

T 2513-1 EN

Type 41-23 Universal Pressure Reducing Valve

Self-operated Pressure Regulators · JIS version



Application

Pressure regulators for set points from **5 to 2800 kPa/0.05 to 28 bar** · Nominal sizes **½B/15A to 4B/100A** · Pressure rating **JIS 10K and JIS 20K** · Suitable for liquids, gases and vapors up to **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 high shut-off requirements
- Low-noise plug (standard)
- 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 ½B/15A to 4B/100A · Plug with metal seal · Body made of either cast iron A126B (FC250), cast steel A216 WCC (SCPH2) or cast stainless steel A351 CF8M (SCS14A) · 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 330 °C

1) With $C_V \leq 3/K_{VS} \leq 2.5$: without balancing bellows

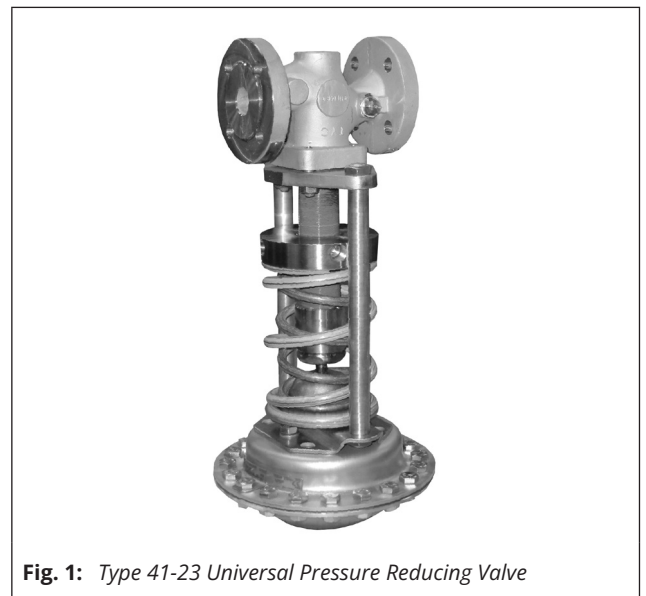


Fig. 1: Type 41-23 Universal Pressure Reducing Valve

- **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)
- Bellows actuator for valves in ½B/15A to 4B/100A Set point ranges 200 to 600 kPa, 500 to 1000 kPa, 1000 to 2200 kPa, 2000 to 2800 kPa (2 to 6 bar, 5 to 10 bar, 10 to 22 bar, 20 to 28 bar)
- Version entirely of stainless steel
- Stellite®-faced seat and plug for low-wear operation
- Free of oil and grease for high-purity applications

- Valve with flow divider ST 1 or ST 3 (2½B/65A to 4B/100A) for particularly low-noise operation with gases and vapors (► T 8081)
- Stainless Cr steel seat and plug with PTFE soft seal (max. 220 °C) or with EPDM soft seal (max. 150 °C)
- Lubricants for ultrapure water or gas
- 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).

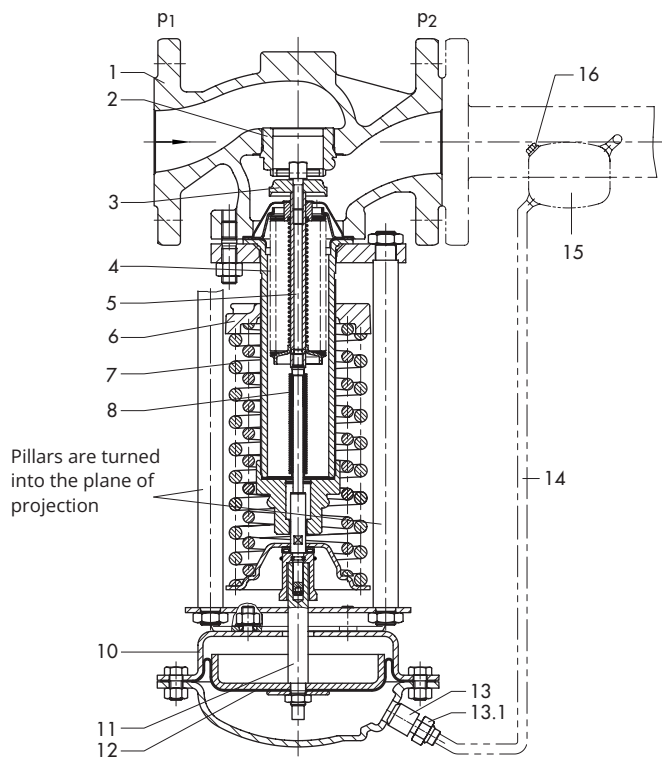
To control the pressure, the operating diaphragm (12) is tensioned by the set point springs (7) and the set point adjuster (6) so that the valve is opened by the force of the set point springs when it is relieved of pressure ($p_1 = p_2$).

