

## T 8074-1 EN

### Series 290 · Type 3296 Angle Valve

### Type 3296-1 and Type 3296-7 Pneumatic Control Valves

ANSI version



#### Application

Control valve for process engineering applications with high industrial requirements

**Valve size** NPS ½ to 8

**Pressure rating** Class 150 to 900

**Temperatures** -325 to +842 °F (-198 to +450 °C)

#### Special features

Type 3296 Angle Valve with

- Type 3271 Pneumatic Actuator (Type 3296-1 Control Valve)
- Type 3277 Pneumatic Actuator (Type 3296-7 Control Valve) for integral positioner attachment

Valve body made of

- Cast steel
- High-temperature cast steel
- Cold-resisting cast steel
- Cast stainless steel

Valve plug

- Metal seal
- Soft seal
- High-performance metal seal
- Balanced to handle high differential pressures
- Quick and easy to service
- Clamped-in seat for quick service

The control valves with their modular design can be equipped with various accessories:

Positioners, solenoid valves and other accessories according to IEC 60534-6<sup>1)</sup> and NAMUR recommendation. Details in Information Sheet ▶ T 8350.

#### Versions

**Standard version** (Fig. 1) · Angle valve with PTFE packing for temperatures from 14 to 430 °F (-10 to +220 °C) · NPS ½ to 8

- **Type 3296-1** (Fig. 1) · Type 3296 Valve with Type 3271 Actuator
- **Type 3296-7** · Type 3296 Valve and Type 3277 Pneumatic Actuator for integral positioner attachment (see Data Sheet ▶ T 8310-1)

<sup>1)</sup> Accessories required. See associated actuator documentation.



**Fig. 1:** Type 3296-1 Control Valve with Type 3271 Pneumatic Actuator, positioner and solenoid valve

#### Further versions:

- **Welding ends or welding-neck ends** according to ANSI B16.25
- **Flow divider** · For noise reduction · See Data Sheet ▶ T 8081
- **Perforated plug trim** · See Data Sheet ▶ T 8086
- **Insulating section or bellows seal** · See Technical data

- **Heating jacket** · Details on request
- **Additional handwheel** · See Data Sheets ▶ T 8310-1 and ▶ T 8310-2
- **Type 3296-3 Hand-operated Valve** · With Type 3273 Hand-operated Actuator for valves with max. 30 mm rated travel · See Data Sheet ▶ T 8312
- **Type 3296-2 Electric Control Valve** · Details on request
- **NACE version for sour gas applications** · Details on request

**Principle of operation** (Fig. 2 to Fig. 4)

The medium flows through the valve in the direction indicated by the arrow. The valve plug position determines the free area between the valve seat and the plug.

The version with bellows seal (Fig. 4) is fitted with a test connection to monitor the stainless steel bellows.

Pressure balancing must be used when high pressures or differential pressures act on the plug and the actuator is unable to produce enough force to counteract the resulting forces.

The valves can be equipped with a flow divider ST 1 (see Data Sheet ▶ T 8081) for noise reduction.

**Fail-safe position**

Depending on how the springs are arranged in the pneumatic actuator (see Data Sheets ▶ T 8310-1 and ▶ T 8310-2), the valve has two different fail-safe positions that become effective when the supply air fails.

- **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.

