# Self-operated Pressure Regulators

# Universal Pressure Reducing Valve Type 41-23

**ANSI Version**

**Application**

Pressure regulator for set point values from **0.075** to **400 psi (5 mbar** to **28 bar)**
Valves in sizes **½"** to **4" (DN 15** to **100)**
Nominal pressure **Class 125** to **300 (PN 16** to **40)**
For liquids, gases and vapors up to **660 °F (350 °C)**

Valve **closes** when the **downstream** pressure **rises**

**Special features**

- Low-maintenance, medium-controlled P regulators requiring no auxiliary energy
- Frictionless plug stem sealed by a stainless steel bellows
- Control line kit available as accessory for direct pressure tapping at the valve body
- Wide set point range and easy set point adjustment using a nut
- Exchangeable positioning springs and actuator
- Spring-loaded, single-seated valve with upstream and downstream pressure balancing[1] using a stainless steel bellows
- Plug with soft sealing for high sealing requirements
- Low-noise standard plug – special version with St I or St III (2 ½" to 4"/DN 65 to 100) flow divider for further noise level reduction (see Data Sheet T 8081 EN)

**Versions**

Pressure regulator for controlling the downstream pressure $p_2$ to the adjusted set point value. The valve closes when the downstream pressure rises.

**Type 41-23** · **Standard version**

**Type 2412** Valve · Valve sizes **½"** to **4" (DN 15** to **100)** · Plug with metal sealing · Body made of either cast iron, carbon steel or stainless steel

**Type 2413** Actuator with EPDM rolling diaphragm and screw joint · All wetted parts are free of non-ferrous metal

**Extended versions**

**Millibar pressure reducing valve**
Only size ½" to 3" (DN 15 to 80)
– for pressure set points from 0.075 to 0.75 psi (5 to 50 mbar)

**Pressure reducing valve for low flow rates**
– valve with micro trim ($C_V$ = 0.0012 to 0.012/$K_{VS}$ = 0.001 to 0.01) or reduced $C_V/K_{VS}$ (special version)

**Steam pressure reducing valve**
– with condensation chamber for steam up to 660 °F (350 °C) (see Fig. 2.1)

**Safety pressure reducing valve**
– with leakage line connection and sealing or two diaphragms and diaphragm rupture indicator (see Fig. 2.2)

[1] For $C_V \leq 3/K_{VS} \leq 2.5$: without balancing bellows

Type 41-23
- without control line -

Type 41-23
- with control line and condensation chamber -

Fig. 1 · Type 41-23 Universal Pressure Reducing Valve

**Special versions**

– Control line kit for pressure tapping at valve body (accessory)
– FPM rolling diaphragm for oils (ASTM I, II, III)
– EPDM diaphragms with PTFE protective foil
– Actuator for remote set point adjustment (autoclave control)
– Bellows actuator for valves up to size 4" (DN 100) · Set point ranges 72 to 150 psi (5 to 10 bar), 150 to 350 psi (10 to 22 bar), 290 to 400 psi (20 to 28 bar) · Bellows housing made of 1.4301, 1.4571, 1.0305 (St 35.8), bellows made of 1.4571
– Valve with St I or St III (2½" to 4") flow divider for particularly low-noise operation for gases and vapors
– All wetted parts in stainless steel version at least 1.4301 for nominal pressure Class 125 to 300 (PN 16 to PN 40)
– Stainless Cr steel seat and plug with PTFE soft sealing (max. 440 °F/220 °C) · With EPDM soft sealing (max. 300 °F/150 °C)
– All wetted parts of plastic comply with FDA regulations
– Free of oil and grease for super-clean applications (EPDM diaph.)
– Seat and plug armored for low-wear operation

**Principle of operation** (see Fig. 2)

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

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

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

The fully balanced valves are equipped with a balancing bellows (4). The downstream pressure $p_2$ acts on the inner bellows surface, whereas the upstream pressure $p_1$ acts on the outer bellows surface. As a result, the forces produced by the upstream and downstream pressures acting on the plug are balanced.

