DATA SHEET

T 2513 EN

Type 41-23 Universal Pressure Reducing Valve

Self-operated Pressure Regulators · ANSI version

Application

Pressure reducing valve for set points from **0.75** to **400 psi/0.05** to **28 ba**r · Valves in **NPS ½** to **4/DN 15** to **100** Pressure rating **Class 125** to **300/PN 16** to **40** · Suitable for liquids, gases and vapors up to **660 °F/350 °C**

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

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 1) by a stainless steel bellows
- Soft-seated plug for strict shut-off requirements
- All wetted parts free of non-ferrous metal

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/DN 15 to 100 · Plug with metal seal · Body made of either cast iron A126B, cast steel A216 WCC or cast stainless steel A351 CF8M · Type 2413 Actuator with EPDM rolling diaphragm

Version with additional features

– **Pressure reducing valve for low flow rates**
Valve with micro-flow trim (C_V = 0.0012 to 0.05/ K_{VS} = 0.001 to 0.04) or special C_V/K_{VS} coefficients (restricted cross-sectional area of flow)
– **Steam pressure reducing valve**
With compensation chamber for steam up to 660 °F/350 °C

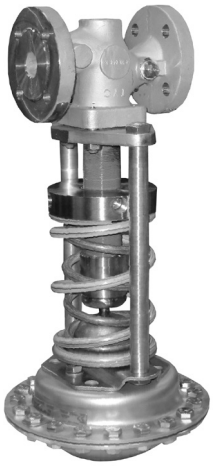

Fig. 1: *Type 41-23 Universal Pressure Reducing Valve*

– **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)
– Valve with flow divider ST 1 or ST 3 (NPS 2½ to 4/ DN 65 to 100) for particularly low-noise operation with gases and vapors (▶ T 8081)
– Bellows actuator for valves NPS ½ to 4 (DN 15 to 100) · Set point ranges 30 to 85 psi, 75 to 145 psi, 145 to 320 psi, 300 to 400 psi (2 to 6 bar, 5 to 10 bar, 10 to 22 bar, 20 to 28 bar)
– Version entirely of stainless steel
– Version for industrial gases

1) With C_V ≤3/K_{VS} ≤2.5: without balancing bellows

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Edition May 2025

- Stainless Cr steel seat and plug with PTFE soft seal (max. 440 °F/220 °C) or with EPDM soft seal (max. 300 °F/150 °C)
- Stellite®-faced seat and plug for low-wear operation
- Free of oil and grease for high-purity applications
- FDA version [1)]

Principle of operation (Fig. 2)

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 (3) 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).

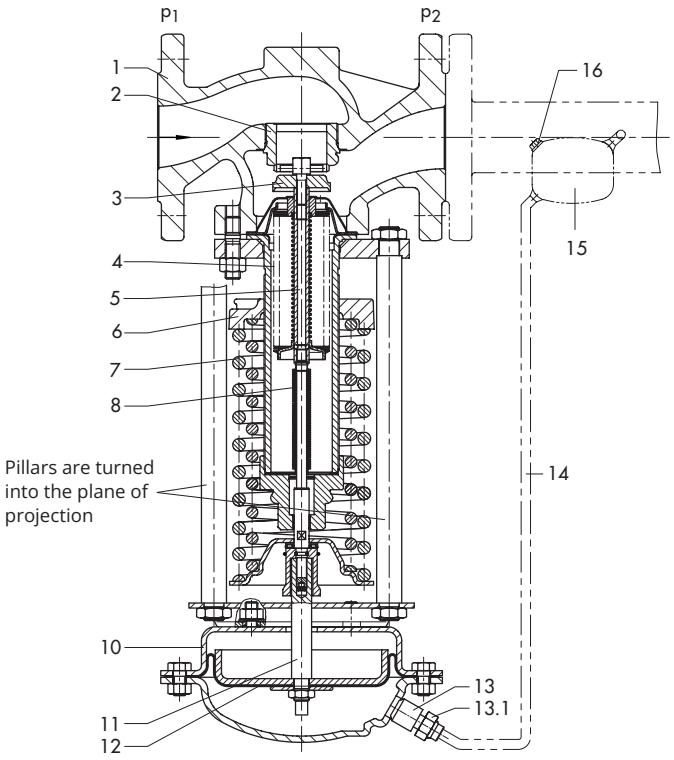
The downstream pressure p_2 to be controlled is tapped downstream of the valve and transmitted over the control line (14) to the operating diaphragm (12) where it is converted into a positioning force. This force is used to move the valve plug (3) according to the force of the set point spring (7). The spring force is adjustable at the set point adjuster (6).

