

## T 8091-1 EN

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

#### Type 3510 Micro-flow Valve

ANSI version



#### Application

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

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

**Flanges, welding ends** NPS  $\frac{1}{2}$  ·  $\frac{3}{4}$  · 1

**Pressure rating** Class 150 to 2500

**Temperatures** -325 to +842 °F · -196 to +450 °C

#### Special features

Type 3510 Micro-flow Valve with

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

Available as

- Globe valve
- Angle valve

Valve body made of

- G, NPT or Rc 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.

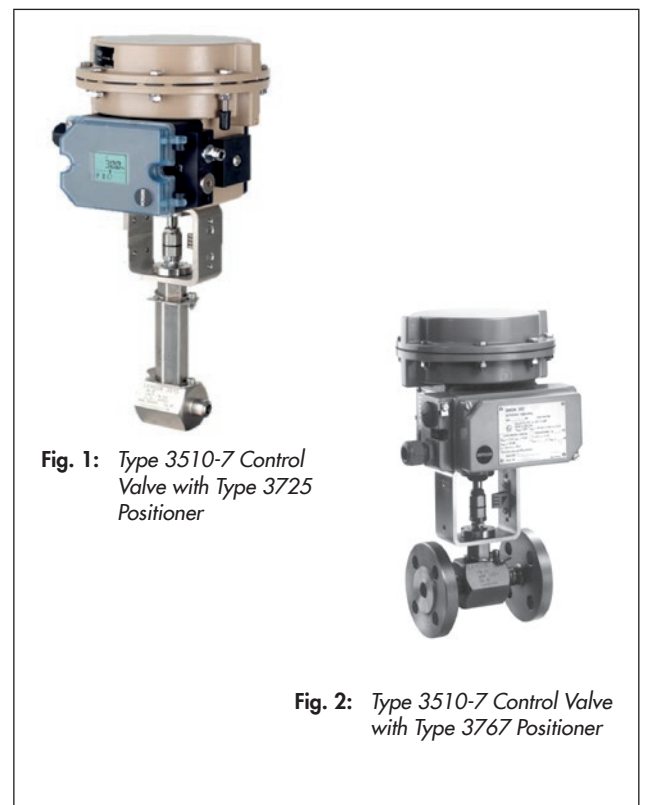
A mounting kit (1400-9031) provides the valve with an interface according to IEC 60534-6-1 (NAMUR) for attachment of positioners, limit switches, solenoid valves and other valve accessories. We recommend using an insulating section or bellows seal for flanged valves to provide more space to mount valve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

#### Standard version

- For temperatures from 14 to 428 °C (-10 to +220 °F)
- Class 150 to 2500
- Globe 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 NPS  $\frac{1}{2}$ ,  $\frac{3}{4}$ , 1, Class 150 to 2500
- Welding ends NPS  $\frac{1}{2}$  and 1 with welding-neck ends

**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



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

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

#### Further versions

- **Insulating section** for temperatures from -325 to +842 °F (-196 to +450 °C), with special material up to +1200 °F (+650 °C)
- **Metal bellows seal** up to Class 1500 with a sealing performance of  $\leq 10^{-5}$  (mbar l)/s
- **Manual adjuster**
- **Electric actuator** · On request
- **Stainless steel actuator** for ambient temperatures down to -76 °C (-60 °C) · On request