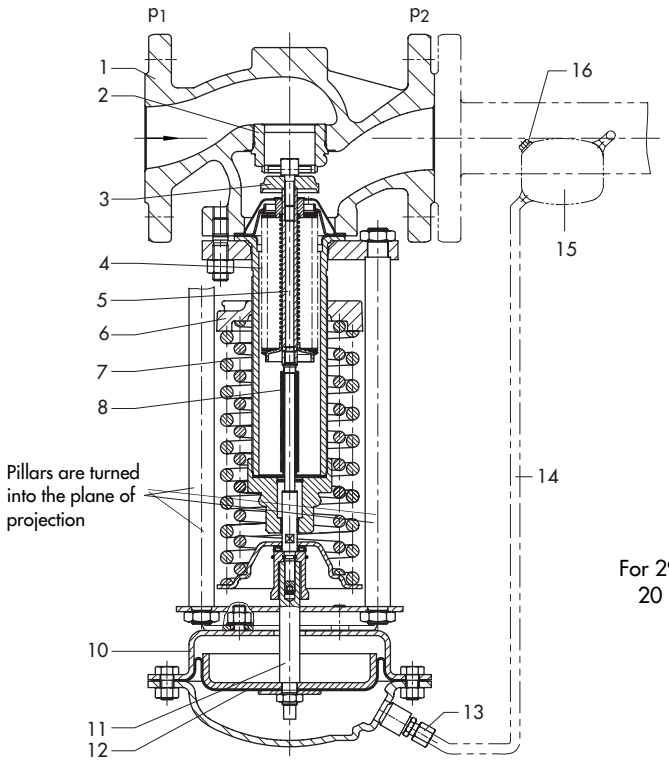
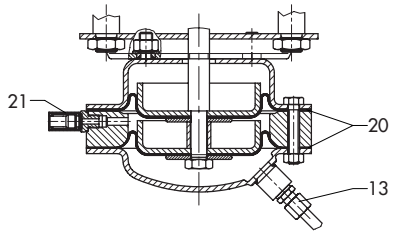
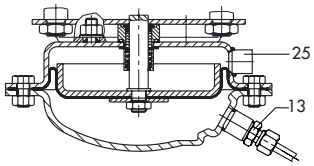


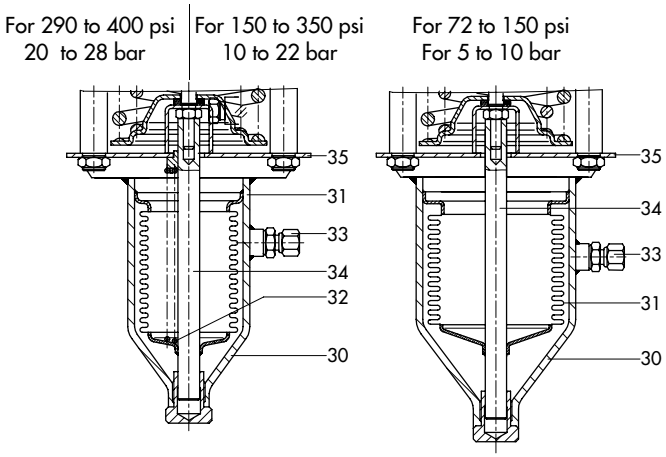

Fig. 2.1 · Type 41-23 Universal Pressure Reducing Valve, principle of operation




Actuator with two diaphragms and diaphragm rupture indicator




Actuator with leakage line connection




Metal bellows actuator

Fig. 2.2 · Type 2413 Actuators, different versions

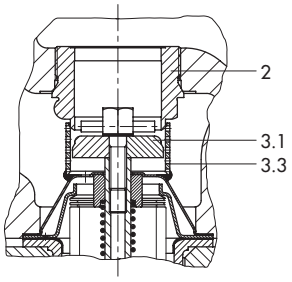
1 Valve body, Type 2412
2 Seat (exchangeable)
3 Plug (with metal sealing)
4 Balancing bellows
5 Plug stem
6 Set point adjustment nut
7 Positioning springs
8 Bellows seal
10 Type 2413 Actuator
11 Actuator stem
12 Operating diaphragm with diaphragm plate
13 Control line connection G3/8 (screw joint with restriction)
14 Control line

Steam pressure reducing valve
15 Condensation chamber
16 Filler neck

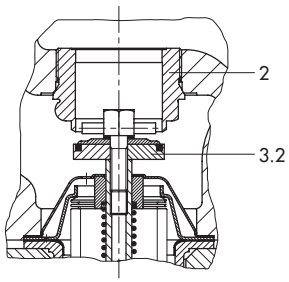
20 Two diaphragms
21 Diaphragm rupture indicator
25 Leakage line connection G1/4

30 Metal bellows actuator
31 Bellows with lower part of body
32 Additional springs
33 Control line connection G3/8
34 Bellows stem
35 Bracket

