

Pneumatic Control Valve Type 3510-1 and Type 3510-7

Micro-flow Valve Type 3510



ANSI version

Application

Control valve designed for controlling low flow rates in pilot plants and technical research facilities.

Valve sizes G, NPT and Rc female thread in
 $\frac{1}{8}$ " · $\frac{1}{4}$ " · $\frac{3}{8}$ " · $\frac{1}{2}$ " · $\frac{3}{4}$ "

Pressure rating Welding ends, flanges NPS $\frac{1}{2}$ · $\frac{3}{4}$ · 1

Temperatures ANSI Class 150 to Class 2500

–200 to +450 °C · –328 to 842 °F

The pneumatic control valve consists of:

- Type 3510 Micro-flow Valve and a
- Type 3271-5 or optionally Type 3277-5 Actuator

Type 3510 Micro-flow Valves are available as:

- Globe valves
- Angle valves

Their valve bodies are available with:

- Screwed connections with G, NPT or Rc thread
- Welding ends or flanges

Stainless steel is used as the standard body material. However, a variety of special materials can also be used according to customer requirements.

Versions

Standard version

- For temperatures from –10 to +220 °C (14 to 428 °F)
- ANSI Class 150 to 2500
- Globe valve or angle valve
- Female thread G $\frac{1}{8}$, G $\frac{1}{4}$, G $\frac{3}{8}$, G $\frac{1}{2}$, G $\frac{3}{4}$ or $\frac{1}{8}$ NPT, $\frac{1}{4}$ NPT, $\frac{3}{8}$ NPT, $\frac{1}{2}$ NPT, $\frac{3}{4}$ NPT or Rc $\frac{1}{8}$, Rc $\frac{1}{4}$, Rc $\frac{3}{8}$, Rc $\frac{1}{2}$, Rc $\frac{3}{4}$
- Flanges $\frac{1}{2}$ NPS, $\frac{3}{4}$, 1, Class 150 to 2500
- Welding ends $\frac{1}{2}$ NPS and 1 with welding-neck connections

Type 3510-1 (Fig. 3) · With Type 3271-5 Pneumatic Actuator, 120 cm² effective diaphragm area or Type 3271-52 Pneumatic Actuator, 60 cm² effective diaphragm area (see Data Sheet T 8310-1 EN)

Type 3510-7 (Figs. 1 and 2) · With Type 3277-5 Pneumatic Actuator with 120 cm² effective diaphragm area, for integral positioner attachment (see Data Sheet T 8310-1 EN)

Other versions with

- **Extension bonnet** for temperatures from –200 to +450 °C (–328 to 842 °F), with special material up to +650 °C (1200 °F)
- **Metal bellows seal** up to Class 1500 with a sealing performance $\leq 10^{-5} \frac{\text{mbar l}}{\text{s}}$, higher pressure ratings on request
- **Handwheel**
- **Electric actuator** · On request