### 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.

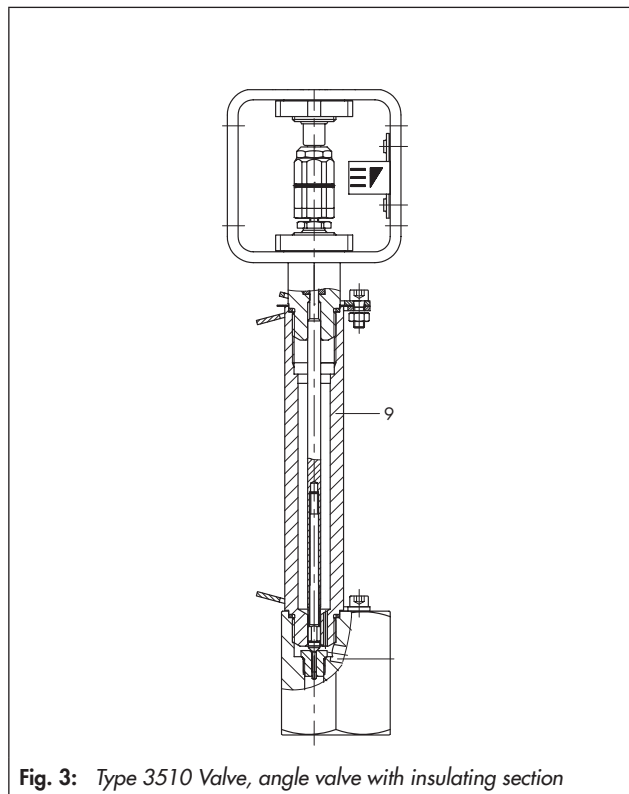


Fig. 3: Type 3510 Valve, angle valve with insulating section

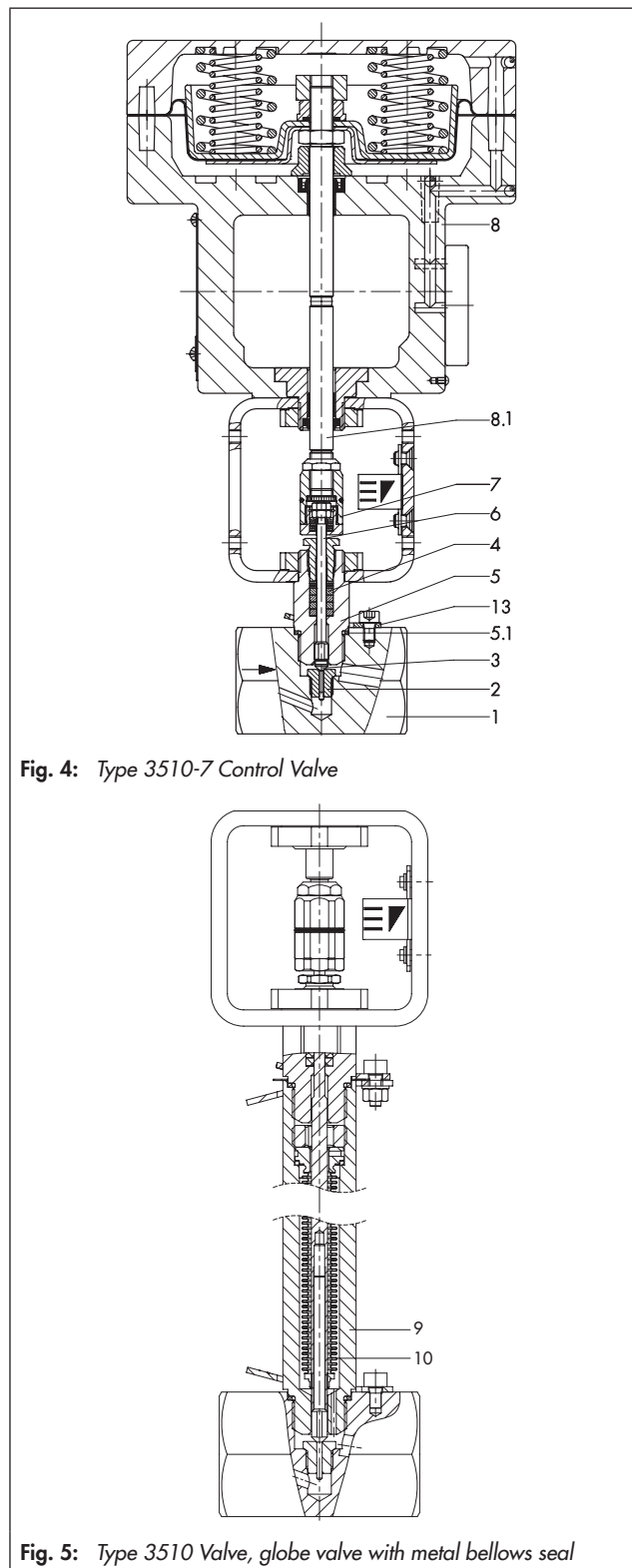


Fig. 4: Type 3510-7 Control Valve

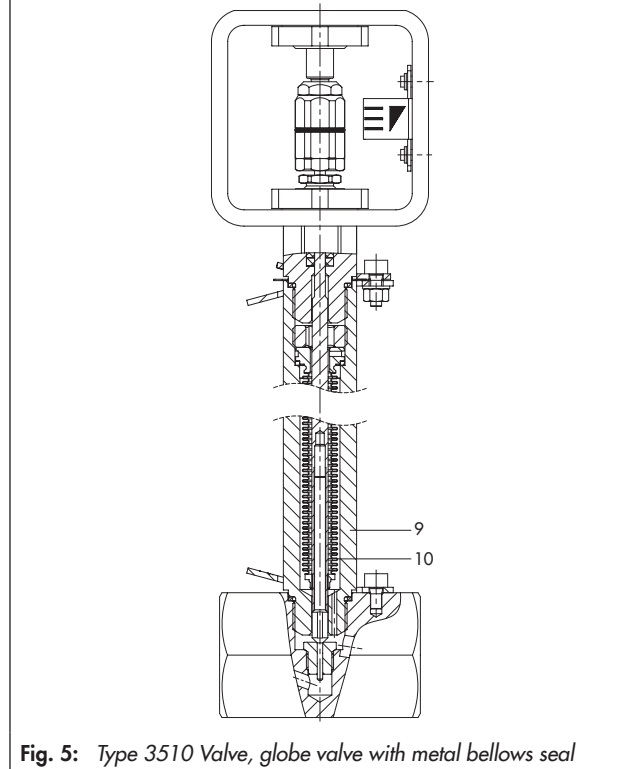


Fig. 5: Type 3510 Valve, globe valve with metal bellows seal

### Legend for Fig. 3, Fig. 4 and Fig. 5

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 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	NPS 1/2 · NPS 1	NPS 1/2 · NPS 3/4 · NPS 1
Pressure rating	Class 150 to 2500		
Seat-plug seal	Metal seal		
Characteristic	Equal percentage with $C_v \geq 0.012$ · Linear · On/off		
Rangeability	50:1 · Lower than 50:1 with $< C_v 0.12$		
Temperature range <sup>1)</sup>	14 to 428 °F (-10 to +220 °C) · With insulating section: -325 to +842 °F (-196 to +450 °C)		
Leakage class According to IEC 60534-4 According to ANSI FCI 70-2	Metal seal: IV · High-performance metal seal: V		
Conformity	CE · UK · EAC		

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

**Table 2: Materials**

Valve body <sup>1)</sup> and valve bonnet <sup>2)</sup>	A479 A316/316L	B 574 N06455