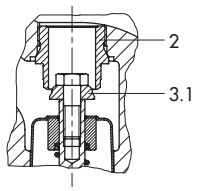
Fig. 2 · Type 41-23 Universal Pressure Reducing Valve




Plug with metal sealing, with St I flow divider




Plug with soft sealing




Valve for small flow rates - $C_V \leq 3/K_{VS} \leq 2.5$ - without balancing bellows

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

Fig. 3 · Type 41-23 Universal Pressure Reducing Valve, equipped

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

| **Valve** | | **Type 2412** | | |
|---|---|---|---|---|
| Nominal pressure | Class | 125, 150 or 300 | | |
| | PN | 16, 25 or 40 (according to DIN 2401) | | |
| Nominal size | inch | ½" to 2" | 2½" and 3" | 4" |
| | mm | 15 to 50 | 65 to 80 | 100 |
| Max. perm. differential pressure | psi | 360 | 290 | 230 |
| | bar | 25 [1] | 20 [1] | 16 |
| Temperature ranges | Valve body | See Fig. 6 · Pressure-temperature diagram | | |
| | Valve plug | Metal sealing, max. 660 °F (350 °C) · Soft sealing, PTFE, max. 430 °F (220 °C) · Soft sealing, EPDM, max. 300 °F (150 °C) | | |
| Leakage rate | | Metal sealing: leakage rate I ≤ 0.05 % of $C_V$ or $K_{VS}$ value · Soft sealing: leakage rate IV | | |
| **Actuator** | | **Type 2413** | | |
| Set point ranges | psi | 0.075 to 0.42 [2] · 0.35 to 0.75 [2] · 0.75 to 3.5 · 1.5 to 8.5 · 3 to 17 10 to 35 ·30 to 75 · 65 to 145 · 115 to 230 · 75 to 145 [3] · 145 to 290 [3] · 290 to 400 [3] | | |
| | bar | 0.005 to 0.030 [2] · 0.025 to 0.050 [2] · 0.05 to 0.25 · 0.1 to 0.6 · 0.2 to 1.2 0.8 to 2.5 · 2 to 5 · 4.5 to 10 · 8 to 16 · 5 to 10 [3] · 10 to 20 [3] · 20 to 28 [3] | | |
| Max. perm. pressure at the actuator | | 1.5 * Max. set point | | |
| Max. perm. temperature | | Gases 660 °F (350 °C); however, max. 175 °F (80 °C) at the actuator · Liquids 300 °F (150 °C), with condensation chamber max. 660 °F (350 °C) · Steam with condensation chamber max. 660 °F (350 °C) | | |
| **Metal bellows actuator** | | **Type 2413** | | |
| Effective diaphragm area | | 5.1 sq. in (33 $cm^2$) · 9.6 sq. in (62 $cm^2$) | | |
| Perm. pressure in the actuator | | 435 psi (30 bar) · 290 psi (20 bar) | | |
| Set point range with add. spring | | 150 to 320 psi (10 to 22 bar) or 290 to 400 psi (20 to 28 bar) · 75 to 150 psi (5 to 10 bar) | | |
| Set point spring | | 8000 N | | |

[1] Max. permissible differential pressure Δp for millibar pressure reducing valve: 10 bar · [2] Only for millibar pressure reducing valve
[3] With metal bellows actuator · [4] Millibar pressure regulator: max. 0.5 bar

**Table 2** · **Materials** (material number according to DIN EN)

| **Valve** | **Type 2412** | | | | |
|---|---|---|---|---|---|
| Nominal pressure | Class 125 (PN 16) | Class 150 (PN 25) | Class 300 (PN 40) | Class 150 (PN 25) | Class 300 (PN 40) |
| Max. perm. temperature | 570 °F (300 °C) | 660 °F (350 °C) | | 660 °F (350 °C) | |
| Body | Cast iron A 126 B | Carbon steel A 216 WCC | | A 351 CF8M | |
| Seat | CrNi steel | | | Stainless steel | |
| Plug | | | | | |
| Sealing ring for soft sealing | PTFE with 15 % glass fiber · EPDM | | | | |
| Guide bushing | PTFE/Graphite | | | | |
| Balancing bellows and bellows stem | Stainless steel 1.4571 | | | | |
| **Actuator** | **Type 2413** | | | | |
| Diaphragm cases | Sheet steel DD11 (StW22) [1] | | | | |
| Diaphragm | EPDM with fabric reinforcement [2] · FPM for oils · EPDM with PTFE protective foil | | | | |

[1] In stainless steel version, CrNi steel · [2] Standard version; further details see "Special versions"