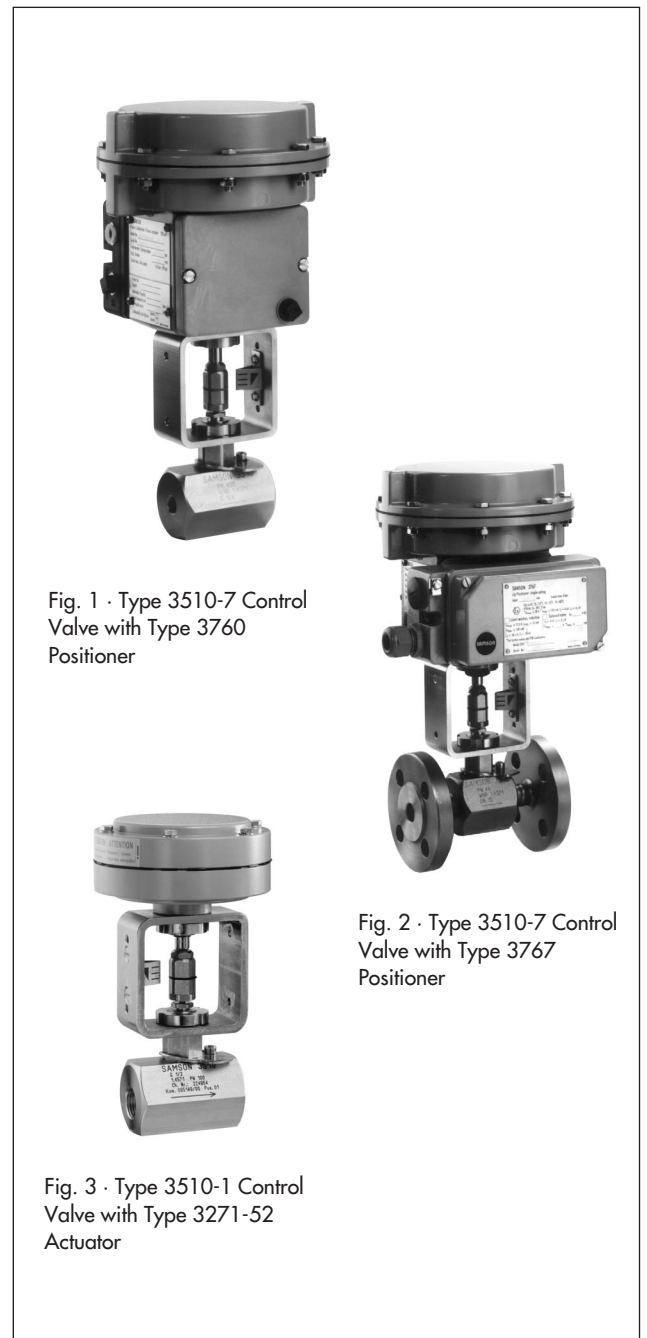


Fig. 1 · Type 3510-7 Control Valve with Type 3760 Positioner

Fig. 2 · Type 3510-7 Control Valve with Type 3767 Positioner

Fig. 3 · Type 3510-1 Control Valve with Type 3271-52 Actuator

Principle of operation

The process medium flows through the micro-flow valve in the direction indicated by the arrow. The position of the valve plug (3) determines the cross-sectional area of flow between the seat (2) and the plug.

The plug stem (6) is connected to the actuator stem (8.1) by the stem connector (7) and sealed with an adjustable packing (4).

To comply with stricter environmental emissions requirements, the valve can be equipped with a double-walled metal bellows (10).

The anti-rotation device (13) prevents loosening of the screw connection between the valve body (1) and the bonnet (5) or the intermediate piece (9).

Fail-safe position

Depending on the arrangement of the compression springs in the actuator (8) (see Data Sheet T 8310-1 EN for details), the control valve has two different fail-safe positions effective upon air supply failure:

Actuator stem extends (FA)

The valve is closed upon air supply failure.

Actuator stem retracts (FE)

The valve is opened upon air supply failure.

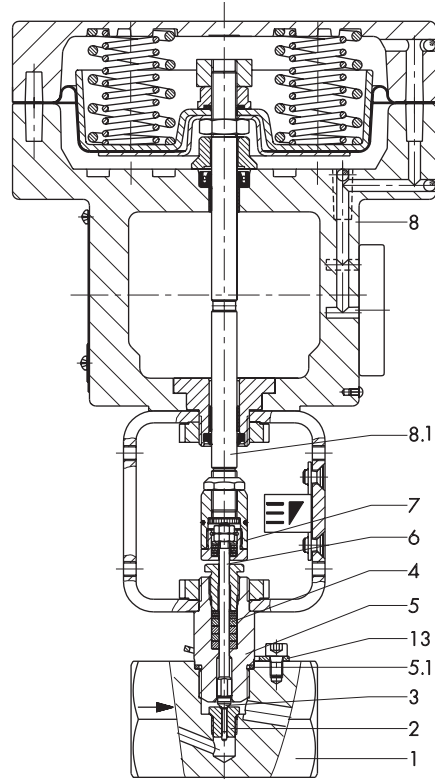


Fig. 4 · Type 3510-7 Control Valve

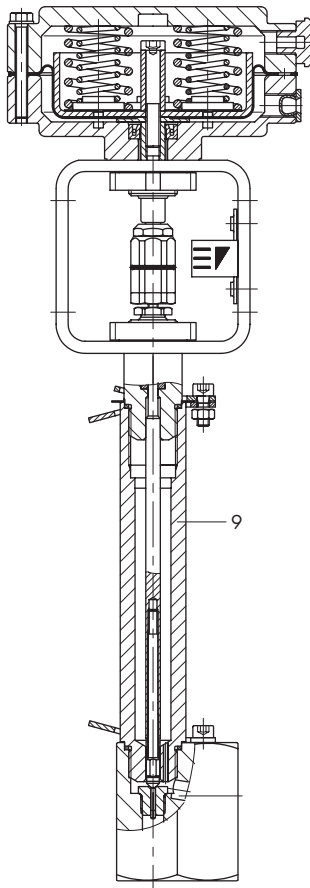


Fig. 5 · Type 3510 Valve, angle valve with extension bonnet and Type 3271-52 Actuator (60 cm²)

