

## T 8091 EN

### Type 3510-1 and Type 3510-7 Pneumatic Control Valves

#### Type 3510 Micro-flow Valve

DIN version

#### Application

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

**Nominal 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  
 DN 10 · DN 15 · DN 25

**Nom. pressure** PN 40 to 400

**Temperatures** -196 to +450 °C

Type 3510 Micro-flow Valve with

- Type 3271-5 Pneumatic Actuator
- Type 3277-5 Pneumatic Actuator

Available as

- Globe valve
- Angle valve

Valve body with

- G or NPT female thread
- Welding ends or flanges

Stainless steel is used as the standard body material. However, a wide variety of special materials can also be used on customer request.

A mounting kit (1400-9031) provides the valve with an interface according to IEC 60534-6-1 (NAMUR) for attachment of positioners, limit switches, solenoid valves and other valve accessories. We recommend using an insulating section or bellows seal for flanged valves to provide more space to mount valve accessories.

#### Standard version

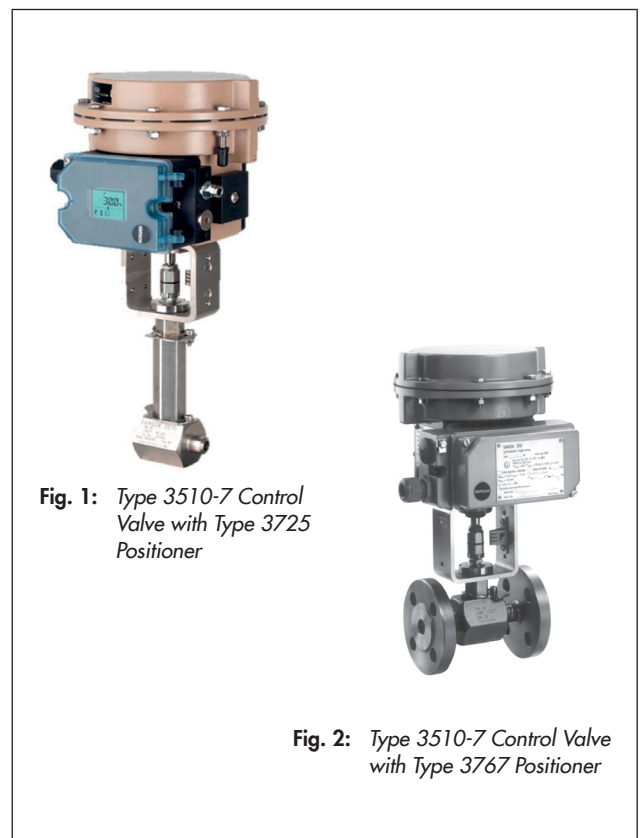
- For temperatures from -10 to +220 °C
- PN 40 to 400
- Globe or angle valve
- Female thread G 1/8, G 1/4, G 3/8, G 1/2, G 3/4 or 1/8 NPT, 1/4 NPT, 3/8 NPT, 1/2 NPT, 3/4 NPT
- Flanges DN 10, 15 or 25
- Welding ends DN 10, 15 or 25

**Type 3510-1** · With Type 3271-5 Pneumatic Actuator (120 cm<sup>2</sup>) · See Data Sheet ▶ T 8310-1

**Type 3510-7** (Fig. 1 and Fig. 2) · With Type 3277-5 Pneumatic Actuator (120 cm<sup>2</sup>) for integral positioner attachment See Data Sheet ▶ T 8310-1

#### Further versions

- **Insulating section** for temperatures from -196 to +450 °C, with special material up to +650 °C



**Fig. 1:** Type 3510-7 Control Valve with Type 3725 Positioner

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

- **Metal bellows seal** up to PN 250 with a sealing performance of  $\leq 10^{-5}$  (mbar l)/s
- **Handwheel**
- **Electric actuator** · On request
- **Stainless steel actuator** for ambient temperatures down to -60 °C · On request
- **Body connections with threaded flanges** and lens ring gaskets in nominal sizes DN 6 and 10, nominal pressure PN 325, dimensions acc. to IG standard ( $K_{V_{Smax}} = 0.4$ )

### Principle of operation

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

The plug stem is connected to the actuator stem by the stem connector and sealed with an adjustable packing.

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

The anti-rotation fixture prevents a loosening of the screw connection between the valve body and the bonnet or the intermediate piece.