**Table 3 · $C_V$, $K_{VS}$ and z values**

| DN | Seat ∅ inch | Seat ∅ mm | $C_V \cdot K_{VS}$ [2] Standard version $C_V$ | Standard version $K_{VS}$ | Special version $C_V$ | Special version KVS | $C_V$ I · $K_{VS}$ I [1] With St I flow divider $C_V$ I | With St I flow divider $K_{VS}$ I | $C_V$ III · $K_{VS}$ III [1] With St III flow divider $C_V$ III | With St III flow divider $K_{VS}$ III | z [1] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ½ " · 15 | 0.236 | 6 | | | 0.12 · 0.5 [2] | 0.1 · 0.4 [2] | – | - | | | |
| | 0.866 | 22 | 5 | 4 | 1.2 · 3 | 1 · 2.5 | 3.6 | 3 | – | - | 0.65 |
| ¾ " · 20 | 0.236 | 6 | | | 0.12 · 0.5 [2] | 0.1 · 0.4 [2] | | | | | |
| | 0.866 | 22 | | | 1.2 · 3 · 5 · 7.5 | 1 · 2.5 · 4 · 6.3 | – | – | – | - | |
| | | | 7.5 | 6.3 | | | 6 | 5 | | | 0.6 |
| 1" · 25 | 0.236 | 6 | | | 0.12 · 0.5 [2] | 0.1 · 0.4 [2] | – | – | | | |
| | 0.866 | 22 | | | 0.12 · 0.5 | 0.1 · 0.4 | – | – | | | |
| | | | 9.4 | 8 | 1.2 · 3 · 5 · 7.5 | 1 · 2.5 · 4 · 6.3 | 7 | 6 | – | - | 0.55 |
| 1½ " · 40 | 1.574 | 40 | | | 9.4 | 8 | | | | | |
| | | | 23 | 20 | | | 18 | 15 | – | - | 0.45 |
| 2" · 50 | 1.574 | 40 | | | 20 | 16 | | | | | |
| | | | 37 | 32 | | | 30 | 25 | – | - | 0.4 |
| 2½ " · 65 | 2.559 | 65 | | | 23 | 20 | | | | | |
| | | | 60 | 50 | | | 45 | 38 | 30 | 25 | 0.4 |
| 3" · 80 | 2.559 | 65 | 94 | 80 | 37 | 32 | | | | | |
| | | | | | | | 70 | 60 | 50 | 40 | 0.35 |
| 4" · 100 | 3.503 | 89 | | | 60 | 50 | | | | | |
| | | | 145 | 125 | | | 110 | 95 | 70 | 60 | 0.35 |

[1] Terms for noise level calculation according to VDMA 24422 - Edition 1989 -
[2] For $C_V$ = 0.0012 to 0.012 ($K_{VS}$ 0.001 to 0.01): valve with micro trim without balancing bellows

The valves can be delivered with an St I or St III flow divider. The valve seat must be exchanged if the flow divider is retrofitted.

**Valve-specific correction terms**

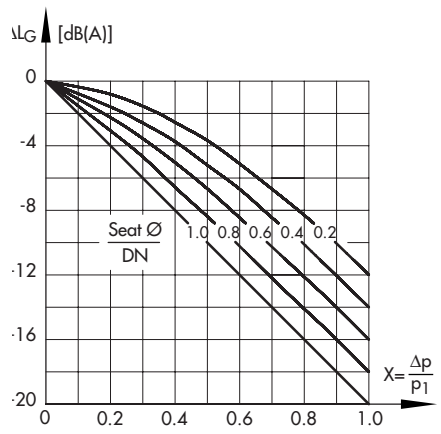



Fig. 4 · Diagram - $\Delta L_G$ for gases and vapors -

**$\Delta L_G$** · For gases and vapors:
Values as specified in the diagram below

**$\Delta L_F$** · For liquids:

$$\Delta L_F = -10 \cdot (X_F - z) \cdot y$$

$$\text{with } X_F = \frac{\Delta p}{p_1 - p_v} \text{ and } y = \frac{C_v}{C_{vs}} \text{ or } \frac{K_v}{K_{vs}}$$

Terms for **control valve sizing** according to DIN IEC 534, Parts 2-1 and 2-2:

$F_L = 0.95 \qquad X_T = 0.75$

**z** · Acoustical valve coefficient

**Flow coefficients $C_V I$, $K_{VS} I$ as well as $C_V$, $K_{VS}$** on installing an St I flow divider

The flow divider reduces the noise level and protects the valve body against high velocity erosion.