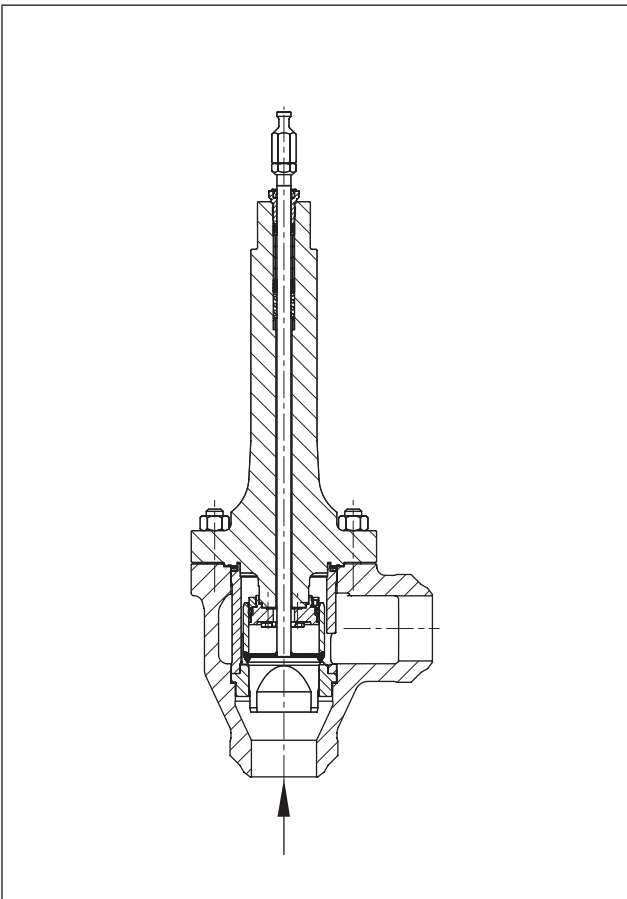


Fig. 3: Type 3296 with welding ends and insulating section

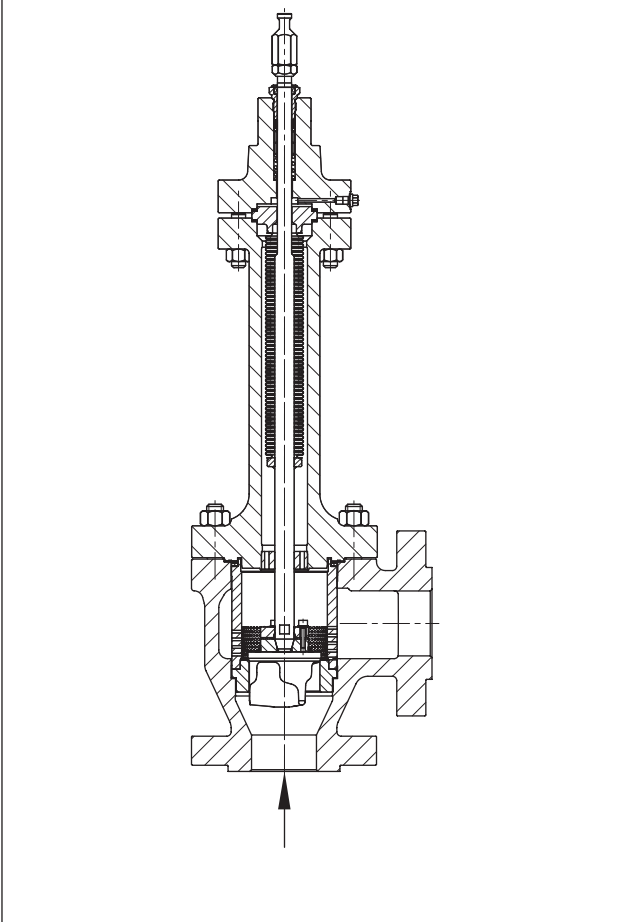


Fig. 4: Type 3296 Valve with bellows seal

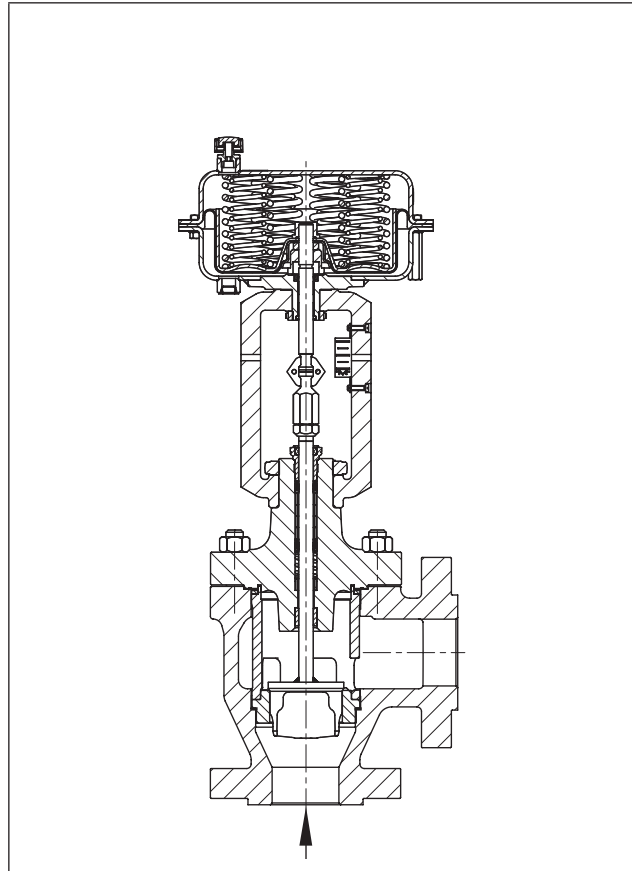


Fig. 2: Type 3296-1 Control Valve with Type 3271 Actuator

**Table 1: Technical data for Type 3296**

Material		Cast steel A352 LCC	Cast steel A216 WCC	Cast steel A217 WC6	Cast stainless steel	
					A351 CF3M	A351 CF8M
Valve size		NPS ½ to 8				
Pressure rating		Class 150 to 900				
Type of connection	Flanges	All ANSI versions				
	Welding ends	According to ANSI B16.25				
Seat-plug seal		Metal seal · Soft seal · High-performance metal seal				
Characteristic		Equal percentage · Linear · On/off				
Rangeability		50:1				
Compliance		<b>CE · EAC</b>				
<b>Temperature ranges</b> in °F (°C) · Permissible operating pressures acc. to pressure-temperature diagrams (see Information Sheet ► T 8000-2)						
Body without insulating section		14 to 428 °F (-10 to +220 °C) · Up to 660 °F (350 °C) with high-temperature packing depending on material				
Body with	Insulating section	-51 to +649 °F (-46 to +343 °C)	-20 to +800 °F (-29 to +425 °C)	-20 to +842 °F (-29 to +450 °C)	-325 to +842 °F (-198 to +450 °C)	-325 to +842 °F (-198 to +450 °C)
	Bellows seal	-51 to +649 °F (-46 to +343 °C)	-20 to +800 °F (-29 to +425 °C)	-20 to +842 °F (-29 to +450 °C)	-325 to +842 °F (-198 to +450 °C)	-325 to +842 °F (-198 to +450 °C)
Valve plug <sup>1)</sup>	Standard	Metal seal: -325 to +842 °F (-198 to +450 °C)				
