DATA SHEET

T 2513 EN

Type 41-23 Universal Pressure Reducing Valve

Self-operated Pressure Regulators · ANSI version

Application

Pressure regulators for set points from **0.75** to **400 psi** · Nominal sizes **NPS ½** to **4** · Pressure rating **Class 125** to **300** · Suitable for liquids, gases and vapors up to **660 °F**

The valve **closes** when the **downstream** pressure rises.

Type 41-23 Universal Pressure Reducing Valve

Special features

- Low-maintenance proportional regulators requiring no auxiliary energy
- Frictionless plug stem seal with stainless steel bellows
- Control line kit available for tapping the pressure directly at the valve body
- Wide set point range and convenient set point adjustment using a nut
- Exchangeable set point springs and actuator
- Spring-loaded, single-seated valve with upstream and downstream pressure balancing by a stainless steel bellows (C_V ≤3: without balancing bellows)
- Soft-seated plug for strict shut-off requirements
- Low-noise plug (standard)
- All wetted parts free of non-ferrous metal

The universal pressure reducing valves consist of a Type 2412 Globe Valve and a Type 2413 Diaphragm or Bellows Actuator.

Versions

Pressure reducing valve to regulate the downstream pressure p_2 to the adjusted set point. The valve **closes** when the **downstream** pressure rises.

– **Type 41-23 · Standard version**
Type 2412 Valve · Valve in NPS ½ to 4 · Plug with metal seal · Body made of cast iron A126B, cast steel A216 WCC or cast stainless steel A351 CF8M · **Type 2413 Actuator** with EPDM rolling diaphragm

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Version with additional features

- **Pressure reducing valve for low flow rates**
  Valve with micro-flow trim (C_V = 0.0012 to 0.05) or special C_V coefficients (restricted cross-sectional area of flow)
- **Steam pressure reducing valve**
  with compensation chamber for steam up to 660 °F
- **Pressure reducing valve with increased safety**
  Actuator with leakage line connection and seal or two diaphragms and diaphragm rupture indicator

Special versions

- Control line kit for tapping the pressure directly at the valve body (accessories)
- With internal parts made of FKM, e.g. for use with mineral oils
- Actuator for remote set point adjustment (autoclave control)
- Bellows actuator for valves NPS ½ to 4 · Set point ranges 30 to 85 psi, 75 to 145 psi, 145 to 320 psi or 300 to 400 psi
- Valve with flow divider ST 1 or ST 3 (NPS 2½ to 4) for particularly low-noise operation with gases and vapors (▶ T 8081)
- Version entirely of stainless steel
- Stainless Cr steel seat and plug with PTFE soft seal (max. 430 °F) or with EPDM soft seal (max. 300 °F)
- Stellite®-faced seat and plug for low-wear operation
- Version for industrial gases
- Free of oil and grease for high-purity applications
- FDA version [1)]

[1)] This version is not suitable for direct contact with products manufactured in the food and pharmaceutical industries. It can only be used close to the product.

Design and principle of operation

⇨ See Fig. 1

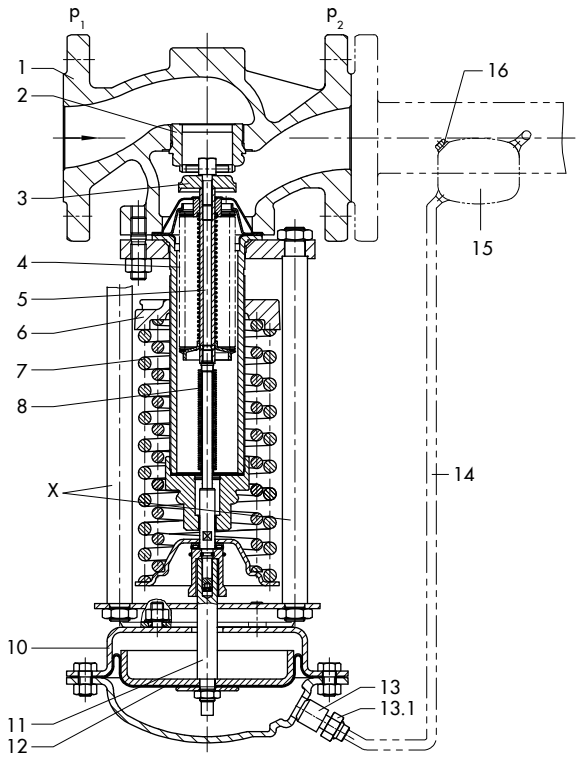
The medium flows through the valve (1) as indicated by the arrow. The position of the plug (3) determines the flow rate across the area released between plug and valve seat (2). The plug stem (5) with the plug is connected to the actuator stem (11) of the actuator (10).