### Fail-safe position

Depending on how the springs are arranged in the pneumatic actuator (► T 8310-1), the valve has two different fail-safe positions.

#### Actuator stem extends (fail-close)

The valve closes when the supply air fails.

#### Actuator stem retracts (fail-open)

The valve opens when the supply air fails.

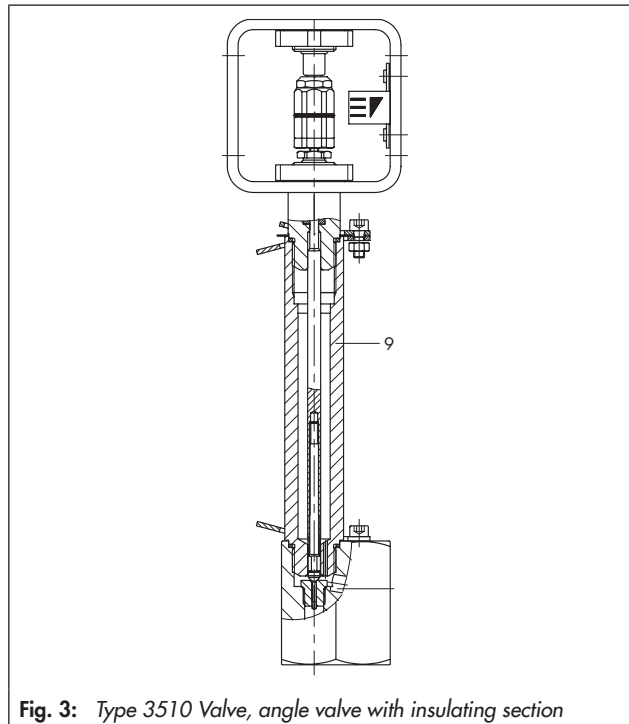


Fig. 3: Type 3510 Valve, angle valve with insulating section

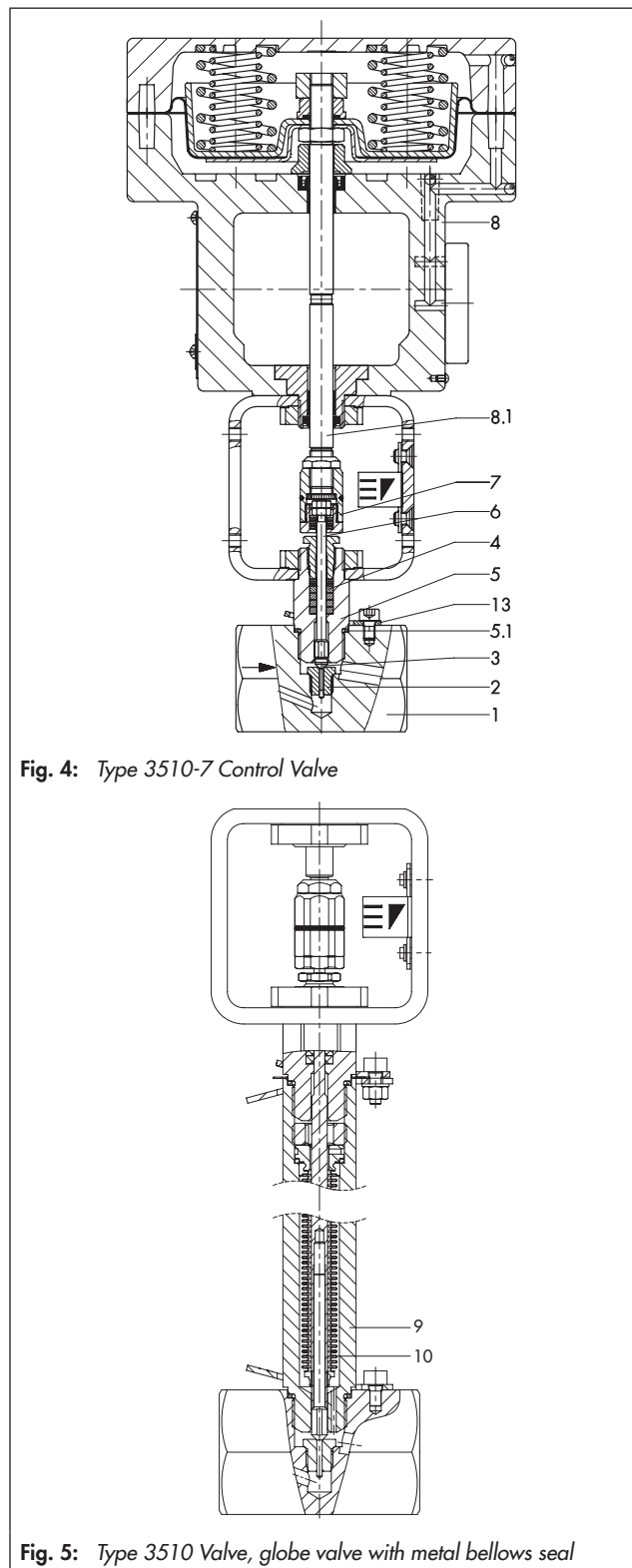


Fig. 4: Type 3510-7 Control Valve

Fig. 5: Type 3510 Valve, globe valve with metal bellows seal

### Legend

|   |              |     |                |    |   |
|---|--------------|-----|----------------|----|---|
| 1 | Valve body   | 5.1 | Body gasket    | 9  | Intermediate piece for insulating section or bellows seal |
| 2 | Seat         | 6   | Plug stem      | 10 | Metal bellows   |
| 3 | Plug         | 7   | Stem connector | 13 | Anti-rotation fixture                                     |
| 4 | Packing      | 8   | Actuator       |    |   |
| 5 | Valve bonnet | 8.1 | Actuator stem  |    |   |

**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<br>1/8 NPT · 1/4 NPT · 3/8 NPT · 1/2 NPT · 3/4 NPT | DN 10 · DN 15 · DN 25 | DN 10 · DN 15 · DN 25 |
| Nominal pressure                       | PN 40 to 400   |                       |                       |
| Seat/plug seal                         | Metal seal   |                       |                       |
| Characteristic                         | Equal percentage with $K_{VS} \geq 0.01$ · Linear · Quick opening                        |                       |                       |
| Rangeability                           | 50:1 · < 50:1 with $K_{VS} < 0.1$  |                       |                       |
| Temperature range <sup>1)</sup>        | -10 to +220 °C · With insulating section: -196 to +450 °C                                |                       |                       |
| Leakage class according to IEC 60534-4 | Metal seal: IV · High-performance metal seal: V  |                       |                       |
| Compliance                             | <b>ERC</b>   |                       |                       |

<sup>1)</sup> Higher temperatures on request