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 springs (7). The spring force is adjustable at the set point adjuster (6).

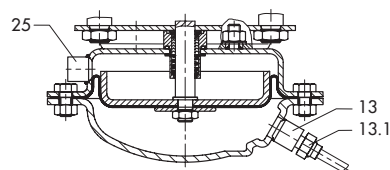
When the force resulting from the downstream pressure p_2 rises above the adjusted pressure set point, the valve closes proportionally to the change in pressure. The fully balanced valve has a balancing bellows (4). The downstream pressure p_2 acts on the inside of the bellows, whereas the upstream pressure 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.

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.

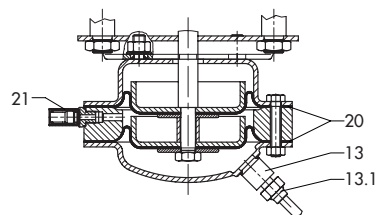
Functional diagram of Type 41-23 Universal Pressure Reducing Valve



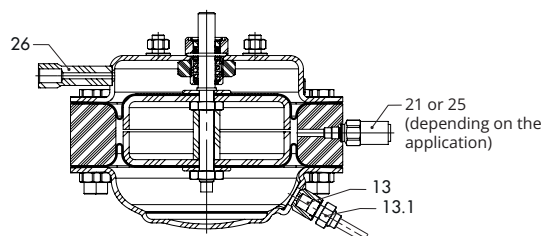
| | | | |
|----|---|------|---|
| 1 | Valve body (Type 2412) | 13.1 | Screw joint with restriction |
| 2 | Seat (exchangeable) | 14 | Control line |
| 3 | Plug (with metal seal) | 15 | Compensation chamber |
| 4 | Balancing bellows | 16 | Filler plug |
| 5 | Plug stem | 20 | Diaphragm |
| 6 | Set point 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 |
| | Control line connection G ¼ · | 34 | Bellows stem |
| 13 | ¼ NPT adapter (accessories) for medium pressure | 35 | Crossbeam |



