 Nm).

- 1 Valve body
- 2 Seat
- 3 Plug
- 4 Balancing bellows
- 5 Plug stem
- 5.1 Bellows
- 6 Set point adjuster
- 7 Set point springs
- 8 Bracket
- 8.1 Pillar
- 8.2 Nuts for pillars
- 8.3 Tapped holes
- 9 Fastening nuts
- 10 Diaphragm actuator
- 11 Actuator stem
- 12 Operating diaphragm
- 12.1 Operating bellows
- 13 Diaphragm plate
- 14 Nut
- 15 Nuts and bolts
- 16 Control line connection G ¼ (for steam including screw joint with restriction)
- 17 Control line installed on site (control line kit available for tapping the pressure directly at the valve body, see T 2595)
- 18 Compensation chamber
- 19 Filler plug



4.2 Mounting position



NOTICE

Protect the regulator from icing up when controlling media that can freeze. Remove the regulator from the pipeline when the plant is shut down if the regulator is not installed areas free from frost.

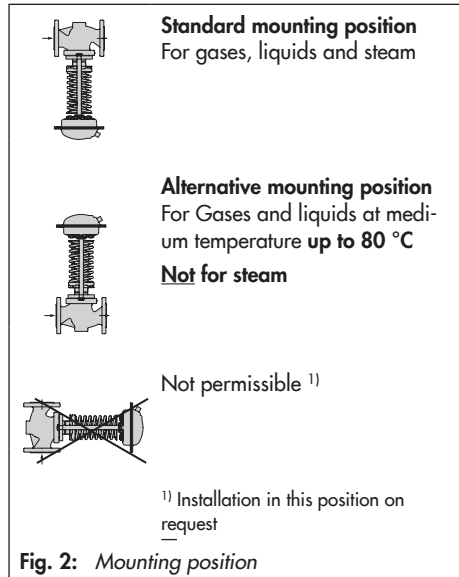
Flush the pipeline thoroughly before installing the regulator to ensure that any sealing parts, weld spatter and other impurities carried along by the process medium do not impair the proper functioning of the valve, above all the tight shut-off.



NOTICE

Install a strainer (e.g. SAMSON Type 2) upstream of the regulator.

Install the excess pressure valve in horizontal pipelines. On installing the valve, make sure the direction of flow corresponds with the arrow on the body. For media with a tendency to condensate, install the pipeline with a slight downward slope on both sides so that the condensate can drain properly. If the pipeline upstream and downstream of the valve run vertically upwards, an automatic water drainage (e.g. SAMSON Type 13 E Steam Trap) is required. Choose a place of installation that allows you to freely access the regulator even after the entire plant has been completed. The regulator must be installed free of stress. If necessary, support the pipe near the connecting flanges.



NOTICE

Do not attach supports directly to the valve or actuator.

If a bypass line is to be used, it must be connected upstream of the pressure tapping point. Install a shut-off valve in the bypass line.



Note:

Do not install any instruments (e.g. temperature regulators or shut-off valves) that restrict the cross-section of the pipe between the pressure tapping point and the valve.

4.3 Control line, compensation chamber and needle valve

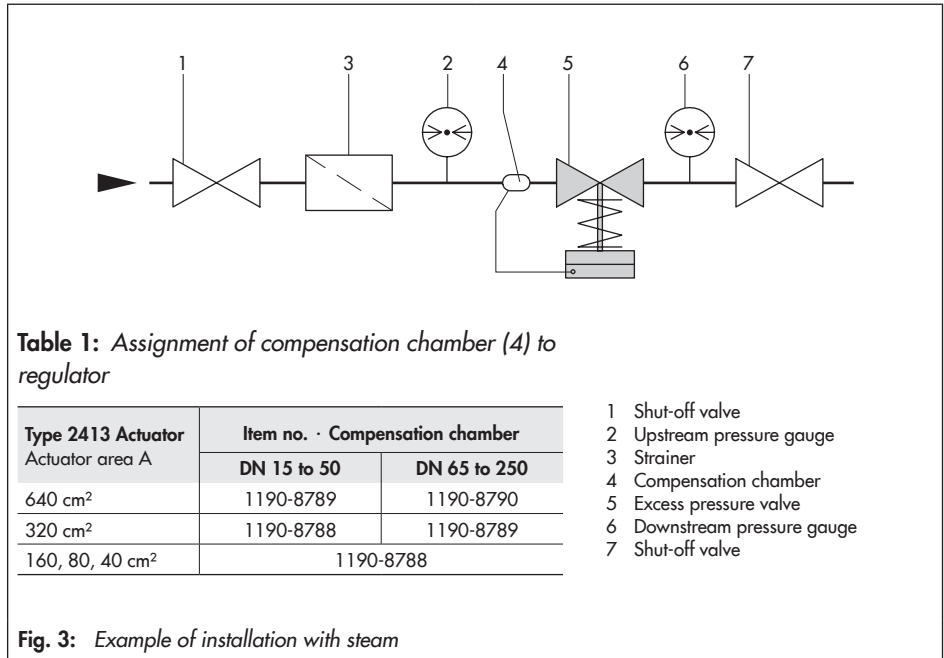
Control line · A control line must be provided at the site of installation, e.g. a 3/8" pipe for steam or an 8 x 1 or 6 x 1 mm pipe for air/water.