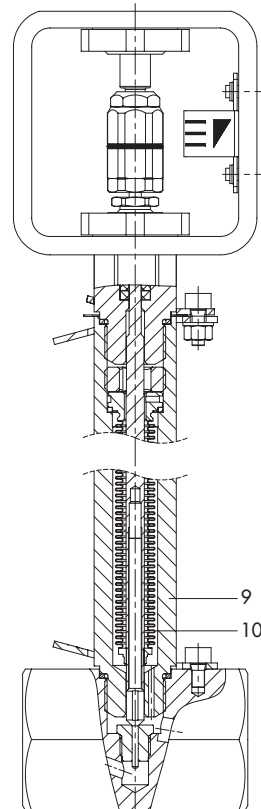


Fig. 6 · Type 3510 Valve, globe valve with metal bellows seal

Table 1 · Technical data for Type 3510

| Connection | Female thread | Welding ends | Flanges |
|--|--|-----------------|---------------------------|
| Valve size | G 1/8 · G 1/4 · G 3/8 · G 1/2 · G 3/4 1/8 NPT · 1/4 NPT · 3/8 NPT · 1/2 NPT · 3/4 NPT Rc 1/8 · Rc 1/4 · Rc 3/8 · Rc 1/2 · Rc 3/4 | 1/2 NPS · 1 NPS | 1/2 NPS · 3/4 NPS · 1 NPS |
| Pressure rating | Class 150 to 2500 | | |
| Seat/plug sealing | Metal sealing | | |
| Characteristic | Equal percentage with $C_v \geq 0.012$ · Linear · Quick opening | | |
| Rangeability | 50 : 1 · Smaller than 50 : 1 with $C_v \leq 0.12$ | | |
| Temperature range ¹⁾ | -10 to 220 °C · With extension bonnet -200 to 450 °C | | |
| Leakage rate acc. to IEC 60534-4 ANSI FCI 70-2 | Metal sealing: High-performance metal sealing: | IV V | |

¹⁾ Higher temperatures available on request

Table 2 · Materials

| Valve body ¹⁾ and bonnet ²⁾ | 1.4571/A 316 Ti (UNS: S31635) | 2.4610 (UNS: N 06455) |
|---|--|-----------------------------|
| Seat and plug | 1.4404/1.4404 (316 L) ³⁾ 1.4122/1.4112 1.4122/Stellite Stellite/Stellite | 2.4610/2.4610 ³⁾ |
| Stuffing box packing | PTFE compound | |
| Body gasket | 1.4571 | 2.4610 |
| Extension bonnet | A 316 Ti | 2.4610 |
| Metal bellows seal | | |
| Intermediate piece | A 316 Ti | 2.4610 |
| Metal bellows up to Class 1500 | 1.4571 | 2.4819 |

¹⁾ Other materials available on request

²⁾ Wetted parts

³⁾ Only with C_v 0.0012 to 2

Legend for Figs. 4 to 6

- 1 Valve body
- 2 Seat
- 3 Plug
- 4 Stuffing box packing
- 5 Valve bonnet
- 5.1 Body gasket
- 6 Plug stem
- 7 Stem connector
- 8 Actuator
- 8.1 Actuator stem
- 9 Intermediate piece for extension bonnet
or bellows seal
- 10 Metal bellows
- 13 Anti-rotation device

Table 3 · Available Cv coefficients
Table 3a · Overview

| | | | | | |
|--------------|----|---------------------------------|------------------|--------|---------------------------|
| Cv | | 0.00012 to 0.0075 ¹⁾ | 0.012 to 0.3 | 0.5 | 0.75 to 2.0 ²⁾ |
| Rangeability | | < 15 : 1 | 15 : 1 to 50 : 1 | 50 : 1 | |
| Seat Ø | mm | 2 | 3 | 4 | 10 |
| Plug stem Ø | mm | 4 | | 4 | |
| Travel | mm | 7.5 | | 7.5 | |