Actuator with leakage line connection



Actuator with two diaphragms for increased safety



Actuator with two diaphragms for autoclave regulator

Different versions of Type 2413 Actuator

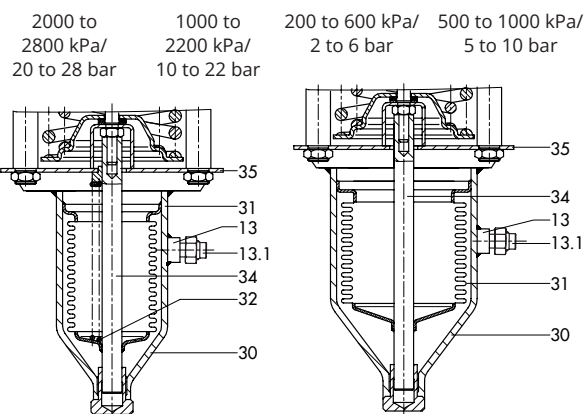


Fig. 2: Functional diagram of Type 41-23 Universal Pressure Reducing Valve

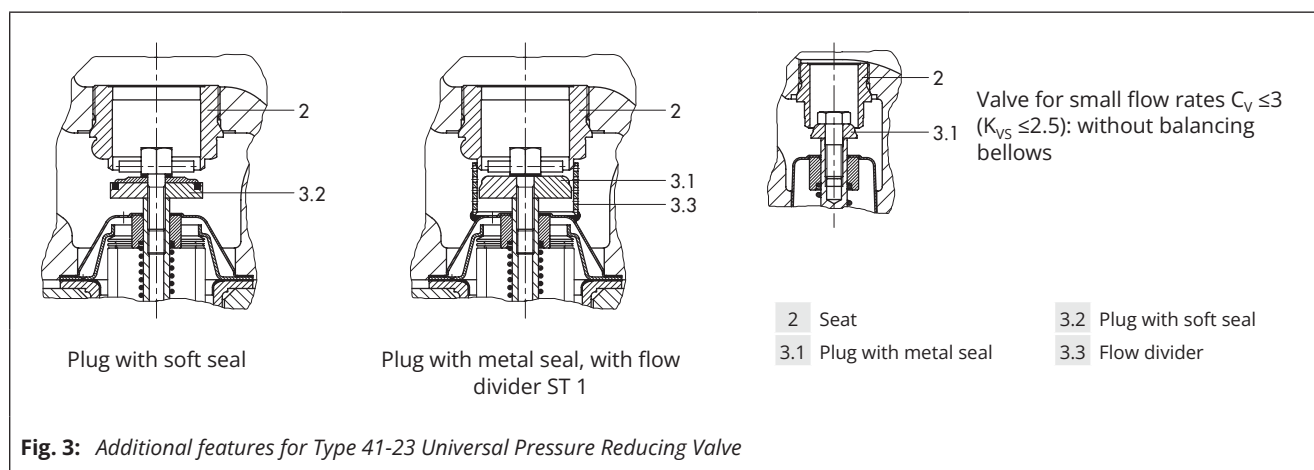


Table 1: Technical data · All pressures in psi and bar (gauge)

| Valve | Type 2412 | | |
|---|---|--|-----------------|
| Pressure rating | JIS 10K or JIS 20K | | |
| Nominal size | ½B to 2B/15A to 50A | 2½B and 3B/65A and 80A | 4B/100A |
| Max. perm. differential pressure Δp | 25 bar/2500 kPa | 20 bar/2000 kPa | 16 bar/1600 kPa |
| Max. permissible temperature ¹⁾ | See pressure-temperature diagram in ► T 2500 | | |
| Valve plug | Metal seal: max. 350 °C · PTFE soft seal: max. 220 °C · EPDM, FKM soft seal: max. 150 °C · NBR soft seal: max. 80 °C | | |
| Leakage class according to IEC 60534-4 | Metal seal: Leakage class I (≤ 0.05 % of C_v/K_{vS} coefficient) Soft seal: Leakage class IV (≤ 0.01 % of C_v/K_{vS} coefficient) | | |
| Conformity | CE | | |
| Diaphragm actuator | Type 2413 | | |
| Set point ranges | 5 to 25 kPa · 10 to 60 kPa · 20 to 120 kPa · 80 to 250 kPa · 200 to 500 kPa · 450 to 1000 kPa · 800 to 1600 kPa 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. permissible temperature ¹⁾ | Gases 350 °C, however, max. 80 °C at the actuator · Liquids 150 °C, with compensation chamber max. 350 °C · Steam with compensation chamber max. 350 °C | | |
| Bellows actuator | Type 2413 | | |
| Actuator area | 33 cm ² | 62 cm ² | |
| Set point ranges | 10 to 22 bar/1000 to 2200 kPa 20 to 28 bar/2000 to 2800 kPa | 2 to 6 bar/200 to 600 kPa 5 to 10 bar/500 to 1000 kPa | |