Connect the control line to the upstream line (p_1) at least one meter away from the valve inlet.

Weld the control line at the side in the middle of the pipe, inclining at a ratio of approximately 1:10 up to the compensation chamber.

Control line kit · A control line kit for tapping pressure directly at the valve body is available as an accessories part from SAMSON.

Compensation chamber (see Table 1) · A compensation chamber is required for liquids above 150 °C as well as for steam. 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 excess pressure valve cannot be guaranteed.

Weld the line coming from the pressure tapping point to the $\frac{3}{8}$ " pipe socket on the chamber. Install the compensation chamber at the highest point of the pipeline. Consequently, the control line between compensation chamber and actuator must also be installed with a downward slope. In this case, use a $\frac{3}{8}$ " pipe with screw fittings.

If the control line connection is located below the middle of the valve inlet flange, arrange the compensation chamber at the same level as the inlet flange. In this case, use a pipe which is at least $\frac{1}{2}$ " in size for the control line from the tapping point to the compensation chamber.

If the control line is connected above the middle of the valve outlet flange, install the compensation chamber at the same level as the upstream pressure tapping point. The additional pressure of the condensate head must be compensated for by adjusting the set point.

Needle valve · If the regulator tends to hunt, we recommend installing a needle valve at the control line connection (16) in addition to the standard SAMSON screw joint with restriction.

4.4 Strainer (filter)

Install the strainer upstream of the excess pressure valve. 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.

4.5 Shut-off valve

Install a hand-operated shut-off valve both upstream of the strainer and downstream of the regulator. This allows the plant to be shut down for cleaning and maintenance, and when the plant is not used for longer periods of time.

4.6 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 upstream side in front of the upstream pressure tapping point (not between the tapping point and the valve).

5 Operation

5.1 Start-up

See Fig. 1 on page 7.

First start up the regulator after mounting all parts. Make sure the control line is open and correctly connected.

Fill the plant **slowly** with the process medium. Avoid pressure surges.

Slowly fill the plant. Make sure that the pressure rises simultaneously upstream and downstream of the regulator to avoid damaging the balancing bellows. Open the shut-off valves first on the upstream pressure side. Afterwards, open all the valves on the consumer side (downstream of the regulator).



NOTICE

The pressure at the actuator must not exceed the permissible pressure on testing the pressure of the plant and during operation (see section 10). If necessary, detach the control line and seal the opening on the valve body with suitable end plug. Alternatively, install a shut-off valve in the control line.

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

Regulation of steam

Unscrew filler plug (19) on the compensation chamber. Use the included plastic funnel or a

jug to pour in water until it starts to overflow. Screw the filler plug back in and tighten it.

- All pipes conveying the process medium must be completely drained and dry.
- Air and condensate must be allowed to escape from the plant.
- Allow time for the pipes and valves to heat up.

Regulation of liquids

To start up the excess pressure valve, open shut-off valves slowly.

- For temperatures above 150 °C, first fill the compensation chamber with the process medium.

5.2 Adjusting the set point

See Fig. 1 on page 7.

The required upstream pressure is set by turning the set point adjuster (6) using an open-end wrench (up to DN 50 with width across flats SW 19 and for DN 65 and larger with SW 24). The set point of the stainless steel regulator must be adjusted using the rod included.