¹⁾ Seat and plug material in 1.4122/Stellite or Stellite/Stellite only

²⁾ Only up to Class 600

Table 3b · Cv coefficients and associated valve sizes

| End connection | | | Female thread | | | Welding ends | | Flanges | | |
|------------------------|------------------|--------|---|----------------------------|---|--------------|-------|---------|---------|-------|
| Flow coefficient Cv | Characteristic | | G 1/8, 1/4 1/8, 1/4 NPT Rc 1/8, 1/4 | G 3/8 3/8 NPT Rc 3/8 | G 1/2, 3/4 1/2, 3/4 NPT Rc 1/2, 3/4 | 1/2 NPS | 1 NPS | 1/2 NPS | 3/4 NPS | 1 NPS |
| | Equal percentage | Linear | | | | | | | | |
| 0.00012 | - | • | • | • | • | • | • | • | • | • |
| 0.00020 | | • | • | • | • | • | • | • | • | • |
| 0.00030 | | • | • | • | • | • | • | • | • | • |
| 0.00050 | | • | • | • | • | • | • | • | • | • |
| 0.00075 | | • | • | • | • | • | • | • | • | • |
| 0.0012 | | • | • | • | • | • | • | • | • | • |
| 0.0020 | | • | • | • | • | • | • | • | • | • |
| 0.0030 | | • | • | • | • | • | • | • | • | • |
| 0.0050 | | • | • | • | • | • | • | • | • | • |
| 0.0075 | | • | • | • | • | • | • | • | • | • |
| 0.012 | | • | • | • | • | • | • | • | • | • |
| 0.020 | • | • | • | • | • | • | • | • | • | |
| 0.030 | • | • | • | • | • | • | • | • | • | |
| 0.050 | • | • | • | • | • | • | • | • | • | |
| 0.075 | • | • | • | • | • | • | • | • | • | |
| 0.12 | • | • | • | • | • | • | • | • | • | |
| 0.20 | • | • | • | • | • | • | • | • | • | |
| 0.30 | • | • | • | • | • | • | • | • | • | |
| 0.50 | • | • | • | • | • | • | • | • | • | |
| 0.75 ¹⁾ | • | • | - | • | • | • | • | • | • | |
| 1.2 ¹⁾ | • | • | | • | • | • | • | • | • | |
| 2.0 ¹⁾ | • | • | | • | • | • | • | • | • | |

¹⁾ Versions up to max. Class 600 can be used.

Table 4 · Permissible differential pressures · Pressures in bar (gauge)**Table 4a · Standard version without bellows seal · Fail-safe position "valve CLOSED"**

| Bench range with actuator size | | 60 cm ² | 0.2 to 1.0 | 0.4 to 2.0 | 1.4 to 2.3 | 2.1 to 3.3 |
|---|---------------------------------|---------------------|--------------------------------|------------|------------|------------|
| | | 120 cm ² | 0.4 to 0.8 | 0.8 to 1.6 | 1.7 to 2.1 | 2.4 to 3.1 |
| Valve size | C _v | Actuator | Δp when p ₂ = 0 bar | | | |
| G/NPT/Rc 1/8 · 1/4 · 3/8 · 1/2 · 3/4 1/2 NPS · 3/4 NPS · 1 NPS | 0.00012 to 0.5 | 60 cm ² | 25 | 100 | 400 | – |
| | | 120 cm ² | 250 | 400 | – | – |
| G/NPT/Rc 1/2 · 3/4 1/2 NPS · 3/4 NPS · 1 NPS | 0.75 to 2.0 ¹⁾ | 60 cm ² | – | 11 | 72 | 100 |
| | | 120 cm ² | 35 | 84 | 100 | – |