To control the pressure, the operating diaphragm (12) is tensioned by the set point springs (7) and the set point adjuster (6) so that the valve is opened by the force of the set point springs when it is relieved of pressure ($p_1 = p_2$).

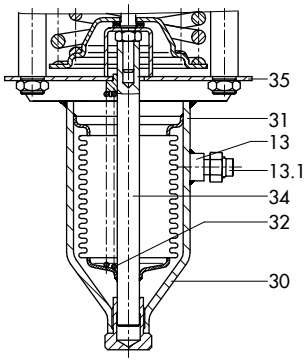
The downstream pressure p_2 to be controlled is tapped downstream of the valve and transmitted over the control line (14) to the operating diaphragm (12) where it is converted into a positioning force. This force is used to move the valve plug (3) according to the force of the set point springs (7). The spring force is adjustable at the set point adjuster (6). When the force resulting from the downstream pressure p_2 rises above the adjusted pressure set point, the valve closes proportionally to the change in pressure.

The fully balanced valve has a balancing bellows (4). The downstream pressure p_2 acts on the inside of the bellows, whereas the upstream pressure p_1 acts on the outside of the bellows. As a result, the forces produced by the upstream and downstream pressures acting on the plug are balanced out.

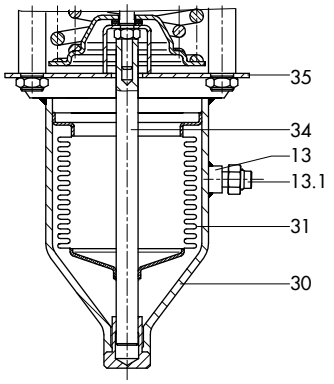
Sectional drawing of Type 41-23 Universal Pressure Reducing Valve



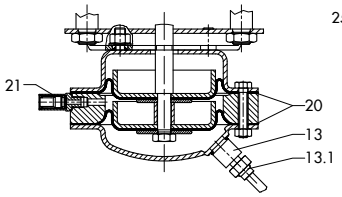
Various versions of Type 2413 Actuator



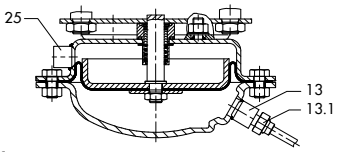
Bellows actuator:
145 to 320 psi
· 300 to 400 psi



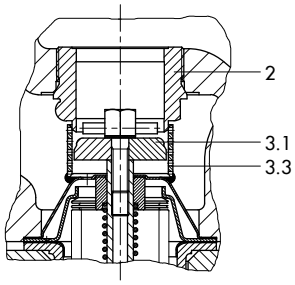
Bellows actuator:
30 to 85 psi · 75 to 145 psi



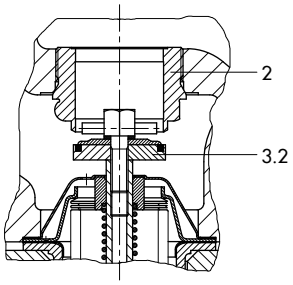
Diaphragm actuator with two diaphragms for increased safety