Seat	A479 A316/316L <sup>3)</sup> 1.4122 Stellite®	B 574 N06455 <sup>3)</sup>
Plug	A479 A316/316L <sup>3)</sup> 1.4112 Stellite®	B 574 N06455 <sup>3)</sup>
Packing	PTFE compound	
Body gasket	A479 A316/316L	B 574 N06455
<b>Insulating section</b>	A479 A316/316L	B 574 N06455
<b>Metal bellows seal</b>		
Intermediate piece	A479 A316/316L	B 574 N06455
Metal bellows up to Class 1500	1.4571	2.4819

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

<sup>2)</sup> Wetted parts

<sup>3)</sup> Only with  $C_v 0.0012$  to 2

**Table 3:** Available  $C_v$  coefficients

**Table 3.1:** Overview

$C_v$ coefficient	0.00012 to 0.0075 <sup>1)</sup>	0.012 to 0.3	0.5	0.75 to 2.0 <sup>2)</sup>	
Rangeability	<15:1	15:1 to 50:1	50:1		
Seat Ø	mm	2	3	4	10
Seat thread <sup>3)</sup>		M10x1			M16x1
Plug stem Ø	mm	4		4	
Rated travel	mm	7.5		7.5	

<sup>1)</sup> Seat and plug made only of 1.4122/1.4112, 1.4122/Stellite® or Stellite®/Stellite®

<sup>2)</sup> Only up to Class 600

<sup>3)</sup> Trims are only interchangeable within the  $C_v$  coefficient ranges  $C_v$  0.00012 to 0.5 (M10x1) and  $C_v$  0.75 to 2.0 (M16x1) due to the different seat threads.