1) Only up to Class 600

Table 4b · Version with bellows seal · Fail-safe position "valve CLOSED"

| Bench range with actuator size | | 60 cm ² | 0.2 to 1.0 | 0.4 to 2.0 | 1.4 to 2.3 | 2.1 to 3.3 |
|---|---------------------------------|---------------------|--------------------------------|------------|------------|------------|
| | | 120 cm ² | 0.4 to 0.8 | 0.8 to 1.6 | 1.7 to 2.1 | 2.4 to 3.1 |
| Valve size | C _v | Actuator | Δp when p ₂ = 0 bar | | | |
| G/NPT/Rc 1/8 · 1/4 · 3/8 · 1/2 · 3/4 1/2 NPS · 3/4 NPS · 1 NPS | 0.00012 to 0.5 | 60 cm ² | – | 10 | 61 | 95 |
| | | 120 cm ² | 30 | 72 | 160 | 250 |
| G/NPT/Rc 1/2 · 3/4 1/2 NPS · 3/4 NPS · 1 NPS | 0.75 to 2.0 ¹⁾ | 60 cm ² | – | 5 | 55 | 90 |
| | | 120 cm ² | 25 | 68 | 100 | – |

1) Only up to Class 600

Table 4c · Standard version without bellows seal · Fail-safe position "valve OPEN"

| Bench range with actuator size | | 60 cm ² | 0.2 to 1.0 | | |
|---|---------------------------------|---------------------|--------------------------------|-----|-----|
| | | 120 cm ² | 0.4 to 0.8 | | |
| | | Supply pressure | 1.2 | 2.5 | 3.5 |
| Valve size | C _v | Actuator | Δp when p ₂ = 0 bar | | |
| G/NPT/Rc 1/8 · 1/4 · 3/8 · 1/2 · 3/4 1/2 NPS · 3/4 NPS · 1 NPS | 0.00012 to 0.5 | 60 cm ² | 24 | 400 | – |
| | | 120 cm ² | 254 | 400 | – |
| G/NPT/Rc 1/2 · 3/4 1/2 NPS · 3/4 NPS · 1 NPS | 0.75 to 2.0 ¹⁾ | 60 cm ² | – | 79 | 100 |
| | | 120 cm ² | 36 | 100 | – |

1) Only up to Class 600

Table 4d · Version with bellows seal · Fail-safe position "valve OPEN"

| Bench range with actuator size | | 60 cm ² | 0.2 to 1.0 | | |
|---|---------------------------------|---------------------|--------------------------------|-----|-----|
| | | 120 cm ² | 0.4 to 0.8 | | |
| | | Supply pressure | 1.2 | 2.5 | 3.5 |
| Valve size | C _v | Actuator | Δp when p ₂ = 0 bar | | |
| G/NPT/Rc 1/8 · 1/4 · 3/8 · 1/2 · 3/4 1/2 NPS · 3/4 NPS · 1 NPS | 0.00012 to 0.5 | 60 cm ² | – | 63 | 100 |
| | | 120 cm ² | 27 | 160 | 250 |
| G/NPT/Rc 1/2 · 3/4 1/2 NPS · 3/4 NPS · 1 NPS | 0.75 to 2.0 ¹⁾ | 60 cm ² | – | 63 | 100 |
| | | 120 cm ² | 27 | 100 | – |

1) Only up to Class 600

Table 5 · Permissible differential pressures · Pressures in psi (gauge)

Table 5a · Standard version without bellows seal · Fail-safe position "valve CLOSED"

| Bench range with actuator size | | 60 cm ² | 3 to 15 | 6 to 30 | 20 to 34 | 40 to 48 |
|---|----------------------|---------------------|--------------------------------|----------|----------|----------|
| | | 120 cm ² | 6 to 12 | 12 to 23 | 25 to 30 | 35 to 45 |
| Valve size | C _v | Actuator | Δp when p ₂ = 0 psi | | | |
| G/NPT/Rc 1/8 · 1/4 · 3/8 · 1/2 · 3/4 1/2 NPS · 3/4 NPS · 1 NPS | 0.00012 to 0.5 | 60 cm ² | 367 | 1470 | 5880 | – |
| | | 120 cm ² | 3675 | 5880 | – | – |
| G/NPT/Rc 1/2 · 3/4 1/2 NPS · 3/4 NPS · 1 NPS | 0.75 to 2.0 1) | 60 cm ² | – | 160 | 1060 | 1470 |
| | | 120 cm ² | 515 | 1235 | 1470 | – |