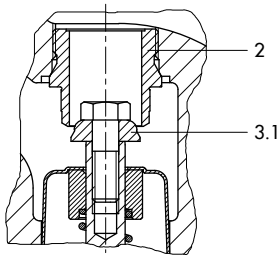
Diaphragm actuator with leakage line connection



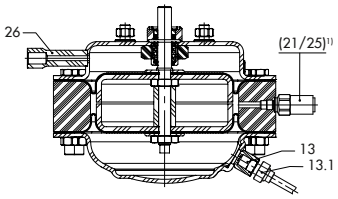
Plug with metal seal, with flow divider ST 1



Plug with soft seal



Valve for small flow rates C_V ≤3: without balancing bellows



Diaphragm actuator with two diaphragms for autoclave regulator (overview of diaphragm actuator connections)

Fig. 1: *Functional diagram of Type 41-23 Universal Pressure Reducing Valve*

1 Valve body (Type 2412)
2 Seat (exchangeable)
3 Plug
3.1 Plug with metal seal
3.2 Plug with soft seal
3.3 Flow divider
4 Balancing bellows
5 Plug stem
6 Set point adjuster
7 Set point springs
8 Bellows seal
10 Actuator housing of Type 2413
11 Actuator stem
12 Operating diaphragm with diaphragm plate
13 Control line connection G ¼
13.1 Screw joint with restriction
14 Control line
15 Compensation chamber
16 Filler plug
20 Diaphragm
21 Diaphragm rupture indicator G ¼
25 Leakage line connection G ¼
30 Bellows actuator
31 Bellows with bottom section
32 Additional springs
34 Bellows stem
35 Crossbeam

Table 1: *Technical data of the valve · All pressures in psi (gauge)*

Valve		**Type 2412**		
Nominal size		NPS ½ to 2	NPS 2½ and 3	NPS 4
Pressure rating		Class 125, 150 or 300		
Max. perm. differential pressure Δp		200 psi [2] · 280 psi [3] · 360 psi	200 psi [2] · 280 psi [3] · 290 psi	200 psi [2] · 230 psi
Max. permissible temperature [1]	Valve	See ▶ T 2500 · Pressure-temperature diagram		
	Valve plug	Metal seal: 660 °F · PTFE soft seal: 430 °F EPDM or FKM soft seal: 300 °F · NBR soft seal: 175 °F		
Leakage class according to ANSI/FCI 70#2		Metal seal: leakage rate I (≤0.05 % of C_V) Soft seal: leakage rate IV (≤0.01 % of C_V)		
Conformity		CE		

[1] FDA version: Max. permissible temperature 140 °F

[2] For Class 125 only

[3] For Class 150 only

Table 2: *Technical data of diaphragm or bellows actuator · All pressures in psi (gauge)*

Diaphragm actuator	**Type 2413**				
Actuator area	100 in²	50 in²	25 in²	12 in²	6 in²
Set point range	0.75 to 3.5 psi 1.5 to 8.5 psi	3 to 17 psi	10 to 35 psi[2]	30 to 75 psi	65 to 145 psi 115 to 230 psi
Max. permissible temperature [3]	Gases 660 °F, however, max. 175 °F at the actuator · Liquids 300 °F, with compensation chamber 660 °F · Steam with compensation chamber 660 °F				
Set point spring	1750 N	4400 N			8000 N
Bellows actuator	**Type 2413**				
Actuator area	5.1 in²		9.6 in²		
Set point range	145 to 320 psi 300 to 400 psi		30 to 85 psi [1] 75 to 145 psi		
Max. permissible temperature [3]	660 °F				
Set point spring	8000 N				

[1] Set point spring 4400 N

[2] Version with actuator with two diaphragms: 14.5 to 35 psi

[3] FDA version: Max. permissible temperature 140 °F

Table 3: *Max. perm. pressure at actuator*

	Set point ranges	**Max. perm. pressure above the set point adjusted at the actuator**
Diaphragm actuator	0.75 to 3.5 psi · 1.5 to 8.5 psi	9 psi
	3 to 17 psi	19 psi
	10 to 35 psi	36 psi
	30 to 75 psi	73 psi
	65 to 145 psi · 115 to 230 psi	145 psi
Bellows actuator	30 to 85 psi · 75 to 145 psi	94 psi
	145 to 320 psi	116 psi
	300 to 400 psi	29 psi