**Table 2: Materials**

| Valve body <sup>1)</sup> and valve bonnet <sup>2)</sup> | 1.4401/1.4404                                      | 2.4610               |
|---|--|----------------------|
| Seat  | 1.4401/1.4404 <sup>3)</sup><br>1.4122<br>Stellite® | 2.4610 <sup>3)</sup> |
| Plug  | 1.4401/1.4404 <sup>3)</sup><br>1.4112<br>Stellite® | 2.4610 <sup>3)</sup> |
| Packing   | PTFE compound                                      |                      |
| Body gasket   | 1.4401/1.4404                                      | 2.4610               |
| <b>Insulating section</b>                               | 1.4401/1.4404                                      | 2.4610               |
| <b>Metal bellows seal</b>                               |  |                      |
| Intermediate piece                                      | 1.4401/1.4404                                      | 2.4610               |
| Metal bellows up to PN 250                              | 1.4571   | 2.4819               |

<sup>1)</sup> Other materials on request

<sup>2)</sup> Wetted parts

<sup>3)</sup> Only with  $K_{VS}$  0.001 to 1.6

**Table 3:** Available  $K_{VS}$  coefficients

**Table 3.1:** Overview

| $K_{VS}$ coefficient      |    | 0.0001 to 0.0063 <sup>1)</sup> | 0.01 to 0.25 | 0.4  | 0.63 to 1.6 <sup>2)</sup> |
|---------------------------|----|--------------------------------|--------------|------|---------------------------|
| Rangedability             |    | <15:1                          | 15:1 to 50:1 | 50:1 |                           |
| Seat Ø                    | mm | 2                              | 3            | 4    | 10                        |
| Seat thread <sup>3)</sup> |    | M10 x 1                        |              |      | M16 x 1                   |
| Plug stem Ø               | mm | 4                              |              | 4    |                           |
| Travel                    | mm | 7.5                            |              | 7.5  |                           |

<sup>1)</sup> Seat and plug made only of 1.4122/1.4122, 1.4122/Stellite® or Stellite®/Stellite®

<sup>2)</sup> Only up to PN 100

<sup>3)</sup> Trims are only interchangeable within the  $K_{VS}$  coefficient ranges  $K_{VS}$  0.0001 to 0.4 (M10x1) and  $K_{VS}$  0.63 to 1.6 (M16x1) due to the different seat threads.