		Soft seal: -325 to +428 °F (-198 to +220 °C)				
		Balanced with PTFE ring: -40 to +428 °F (-40 to +220 °C) · Lower temperatures on request				
		Balanced with graphite ring: -40 to +842 °F (-40 to +450 °C)				
<b>Leakage class</b> according to ANSI/FCI 70-2 (2006)						
Valve plug	Standard	Metal seal: IV · High-performance metal seal: V				
		Soft seal <sup>2)</sup> : VI				
		Balanced, metal seal: Standard: IV (with PTFE or graphite ring) High-performance metal seal: V (only with PTFE ring)				

<sup>1)</sup> Only in combination with suitable body material

<sup>2)</sup> On request

**Table 2: Materials (EN material number)**

Standard version		Cast steel A352 LCC	Cast steel A216 WCC	Cast steel A217 WC6	Cast stainless steel	
					A351 CF3M	A351 CF8M
Body and flanges <sup>1)</sup>						
Seat and plug <sup>2)</sup>	Metal seal	1.4006/1.4404	1.4006/1.4404	1.4006/1.4404	1.4404	1.4404
Seal ring for	Soft seal	PTFE with 15 % glass fiber				
	Pressure balancing	PTFE with carbon · Graphite				
Guide bushings		1.4112		1.4112	2.4610	
Packing		V-ring packing: PTFE with carbon; spring: 1.4310 · High-temperature packing				
Body gasket		Graphite seal on metal core				
Insulating section <sup>3)</sup>		A352 LCC/ A350 LF2	A216 WCC/ A182 F12 Cl. 2/ A105	A217 WC6/ A182 F12 Cl. 2	A351 CF3M/ A182 F316L	A351 CF8M/ A182 F316
<b>Metal bellows seal</b>						
Intermediate piece <sup>3)</sup>		A352 LCC/ A350 LF2	A216 WCC/ A182 F12 Cl. 2/ A105	A217 WC6/ A182 F12 Cl. 2	A351 CF3M/ A182 F316L	A351 CF8M/ A182 F316
Metal bellows		1.4571				
Heating jacket		1.4404/A240 316L				