¹⁾ FDA version: Max. permissible temperature 60 °C

Table 2: Max. perm. pressure at actuator

| Set point ranges · 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 |
| 5 to 25 kPa | 10 to 60 kPa | 20 to 120 kPa | 80 to 250 kPa | 200 to 500 kPa | 450 to 1000 kPa | 800 to 1600 kPa |
| Max. perm. pressure 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 |
| 60 kPa | 60 kPa | 130 kPa | 250 kPa | 500 kPa | 1000 kPa | 1000 kPa |
| Set point ranges · Metal bellows actuator | | | | | | |
| 2 to 6 bar | | 5 to 10 bar | | 10 to 22 bar | | 20 to 28 bar |
| 200 to 600 kPa | | 500 to 1000 kPa | | 100 to 2200 kPa | | 200 to 2800 kPa |
| Max. perm. pressure above the set point adjusted at the actuator | | | | | | |
| 6.5 bar | | 6.5 bar | | 8 bar | | 2 bar |
| 650 kPa | | 650 kPa | | 800 kPa | | 200 kPa |

Table 3: Materials

| Valve | Type 2412 | | |
|--|---|--------------------------------------|---|
| Pressure rating | JIS 10K | JIS 10K · JIS 20K | |
| Max. permissible temperature ³⁾ | 300 °C | 350 °C | |
| Body | Cast iron A126B (FC250) | Cast steel A216 WCC (SCPH2) | Cast stainless steel A351 CF8M (SCS14A) |
| 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 ²⁾ · FKM for 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 60 °C

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.
- The control line must be adapted to match the onsite conditions and is not delivered with the valve. On customer request, a control line kit for pressure tapping directly at the valve body (see accessories) is available.

For further details on installation refer to Mounting and Operating Instructions

► EB 2512.



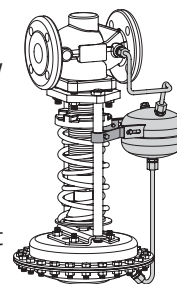
Accessories

Included in the scope of delivery:

- Screw joint with restriction for 3/8" control line.

To be ordered separately:

- Adapter G 1/4 to 1/4 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 ≥80 kPa/0.8 bar).
- **Compensation chamber** for condensation and to protect the operating diaphragm against extreme temperatures. A compensation chamber is required for liquids above 150 °C as well as for steam.



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

Ordering text

Type 41-23 Universal Pressure Reducing Valve (JIS version)

Additional features ...

Nominal size ...

Body material ...

K_{VS}/C_V coefficient ...

Set point range ... kPa/bar

Accessories ... (► T 2595)

Optionally, special version ...