**Table 3.2:**  $K_{VS}$  coefficients and associated nominal sizes

| Connection                   |                  | Female thread |                             |                  |                             | Welding ends |       |       | Flanges |       |       |
|------------------------------|------------------|---------------|-----------------------------|------------------|-----------------------------|--------------|-------|-------|---------|-------|-------|
| Flow coefficient<br>$K_{VS}$ | Characteristic   |               | G 1/8<br>1/8 NPT<br>1/4 NPT | G 3/8<br>3/8 NPT | G 1/2<br>1/2 NPT<br>3/4 NPT | DN 10        | DN 15 | DN 25 | DN 10   | DN 15 | DN 25 |
|                              | Equal percentage | Linear        |                             |                  |                             |              |       |       |         |       |       |
| 0.00010                      | -                | •             | •                           | •                | •                           | •            | •     | •     | •       | •     | •     |
| 0.00016                      |                  | •             | •                           | •                | •                           | •            | •     | •     | •       | •     | •     |
| 0.00025                      |                  | •             | •                           | •                | •                           | •            | •     | •     | •       | •     | •     |
| 0.00040                      |                  | •             | •                           | •                | •                           | •            | •     | •     | •       | •     | •     |
| 0.00063                      |                  | •             | •                           | •                | •                           | •            | •     | •     | •       | •     | •     |
| 0.0010                       |                  | •             | •                           | •                | •                           | •            | •     | •     | •       | •     | •     |
| 0.0016                       |                  | •             | •                           | •                | •                           | •            | •     | •     | •       | •     | •     |
| 0.0025                       |                  | •             | •                           | •                | •                           | •            | •     | •     | •       | •     | •     |
| 0.0040                       |                  | •             | •                           | •                | •                           | •            | •     | •     | •       | •     | •     |
| 0.0063                       |                  | •             | •                           | •                | •                           | •            | •     | •     | •       | •     | •     |
| 0.010                        | •                | •             | •                           | •                | •                           | •            | •     | •     | •       | •     |       |
| 0.016                        | •                | •             | •                           | •                | •                           | •            | •     | •     | •       | •     |       |
| 0.025                        | •                | •             | •                           | •                | •                           | •            | •     | •     | •       | •     |       |
| 0.040                        | •                | •             | •                           | •                | •                           | •            | •     | •     | •       | •     |       |
| 0.063                        | •                | •             | •                           | •                | •                           | •            | •     | •     | •       | •     |       |
| 0.10                         | •                | •             | •                           | •                | •                           | •            | •     | •     | •       | •     |       |
| 0.16                         | •                | •             | •                           | •                | •                           | •            | •     | •     | •       | •     |       |
| 0.25                         | •                | •             | •                           | •                | •                           | •            | •     | •     | •       | •     |       |
| 0.40                         | •                | •             | •                           | •                | •                           | •            | •     | •     | •       | •     |       |
| 0.63 <sup>1)</sup>           | •                | •             | -                           | •                | -                           | •            | •     | -     | •       | •     |       |
| 1.0 <sup>1)</sup>            | •                | •             |                             | •                |                             | •            | •     |       |         |       |       |
| 1.6 <sup>1)</sup>            | •                | •             |                             | •                |                             | •            | •     |       |         |       |       |