1) Only up to Class 600

Table 5b · Version with bellows seal · Fail-safe position "valve CLOSED"

| Bench range with actuator size | | 60 cm ² | 3 to 15 | 6 to 30 | 20 to 34 | 40 to 48 |
|---|----------------------|---------------------|--------------------------------|----------|----------|----------|
| | | 120 cm ² | 6 to 12 | 12 to 23 | 25 to 30 | 35 to 45 |
| Valve size | C _v | Actuator | Δp when p ₂ = 0 psi | | | |
| G/NPT/Rc 1/8 · 1/4 · 3/8 · 1/2 · 3/4 1/2 NPS · 3/4 NPS · 1 NPS | 0.00012 to 0.5 | 60 cm ² | – | 145 | 900 | 1395 |
| | | 120 cm ² | 440 | 1060 | 2220 | 3705 |
| G/NPT/Rc 1/2 · 3/4 1/2 NPS · 3/4 NPS · 1 NPS | 0.75 to 2.0 1) | 60 cm ² | – | 75 | 805 | 1325 |
| | | 120 cm ² | 365 | 1000 | 1470 | – |

1) Only up to Class 600

Table 5c · Standard version without bellows seal · Fail-safe position "valve OPEN"

| Bench range with actuator size | | 60 cm ² | 3 to 15 | | |
|---|----------------------|---------------------|--------------------------------|------|------|
| | | 120 cm ² | 6 to 12 | | |
| | | Supply pressure | 18 | 36 | 51 |
| Valve size | C _v | Actuator | Δp when p ₂ = 0 psi | | |
| G/NPT/Rc 1/8 · 1/4 · 3/8 · 1/2 · 3/4 1/2 NPS · 3/4 NPS · 1 NPS | 0.00012 to 0.5 | 60 cm ² | 350 | 5880 | – |
| | | 120 cm ² | 3735 | 5880 | – |
| G/NPT/Rc 1/2 · 3/4 1/2 NPS · 3/4 NPS · 1 NPS | 0.75 to 2.0 1) | 60 cm ² | – | 1160 | 1470 |
| | | 120 cm ² | 530 | 1470 | – |

1) Only up to Class 600

Table 5d · Version with bellows seal · Fail-safe position "valve OPEN"

| Bench range with actuator size | | 60 cm ² | 3 to 15 | | |
|---|----------------------|---------------------|--------------------------------|------|------|
| | | 120 cm ² | 6 to 12 | | |
| | | Supply pressure | 18 | 36 | 51 |
| Valve size | C _v | Actuator | Δp when p ₂ = 0 psi | | |
| G/NPT/Rc 1/8 · 1/4 · 3/8 · 1/2 · 3/4 1/2 NPS · 3/4 NPS · 1 NPS | 0.00012 to 0.5 | 60 cm ² | – | 925 | 1470 |
| | | 120 cm ² | 395 | 2220 | 3705 |
| G/NPT/Rc 1/2 · 3/4 1/2 NPS · 3/4 NPS · 1 NPS | 0.75 to 2.0 1) | 60 cm ² | – | 925 | 1470 |
| | | 120 cm ² | 395 | 1470 | – |