<sup>1)</sup> See also pressure-temperature diagrams (► T 8000-2)

<sup>2)</sup> Seats and metal-seated plug also with Stellite® facing or plug made of solid Stellite® available

<sup>3)</sup> Depending on valve bonnet material

**Table 3:**  $C_V$  and  $K_{VS}$  coefficients · Class 150 to 600

Versions highlighted in gray also available with balanced plug

**Table 3.1:** Overview with flow divider ST 1 ( $C_V-1/K_{VS}-1$ )

$C_V$	0.12	0.2	0.3	0.5	0.75	1.2	2	3	5	7.5	10.5	12	20	23	30	42	47	75	105	120	170	190	290	375	420	650	
$K_{VS}$	0.1	0.16	0.25	0.4	0.63	1.0	1.6	2.5	4	6.3	9	10	16	20	25	36	40	63	90	100	144	160	250	320	360	560	
$C_V-1$	-								4.2	7	9.5	-	17	21	26	37	42	67	95	105	145	170	265	325	375	570	
$K_{VS}-1$	-								3.6	5.7	8	-	14.5	18	22	32	36	57	80	90	125	144	225	280	320	490	
Seat Ø mm	6/8						12		24				31	38	50	63	80	100	125	150	200						
Rated travel	in	0.5												1.18						2.36							
	mm	15												30						60							

**Table 3.2:** Versions without flow divider

$C_V$	0.12	0.2	0.3	0.5	0.75	1.2	2	3	5	7.5	10.5	12	20	23	30	42	47	75	105	120	170	190	290	375	420	650	
NPS																											
½	•	•	•	•	•	•	•	•	•																		
1	•	•	•	•	•	•	•	•	•	•	•																
1½	•	•	•	•	•	•	•	•	•	•		•	•	•													
2									•	•		•	•		•	•											
3									•	•		•	•		•	•	•	•	•								
4															•	•	•	•	•	•	•	•					
6																		•	•	•	•	•	•	•	•	•	
8																						•	•		•	•	

**Table 3.3:** Versions with flow divider ST 1

$C_V-1$	-								4.2	7	9.5	-	17	21	26	37	-	67	95	105	145	170	265	325	375	570	
NPS																											
½																											
1									•	•	•																
1½													•	•													
2															•	•											
3																	•	•									
4																			•	•							
6																					•	•	•	•			
8																									•	•	

**Table 4:**  $C_V$  and  $K_{VS}$  coefficients · Class 900

Versions highlighted in gray also available with balanced plug

**Table 4.1:** Overview with flow divider ST 1 ( $C_V-1/K_{VS}-1$ )

$C_V$	0.12	0.2	0.3	0.5	0.75	1.2	2	3	5	7.5	9.5	12	20	21	30	37	47	75	95	120	145	190	290	325	420	570
$K_{VS}$	0.1	0.16	0.25	0.4	0.63	1.0	1.6	2.5	4	6.3	8	10	16	18	25	32	40	63	80	100	125	160	250	280	360	490
$C_V-1$	-								4.2	7	9.5	-	17	21	26	37	42	67	95	105	145	170	265	325	375	570
$K_{VS}-1$	-								3.6	5.7	8	-	14.5	18	22	32	36	57	80	90	125	144	225	280	320	490
Seat $\varnothing$ mm	6/8						12		24				31	38	50		63		80		100		125	150		200
Rated travel	in	0.5												1.18						2.36						
	mm	15												30						60						

**Table 4.2:** Versions without flow divider

$C_V$	0.12	0.2	0.3	0.5	0.75	1.2	2	3	5	7.5	9.5	12	20	21	30	37	47	75	95	120	145	190	290	325	420	490	
NPS																											
1/2	•	•	•	•	•	•	•	•	•																		
1	•	•	•	•	•	•	•	•	•	•	•																
1 1/2	•	•	•	•	•	•	•	•	•	•		•	•	•													
2									•	•		•	•		•	•											
3									•	•		•	•		•	•	•	•	•								
4															•		•	•		•	•						
6																		•		•		•	•	•			
8																							•	•		•	•