Table 4: *Weights · Compensation chambers (standard version) made of steel*

Order no.	Designation	Weight, approx.
1190-8788	Compensation chamber 0.7 l	3.5 lbs
1190-8789	Compensation chamber 1.5 l	5.7 lbs
1190-8790	Compensation chamber 2.4 l	8.2 lbs

Table 5: *C_V coefficients and x_{FZ} values · Terms for noise level calculation according to VDMA 24422 (edition 1.89)*

Nominal size	NPS ½	NPS ⅜	NPS 1	NPS 1½	NPS 2	NPS 2½	NPS 3	NPS 4
C_V[1] (standard version)	5	7.5	9.4	23	37	60	94	145
x_{FZ}	0.5	0.45	0.4				0.35	
C_V[1] (special version)	0.12 · 0.5 · 1.2 · 3	0.12 · 0.5 · 1.2 · 3 · 5	0.12 · 0.5 · 1.2 · 3 · 5 · 7.5	7.5 · 9.4 · 20	9.4 · 20 · 23	23 · 37	37 · 60	60
C_V-1[1] with flow divider ST 1	3.5	6	7.2	17	7.2 · 30	30 · 45	30 · 70	45 · 110
C_V-3[1] with flow divider ST 3	–					30	46	70

[1] With C_V 0.0012 to 0.05: Valve with micro-trim (NPS ½ to 1 only) without balancing bellows

Table 6: *Materials · Material numbers according to ASTM and DIN EN*

Valve		Type 2412		
Pressure rating		Class 125	Class 150 · Class 300	
Max. permissible temperature [3]		570 °F	660 °F	
Body		Cast iron A126B	Cast steel A216 WCC	Cast stainless steel A351 CF8M
Seat		CrNi steel		CrNiMo steel
Plug	Material	CrNi steel		CrNiMo steel
	Seal	PTFE with 15 % glass fiber · EPDM · NBR · FKM		
Guide bushing		Graphite		
Balancing bellows and bellows seal		CrNiMo steel		
Actuator		**Type 2413**		
		Diaphragm actuator	**Bellows actuator**	
Diaphragm cases		1.0332 [1]	–	
Diaphragm		EPDM with fabric reinforcement [2] · FKM, e.g. for mineral oils · NBR	–	
Bellows housing		–	1.0460/1.4301 (stainless steel only)	
Bellows		–	CrNiMo steel	

[1] In corrosion-resistant version (CrNi steel)

[2] Standard version; see Special versions for others

[3] FDA version: Max. permissible temperature 140 °F

Table 7: *Dimensions in inch and weights in lbs*

Type 41-23 Universal Pressure Reducing Valve										
Nominal size			**NPS ½**	**NPS ⅜**	**NPS 1**	**NPS 1½**	**NPS 2**	**NPS 2½**	**NPS 3**	**NPS 4**
Length L		Class 125	–		7.2"	8.7"	10"	10.9"	11.7"	13.9"
		Class 150	7.2"							
		Class 300	7.5"	7.6"	7.8"	9.3"	10.5"	11.5"	12.5"	14.5"
Height H1			13.2"			15.4"		20.4"		21.3"
Height H2	Forged steel		2.1"	–	2.8"	3.6"	3.9"	–	5"	–
	Cast steel		1.7"			2.8"		3.9"		4.6"
Height H4			3.9"							