The following generally applies:

- Turn clockwise ☺ (tensioning the spring): to increase the upstream pressure
- Turn counterclockwise ☹ (relieving the tension on the spring): to reduce the upstream pressure

The pressure gauge located on the upstream pressure side allows the adjusted set point to be monitored.

An adjustment of the set point can also be made by turning the set point adjuster until the distance x is reached.

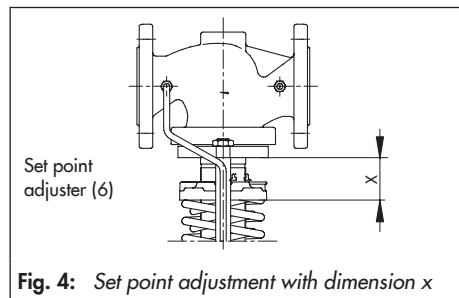


Fig. 4: Set point adjustment with dimension x



Note:

Note that only a rough set point adjustment is performed by turning the set point adjustment until the distance x is reached. The special properties of the process medium and plant are not taken into account in this case. Check the pressure at the pressure gauge upstream of the regulator for a precise set point adjustment.

Table 2: Set point adjustment – Dimension x

Set point range	Nominal size DN Assigned dimension x			
	15 to 25	32 to 50	65 to 100	
8 to 16 bar	10 bar	$x=89$ mm	$x=111$ mm	$x=153$ mm
	12 bar	$x=97$ mm	$x=122$ mm	$x=170$ mm
	14 bar	$x=104$ mm	$x=133$ mm	$x=188$ mm
4.5 to 10 bar				
Set point	5.9 bar	$x=85$ mm	$x=105$ mm	$x=151$ mm
	7.3 bar	$x=93$ mm	$x=117$ mm	$x=172$ mm
	8.6 bar	$x=101$ mm	$x=123$ mm	$x=192$ mm
2 to 5 bar				
Set point	2.8 bar	$x=83$ mm	$x=102$ mm	$x=146$ mm
	3.5 bar	$x=92$ mm	$x=115$ mm	$x=168$ mm
	4.3 bar	$x=100$ mm	$x=127$ mm	$x=190$ mm
0.8 to 2.5 bar				
Set point	1.2 bar	$x=79$ mm	$x=97$ mm	$x=137$ mm
	1.7 bar	$x=89$ mm	$x=111$ mm	$x=162$ mm
	2.1 bar	$x=99$ mm	$x=126$ mm	$x=187$ mm
0.2 to 1.2 bar				
Set point	0.45 bar	$x=71$ mm	$x=86$ mm	$x=118$ mm
	0.70 bar	$x=83$ mm	$x=103$ mm	$x=147$ mm
	1.0 bar	$x=95$ mm	$x=120$ mm	$x=177$ mm
0.1 to 0.6 bar				
Set point	0.23 bar	$x=71$ mm	$x=86$ mm	$x=118$ mm
	0.35 bar	$x=83$ mm	$x=103$ mm	$x=147$ mm
	0.48 bar	$x=95$ mm	$x=120$ mm	$x=177$ mm
0.05 to 0.25 bar				
Set point	0.10 bar	$x=70$ mm	$x=85$ mm	$x=112$ mm
	0.15 bar	$x=81$ mm	$x=100$ mm	$x=136$ mm
	0.20 bar	$x=91$ mm	$x=115$ mm	$x=159$ mm

Table 2 lists the set points and their assigned distance x for the regulators and their various set point ranges.

5.3 Decommissioning

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

6 Cleaning and maintenance

See Fig. 1 on page 7.

The regulator does not require any maintenance. Nevertheless, it is subject to natural wear, particularly at the seat, plug and operating diaphragm.

Depending on the operating conditions, check the regulator at regular intervals to avoid possible malfunctions.

Details on faults and how to remedy them can be found in Table 3 on page 14.



WARNING!

Before performing any work on the regulator, make sure the relevant plant section has been depressurized and, depending on the process medium, drained as well. We recommend removing the valve from the pipeline. When used at high temperatures, allow the plant section to cool down to ambient temperature. Disconnect or shut off the control line to prevent the risk of moving regulator parts. As valves are not free of cavities, remember that residual process medium might still be contained in the valve.



NOTICE

Make absolutely sure that no torque is applied to the bellows seal (5.1) during assembly or disassembly. Otherwise, the metal bellows will be destroyed.

6.1 Replacing the operating diaphragm

If the upstream pressure deviates considerably from the set point, check if the diaphragm is leaking and, if necessary, replace it.