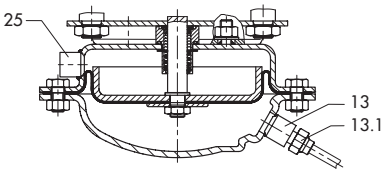
When the force resulting from the downstream pressure p_2 rises above the adjusted pressure set point, the valve closes proportionally to the change in pressure.

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.

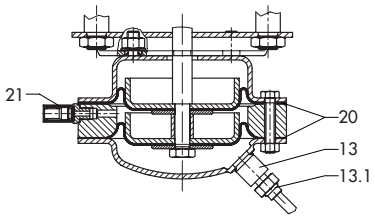
1) This version is not suitable for direct contact with products manufactured in the food and pharmaceutical industries. It can only be used close to the product.

Functional diagram of Type 41-23 Universal Pressure Reducing Valve

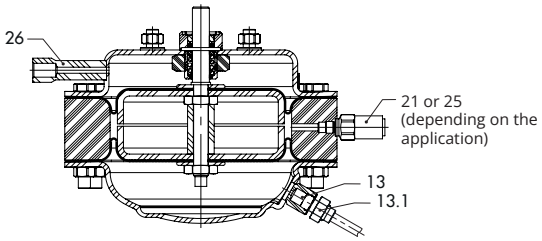




Actuator with leakage line connection



Actuator with two diaphragms for increased safety



Actuator with two diaphragms for autoclave regulator

1	Valve body (Type 2412)	13.1	Screw joint with restriction
2	Seat (exchangeable)	14	Control line
3	Plug (with metal seal)	15	Compensation chamber
4	Balancing bellows	16	Filler plug
5	Plug stem	20	Diaphragm
6	Set point adjuster	21	Diaphragm rupture indicator
7	Set point springs	25	Leakage line connection G ¼ · Adapter ¼ NPT (accessories)
8	Bellows seal	26	Control line connection (control pressure)
10	Type 2413 Actuator	30	Bellows actuator
11	Actuator stem	31	Bellows with bottom section
12	Operating diaphragm with diaphragm plate	32	Additional springs
13	Control line connection G ¼ · ¼ NPT adapter (accessories) for medium pressure	34	Bellows stem
		35	Crossbeam

Different versions of Type 2413 Actuator

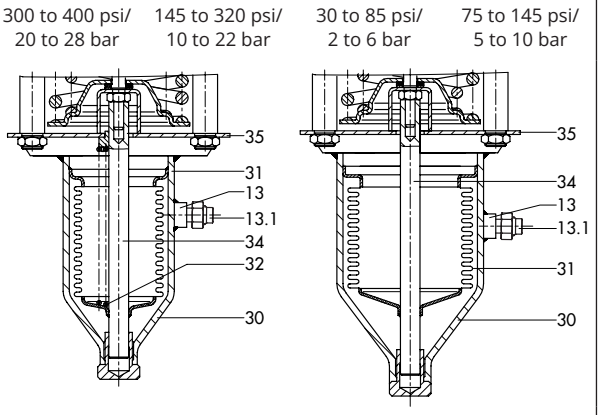
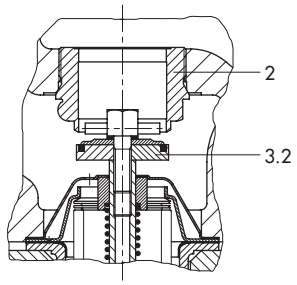
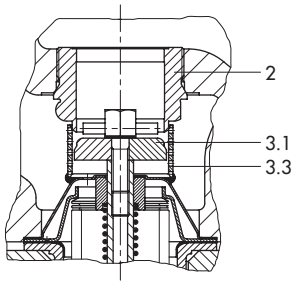