**Table 4.3:** Versions with flow divider ST 1

$C_V-1$	-								4.2	7	9.5	-	17	21	26	37	-	67	95	-	145	170	265	325	375	490		
NPS																												
1/2																												
1									•	•	•																	
1 1/2													•	•														
2														•	•													
3																	•	•										
4																				•								
6																						•	•	•				
8																										•	•	

**Table 5:** Dimensions for Type 3296-1 and Type 3296-7 in standard version

**Table 5.1:** Type 3296 Valve

Valve		NPS	½	1	1½	2	3	4	6	8	
		DN	15	25	40	50	80	100	150	200	
Length L1	Class 150	in	3.62	3.62	4.37	5.0	5.88	6.94	8.88	10.69	
		mm	92	92	111	127	149	176	226	272	
	Class 300	in	3.75	3.88	4.62	5.25	6.25	7.25	9.31	11.19	
		mm	95	99	117	133	159	184	236	284	
	Class 600	in	4.00	4.12	4.94	5.62	6.62	7.75	10.00	12.00	
		mm	101	105	125	143	168	197	254	305	
Class 900	in	4.25	5.00	6.00	7.25	7.50	9.00	12.00	14.50		
	mm	108	127	152	184	190	229	305	368		
Height H4	Class 150 to 600	in	5.28	5.08	5.08	6.89	6.30	6.69	9.17	On request	
		mm	134	129	129	175	160	170	233		
	Class 900	in	6.89	6.69	6.69	8.70	6.30	6.69	9.17		
		mm	175	170	170	221	160	170	233		
H8 for actuator	350 cm <sup>2</sup>	in	9.45	9.45	9.45	9.45	9.45	9.45	-		
		mm	240	240	240	240	240	240	-		
	355v2 cm <sup>2</sup>	in	9.45	9.45	9.45	9.45	9.45	9.45	15.55	-	
		mm	240	240	240	240	240	240	395	-	
	700 cm <sup>2</sup>	in	9.45	9.45	9.45	9.45	9.45	9.45	15.55	15.55	
		mm	240	240	240	240	240	240	395	395	
	1000 cm <sup>2</sup>	in	-				11.61	11.61	11.61	15.55	15.55
		mm	-				295	295	295	395	395
	1400-60 cm <sup>2</sup>	in	-				11.61	11.61	11.61	15.55	15.55
		mm	-				295	295	295	395	395
	1400-120 cm <sup>2</sup>	in	-						18.90	18.90	18.90
		mm	-						480	480	480
2800 cm <sup>2</sup>	in	-						18.90	18.90	18.90	
	mm	-						480	480	480	

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

Actuator area	cm <sup>2</sup>	350	355v2	700	750v2	1000	1400-60	1400-120	2800	2 x 2800	
Diaphragm ØD	in	11.02	11.02	15.35	15.51	18.19	20.87	21.02	30.32	30.32	
	mm	280	280	390	394	462	530	534	770	770	
H <sup>1)</sup>	in	3.23	4.76	7.83	9.29	15.87	13.27	23.54	28.07	47.76	
	mm	82	121	199	236	403	337	598	713	1213	
H3 <sup>2)</sup>	in	4.33	4.33	7.48	7.48	24.02	24.02	25.59	25.59	25.59	
	mm	110	110	190	190	610	610	650	650	650	
H5	Type 3277 in	3.98	3.98	3.98	3.98	-	-	-	-	-	
	Type 3277 mm	101	101	101	101	-	-	-	-	-	
Thread	Type 3271	M30x1.5				M60x1.5		M100x2			
	Type 3277	M30x1.5				-	-	-	-	-	
α	Type 3271	G 3/8 (3/8 NPT)	G 3/8 (3/8 NPT)	G 3/8 (3/8 NPT)	G 3/8 (3/8 NPT)	G 3/4 (3/4 NPT)	G 3/4 (3/4 NPT)	G 1 (1 NPT)	G 1 (1 NPT)	G 1 (1 NPT)	
α2	Type 3277	G 3/8	G 3/8	G 3/8	G 3/8	-	-	-	-	-	

1) Height including lifting eyelet or female thread and eyebolt according to DIN 580. Height of the swivel hoist may differ. Actuators up to 355v2 cm<sup>2</sup> without lifting eyelet or female thread