**Table 3.2:**  $C_v$  coefficients and associated valve sizes

Flow coefficient $C_v$	Connection		Female thread			Welding ends		Flanges		
	Equal percentage	Linear	G 1/8 · G 1/4 · 1/8 NPT · 1/4 NPT · Rc 1/8 · Rc 1/4	G 3/8 · 3/8 NPT · Rc 3/8	G 1/2 · G 3/4 · 1/2 NPT · 3/4 NPT · Rc 1/2 · Rc 3/4	NPS 1/2	NPS 1	NPS 1/2	NPS 3/4	NPS 1
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 <sup>1)</sup>	•	•	-	•	•	•	•	•	•	
1.2 <sup>1)</sup>	•	•		•	•	•	•	•	•	
2.0 <sup>1)</sup>	•	•		•	•	•	•	•	•	

<sup>1)</sup> Versions can be used up to Class 600 at the maximum

**Table 3.3:** Valve selection guide

Class	150 to 300		600		900 to 1500		2500	
Metal bellows	Optional		Optional		Optional		-	Optional
C <sub>v</sub>								
0.00012	Type 3510		Type 3510		Type 3510		Type 3510	
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				Type 3252				Type 3252
0.20		Type 3241		Type 3251		Type 3251		Type 3251
0.30								
0.50					Type 3252			
0.75					Type 3251			
1.2								
2.0								
3.0								
5.0								
7.5								
12								

Detailed information on each valve version can be found in the following data sheets:

- 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 · Maximum permissible supply pressure: 4 bar

Bench range with actuator area		120 cm <sup>2</sup>	0.8 to 1.6	1.7 to 2.1	2.4 to 3.0
Valve size	C <sub>v</sub> coefficient	Actuator	Δp when p <sub>2</sub> = 0 bar		
G/NPT/Rc 1/8 · 1/4 · 3/8 · 1/2 · 3/4 NPS 1/2 · 3/4 · 1	0.00012 to 0.5	120 cm <sup>2</sup>	400	–	–
G/NPT/Rc 1/2 · 3/4 NPS 1/2 · 3/4 · 1	0.75 to 2.0 <sup>1)</sup>	120 cm <sup>2</sup>	84	100	–

<sup>1)</sup> Only up to Class 600

**Table 4.2:** Standard version with bellows seal · Fail-close · Maximum permissible supply pressure: 4 bar

Bench range with actuator area		120 cm <sup>2</sup>	0.8 to 1.6	1.7 to 2.1	2.4 to 3.0
Valve size	C <sub>v</sub> coefficient	Actuator	Δp when p <sub>2</sub> = 0 bar		
G/NPT/Rc 1/8 · 1/4 · 3/8 · 1/2 · 3/4 NPS 1/2 · 3/4 · 1	0.00012 to 0.5	120 cm <sup>2</sup>	72	160	250
G/NPT/Rc 1/2 · 3/4 NPS 1/2 · 3/4 · 1	0.75 to 2.0 <sup>1)</sup>	120 cm <sup>2</sup>	68	100	–

<sup>1)</sup> Only up to Class 600

**Table 4.3:** Standard version without bellows seal · Fail-open · Maximum permissible supply pressure: see Table 4.5

Bench range with actuator area		120 cm <sup>2</sup>	0.8 to 1.6		
		Supply pressure	2.0	3.3	4.3
Valve size	C <sub>v</sub> coefficient	Actuator	Δp when p <sub>2</sub> = 0 bar		
G/NPT/Rc 1/8 · 1/4 · 3/8 · 1/2 · 3/4 NPS 1/2 · 3/4 · 1	0.00012 to 0.5	120 cm <sup>2</sup>	254	400	–
G/NPT/Rc 1/2 · 3/4 NPS 1/2 · 3/4 · 1	0.75 to 2.0 <sup>1)</sup>	120 cm <sup>2</sup>	36	100	–