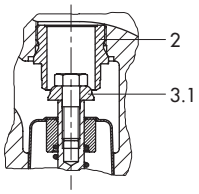
Fig. 2: *Functional diagram of Type 41-23 Universal Pressure Reducing Valve*



Plug with soft seal



Plug with metal seal, with flow divider ST 1



Valve for small flow rates C_V ≤3 (K_{VS} ≤2.5): without balancing bellows

2 Seat
3.1 Plug with metal seal
3.2 Plug with soft seal
3.3 Flow divider

Fig. 3: *Additional features for Type 41-23 Universal Pressure Reducing Valve*

Table 1: *Technical data · All pressures in psi and bar (gauge)*

Valve		**Type 2412**		
Pressure rating	Class	125, 150 or 300		
	PN	16, 25 or 40		
Nominal size	NPS	½ to 2	2½ and 3	4
	DN	15 to 50	65 and 80	100
Max. perm. differential pressure Δp	psi	200 [2] · 280 [3] · 360	200 [2] · 280 [3] · 290	200 [2] · 230
	bar	16 [2] · 25	16 [2] · 20	16
Max. permissible temperature [4]		See pressure-temperature diagram in ▶ T 2500		
	Valve plug	Metal seal: max. 660 °F/350 °C · PTFE soft seal: max. 430 °F/220 °C · EPDM, FPM soft seal: max. 300 °F/150 °C · NBR soft seal: max. 175 °F/80 °C		
Leakage class according to ANSI/FCI 70-2		Metal seal: leakage rate I (≤0.05 % of C_V/K_{VS}) Soft seal: leakage rate IV (≤0.01 % of C_V/K_{VS})		
Conformity		CE		
Diaphragm actuator		**Type 2413**		
Set point ranges		0.75 to 3.5 psi · 1.5 to 8.5 psi · 3 to 17 psi · 10 to 35 psi [1] 30 to 75 psi · 65 to 145 psi · 115 to 230 psi		
		0.05 to 0.25 bar · 0.1 to 0.6 bar · 0.2 to 1.2 bar · 0.8 to 2.5 bar [1] · 2 to 5 bar · 4.5 to 10 bar · 8 to 16 bar		
Max. permissible temperature [4]		Gases 660 °F/350 °C, however, max. 175 °F/80 °C at the actuator · Liquids 300 °F/150 °C, with compensation chamber max. 660 °F/350 °C · Steam with compensation chamber max. 660 °F/350 °C		
Bellows actuator		**Type 2413**		
Actuator area		5.1 sq. in/33 cm²	9.6 sq. in/62 cm²	
Set point ranges		145 to 320 psi/10 to 22 bar 300 to 400 psi/20 to 28 bar	30 to 85 psi/2 to 6 bar 75 to 145 psi/5 to 10 bar	

[1] Actuator with two diaphragms: 14.5 to 35 psi/1 to 2.5 bar
[2] For Class 125/PN 16 only
[3] For Class 150 only
[4] FDA version: Max. permissible temperature 140 °F/60 °C

Table 2: *Max. perm. pressure at actuator*

Set point ranges · Actuator with rolling diaphragm						
0.75 to 3.5 psi/ 0.05 to 0.25 bar	1.5 to 8.5 psi/ 0.1 to 0.6 bar	3 to 17 psi/ 0.2 to 1.2 bar	10 to 35 psi/ 0.8 to 2.5 bar	30 to 75 psi/ 2 to 5 bar	65 to 145 psi/ 4.5 to 10 bar	115 to 230 psi/ 8 to 16 bar
Max. perm. pressure above the set point adjusted at the actuator						
9 psi/0.6 bar	9 psi/0.6 bar	19 psi/1.3 bar	36 psi/2.5 bar	73 psi/5 bar	145 psi/10 bar	145 psi/10 bar
Set point ranges · Bellows actuator						
30 to 85 psi/2 to 6 bar		75 to 145 psi/5 to 10 bar		145 to 320 psi/10 to 22 bar		300 to 400 psi/20 to 28 bar
Max. perm. pressure above the set point adjusted at the actuator						
94 psi/6.5 bar		94 psi/6.5 bar		116 psi/8 bar		29 psi/2 bar