Table 4: Dimensions and weights

| Type 41-23 Universal Pressure Reducing Valve | | | | | | | | | |
|---|---------------------------|---------------------------------------|---------|---------|---------|---------|---------|---------|---------|
| Nominal size | | ½B/15A | ¾B/20A | 1B/25A | 1½B/40A | 2B/50A | 2½B/65A | 3B/80A | 4B/100A |
| Overall length L | JIS 10K | 184 mm | 184 mm | 184 mm | 222 mm | 254 mm | 276 mm | 298 mm | 352 mm |
| | JIS 20K | 191 mm | 194 mm | 197 mm | 235 mm | 267 mm | 292 mm | 318 mm | 368 mm |
| Height H1 | | 335 mm | | | 390 mm | | 517 mm | | 540 mm |
| Height H2 | | 55 mm | | | 72 mm | | 100 mm | | 120 mm |
| Height H4 | | 100 | | | | | | | |
| Standard version with Type 2413 Actuator with rolling diaphragm | | | | | | | | | |
| Set point range | | Dimensions in mm | | | | | | | |
| 5 to 25 kPa 0.05 to 0.25 bar | Height H ^{3) 4)} | 445 mm | | | 500 mm | | 627 mm | | 650 mm |
| | Actuator | Ø D = 380 mm, A = 640 cm ² | | | | | | | |
| 10 to 60 kPa 0.1 to 0.6 bar | Height H ^{3) 4)} | 445 mm | | | 500 mm | | 627 mm | | 650 mm |
| | Actuator | Ø D = 380 mm, A = 640 cm ² | | | | | | | |
| 20 to 120 kPa 0.2 to 1.2 bar | Height H ^{3) 4)} | 430 mm | | | 480 mm | | 607 mm | | 635 mm |
| | Actuator | Ø D = 285 mm, A = 320 cm ² | | | | | | | |
| 80 to 250 kPa 0.8 to 2.5 bar ²⁾ | Height H ^{3) 4)} | 430 mm | | | 485 mm | | 612 mm | | 635 mm |
| | Actuator | Ø D = 225 mm, A = 160 cm ² | | | | | | | |
| 200 to 500 kPa 2 to 5 bar | Height H ^{3) 4)} | 410 mm | | | 465 mm | | 592 mm | | 615 mm |
| | Actuator | ØD = 170 mm, A = 80 cm ² | | | | | | | |
| 450 to 1000 kPa 4.5 to 10 bar | Height H ^{3) 4)} | 410 mm | | | 465 mm | | 592 mm | | 615 mm |
| | Actuator | Ø D = 170 mm, A = 40 cm ² | | | | | | | |
| 800 to 1600 kPa 8 to 16 bar | Height H ^{3) 4)} | 410 mm | | | 465 mm | | 592 mm | | 615 mm |
| | Actuator | Ø D = 170 mm, A = 40 cm ² | | | | | | | |
| Weight ¹⁾ , approx. | | | | | | | | | |
| 5 to 60 kPa/0.05 to 0.6 bar | | 24.8 kg | 25.9 kg | | 34.7 kg | 38.5 kg | 56.1 kg | 63.8 kg | 73.7 kg |
| 20 to 250 kPa/0.2 to 2.5 bar | | 20.6 kg | 22.8 kg | | 31.1 kg | 34.9 kg | 52.5 kg | 60.2 kg | 70.1 kg |
| 200 to 1600 kPa/2 to 16 bar | | 13.2 kg | 14.3 kg | | 23.1 kg | 26.4 kg | 44.0 kg | 51.7 kg | 61.6 kg |
| Version with Type 2413 Bellows Actuator | | | | | | | | | |
| 200 to 600 kPa 2 to 6 bar | Height H | 550 mm | | | 605 mm | | 732 mm | | 755 mm |
| | Actuator | Ø D = 120 mm, A = 62 cm ² | | | | | | | |
| 500 to 1000 kPa 5 to 10 bar | Height H | 550 mm | | | 605 mm | | 732 mm | | 755 mm |
| | Actuator | Ø D = 120 mm, A = 62 cm ² | | | | | | | |
| 1000 to 2200 kPa 10 to 22 bar | Height H | 535 mm | | | 590 mm | | 717 mm | | 740 mm |
| | Actuator | ØD = 90 mm, A = 33 cm ² | | | | | | | |
| 2000 to 2800 kPa 20 to 28 bar | Height H | 535 mm | | | 590 mm | | 717 mm | | 740 mm |
| | Actuator | ØD = 90 mm, A = 33 cm ² | | | | | | | |
| Weight ¹⁾ , approx. | | | | | | | | | |
| A = 33 cm ² | | 18.2 kg | 19.3 kg | 19.8 kg | 28.1 kg | 31.9 kg | 48.4 kg | 61.6 kg | 71.5 kg |
| A = 62 cm ² | | 22.6 kg | 23.7 kg | 24.2 kg | 32.5 kg | 36.3 kg | 60.5 kg | 68.2 kg | 78.1 kg |