<sup>1)</sup> Versions can be used up to PN 100 at the maximum

**Table 3.3:** Valve selection guide

| PN            | 16 to 40  |           | 63 to 100 |           | 160 to 250 |           | 400       |           |
|---------------|-----------|-----------|-----------|-----------|------------|-----------|-----------|-----------|
| Metal bellows | Optional  |           | Optional  |           | Optional   |           | -         | Optional  |
| $K_{VS}$      |           |           |           |           |            |           |           |           |
| 0.0001        | Type 3510 |           | Type 3510 |           | Type 3510  |           | Type 3510 |           |
| 0.00016       |           |           |           |           |            |           |           |           |
| 0.00025       |           |           |           |           |            |           |           |           |
| 0.0004        |           |           |           |           |            |           |           |           |
| 0.00063       |           |           |           |           |            |           |           |           |
| 0.001         |           |           |           |           |            |           |           |           |
| 0.0016        |           |           |           |           |            |           |           |           |
| 0.0025        |           |           |           |           |            |           |           |           |
| 0.004         |           |           |           |           |            |           |           |           |
| 0.0063        |           |           |           |           |            |           |           |           |
| 0.01          |           |           |           |           |            |           |           |           |
| 0.016         |           |           |           |           |            |           |           |           |
| 0.025         |           |           |           |           |            |           |           |           |
| 0.04          |           |           |           |           |            |           |           |           |
| 0.063         |           |           |           |           |            |           |           |           |
| 0.1           |           |           |           |           |            |           |           |           |
| 0.16          | Type 3252 | Type 3241 | Type 3252 | Type 3251 | Type 3252  | Type 3251 | Type 3252 | Type 3251 |
| 0.25          |           |           |           |           |            |           |           |           |
| 0.4           |           |           |           |           |            |           |           |           |
| 0.63          |           |           |           |           |            |           |           |           |
| 1             |           |           |           |           |            |           |           |           |
| 1.6           |           |           |           |           |            |           |           |           |
| 2.5           |           |           |           |           |            |           |           |           |
| 4             |           |           |           |           |            |           |           |           |
| 6.3           |           |           |           |           |            |           |           |           |
| 10            |           |           |           |           |            |           |           |           |

Refer to the following data sheets for detailed information on the corresponding valves:

- Type 3241: ▶ T 8015 (DIN) and ▶ T 8012 (ANSI)
- Type 3251: ▶ T 8051 (DIN) and ▶ T 8052 (ANSI)
- Type 3252: ▶ T 8053

**Table 4:** Permissible differential pressures · Pressures stated in bar (gauge)

**Table 4.1:** Standard version without bellows seal · Fail-close

| Bench range with actuator area  |                             | 120 cm <sup>2</sup> | 0.4 to 0.8                     | 0.8 to 1.6 | 1.7 to 2.1 | 2.4 to 3.1 |
|---|-----------------------------|---------------------|--------------------------------|------------|------------|------------|
| Nominal size  | K <sub>VS</sub> coefficient | Actuator            | Δp when p <sub>2</sub> = 0 bar |            |            |            |
| G 1/8 · G 1/4 · G 3/8 · G 1/2 · G 3/4<br>1/8 NPT · 1/4 NPT · 3/8 NPT · 1/2 NPT · 3/4 NPT<br>DN 10 · DN 15 · DN 25 | 0.0001 to 0.4               | 120 cm <sup>2</sup> | 250                            | 400        | –          | –          |
| G 1/2 · G 3/4<br>1/2 NPT · 3/4 NPT<br>DN 15 · DN 25   | 0.63 to 1.6                 | 120 cm <sup>2</sup> | 35                             | 84         | 100        | –          |

**Table 4.2:** Standard version with bellows seal · Fail-close

| Bench range with actuator area  |                             | 120 cm <sup>2</sup> | 0.4 to 0.8                     | 0.8 to 1.6 | 1.7 to 2.1 | 2.4 to 3.1 |
|---|-----------------------------|---------------------|--------------------------------|------------|------------|------------|
| Nominal size  | K <sub>VS</sub> coefficient | Actuator            | Δp when p <sub>2</sub> = 0 bar |            |            |            |
| G 1/8 · G 1/4 · G 3/8 · G 1/2 · G 3/4<br>1/8 NPT · 1/4 NPT · 3/8 NPT · 1/2 NPT · 3/4 NPT<br>DN 10 · DN 15 · DN 25 | 0.0001 to 0.4               | 120 cm <sup>2</sup> | 30                             | 72         | 160        | 250        |
| G 1/2 · G 3/4<br>1/2 NPT · 3/4 NPT<br>DN 15 · DN 25   | 0.63 to 1.6                 | 120 cm <sup>2</sup> | 25                             | 68         | 100        | –          |

**Table 4.3:** Standard version without bellows seal · Fail-open

| Bench range with actuator area  |                             | 120 cm <sup>2</sup> | 0.4 to 0.8                     |     |     |
|---|-----------------------------|---------------------|--------------------------------|-----|-----|
|   |                             | Supply pressure     | 1.2                            | 2.5 | 3.5 |
| Nominal size  | K <sub>VS</sub> coefficient | Actuator            | Δp when p <sub>2</sub> = 0 bar |     |     |
| G 1/8 · G 1/4 · G 3/8 · G 1/2 · G 3/4<br>1/8 NPT · 1/4 NPT · 3/8 NPT · 1/2 NPT · 3/4 NPT<br>DN 10 · DN 15 · DN 25 | 0.0001 to 0.4               | 120 cm <sup>2</sup> | 254                            | 400 | –   |
| G 1/2 · G 3/4<br>1/2 NPT · 3/4 NPT<br>DN 15 · DN 25   | 0.63 to 1.6                 | 120 cm <sup>2</sup> | 36                             | 100 | –   |