- Shut down the plant by slowly closing the shut-off valves. Depressurize the relevant section of the pipeline and, if necessary, drain it as well.
- Unscrew the control line (17) and clean it.
- Loosen the bolts (15) at the actuator and remove the casing.
- Unscrew the nut (14) and lift off the diaphragm plate (13).
- Replace the operating diaphragm (12) with a new one.
- Proceed in the reverse order to reassemble the regulator. For start-up, proceed as described in section 5.1.

Table 3: Troubleshooting

Malfunction	Possible reasons	Recommended action
Pressure exceeds the adjusted set point.	Insufficient pressure pulses on the operating diaphragm.	Clean the control line and the screw joint with restriction.
	Seat and plug worn down by deposits or foreign particles.	Disassemble the regulator and replace damaged parts.
	Pressure tapped at the wrong place.	Reconnect control lines at a different place. Do not tap pressure at pipe bends or necks.
	With steam: compensation chamber in the wrong position or too small.	Reconnect chamber at a different place or replace it (see Table 1 and section 4.3).
	Control response too slow.	Install larger screw joint at the diaphragm actuator.
	Foreign particles blocking the plug	Disassemble the regulator and replace damaged parts.
Pressure drops below the adjusted set point.	Valve installed against the flow; see arrow on body.	Check direction of flow. Install valve correctly.
	Pressure tapped at the wrong place.	Reconnect control line at a different place.
	Valve or K_{VS} coefficient too small	Check valve sizing. Install larger valve, if necessary.
	With steam: compensation chamber in the wrong position or too small.	Reconnect chamber at a different place or replace it (see Table 1 and section 4.3).
	Foreign particles blocking the plug	Disassemble the regulator and replace damaged parts.
Jerky control response.	Increased friction, e.g. due to foreign particles between seat and plug.	Remove foreign particles. Replace damaged parts.
Slow control response.	Restriction in the screw joint of the actuator dirty or too small.	Clean screw joint or install larger screw joint.
	Dirt in the control line.	Clean the control line.
Upstream pressure fluctuates	Valve too large	Check valve sizing. Select smaller K_{VS} coefficient, if necessary.
	Restriction in the screw joint of the actuator too large.	Install smaller screw joint.
	Pressure tapped at the wrong place.	Select better place for pressure tapping.
Loud noises.	High flow velocity, cavitation.	Check sizing. Install flow divider with gases and steam.

7 Nameplate

Nameplates are attached to the valve and the actuator.