<sup>1)</sup> Only up to Class 600

**Table 4.4:** Standard version with bellows seal · Fail-open · Maximum permissible supply pressure: see Table 4.5

Bench range with actuator area		120 cm <sup>2</sup>	0.8 to 1.6		
		Supply pressure	2.0	3.3	4.3
Valve size	C <sub>v</sub> coefficient	Actuator	Δp when p <sub>2</sub> = 0 bar		
G/NPT/Rc 1/8 · 1/4 · 3/8 · 1/2 · 3/4 NPS 1/2 · 3/4 · 1	0.00012 to 0.5	120 cm <sup>2</sup>	27	160	250
G/NPT/Rc 1/2 · 3/4 NPS 1/2 · 3/4 · 1	0.75 to 2.0 <sup>1)</sup>	120 cm <sup>2</sup>	27	100	–

<sup>1)</sup> Only up to Class 600

**Table 4.5:** Maximum permissible supply pressure for fail-open version

Bench range	Adjusted to	Max. permissible supply pressure
0.4 to 2.0	0.8 to 1.6	3.3
1.4 to 2.3	1.7 to 2.1	3.8
2.1 to 3.3	2.4 to 3.0	4.7

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

**Table 5.1:** Standard version without bellows seal · Fail-close · Maximum permissible supply pressure: 58 psi

Bench range with actuator area		120 cm <sup>2</sup>	12 to 23	25 to 30	35 to 44
Valve size	C <sub>v</sub> coefficient	Actuator	Δp when p <sub>2</sub> = 0 psi		
G/NPT/Rc 1/8 · 1/4 · 3/8 · 1/2 · 3/4 NPS 1/2 · 3/4 · 1	0.00012 to 0.5	120 cm <sup>2</sup>	5880	–	–
G/NPT/Rc 1/2 · 3/4 NPS 1/2 · 3/4 · 1	0.75 to 2.0 <sup>1)</sup>	120 cm <sup>2</sup>	1235	1470	–

<sup>1)</sup> Only up to Class 600

**Table 5.2:** Standard version with bellows seal · Fail-close · Maximum permissible supply pressure: 58 psi

Bench range with actuator area		120 cm <sup>2</sup>	12 to 23	25 to 30	35 to 44
Valve size	C <sub>v</sub> coefficient	Actuator	Δp when p <sub>2</sub> = 0 psi		
G/NPT/Rc 1/8 · 1/4 · 3/8 · 1/2 · 3/4 NPS 1/2 · 3/4 · 1	0.00012 to 0.5	120 cm <sup>2</sup>	1060	2220	3705
G/NPT/Rc 1/2 · 3/4 NPS 1/2 · 3/4 · 1	0.75 to 2.0 <sup>1)</sup>	120 cm <sup>2</sup>	1000	1470	–

<sup>1)</sup> Only up to Class 600

**Table 5.3:** Standard version without bellows seal · Fail-open · Maximum permissible supply pressure: see Table 5.5

Bench range with actuator area		120 cm <sup>2</sup>	12 to 23		
		Supply pressure	30	48	63
Valve size	C <sub>v</sub> coefficient	Actuator	Δp when p <sub>2</sub> = 0 psi		
G/NPT/Rc 1/8 · 1/4 · 3/8 · 1/2 · 3/4 NPS 1/2 · 3/4 · 1	0.00012 to 0.5	120 cm <sup>2</sup>	3735	5880	–
G/NPT/Rc 1/2 · 3/4 NPS 1/2 · 3/4 · 1	0.75 to 2.0 <sup>1)</sup>	120 cm <sup>2</sup>	530	1470	–

<sup>1)</sup> Only up to Class 600

**Table 5.4:** Standard version with bellows seal · Fail-open · Maximum permissible supply pressure: see Table 5.5

Bench range with actuator area		120 cm <sup>2</sup>	12 to 23		
		Supply pressure	30	48	63
Valve size	C <sub>v</sub> coefficient	Actuator	Δp when p <sub>2</sub> = 0 psi		
G/NPT/Rc 1/8 · 1/4 · 3/8 · 1/2 · 3/4 NPS 1/2 · 3/4 · 1	0.00012 to 0.5	120 cm <sup>2</sup>	395	2220	3705
G/NPT/Rc 1/2 · 3/4 NPS 1/2 · 3/4 · 1	0.75 to 2.0 <sup>1)</sup>	120 cm <sup>2</sup>	395	1470	–