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.

**Table 4 · Dimensions and weights**

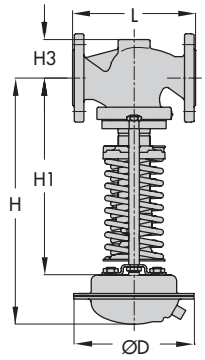
| **Pressure reducing valve** | | | **Type 41-23** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Nominal size** | | **DN** | **½″** (15) | **¾″** (20) | **1″** (25) | **1½″** (40) | **2″** (50) | **2½″** (65) | **3″** (80) | **4″** (100) |
| Length L | Class 125 | inch | – | – | 7.25 | 8.75 | 10 | 10.88 | 11.73 | 13.88 |
| | | mm | – | – | 184 | 222 | 254 | 276 | 298 | 352 |
| | Class 150 | inch | 7.25 | 7.25 | 7.25 | 8.75 | 10 | 10.88 | 11.73 | 13.88 |
| | | mm | 184 | 184 | 184 | 222 | 254 | 276 | 298 | 352 |
| | Class 300 | inch | 7.50 | 7.63 | 7.75 | 9.25 | 10.50 | 11.50 | 12.50 | 14.50 |
| | | mm | 191 | 194 | 197 | 235 | 267 | 292 | 318 | 368 |
| Height H1 | | inch | 13.19 | | | 15.35 | | 20.08 | | 20.67 |
| | | mm | 335 | | | 390 | | 510 | | 525 |
| Height H3 | | inch | 2.17 | | | 2.83 | | 3.94 | | 4.73 |
| | | mm | 55 | | | 72 | | 100 | | 120 |

| **Set point ranges** psi | **Set point ranges** bar | **Dimension** | Dimensions in inches and (mm) | | | |
|---|---|---|---|---|---|---|
| 0.075 to 0.42 | 0.005 to 0.03 | Height H | 17.13 (435) | | | – |
| | | Actuator | ∅ D =19.29 (490), A = 186 sq. in (1200 cm²) | | | |
| | | Valve spring force F | 600 N | | | |
| 0.35 to 0.75 | 0.025 to 0.05 | Height H | 17.13 (435) | 19.29 (490) | 24 (610) | – |
| | | Actuator | ∅ D = 19.29 (490), A = 186 sq. in (1200 cm²) | | | |
| | | Valve spring force F | 1200 N | | | |
| 0.75 to 3.5 | 0.05 to 0.25 | Height H | 17.52 (445) | 19.68 (500) | 24.41 (620) | 25 (635) |
| | | Actuator | ∅ D = 14.96 (380), A = 99.2 sq. in (640 cm²) | | | |
| | | Valve spring force F | 1750 N | | | |
| 1.5 to 8.5 | 0.1 to 0.6 | Height H | 17.52 (445) | 19.68 (500) | 24.41 (620) | 25 (635) |
| | | Actuator | ∅ D = 14.96 (380), A = 99.2 sq. in (640 cm²) | | | |
| | | Valve spring force F | 4400 N | | | |
| 3 to 17 | 0.2 to 1.2 | Height H | 16.93 (430) | 19.9 (480) | 23.62 (600) | 24.41 (620) |
| | | Actuator | ∅ D = 11.22 (285), A = 49.6 sq. in (320 cm²) | | | |
| | | Valve spring force F | 4400 N | | | |
| 10 to 35 | 0.8 to 2.5 | Height H | 16.93 (430) | 18.09 (485) | 23.82 (605) | 24.41 (620) |
| | | Actuator | ∅ D = 8.86 (225), A = 24.8 sq. in (160 cm²) | | | |
| | | Valve spring force F | 4400 N | | | |
| 30 to 75 | 2 to 5 | Height H | 16.14 (410) | 18.31 (465) | 23.03 (585) | 23.62 (600) |
| | | Actuator | ∅ D = 6.69 (170), A = 12.4 sq. in (80 cm²) | | | |
| | | Valve spring force F | 4400 N | | | |
| 65 to 145 | 4.5 to 10 | Height H | 16.14 (410) | 18.31 (465) | 23.03 (585) | 23.62 (600) |
| | | Actuator | ∅ D = 6.69 (170), A = 6.2 sq. in (40 cm²) | | | |
| | | Valve spring force F | 4400 N | | | |
| 115 to 230 | 8 to 16 | Height H | 16.14 (410) | 18.31 (465) | 23.03 (585) | 23.62 (600) |
| | | Actuator | ∅ D = 6.69 (170), A = 6.2 sq. in (40 cm²) | | | |
| | | Valve spring force F | 8000 N | | | |