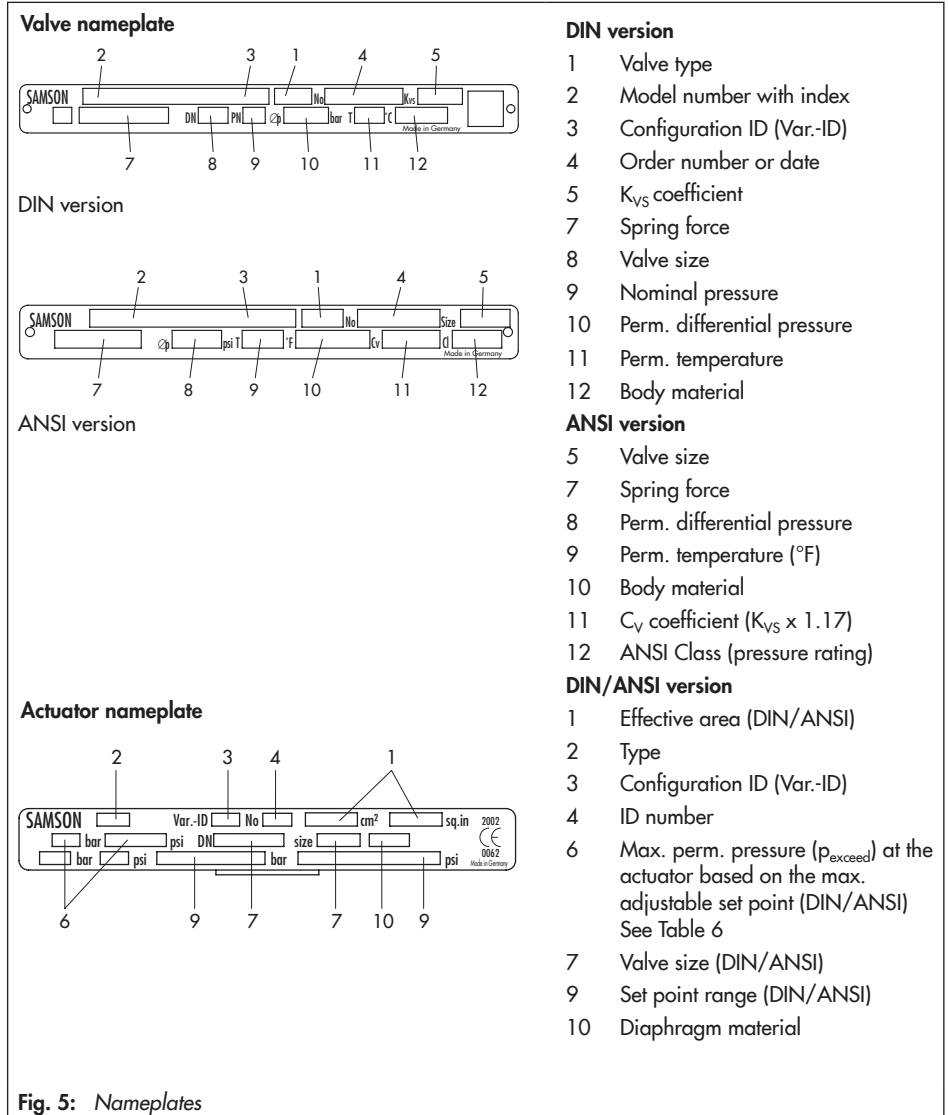


Fig. 5: Nameplates

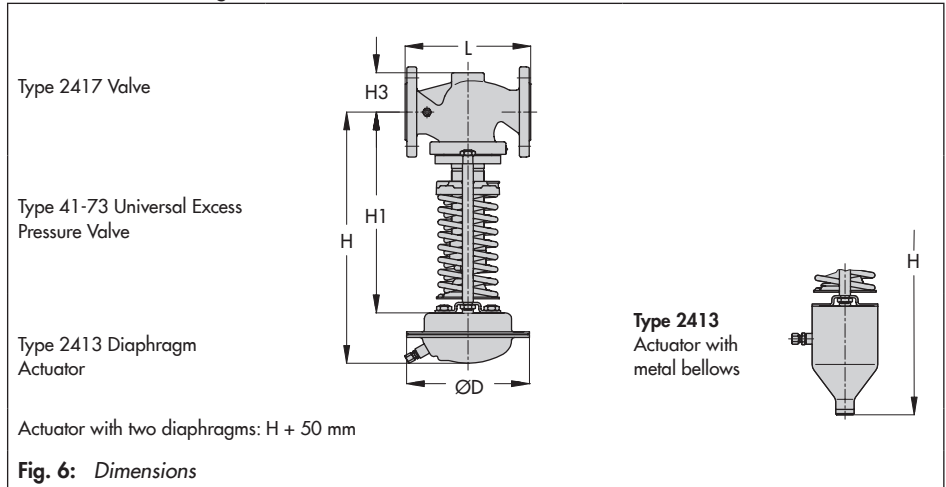
8 Dimensions

Table 4: Dimensions in mm and weights in kg

Excess pressure valve		Type 41-73									
Nominal size DN		15	20	25	32	40	50	65	80	100	
Length L		130	150	160	180	200	230	290	310	350	
Height H1		335			390			510		525	
Height H3		55			72			100		120	
Standard version with rolling diaphragm											
Set point ranges	0.05 to 0.25 bar	Height H	445			500			620		625
		Actuator	ØD = 380 mm, A = 640 cm ²								
	0.1 to 0.6 bar	Height H	445			500			620		635
		Actuator	ØD = 380 mm, A = 640 cm ²								
	0.2 to 1.2 bar	Height H	430			480			600		620
		Actuator	ØD = 285 mm, A = 320 cm ²								
	0.8 to 2.5 bar ²⁾	Height H	430			485			605		620
		Actuator	ØD = 225 mm, A = 160 cm ²								
	2 to 5 bar	Height H	410			465			585		600
		Actuator	ØD = 170 mm, A = 80 cm ²								
	4.5 to 10 bar	Height H	410			465			585		600
		Actuator	ØD = 170 mm, A = 40 cm ²								
	8 to 16 bar	Height H	410			465			585		600
		Actuator	ØD = 170 mm, A = 40 cm ²								
Weight for version with rolling diaphragm											
Set point ranges	0.05 to 0.6 bar	Weight, based on cast iron ¹⁾ , approx. kg	22.5	23.5	29.5	31.5	35	51	58	67	
	0.2 to 2.5 bar		16	18	23.5	25.5	29	45	52	61	
	2 to 16 bar		12	13	18.5	21	24	40	47	56	
Special version with metal bellows actuator											
Set point ranges	2 to 6 bar	Height H	550			605			725		740
		Actuator	A = 62 cm ²								
	5 to 10 bar	Height H	550			605			725		740
		Actuator	A = 62 cm ²								
	10 to 22 bar	Height H	535			590			710		725
		Actuator	A = 33 cm ²								
20 to 28 bar	Height H	535			590			710		725	
	Actuator	A = 33 cm ²									
Weight for version with metal bellows actuator											
A = 33 cm ²	Based on cast iron ¹⁾ , approx. kg	16.5	17.9	18	23.5	25.5	29	48	56	66	
A = 62 cm ²		20.9	21.5	22	27.5	29.5	33	54	65	75	

¹⁾ +10 % for other materials · ²⁾ Version with actuator with two diaphragms: 1 to 2.5 bar

Dimensional drawing



9 Customer inquiries

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

E-mail address: aftersaleservice@samson.de

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:

- 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.)

10 Technical data