<sup>1)</sup> Only up to Class 600

**Table 5.5:** Maximum permissible supply pressure for fail-open version

Bench range	Adjusted to	Max. permissible supply pressure
6 to 30	12 to 23	48
20 to 33	25 to 30	55
30 to 48	35 to 44	68

**Table 6:** Dimensions in inches and mm

**Table 6.1:** Type 3510 Valve

Valve	Connection	Female thread G/NPT/Rc 1/8 to 3/4	Welding ends		Flanges			
			NPS 1/2	NPS 1	NPS 1/2	NPS 3/4	NPS 1	
L <sup>1)</sup>	Class 150	in	7.25	7.25	7.25	7.25	7.25	
		mm	184	184	184	184	184	
	Class 300	in	7.50	7.75	7.50	7.62	7.75	
		mm	190	197	190	194	197	
	Class 600	in	8.00	8.25	8.00	8.12	8.25	
		mm	203	210	203	206	210	
	Class 900/ Class 1500	in	8.50	10.00	8.50	9.00	10.00	
		mm	216	254	216	229	254	
Class 2500	in	10.38	12.12	10.38	10.75	12.12		
	mm	264	308	264	273	308		
L1 <sup>1)</sup>	Class 150	in	3.62	3.62	3.62	3.62	3.62	
		mm	92	92	92	92	92	
	Class 300	in	3.75	3.88	3.75	3.81	3.88	
		mm	95	99	95	97	99	
	Class 600	in	4.00	4.12	4.00	4.06	4.12	
		mm	101	105	101	103	105	
	Class 900/ Class 1500	in	4.25	5.00	4.25	4.50	5.00	
		mm	108	127	108	114	127	
Class 2500	in	5.19	6.06	5.19	5.38	6.06		
	mm	132	154	132	137	154		
H1	120 cm <sup>2</sup>	in	4.80					
		mm	122					
H4	Insulating section	Up to Class 2500	10.35"/263 mm					
	Bellows seal	Up to Class 600	10.35"/263 mm					
		Class 1500	14.37"/365 mm					
H2 or flange Ø D1	Class 150	in	0.90" <sup>2)</sup> 23 mm <sup>2)</sup>	0.90" <sup>2)</sup> 23 mm <sup>2)</sup>	0.90" <sup>2)</sup> 23 mm <sup>2)</sup>	3.54	3.94	4.33
		mm				90	100	110
	Class 300	in				3.74	4.53	4.91
		mm				95	115	125
	Class 600	in				3.74	4.53	4.91
		mm				95	115	125
	Class 900/ Class 1500	in				4.72	5.12	5.91
		mm				120	130	150
Class 2500	in	5.31	5.51	6.30				
	mm	135	140	160				

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

<sup>2)</sup> H2 = 1.10" (28 mm) with body material B 574 N06455



**Table 6.2:** Types 3271 and 3277 Pneumatic Actuators

Actuator area		cm <sup>2</sup>	120
Diaphragm ØD		in	6.61
		mm	168
H		in	2.71
		mm	69
H3 <sup>1)</sup>		in	4.33
		mm	110
H5	Type 3277	in	3.46
	Type 3277	mm	88
Thread	Type 3271		M30x1.5
	Type 3277		M30x1.5
a			G ½ (½ NPT)