Table 3: *Materials · Material numbers according to ASTM and DIN EN*

Valve	**Type 2412**		
Pressure rating	Class 125/PN 16	Class 150/PN 25 · Class 300/PN 40	Class 150/PN 25 · Class 300/PN 40
Max. permissible temperature [2]	570 °F/300 °C	660 °F/350 °C	660 °F/350 °C
Body	Cast iron A126B	Cast steel A216 WCC	Cast stainless steel A351 CF8M
Seat	CrNi steel		CrNiMo steel
Plug	CrNi steel		CrNiMo steel
Seal for soft-seated plug	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 [3] · 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] FDA version: Max. permissible temperature 140 °F/60 °C
[3] Standard version; see Special versions for others

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 „Accessories“).

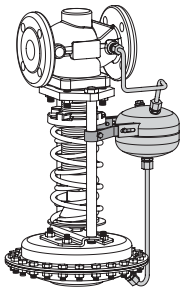
For further details on installation refer to Mounting and Operating Instructions ▶ EB 2512.

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/≥0.8 bar).
- **Compensation chamber** for condensation and to protect the operating diaphragm against extreme temperatures. A compensation chamber is required for liquids above 300 °F/150 °C as well as for steam.

For detailed information on accessories refer to Data Sheet ▶ T 2595

Table 4: *Dimensions and weights*

Universal Pressure Reducing Valve			Type 41-23							
Nominal size NPS/DN			**½/15**	**¾/20**	**1/25**	**1½/40**	**2/50**	**2½/65**	**3/80**	**4/100**
Overall length L	Class 125	inch	–	–	7.2	8.7	10	10.9	11.7	13.9
		mm	–	–	184	222	254	276	298	352
	Class 150	inch	7.2			8.7	10	10.9	11.7	13.9
		mm	184			222	254	276	298	352
	Class 300	inch	7.5	7.6	7.8	9.3	10.5	11.5	12.5	14.5
		mm	191	194	197	235	267	292	318	368
Height H1		inch	13.2			15.4		20.4		21.3
		mm	335			390		517		540
Height H2	Cast steel	inch	1.7			2.8		3.9		4.6
		mm	44			72		98		118
	Forged steel	inch	2.1	–	2.8	3.6	3.9	–	5	–
		mm	53	–	70	92	98	–	128	–
Height H4		inch	3.9							
		mm	100							

Standard version with Type 2413 Actuator with rolling diaphragm

Set point ranges psi	Set point ranges bar		Dimensions			
0.75 to 3.5	0.05 to 0.25	Height H [3) 4)]	17.5″/445 mm	19.7″/500 mm	24.7″/627 mm	25.6″/650
		Actuator	Ø D = 15″/380 mm, A = 100 in²/640 cm²			
		Valve spring force	1750 N			
1.5 to 8.5	0.1 to 0.6	Height H [3) 4)]	17.5″/445 mm	19.7″/500 mm	24.7″/627 mm	25.6″/650
		Actuator	Ø D = 15″/380 mm, A = 100 in²/640 cm²			
		Valve spring force	4400 N			
3 to 17	0.2 to 1.2	Height H [3) 4)]	16.9″/430 mm	18.9″/480 mm	23.9″/607 mm	25″/635
		Actuator	Ø D = 11.2″/285 mm, A = 50 in²/320 cm²			
		Valve spring force	4400 N			
10 to 35 [2)]	0.8 to 2.5 [2)]	Height H [3) 4)]	16.9″/430 mm	19.1″/485 mm	24.1″/612 mm	25″/635
		Actuator	Ø D = 8.9″/225 mm, A = 25 in²/160 cm²			
		Valve spring force	4400 N			
30 to 75	2 to 5	Height H [3) 4)]	16.1″/410 mm	18.3″/465 mm	23.3″/592 mm	24.2″/615
		Actuator	Ø D = 6.7″/170 mm, A = 12 in²/80 cm²			
		Valve spring force	4400 N			
65 to 145	4.5 to 10	Height H [3) 4)]	16.1″/410 mm	18.3″/465 mm	23.3″/592 mm	24.2″/615
		Actuator	Ø D = 6.7″/170 mm, A = 6 in²/40 cm²			
		Valve spring force	4400 N			
115 to 230	8 to 16	Height H [3) 4)]	16.1″/410 mm	18.3″/465 mm	23.3″/592 mm	24.2″/615
		Actuator	Ø D = 6.7″/170 mm, A = 6 in²/40 cm²			
		Valve spring force	8000 N			