**Table 4.4:** Standard version with bellows seal · Fail-open

| Bench range with actuator area  |                             | 120 cm <sup>2</sup> | 0.4 to 0.8                     |     |     |
|---|-----------------------------|---------------------|--------------------------------|-----|-----|
|   |                             | Supply pressure     | 1.2                            | 2.5 | 3.5 |
| Nominal size  | K <sub>VS</sub> coefficient | Actuator            | Δp when p <sub>2</sub> = 0 bar |     |     |
| G 1/8 · G 1/4 · G 3/8 · G 1/2 · G 3/4<br>1/8 NPT · 1/4 NPT · 3/8 NPT · 1/2 NPT · 3/4 NPT<br>DN 10 · DN 15 · DN 25 | 0.0001 to 0.4               | 120 cm <sup>2</sup> | 27                             | 160 | 250 |
| G 1/2 · G 3/4<br>1/2 NPT · 3/4 NPT<br>DN 15 · DN 25   | 0.63 to 1.6                 | 120 cm <sup>2</sup> | 27                             | 100 | –   |

**Table 5: Dimensions in mm****Table 5.1: Dimensions for Type 3510 Valve**

| Connection                 |                     | Female thread    | Welding ends     | Flanges |       |       |
|----------------------------|---------------------|------------------|------------------|---------|-------|-------|
| Valve                      |                     | G/NPT            | DN 10. 15. 25    | DN 10   | DN 15 | DN 25 |
| L <sup>1)</sup>            | PN 40               | 74               | 80               | 130     | 130   | 160   |
|                            | PN 63 to 160        |                  |                  | 210     | 210   | 230   |
|                            | PN 250 to 320       |                  |                  | 230     | 230   | 260   |
|                            | PN 400              |                  |                  | –       | 264   | 308   |
| L1 <sup>1)</sup>           | PN 40               | 34               | 40               | 90      | 90    | 100   |
|                            | PN 63 to 160        |                  |                  | 105     | 105   | 115   |
|                            | PN 250 to 320       |                  |                  | 115     | 115   | 130   |
|                            | PN 400              |                  |                  | –       | 132   | 154   |
| H1                         | 120 cm <sup>2</sup> |                  |                  | 122     |       |       |
| H4 with insulating section | PN 40 to 400        |                  |                  | 263     |       |       |
| H4 with bellows seal       | PN 40 to 100        |                  |                  | 263     |       |       |
|                            | PN 160 to 250       |                  |                  | 365     |       |       |
| H2 or flange ØD1           | PN 40               | 23 <sup>2)</sup> | 23 <sup>2)</sup> | 90      | 95    | 115   |
|                            | PN 63 to 160        |                  |                  | 100     | 105   | 140   |
|                            | PN 250 to 320       |                  |                  | 125     | 130   | 160   |
|                            | PN 400              |                  |                  | 125     | 145   | 180   |

<sup>1)</sup> Face-to-face dimensions of flanges according to DIN EN 558

<sup>2)</sup> H2 = 28 mm when body is made of 2.4610

**Table 5.2: Type 3271 and Type 3277 Pneumatic Actuators**

|                      |                       |                 |
|----------------------|-----------------------|-----------------|
| <b>Actuator area</b> | <b>cm<sup>2</sup></b> | <b>120</b>      |
| Diaphragm ØD         | mm                    | 168             |
| H <sup>1)</sup>      | mm                    | 69              |
| H3 <sup>2)</sup>     | mm                    | 110             |
| H5                   | Type 3277 mm          | 88              |
| Thread               | Type 3271             | M20 x 1.5       |
|                      | Type 3277             | M20 x 1.5       |
| α                    | Type 3271             | G 1/8 (1/8 NPT) |