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

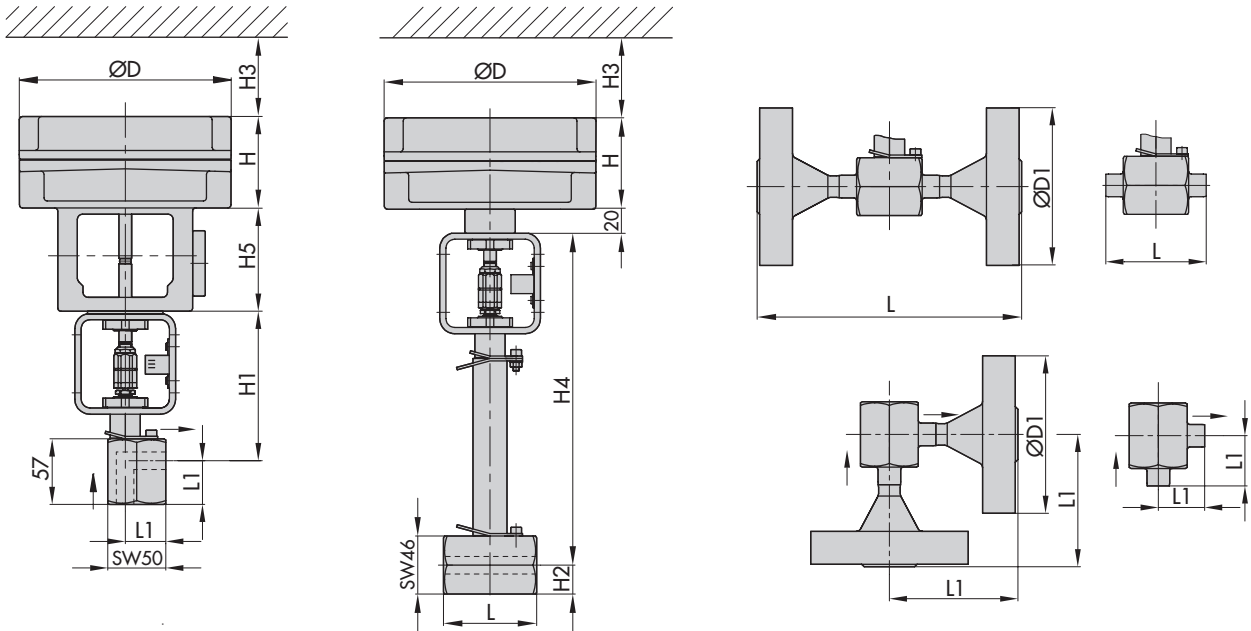
**Table 7:** Dimensions in lbs and kg**Table 7.1:** Type 3510 Valve

Valve	Connection		Female thread G/NPT/Rc ½ to ¾	Welding ends NPS ½, NPS 1	Flanges			
					NPS ½	NPS ¾	NPS 1	
Valve without actuator	Class 150	lbs	3.74	4.0	5.8	7.3	8.2	
		kg	1.7	1.8	2.6	3.3	3.7	
	Class 300	lbs	3.74	4.0	7.1	9.3	10.6	
		kg	1.7	1.8	3.2	4.2	4.8	
	Class 600	lbs	3.74	4.0	7.5	10.6	11.5	
		kg	1.7	1.8	3.4	4.8	5.2	
	Class 900/1500	lbs	3.74	4.0	14.4	16.8	19.2	
		kg	1.7	1.8	5.2	7.6	8.7	
	Class 2500	lbs			14.4	20	21.7	
		kg			6.5	9.0	9.8	
	Optional	Insulating section	lbs	1.2				
			kg	0.5				
Bellows seal		lbs	1.4					
		kg	0.6					

**Table 7.2:** Types 3271 and 3277 Pneumatic Actuators

Actuator		120 cm <sup>2</sup>
Approx. weight	lbs	7.8
	kg	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

### Order specifications:

Type 3510 Micro-flow Valve	Globe or angle valve
Valve size	NPS
Pressure rating	Class
Body material	Refer to Table 2
Type of connection	G, NPT or R <sub>C</sub> female thread Flanges/welding ends
Direction of flow	Flow-to-open or flow-to-close
Characteristic	Equal percentage, linear or on/off
Pneumatic actuator	Type 3271-5 or Type 3277-5, 120 cm <sup>2</sup> (see Data Sheet ► T 8310-1)
Fail-safe position	Fail-close or fail-open
Process medium	Density in kg/m <sup>3</sup> and temperature in °C or °F
Flow rate	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/psi (absolute pressure p <sub>abs</sub> ) (with minimum, normal and maximum flow rate)
Valve accessories*	Positioner and/or limit switch

\*Mounting kit (1400-9031) required

Note: The temperature limits for DIN and ANSI versions are not directly converted temperatures.