1) Only up to Class 600

Table 6 · Dimensions

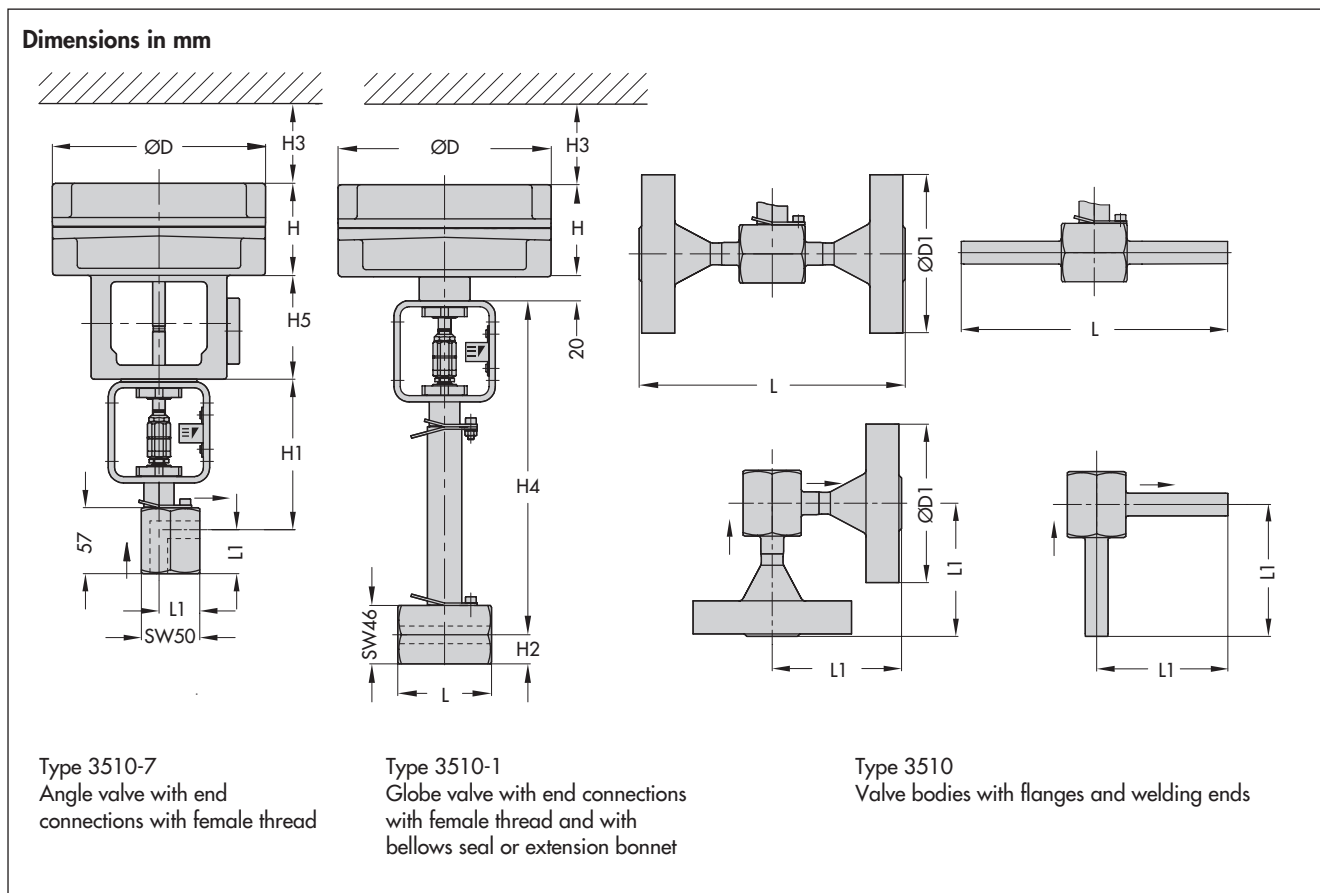
| Valve | Connection | Female thread G/NPT/Rc 1/8 to 3/4 | Welding ends | | Flanges | | | |
|----------------------|------------------------|---|-----------------|----------------|----------------|---------|-------|-------|
| | | | 1/2 NPS | 1 NPS | 1/2 NPS | 3/4 NPS | 1 NPS | |
| L | Class 150 | mm | 74 mm 2.91" | 184 | 184 | 184 | 184 | 184 |
| | | in | | 7.25" | 7.25" | 7.25" | 7.25" | 7.25" |
| | Class 300 | mm | | 190 | 197 | 190 | 194 | 197 |
| | | in | | 7.50" | 7.75" | 7.50" | 7.62" | 7.75" |
| | Class 600 | mm | | 203 | 210 | 203 | 206 | 210 |
| | | in | | 8.0" | 8.25" | 8.0" | 8.12" | 8.25" |
| | Class 900/1500 | mm | | 216 | 254 | 216 | 229 | 254 |
| | | in | | 8.50" | 10.0" | 8.50" | 9.0" | 10.0" |
| Class 2500 | mm | 264 | 308 | 264 | 273 | 308 | | |
| | in | 10.38" | 12.12" | 10.38" | 10.75" | 12.12" | | |
| H1 | 60/120 cm ² | | 122 mm / 4.80" | | | | | |
| H4 | Extension bonnet | Up to Cl. 2500 | 263 mm / 10.35" | | | | | |
| | Bellows seal | Up to Cl. 600 | 263 mm / 10.35" | | | | | |
| | | Class 1500 | 365 mm / 14.37" | | | | | |
| H2 or Flange Ø D1 | Class 150 | mm | 23 mm 0.90" | 23 mm 0.90" | 23 mm 0.90" | 90 | 100 | 108 |
| | | in | | | | 3.54" | 3.94" | 4.25" |
| | Class 300 | mm | | | | 96 | 118 | 124 |
| | | in | | | | 3.78" | 4.65" | 4.88" |
| | Class 600 | mm | | | | 96 | 118 | 124 |
| | | in | | | | 3.78" | 4.65" | 4.88" |
| | Class 900/1500 | mm | | | | 122 | 132 | 150 |
| | | in | | | | 4.80" | 5.20" | 5.91" |
| Class 2500 | mm | 134 | 140 | 158 | | | | |
| | in | 5.28" | 5.51" | 6.22" | | | | |
| H3 | 60/120 cm ² | | 150 mm / 5.90" | | | | | |
| L1 | Class 150 | mm | 34 mm 1.33" | 92 | 92 | 92 | 92 | 92 |
| | | in | | 3.62" | 3.62" | 3.62" | 3.62" | 3.62" |
| | Class 300 | mm | | 95 | 98 | 95 | 97 | 98 |
| | | in | | 3.74" | 3.86" | 3.74" | 3.82" | 3.86" |
| | Class 600 | mm | | 101 | 105 | 101 | 103 | 105 |
| | | in | | 3.98" | 4.13" | 3.98" | 4.06" | 4.13" |
| | Class 900/1500 | mm | | 108 | 127 | 108 | 114 | 127 |
| | | in | | 4.25" | 5.0" | 4.25" | 4.5" | 5.0" |
| Class 2500 | mm | 132 | 154 | 132 | 137 | 154 | | |
| | in | 5.20" | 6.06" | 5.20" | 5.39" | 6.06" | | |