| **Set point ranges** psi | **Set point ranges** bar | Weight in lb and kg | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0.075 to 0.75 | 0.005 to 0.05 | Weight for Class 150[1], approx. | lb | 63 | 65 | 83 | 90 | 125 | 141 | – |
| | | | kg | 28 | 29 | 37 | 41 | 57 | 64 | – |
| 1.5 to 8.5 | 0.05 to 0.6 | | lb | 51 | 53 | 73 | 80 | 121 | 130 | 158 |
| | | | kg | 23 | 24 | 33 | 36 | 55 | 59 | 72 |
| 3 to 35 | 0.2 to 2.5 | | lb | 39 | 41 | 58 | 68 | 107 | 124 | 146 |
| | | | kg | 18 | 19 | 26 | 31 | 49 | 56 | 66 |
| 30 to 230 | 2 to 16 | | lb | 29 | 32 | 51 | 58 | 97 | 114 | 136 |
| | | | kg | 14 | 15 | 23 | 27 | 44 | 52 | 62 |

[1] +10 % for Class 300

**Dimensions**

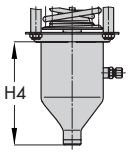



Type 41-23
Universal Pressure Reducing Valve

Fig. 5 · Dimensions

**Table 5** · Type 2413 Metal Bellows Actuator

| | | | |
|---|---|---|---|
| **Effective diaphragm area** | | 5.1 sq.in<br>33 cm² | 9.6 sq.in<br>62 cm2 |
| **Height H4** | inch | 7.9 | 8.5 |
| | mm | 200 | 215 |




Type 2413
Metal Bellows Actuator

**Pressure-temperature diagram**

The valves' application range and the permissible pressures and temperatures are limited by the pressure-temperature diagram and the nominal pressure ratings (according to DIN 2401).

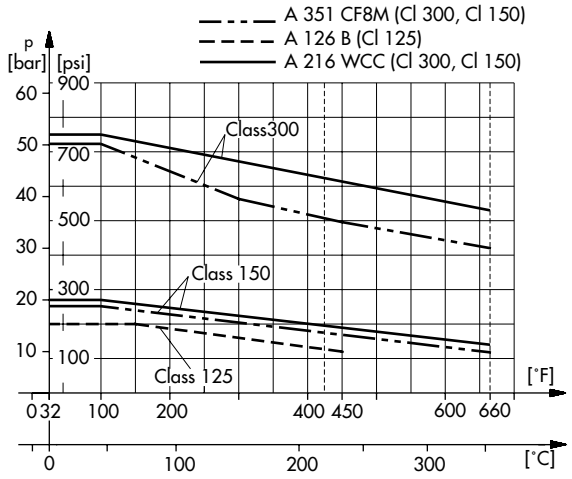



Fig. 6 · Pressure-temperature diagram

**Installation**

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

Millibar pressure reducing valves are to be installed vertically with the actuator pointing upwards.

For further details on installation, refer to Mounting and operating instructions EB 2512 EN.

The direction of medium flow must correspond with the arrow on the valve body.

– Valve and actuator are delivered separately.
– The control line must be adapted to fit the plant size and is not delivered with the valve.
– The control line connection must be at least 3.3 ft (1m) away from the regulator. On customer request, a control line kit for the direct pressure tapping at the valve body (see accessories) is available.

**Accessories**

– Screw joint for connection of the ⅜" control line to the filler neck. Other screw joints available on request.
– Condensation chamber for steam condensation and protection of the operating diaphragm against extreme temperatures. This chamber is needed for steam and liquids above 300 °F (150 °C).
– Control line kit - optionally with or without condensation chamber - for direct attachment to the valve and actuator (pressure tapped directly at the valve body, for set points ≥ 30 psi or ≥ 2 bar).

For detailed information on accessories, refer to Data Sheet T 2595 EN.

**Ordering text**

Universal Pressure Reducing Valve Type 41-23
Extended version ...
DN ...
Class (PN) ...
Body material ...
$C_V$ ($K_{VS}$) value ...
Set point range ... psi (bar)
Optionally, special version ...
Accessories ...

Specifications subject to change without notice.

SAMSON AG · MESS- UND REGELTECHNIK
Weismüllerstraße 3 · 60314 Frankfurt am Main · Germany
Phone: +49 69 4009-0 · Fax: +49 69 4009-1507
Internet: http://www.samson.de