2) Minimum clearance required to remove the actuator

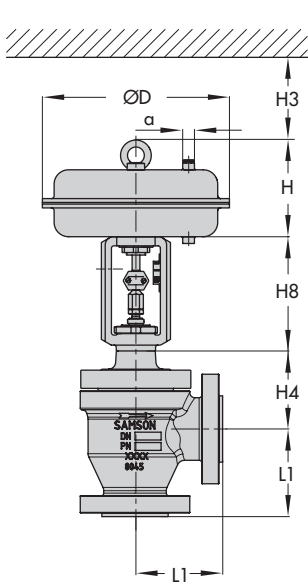
**Table 6: Weights for standard version of Type 3296-1 and Type 3296-7****Table 6.1: Type 3296 Valve**

Valve	NPS	1/2	1	1 1/2	2	3	4	6	8		
Valve without actuator (approx.)	Class 150 and 300	lbs	26	On request		77	128	165	419	On request	
		kg	12			35	58	75	190		
Valve without actuator (approx.)	Class 600	lbs	On request		128	203	On request				
		kg			58	92					
	Class 900	lbs	On request	84	126	200					242
		kg		38	57	91					110

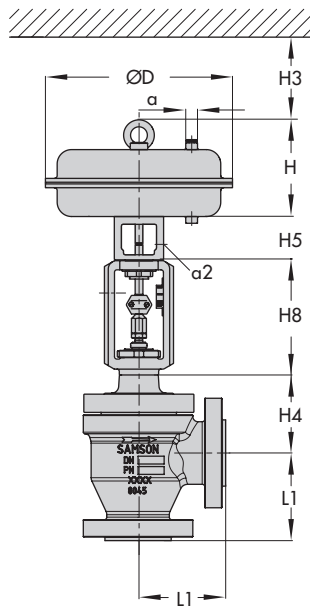
**Table 6.2: Types 3271 and 3277 Pneumatic Actuators**

Actuator	cm <sup>2</sup>	350	355v2	700	1000	1400-60	1400-120	2800	2 x 2800	
Type 3271 (approx.)	Without handwheel	lbs	17.6	42	48.5	177	154.5	386	992	2095
		kg	8	19	22	80	70	175	450	950
Type 3271 (approx.)	With handwheel	lbs	28.7	On request	59.5	Only with side-mounted handwheel (► T 8310-2)		On request		
		kg	13		27					
Type 3277 (approx.)	Without handwheel	lbs	26	42	57	-				
		kg	12	19	26					
	With handwheel	lbs	37	51	68					
		kg	17	23	31					

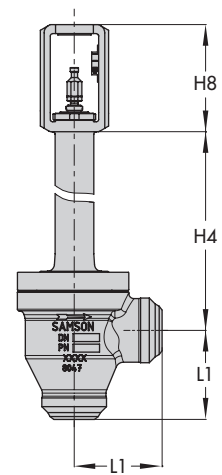
Dimensional drawings



Type 3296 with Type 3271 Actuator



Type 3296 with Type 3277 Actuator



Type 3296 with bellows seal or insulating section



**Table 7: Dimensions and weights for the standard version of Type 3296 with insulating section · Without actuator**

Valve		NPS	½	1	1½	2	3	4	6	8	
Class 300/600 H4 for actuator	350 cm <sup>2</sup>	in	22.63	22.44	22.48	26.97	26.37	26.77	-	On request	
		mm	575	570	571	685	670	680			
	355√2 cm <sup>2</sup>	in	On request								-
		mm	On request								
	700 cm <sup>2</sup>	in	22.63	22.44	22.48	26.97	26.37	26.77	-		
		mm	575	570	571	685	670	680			
	1000 cm <sup>2</sup>	in	-			On request					-
		mm	-			On request					
	1400-60	in	-			29.13	28.54	28.93	38.5		-
		mm	-			740	725	735	978		
1400-120	in	-						On request		-	
	mm	-						On request			
2800 cm <sup>2</sup>	in	-						36.22	41.85	-	
	mm	-						920	1063		
Class 900 H4 for actuator	350 cm <sup>2</sup>	in	23.85	23.85	23.85	28.62	26.37	26.77	-	On request	
		mm	606	606	606	727	670	680			
	355√2 cm <sup>2</sup>	in	On request								-
		mm	On request								
	700 cm <sup>2</sup>	in	23.85	23.85	23.85	28.62	26.37	26.77	38.5		-
		mm	606	606	606	727	670	680	978		
	1000 cm <sup>2</sup>	in	-			On request					-
		mm	-			On request					
	1400-60	in	-			30.78	28.54	28.93	38.5		-
		mm	-			782	725	735	978		
1400-120	in	-						On request		-	
	mm	-						On request			
2800 cm <sup>2</sup>	in	-						36.22	41.85	-	
	mm	-						920	1063		
<b>Weights</b>											
Weight without actuator (approx.) for	Class 300	lbs	44			On request	95	146	207	463	On request
		kg	20				43	66	94	210	
	Class 600	lbs	On request			146	220	On request			
		kg				66	100				
	Class 900	lbs	101	143	218	264	On request				
		kg	46	65	99	120					