Version with Type 2413 Diaphragm Actuator										
Nominal size			**NPS ½**	**NPS ⅜**	**NPS 1**	**NPS 1½**	**NPS 2**	**NPS 2½**	**NPS 3**	**NPS 4**
Set point ranges	0.75 to 3.4 psi	Height H [3)4)]	17.5"			19.7"		24.7"		25.6"
		Actuator	ØD = 15", A = 100 in²							
		Valve spring force F	1750 N							
	1.5 to 8.5 psi	Height H [3)4)]	17.5"			19.7"		24.7"		25.6"
		Actuator	ØD = 15", A = 100 in²							
		Valve spring force F	4400 N							
	3 to 17 psi	Height H [3)4)]	16.9"			18.9"		23.9"		25"
		Actuator	ØD = 11.2", A = 50 in²							
		Valve spring force F	4400 N							
	10 to 35 psi [2)]	Height H [3)4)]	16.9"			19.1"		24.1"		25"
		Actuator	ØD = 8.9", A = 25 in²							
		Valve spring force F	4400 N							
	30 to 75 psi	Height H [3)4)]	16.1"			18.3"		23.3"		24.2"
		Actuator	ØD = 6.7", A = 12 in²							
		Valve spring force F	4400 N							
	65 to 145 psi	Height H [3)4)]	16.1"			18.3"		23.3"		24.2"
		Actuator	ØD = 6.7", A = 6 in²							
		Valve spring force F	4400 N							
	115 to 230 psi	Height H [3)4)]	16.1"			18.3"		23.3"		24.2"
		Actuator	ØD = 6.7", A = 6 in²							
		Valve spring force F	8000 N							

Weight for version with Type 2413 Diaphragm Actuator									
Set point ranges	0.75 to 8.5 psi	Weight [1)] (approx. lbs)	54.7	57.1	76.5	84.9	123.7	140.7	162.5
	3 to 35 psi		45.5	50.3	68.6	77	115.8	132.8	154.6
	30 to 230 psi		29.1	31.6	51	58.2	97	114	135.8

1) Based on Class 150; +10 % for Class 300

2) Actuator with two diaphragms: 14.5 to 35 psi

3) Actuator with two diaphragms for autoclave regulator: H = +2"

4) Actuator with two diaphragms for increased safety: H = +1.3"

Version with Type 2413 Bellows Actuator										
Nominal size			**NPS ½**	**NPS ⅜**	**NPS 1**	**NPS 1½**	**NPS 2**	**NPS 2½**	**NPS 3**	**NPS 4**
Set point ranges	30 to 85 psi	Height H	21.7"			23.8"		28.8"		29.7"
		Actuator	Ø D = 4.7", A = 9.6 in²							
		Valve spring force F	4400 N							
	75 to 145 psi	Height H	21.7"			23.8"		28.8"		29.7"
		Actuator	Ø D = 4.7", A = 9.6 in²							
		Valve spring force F	8000 N							
	145 to 320 psi	Height H	21.1"			23.2"		28.2"		29.1"
		Actuator	Ø D = 3.5", A = 5.1 in²							
		Valve spring force F	8000 N							
	300 to 400 psi	Height H	21.1"			23.2"		28.2"		29.1"
		Actuator	Ø D = 3.5", A = 5.1 in²							
		Valve spring force F	8000 N							
Weight for version with bellows actuator										
Set point ranges	30 to 145 psi	Weight [1] (approx. lbs)	49.9	52.3	53.4	71.7	80	133.4	150.4	172.2
	145 to 400 psi		40.2	42.6	43.7	62	70.4	106.8	135.8	157.7