1) Based on Class 150; +10 % for Class 300
2) Actuator with two diaphragms: 14.5 to 35 psi/1 to 2.5 bar
3) Actuator with two diaphragms for increased safety: H = +1.3″/32 mm
4) Actuator with two diaphragms for autoclave regulator: H = +2″/50 mm

Table 4: *Dimensions and weights*

Universal Pressure Reducing Valve				Type 41-23							
Nominal size NPS/DN				½/15	¾/20	1/25	1½/40	2/50	2½/65	3/80	4/100
0.75 to 8.5	0.05 to 0.6	Weight [1], approx.	lb	54.7	57.1		76.5	84.9	123.7	140.7	162.5
			kg	24.8	25.9		34.7	38.5	56.1	63.8	73.7
3 to 35	0.2 to 2.5		lb	45.5	50.3		68.6	77	115.8	132.8	154.6
			kg	20.6	22.8		31.1	34.9	52.5	60.2	70.1
30 to 230	2 to 16		lb	29.1	31.6		51	58.2	97	114	135.8
			kg	13.2	14.3		23.1	26.4	44	51.7	61.6
Version with Type 2413 Bellows Actuator											
Set point ranges				**Dimensions**							
psi	bar										
30 to 85	2 to 6	Height H		21.7"/550 mm			23.8"/605 mm		28.8"/732 mm		29.7"/755
		Actuator		Ø D = 4.7"/120 mm, A = 9.6 in²/62 cm²							
		Valve spring force		4400 N							
75 to 145	5 to 10	Height H		21.7"/550 mm			23.8"/605 mm		28.8"/732 mm		29.7"/755
		Actuator		Ø D = 4.7"/120 mm, A = 9.6 in²/62 cm²							
		Valve spring force		8000 N							
145 to 320	10 to 22	Height H		21.1"/535 mm			23.2"/590 mm		28.2"/717 mm		29.1"/740
		Actuator		Ø D = 3.5"/90 mm, A = 5.1 in²/33 cm²							
		Valve spring force		8000 N							
300 to 400	20 to 28	Height H		21.1"/535 mm			23.2"/590 mm		28.2"/717 mm		29.1"/740
		Actuator		Ø D = 3.5"/90 mm, A = 5.1 in²/33 cm²							
		Valve spring force		8000 N							
A = 5.1 in²/33 cm²		Weight [1], approx.	lb	40.2	42.6	43.7	62	70.4	106.8	135.8	157.7
			kg	18.2	19.3	19.8	28.1	31.9	48.4	61.6	71.5
A = 9.6 in²/62 cm²		Weight [1], approx.	lb	49.9	52.3	53.4	71.7	80	133.4	150.4	172.2
			kg	22.6	23.7	24.2	32.5	36.3	60.5	68.2	78.1

[1] Based on Class 150; +10 % for Class 300
[2] Actuator with two diaphragms: 14.5 to 35 psi/1 to 2.5 bar
[3] Actuator with two diaphragms for increased safety: H = +1.3"/32 mm
[4] Actuator with two diaphragms for autoclave regulator: H = +2"/50 mm