**Table 8: Dimensions and weights for the standard version of Type 3296 with bellows seal · Without actuator**

Valve	NPS	½	1	1½	2	3	4	6	8					
Class 300/600 H4 for actuator	350 cm <sup>2</sup>	in	22.52	22.32	22.36	31.26	30.67	30.27	-					
		mm	572	567	568	794	779	769						
	355v2 cm <sup>2</sup>	in	On request											
		mm	On request											
	700 cm <sup>2</sup>	in	22.52	22.32	22.36	31.26	30.67	30.27			45.98	56.89		
		mm	572	567	568	794	779	769			1168	1445		
	1000 cm <sup>2</sup>	in	-			On request								
		mm	-			On request								
	1400-60	in	-			33.42	33.1	32.44			45.98	56.89		
		mm	-			849	841	824			1168	1445		
1400-120	in	-					On request							
	mm	-					On request							
2800 cm <sup>2</sup>	in	-					39.72	49.33	60.24					
	mm	-					1009	1253	1530					
Class 900 H4 for actuator	350 cm <sup>2</sup>	in	33.26	33.26	On request	30.67	30.27	-						
		mm	845	845		779	769							
	355v2 cm <sup>2</sup>	in	On request											
		mm	On request											
	700 cm <sup>2</sup>	in	33.26	33.26	On request	30.67	30.27			45.98	On request			
		mm	845	845		779	769			1168				
	1000 cm <sup>2</sup>	in	-			On request								
		mm	-			On request								
	1400-60	in	-			On request	32.83			32.44		45.98		
		mm	-				834			824		1068		
1400-120	in	-					On request							
	mm	-					On request							
2800 cm <sup>2</sup>	in	-					39.72	49.33						
	mm	-					1009	1253						
<b>Weights</b>														
Weight without actuator (approx.) for	Class 300	lbs	44	On request		95	146	207	463	On request				
		kg	20			43	66	94	210					
	Class 600	lbs	On request			146	220	On request						
		kg				66	100							
	Class 900	lbs				101	143					218	264	
		kg				46	65					99	120	



### Selection and sizing of the control valve

1. Calculate the  $C_v$  ( $K_{vs}$ ) coefficient according to IEC 60534.
2. Select the valve size and  $C_v$  ( $K_{vs}$ ) coefficient from Table 3 and Table 4.
3. Select the actuator and determine the permissible differential pressure from the Information Sheet ► T 8000-4.
4. Select the valve body material from Table 1 and Table 2 as well as from the pressure-temperature diagrams (see Information Sheet ► T 8000-2).

### The following specifications are required on ordering:

Valve size	NPS ...
Pressure rating	Class ...
Body material	Refer to Table 2
Type of connection	Flanges/welding ends
Plug	Standard or balanced
Facing	Soft seal, metal seal or high-performance metal seal
Characteristic	Equal percentage, linear or on/off
Actuator	Type 3271 or Type 3277 (► T 8310-1 or ► T 8310-2)
Fail-safe position	Fail-close or fail-open
Medium	Density and temperature (other medium data, if required)
Flow rate	Under normal or operating condition as well as for various cases
Pressure	Upstream pressure $p_1$ and downstream pressure $p_2$ or differential pressure $\Delta p$ for various cases
Valve accessories	Positioner and/or limit switch, solenoid valve etc. (see Information Sheet ► T 8350)