[1] Based on Class 150; +10 % for Class 300

Dimensional drawings

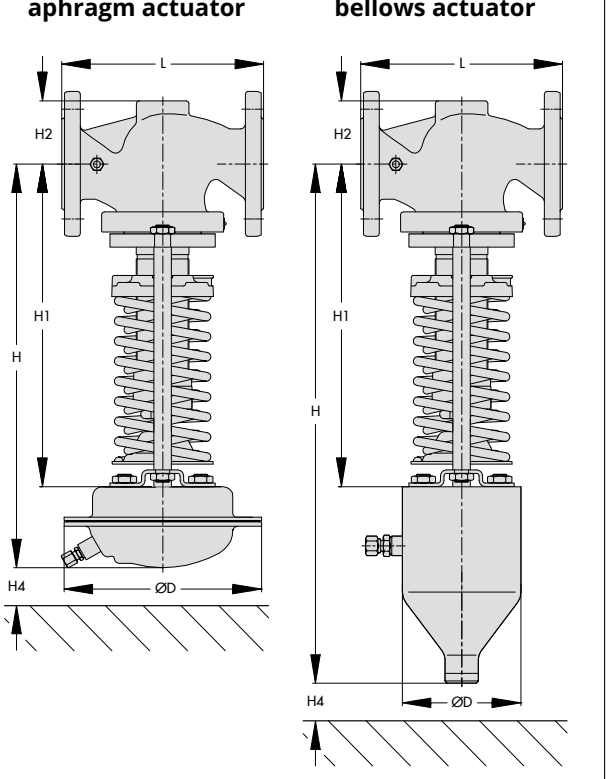


Fig. 2: *Dimensions of Type 41-23*

Installation

Normally, the valve is installed with the actuator suspended downwards. Install pipelines horizontally with a slight downward slope on both sides of the valve for drainage of the condensate.

- The direction of flow must match the arrow on the valve body.
- Adapt the control line to the conditions on site. The control line is not included in the scope of delivery. A control line kit is available for tapping the pressure directly at the valve body (see section Accessories).

i Note

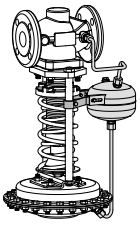
For further details on installation in ▶ EB 2512.

Accessories

Included in the scope of delivery:

- Screw joint with restriction for ⅜" control line

To be ordered separately:



- **Adapter** G ¼ to ¼ NPT, various screw fittings
- **Control line kit** optionally with or without compensation chamber. For direct attachment to the valve and actuator (pressure tapped directly at the valve body, for set points ≥12 psi).
- **Compensation chamber** for condensation and to protect the operating diaphragm against extreme temperatures. A compensation chamber is required for liquids above 300 °F as well as for steam.

i Note

For further details on accessories in ▶ T 2595.

Valve-specific correction terms

- ΔL_G for gases and vapors:

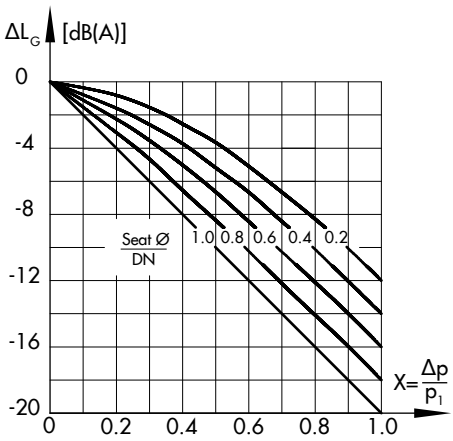


Fig. 3: *Diagram · ΔL_G for gases and vapors*

- **ΔL_F** · For liquids:
  $\Delta L_F = -10 \cdot (x_F - x_{FZ}) \cdot y$

  with $x_F = \frac{\Delta p}{p_1 - p_V}$ and $y = \frac{K_V}{K_{VS}}$

  Terms for control valve sizing according to IEC 60534, Parts 2-1 and 2-2:
  - **F_L** = 0.95; **x_T** = 0.75
  - **x_{FZ}** · Acoustical valve coefficient

- **C_V-1, C_V-3** · When a flow divider ST 1 or ST 3 is installed as a noise-reducing component
  Flow characteristic differences between valves with and valves without flow dividers do not occur until the valve has passed through approx. 80 % of its travel range

Ordering text

Type 41-23 Universal Pressure Reducing Valve

Additional features …

NPS …

Body material …

Class …

C_V coefficient …

Set point range … psi

Optionally, accessories … (▶ T 2595)

Optionally, special version …

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