Table 5: Technical data · All pressures in bar (gauge)

Valve	Type 2417		
Nominal pressure	PN 16, 25 or 40		
Nominal size	DN 15 to 50	DN 65 to 80	DN 100
Max. permissible differential pressure Δp	25 bar	20 bar	16 bar
Max. permissible temperature	See pressure-temperature diagram in ► T 2500		
Valve plug	Metal seal: max. 350 °C · PTFE soft seal: max. 220 °C · EPDM or FPM soft seal: max. 150 °C · NBR soft sealing: max. 80 °C ¹⁾		
Leakage class according to IEC 60534-4	Metal seal: leakage class I (≤ 0.05 % of K_{VS} coefficient) Soft seal: leakage class IV (≤ 0.01 % of K_{VS} coefficient)		
Compliance	CE · EAC		
Diaphragm actuator	Type 2413		
Set point ranges	0.05 to 0.25 bar · 0.1 to 0.6 bar · 0.2 to 1.2 bar · 0.8 to 2.5 bar ³⁾ 2 to 5 bar · 4.5 to 10 bar · 8 to 16 bar		
Max. permissible temperature	Gases 350 °C, however, max. 80 °C at the actuator ¹⁾ · Liquids 150 °C, with compensation chamber max. 350 °C · Steam with compensation chamber max. 350 °C		
Metal bellows actuator	Type 2413		
Actuator area	33 cm ²	62 cm ²	
Set point ranges	10 to 22 bar 20 to 28 bar	2 to 6 bar ²⁾ 5 to 10 bar	
Set point spring	8000 N		

¹⁾ With oxygen: max. 60 °C

²⁾ Set point spring: 4400 N

³⁾ Version with actuator with two diaphragms: 1 to 2.5 bar

Table 6: Max. permissible pressure at actuator

Set point range · Actuator with rolling diaphragm						
0.05 to 0.25 bar	0.1 to 0.6 bar	0.2 to 1.2 bar	0.8 to 2.5 bar	2 to 5 bar	4.5 to 10 bar	8 to 16 bar
Max. perm. pressure (p_{exceed}) above the set point adjusted at the actuator						
0.6 bar	0.6 bar	1.3 bar	2.5 bar	5 bar	10 bar	10 bar
Set point range · Metal bellows actuator						
2 to 6 bar		5 to 10 bar		10 to 22 bar		20 to 28 bar
Max. perm. pressure (p_{exceed}) above the set point adjusted at the actuator						
6.5 bar		6.5 bar		8 bar		2 bar

The maximum permissible pressure at the actuator depends on the adjusted set point. The value specified in the table must be added to this set point.

Example:

Set point range: 0.2 to 1.2 bar, adjusted set point: 0.8 bar

Max. permissible pressure at the actuator:

$$0.8 \text{ bar} + 1.3 \text{ bar} = \mathbf{2.1 \text{ bar}}$$



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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