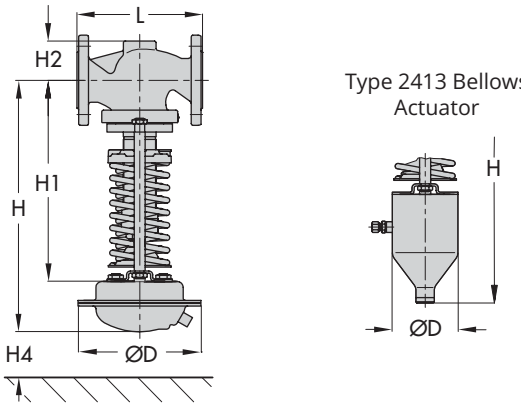
Table 5: *C_V/K_{VS} coefficients and x_{FZ} values · Terms for noise level calculation according to VDMA 24422 (edition 1.89)*

Nominal size		Standard		x_{FZ}	Special version		x_{FZ}	With flow divider			
NPS	DN	C_V	K_{VS}		C_V [1]	K_{VS} [1]		C_V ST 1	K_{VS}-ST 1	C_V ST 3	K_{VS}-ST 3
½	15	–			0.12 · 0.5 · 1.2	0.1 · 0.4 · 1.0	0.7 · 0.65 · 0.6	–			
					3.0	2.5	0.55				
		5	4	0.5	–			3.5	3.0	–	
¾	20	–			0.12 · 0.5 · 1.2	0.1 · 0.4 · 1.0	0.7 · 0.65 · 0.6	–			
					3.0	2.5	0.55				
					5.0	4.0	0.5				
		7.5	6.3	0.45	–			6.0	5.0	–	
1	25	–			0.12 · 0.5 · 1.2	0.1 · 0.4 · 1.0	0.7 · 0.65 · 0.6	–			
					3.0	2.5	0.55				
		9.4	8	0.4	5.0 · 7.5	4.0 · 6.3	0.5 · 0.45	7.2	6.0	–	
1½	40	–			7.5 · 9.4	6.3 · 8.0	0.45 · 0.4	–			
		23	20	0.4	20	16	0.4	17	15	–	
2	50	–			9.4	8.0	0.4	7.2	6.0	–	
		37	32	0.4	20 · 23	16 · 20	0.45 · 0.4	30	25		
2½	65	–			23 · 37	20 · 32	0.4	30	25	–	
		60	50	0.4	–			45	38	30	25
3	80	–			37	32	0.4	30	25	–	
		94	80	0.35	60	50	0.4	70	60	46	40
4	100	–			60	50	0.4	45	38	–	
		145	125	0.35	–			110	95	70	60

[1] With C_V 0.0012 to 0.05/K_{VS} 0.001 to 0.04: valve with micro-trim (NPS ½ to 1/DN 15 to 25 only) without balancing bellows

Dimensional drawings (see Table 4**)**

Type 41-23 Universal Pressure Reducing Valve



Actuator with two diaphragms for increased safety: H = +1.3"/32 mm

Actuator with two diaphragms for autoclave regulator: H = +2"/50 mm

Fig. 5: *Dimensional drawings*

Valve-specific correction terms

– **ΔL_G** · For gases and vapors: values according to Fig. 4

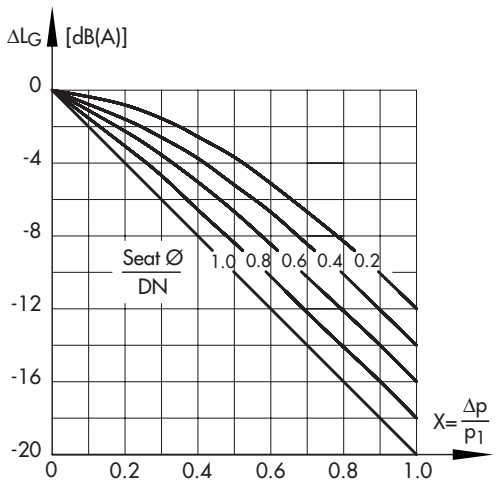


Fig. 4: *Diagram · ΔL_G for gases and vapors*

– **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-ST 1/K_{VS}-ST 1, C_V-ST 3/K_{VS}-ST 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 …

Nominal size NPS/DN …

Class/PN …

Body material …

K_{VS}/C_V coefficient …

Set point range … psi/bar

Accessories … (▶ T 2595)

Optionally, special version …