| Actuator | 60 cm ² | 120 cm ² |
|-----------------------------|--------------------|---------------------|
| Diaphragm Ø D | 120 mm / 4.72" | 168 mm / 6.6" |
| H | 63 mm / 2.48" | 70 mm / 2.76" |
| H3 | 150 mm / 5.90" | 150 mm / 5.90" |
| H5 | – | 88 mm / 3.46" |
| Thread | M20 x 1.5 | M20 x 1.5 |
| Loading pressure connection | G 1/8 or 1/8 NPT | G 1/8 or 1/8 NPT |

Table 7 · Weights

| Valve | Connection | | Female thread G/NPT/Rc 1/8 to 3/4 | Welding ends 1/2 NPS, 1 NPS | Flanges | | |
|------------------------|------------------|--------|---|--------------------------------|----------|----------|----------|
| | | | | | 1/2 NPS | 3/4 NPS | 1 NPS |
| Valve without actuator | Class 150 | kg/lbs | 1.7/3.74 | 1.8/4.0 | 2.6/5.8 | 3.3/7.3 | 3.7/8.2 |
| | Class 300 | kg/lbs | | | 3.2/7.1 | 4.2/9.3 | 4.8/10.6 |
| | Class 600 | kg/lbs | | | 3.4/7.5 | 4.8/10.6 | 5.2/11.5 |
| | Class 900/1500 | kg/lbs | | | 5.2/14.4 | 7.6/16.8 | 8.7/19.2 |
| | Class 2500 | kg/lbs | | | 6.5/14.4 | 9.0/20 | 9.8/21.7 |
| Optional | Extension bonnet | kg/lbs | 0.5 / 1.2 | | | | |
| | Bellows seal | kg/lbs | 0.6 / 1.4 | | | | |

| Actuator | 60 cm ² | 120 cm ² |
|----------------|--------------------|---------------------|
| Approx. kg/lbs | 1.3 / 2.9 | 3.5 / 7.8 |



Ordering text

Micro-flow Valve Type 3510 Globe or angle valve in ANSI version
 Valve size NPS ...
 Pressure rating Class ...
 Body material According to Table 2
 End connections Female thread G, NPT, Rc, flanges or welding ends
 Direction of flow FTO or FTC
 Characteristic Equal percentage, linear, quick opening
 Pneumatic actuator Type 3271-5/Type 3277-5
 60 or 120 cm² (T 8310-1 EN)

Fail-safe position Valve CLOSED or valve OPEN
 Process medium ...
 Density ... kg/m³
 Maximum flow rate ... kg/h or m³/h in standard or operating state
 Pressure p₁ and p₂ in bar/psi (absolute pressure)
 Medium temperature °C or K
 Accessories Positioner and/or limit switch
 Specifications subject to change without notice.