¹⁾ Based on JIS 10K: +10 % for JIS 20K

²⁾ Actuator with two diaphragms: 100 to 250 kPa/1 to 2.5 bar

³⁾ Actuator with two diaphragms for increased safety: H = +32 mm

⁴⁾ Actuator with two diaphragms for autoclave regulator: H = +50 mm

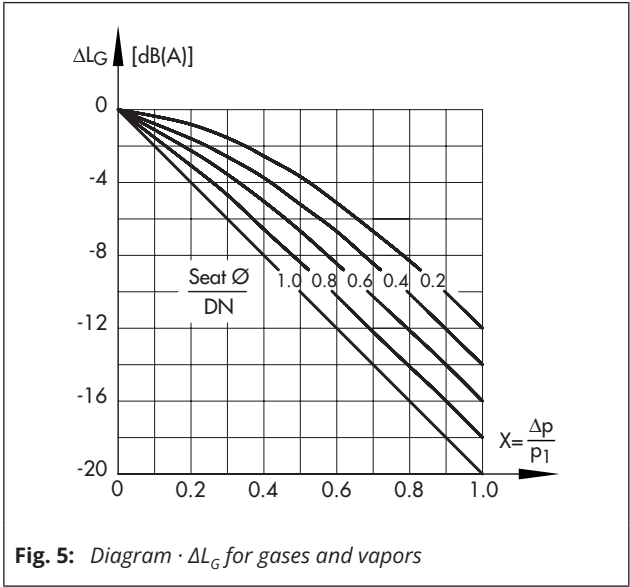
Table 5: C_V/K_{VS} coefficients and x_{FZ} values · Terms for noise level calculation according to VDMA 24422 (edition 1.89)

| Nominal size | Standard | | | x_{FZ} | Special version | | x_{FZ} | With flow divider | | | |
|--------------------------|----------|----------|------|----------|----------------------------|-------------------------|----------------------------|-------------------|----------------|------------|----------------|
| | 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 |
| ½B 15A | | | | | $0.12 \cdot 0.5 \cdot 1.2$ | $0.1 \cdot 0.4 \cdot 1$ | $0.7 \cdot 0.65 \cdot 0.6$ | | | | |
| | | | | | 3 | 2.5 | 0.55 | | | | |
| | 5 | 4 | 0.5 | | | | | 3.5 | 3 | | |
| ¾B 20A | | | | | $0.12 \cdot 0.5 \cdot 1.2$ | $0.1 \cdot 0.4 \cdot 1$ | $0.7 \cdot 0.65 \cdot 0.6$ | | | | |
| | | | | | 3 | 2.5 | 0.55 | | | | |
| | | | | | 5 | 4 | 0.5 | | | | |
| | 7.5 | 6.3 | 0.45 | | | | | 6 | 5 | | |
| 1B 25A | | | | | $0.12 \cdot 0.5 \cdot 1.2$ | $0.1 \cdot 0.4 \cdot 1$ | $0.7 \cdot 0.65 \cdot 0.6$ | | | | |
| | | | | | 3 | 2.5 | 0.55 | | | | |
| | 9.4 | 8 | 0.4 | | $3 \cdot 5 \cdot 7.5$ | $4 \cdot 6.3$ | $0.5 \cdot 0.45$ | 7.2 | 6 | | |
| 1½B 40A | | | | | $7.5 \cdot 9.4$ | $6.3 \cdot 8$ | $0.45 \cdot 0.4$ | | | | |
| | 23 | 20 | 0.4 | | 20 | 16 | 0.4 | 17 | 15 | | |
| 2B 50A | | | | | 9.4 | 8 | 0.4 | 7.2 | 6 | | |
| | 37 | 32 | 0.4 | | $20 \cdot 23$ | $16 \cdot 20$ | $0.45 \cdot 0.4$ | 30 | 25 | | |
| 2½B 65A | | | | | $23 \cdot 37$ | $20 \cdot 32$ | 0.4 | 30 | 25 | | |
| | 60 | 50 | 0.4 | | | | | 45 | 38 | 30 | 25 |
| 3B 80A | | | | | 37 | 32 | 0.4 | 30 | 25 | | |
| | 94 | 80 | 0.35 | | 60 | 50 | 0.4 | 70 | 60 | 46 | 40 |
| 4B 100A | | | | | 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 (½B | 15A to 1B | 25A only) without balancing bellows

Valve-specific correction terms

- ΔL_G · For gases and vapors: values according to Fig. 5



- 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.

Dimensional drawings (see Table 4)