<sup>1)</sup> Minimum clearance required to remove the actuator

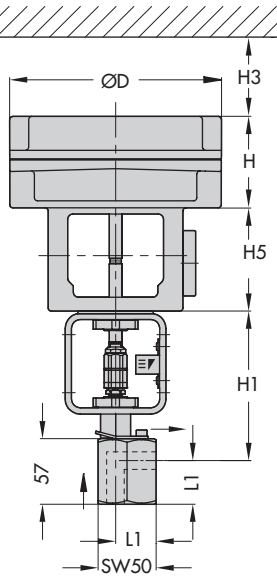
**Table 6: Weights in kg****Table 6.1: Weights for Type 3510 Valve**

| Connection             |                    | Female thread | Welding ends  | Flanges |       |       |
|------------------------|--------------------|---------------|---------------|---------|-------|-------|
| Valve                  |                    | G/NPT         | DN 10. 15. 25 | DN 10   | DN 15 | DN 25 |
| Valve without actuator | PN 40              | 1.7           | 1.5           | 2.9     | 3.1   | 4.2   |
|                        | PN 63 to 160       |               |               | 3.9     | 4.2   | 7.3   |
|                        | PN 250 to 320      |               |               | 5.6     | 6.0   | 8.7   |
|                        | PN 400             |               |               | 7.1     | 9.1   | 9.8   |
| Optional               | Insulating section |               |               | 0.5     |       |       |
|                        | Bellows seal       |               |               | 0.6     |       |       |

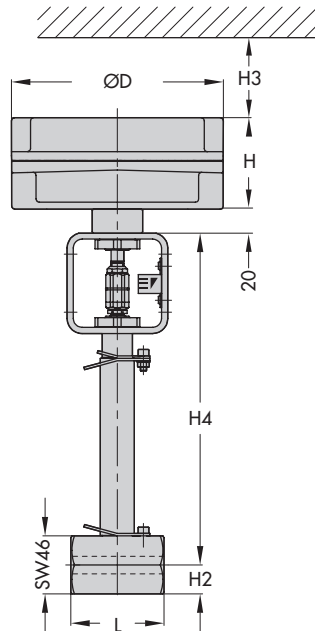
**Table 6.2: Weight for actuator**

|                 |                           |
|-----------------|---------------------------|
| <b>Actuator</b> | <b>120 cm<sup>2</sup></b> |
| kg (approx.)    | 3.5                       |

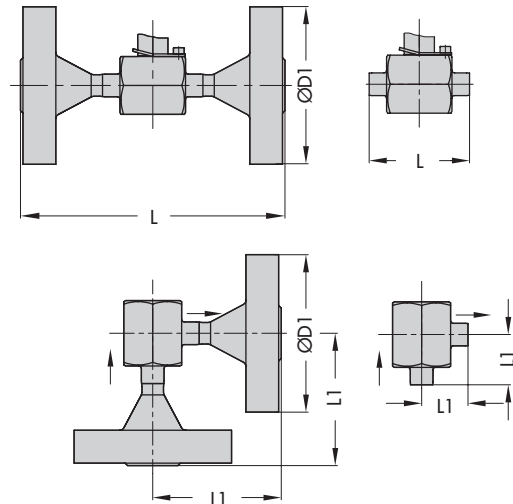
## Dimensional drawings



Type 3510-7 as angle valve with female thread



Type 3510-1 as globe valve with female thread, with bellows seal or insulating section



Type 3510 · Valve body with flanges and welding ends

## Ordering text

Type 3510 Micro-flow Globe or angle valve  
Valve

|                                    |  |
|------------------------------------|--|
| Nominal size                       | DN   |
| Nominal pressure                   | PN   |
| Body material                      | According to Table 2   |
| Type of end connections            | G or NPT female thread<br>Flanges/welding ends   |
| Direction of flow                  | Flow-to-open or flow-to-close  |
| Characteristic                     | Equal percentage, linear or quick opening  |
| Pneumatic actuator                 | Type 3271-5 or Type 3277-5, 120 cm <sup>2</sup>  |
| Fail-safe position                 | Fail-close or fail-open  |
| Process medium                     | Density in kg/m <sup>3</sup> and temperature in °C   |
| Flow coefficient                   | kg/h or m <sup>3</sup> /h in standard or operating state   |
| Pressure                           | p <sub>1</sub> and p <sub>2</sub> in bar (absolute pressure p <sub>abs</sub> )<br>(with minimum, normal and maximum flow rate) |
| Valve accessories*                 | Positioner and/or limit switch   |
| *Mounting kit (1400-9031) required |  |